

An Economic Impact Study of the Alabama Horse Industry

by

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Abstract

This thesis evaluates the economic impact of the Alabama horse industry. Budgets have been developed for three separate levels of horse care described as low, moderate, and high cost. The budgets along with the population estimate are used to determine total expenditures for different categories of expenditures. The horse industry is responsible for an estimated \$2.084 billion in total economic output for Alabama. The horse industry supports many recreational and agricultural services and was estimated to contribute to almost 24,000 jobs in the Alabama economy. A cluster analysis shows there are differences in the average cost spent per horse by horse owners and the levels of utility they get from their horse(s).

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Introduction

The purpose of this study is to estimate the economic impact of the Alabama horse industry. The horse industry includes people who own horses or provide goods or services for horses. This industry includes veterinarians, farriers, trainers, riding instructors, barn managers, tack shops, and feed stores to name a few. There are shows and events that cater specifically to certain breeds and others that allow anyone to participate. Types of horses are vast and include animals that are registered to a certain breed association and others that are considered grade animals with no papers. This economic impact study only encompasses the horse industry, and other equids (e.g. donkeys, mules) are not considered.

Over the years, the use of horses has shifted from essential transportation and work into a more recreational role. Figure 1 shows farm horse numbers from 1850 to 2012.

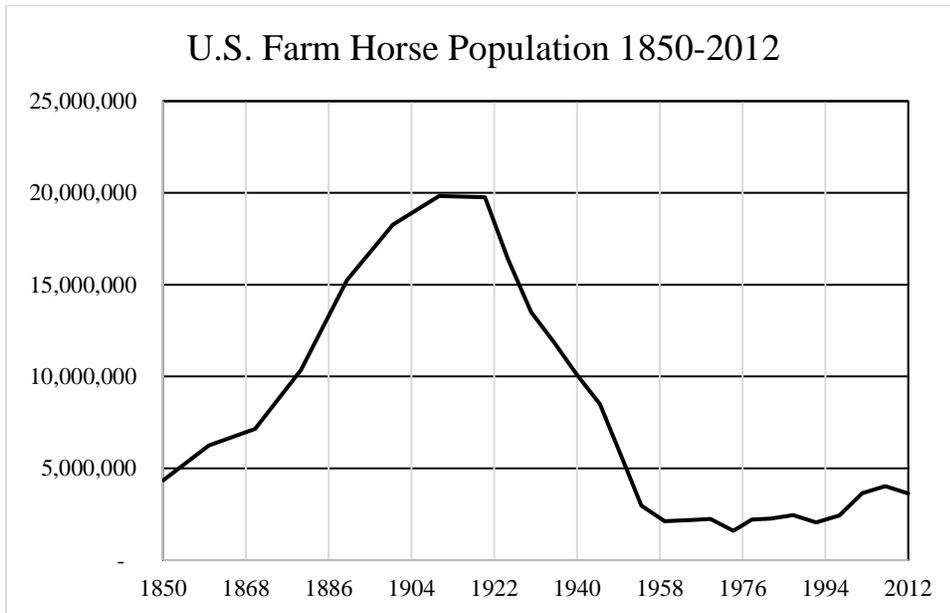


Figure 1. U.S. Farm Horse Population (USDA)

Although the United States Department of Agriculture (USDA) only counts the farm horses in the Census of Agriculture data, the American Veterinary Medical Association (AVMA) does a

pet demographics survey which encompasses the recreational and pet horses. The American Horse Council has the most recent total population study done in 2005 (American Horse Council, 2005) which estimated the entire U.S. population at 9.2 million horses.

Alabama Horse Industry

The Alabama industry is characterized by the various events, shows, recreation, goods, services, and ownership. There are many places for people to show or enjoy a leisurely trail ride to enjoy the recreational side of an equine companion. Horses are still used as work animals on farms and even though that number has decreased over time, there is still a market for a good farm horse. Some people make their livings off of training show horses and others by training ranch horses. Both sides are important to the horse industry whether it be for practical or recreational use.

Shows and events make up a sizeable portion of the Alabama industry; these are coordinated by numerous organizations within the state. Non-organized groups or disciplines such as pony clubs, drill teams, or team ropers are not easily accounted for and are estimated as best as possible in this thesis.

Industry Changes

In the past decade, the horse industry has taken some major financial hits caused by recession and the effective ban on horse slaughter. Horse “slaughter” refers to slaughtering horses for their meat. In 2005, the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act eliminated federal funding for horse meat inspection, essentially eliminating horse slaughter in the U.S., with the last U.S. horse slaughter house closing in 2007. Shortly thereafter, the U.S. entered into a serious economic recession. Subsequent, the bottom of the horse industry fell out, especially with the lower end horses (Vestal 2012), causing the United States to have a large amount of neglected and unwanted horses unable to be moved

because of the lack of market. Research has shown that both the recession and horse slaughter ban negatively affected the industry (Garrett 2013). It is estimated that the total impact from the slaughter ban was \$65 million from exports alone in 2006 (Cowan 2013).

Previous Studies

The American Horse Council conducted a 2005 survey of the horse industry for the entire United States (American Horse Council 2005) in which there were a few break out states, but Alabama was not one of those. The last comprehensive state study published for Alabama was in 2006 (Whiting, Molnar and McCall 2006). That study worked up costs associated with various parts of the industry, and an online survey was distributed among experienced individuals in the industry who gave input on the expenses Alabama horse owners incurred. Other studies used to supplement this thesis included “The Economic Impact of the Horse Industry in Virginia” (Rephann 2011) and “A Report on the Texas Horse Industry” (Texas Agricultural Extension Service 1998). The Virginia study used the Impacts for Planning (IMPLAN) software that is also being used in this thesis. Studies and budgets were reviewed from Alabama (Whiting, Molnar and McCall 2006), Arizona (Beattie, et al. 2001), Virginia (Rephann 2011), Pennsylvania (Swinker, et al. 2003), Kentucky (not including racing industry) (Stowe 2013), and Tennessee (Menard, et al. 2010).

The Alabama equine study (Whiting, Molnar and McCall 2006) used seven major categories to evaluate total horse ownership costs. These categories included horse care and maintenance, appearance, training, breeding, travel and lodging, barn, and facilities. Their study estimated a total of 186,871 horses in Alabama given previous Census of Agriculture data and calculations. An estimated \$10,158,119 was spent on major Alabama horse shows and events.

In the economic impact section of the 2006 Alabama study (Whiting, Molnar and McCall 2006) budgets were developed and an online survey was distributed to a set of experienced individuals in the industry who gave input on different expenses incurred by horse owners in the state. There were three different budgets by level of cost, economical, moderate, and high, with the median of the cost for each level used as the total annual expenditure for each category. The impact portion of the study used the total expenditures gathered from the surveys as the direct impact, used an income multiplier of 1.9 to generate the indirect economic activity, then used the summation of the indirect and direct impact for the total impact in Alabama. The economic impact section found \$801,227,824 in direct impact, \$1,522,332,866 in indirect impact, and a total impact of \$2,323,560,691 for the Alabama equine industry.

Objectives

This study focuses on reassessing the economic impact of the horse industry in Alabama, particularly after the recession and the changes in slaughter laws. The goals of this study are to develop a set of budgets for horse ownership based on three different levels of care – low, moderate, and high. To get a gross expenditure from horse ownership for the state, the horse population in the state will be calculated. From the population and budgets, total category expenditures will be estimated. These categories will be input into the IMPLAN software, the generated numbers will be analyzed, and the total impact will be determined. After the results are formulated, the new impact will be compared to the estimated impact from the 2006 study (Whiting, Molnar and McCall 2006).

To get more current data, a 2016 Alabama Horse Owner Survey has been developed and distributed online. These responses will help determine some of the expenditures and percentages of different types of horses and what people are using them for in Alabama. This

survey will be used in developing budgets, determining total expenditure, and also used in a cluster analysis to evaluate any trends between respondents.

Methods

This chapter describes key components of the research design used to generate estimates for the economic impact of the Alabama horse industry. Also provided is an explanation of the economic model used to produce the impact estimates. For this study, the horse industry was defined as any activities involved with horses as well as involvement in the care and support of horses.

The methods used in this study included a horse owner survey that was used in a cluster analysis and as a check on the budgets, various sources of information that were used to develop budgets by level of care, and IMpacts for PLANning (IMPLAN), which was used to conduct an economic impact analysis for the horse industry. Since there is no current information on the Alabama horse industry, this project initiated an online survey open to all Alabama horse owners to collect information on and how much they spend on their horses. This was the best way to get, at a reasonable cost, a good number of observations on what people participate in and how much they spend overall. To determine current prices of goods and services online retailers and service providers were identified and price information was obtained via the website, if posted, or by phone if not. Initial estimates of expenditures developed from the various data sources were subsequently reviewed by a panel of 10 experts in the field. IMPLAN was used as the input-output software since it is a reputable source and other studies have used it with success.

Population

Determining the horse population in Alabama was a difficult undertaking. There have been no recent studies done for Alabama's equine population. Horses are difficult to count because they fall into two distinct categories. The first category is the farm horse, one that is counted in the United States Department of Agriculture Census of Agriculture. The second category, which has

grown popular over the years, is the recreation/pet horse. The fact that there is no single method of classifying people who own horses made coming up with a population number difficult; however, two previous survey studies were used to estimate the number of Alabama horses.

The American Veterinary Medical Association conducted a pet demographics survey in 2012 that concluded that 2.2% of households in the East South Central Region, which includes the state of Alabama, owned 2.4 horses on average. Alabama has 1,838,683 total households (United States Census Bureau 2015) which was multiplied by the 2.2% from the survey and then by the average of 2.4 horses per household. Based on this survey, Alabama has an estimated 97,082 pet or recreational horses. The last Census of Agriculture determined that Alabama has 63,707 farm horses and ponies (United States Department of Agriculture 2014). A straight combination of these numbers gives a total of 160,789 horses; however, the Pet Demographics Survey indicated that 14% of horse owners in this region considered their horse as property. It is possible that these same 14% are farm horse owners who participated in the last Census of Agriculture. If this were a straight overlap, the total number of horses is 147,198 for Alabama. To make up for this potential overlap and to discourage double counting, the median of the two numbers was used for a total of 153,904 horses and ponies residing in Alabama. (Mules and donkeys were not counted in this evaluation.)

Data Collection

Data on expenses incurred by horse owners was collected through surveys, previous studies, and online searches. This data included prices for board, farriers, veterinary and health, lessons, training, grooming supplies, shows, facility maintenance, utilities, equipment, feed, bedding, insurance, breeding fees, and publicity. Any costs or prices from previous studies that was not collected within the past year was inflated to current market values.

Horse Owner Survey

To obtain current information from horse owners, a survey was developed for this project. Horse owners were asked to participate online in the 2016 Alabama Horse Owner Survey (Appendix A) distributed through email, social media, and a magazine article. Participation was voluntary and responses were anonymous. The survey was built through Qualtrics and participants were encouraged to read the letter of intent approved by the Auburn University Institutional Review Board before participating in the survey. In addition to the base questions, participants were asked to verify they were at least nineteen years of age and to enter their zip code to ensure only Alabama residents were counted in the results. There were eleven base questions to collect data which could be branched out to sixteen questions depending on responses. Questions included number of horses owned, where they were kept, breeds owned, training participated in, shows participated in, other disciplines for horses not shown or trained, training and show expenses, number of lessons taken, associations or organizations associated with, if horses were insured, and the total annual cost excluding training or shows.

1,271 people started taking the survey and from those there were 1,090 usable responses for budget and economic impact data. Out of the 1,090 responses, there were 5,113 horses that the respondents owned or paid bills on. This number is nearly twice as many as what was found in the American Veterinary Medical Association survey. This probably occurred because people with multiple horses were more likely to be reached by the survey methods stated earlier and there were multiple occasions when the respondent claimed to have ten or more horses. These horses were split up into groups depending on if they were kept at home, 643 or 12.6%, or boarded, 4,467 or 87.4%. The percent boarded is higher than anticipated which could be because more people who board their horses responded if their boarding barn shared the survey. There

are a lot of different breeds represented in Alabama, this survey captured forty-one different categories of breeds including the Quarter Horse, Tennessee Walking Horse, Appaloosa, Thoroughbred, Arabian, Saddlebred, Connemara, Hackney, Pony of the Americas, Shetland, Welsh, Mustang, Fox Trotter, Drafts, Warmbloods, Paso Fino, Morgan, McCurdy, Australian Stock Horse, Icelandic, Kentucky Mountain Horse, Peruvian Paso, Rocky Mountain Horse, Single Footer, Standardbred, Paint, Spotted Saddle Horse, Gypsy Vanner, Clydesdale, Belgian, Haflinger, Percheron, Friesan, Holsteiner, Trakhener, Andalusian/Lusitano, Oldenburg, Hanoverian, Miniature Horse, grade ponies, and grade horses. Respondents could choose multiple categories. Figure 2 shows the breed distribution organized by popularity. For horses that represented a small portion of the total breed composition in Alabama, these were combined into the “Other” category. Also, grouped together were warmblood breeds into “Warmblood,” draft breeds into “Draft,” and all ponies and miniatures are in the “Pony/Miniature” category.

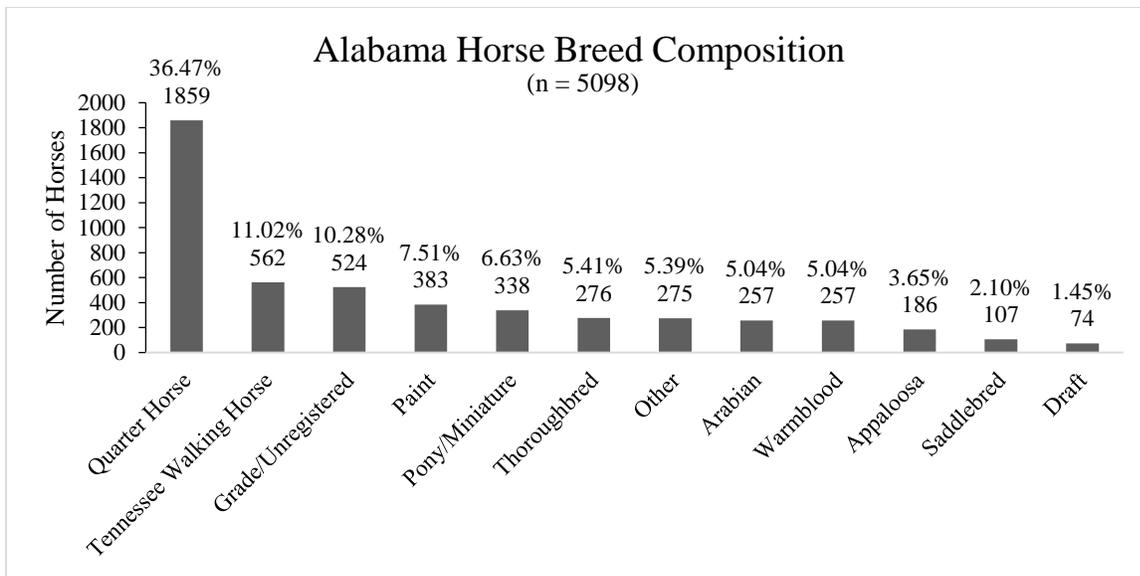


Figure 2. Alabama Horse Breed Composition

The survey revealed that 24% of respondents take some sort of riding lessons. These 263 people were broken down further into people who take private lessons and those who take group

lessons. Out of the 24% of total respondents who take riding lessons, 81% take private lessons and 19% take group lessons. Respondents took an average of 4.5 lessons each month.

When asked about training, 32% of respondents have a horse in some type of training. The breakdown of disciplines is shown in figure 3. Out of the 32% of respondents who have a horse in training, the percent of owners who have one or more horses in each of the following categories are listed: 12.6% barrel racing, 11.9% starting/breaking/backing, 9.1% hunter/jumper, 9.1% western pleasure, 9% “other,” 7.9% recreation, 6.5% eventing, 6.4% dressage, 5.5% English pleasure, 5.2% gaited, 4.3% halter, 3.4% roping, 2.9% cutting, 2.9% reining, 1.4% driving, 1.2% racing, and 0.7% team penning. Respondents could choose multiple categories.

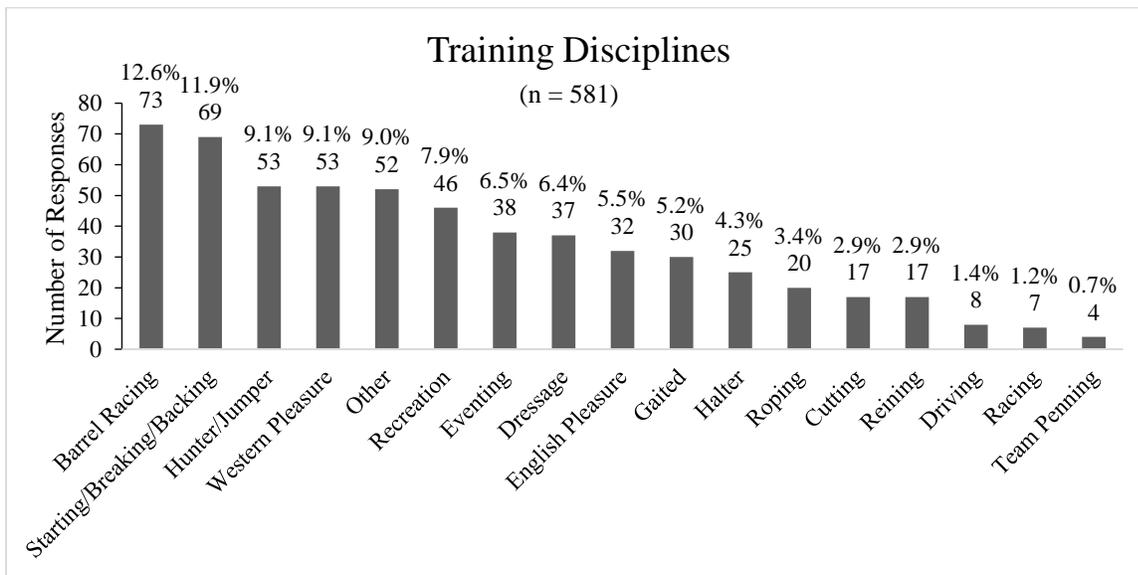


Figure 3. Training Disciplines

The cost to train horses was asked in increments and encompasses the total dollar amount spent each year on training for all of the respondents’ horses. As seen in figure 4, the majority of owners spend less than \$5,000 a year for training services. Annually, 31.9% pay less than \$1,000, 28.4% between \$1,000 and \$5,000, 0.9% between \$5,000 and \$10,000, 19.9% between \$10,000 and \$15,000, 0.6% between \$15,000 and \$20,000, 8.8% between \$20,000 and \$25,000,

3.5% between \$25,000 and \$30,000, 2.3% between \$30,000 and \$35,000, 1.5% between \$35,000 and \$40,000, 0.9% between \$40,000 and \$45,000, 0.3% between \$45,000 and \$50,000, 1.2% pay over \$50,000.

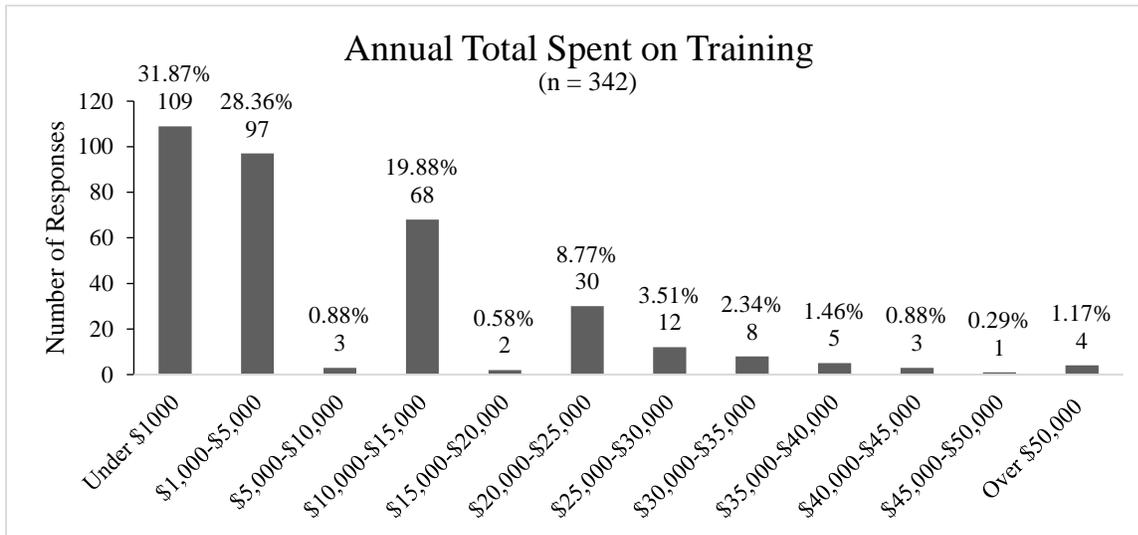


Figure 4. Annual Training Expenditures

Out of 1,063 responses on whether the owner shows their horse(s), 511 owners, or 48%, said they show. The types of shows varied from breed type shows, eventing or horse trials, racing, endurance or competitive trail, hunter/jumper, 4-H, rodeos, dressage, gaited shows, or other shows that were not a sanctioned club or organization event. Some respondents participated in more than one type of show. The types of shows owners attended are in figure 5. There were 20.86% respondents who showed in “other” type shows, 17.12% showed in breed type shows, 13.83% showed in rodeos, 10.66% showed in dressage shows, 10.09% showed in eventing or horse trials, 9.98% showed in hunter/jumper shows, 6.24% showed in endurance, competitive trail, or obstacle trail, 4.42% participated in 4-H shows, 4.42% showed in gaited shows, and 2.38% did some sort of racing.

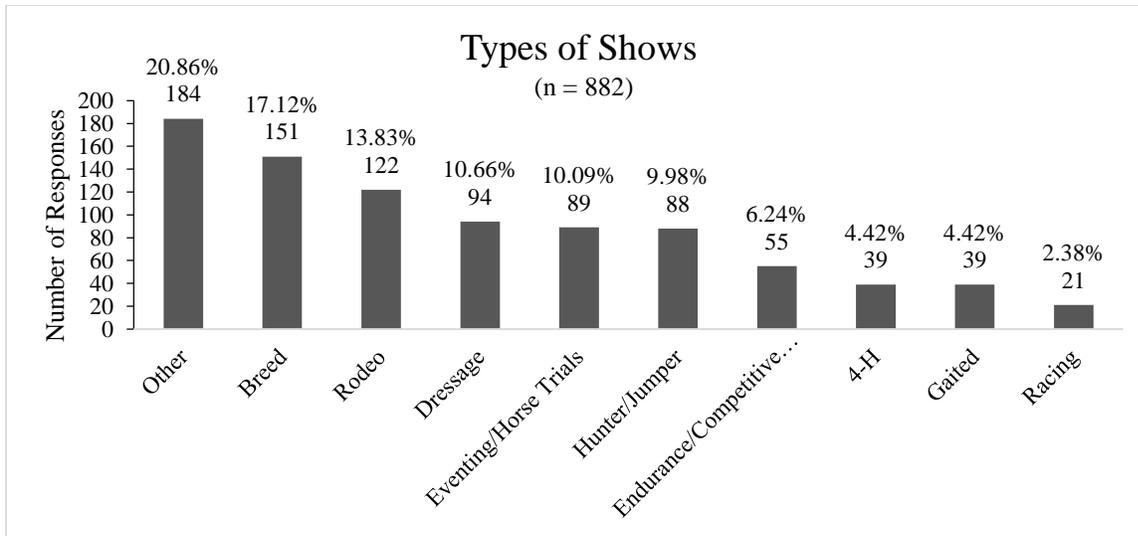


Figure 5. Types of Shows Attended in Alabama

The location of shows was either local or state competitions, regional, or national. The breakdown is in figure 6. Out of the respondents who claimed to show their horse(s), 28.54% of respondents only showed locally, 7.78% only showed regionally, 2% only showed nationally, 26.95% showed both locally and regionally, 4.59% showed both locally and nationally, 2.99% showed regionally and nationally, and 27.15% showed at the local, regional, and national levels.

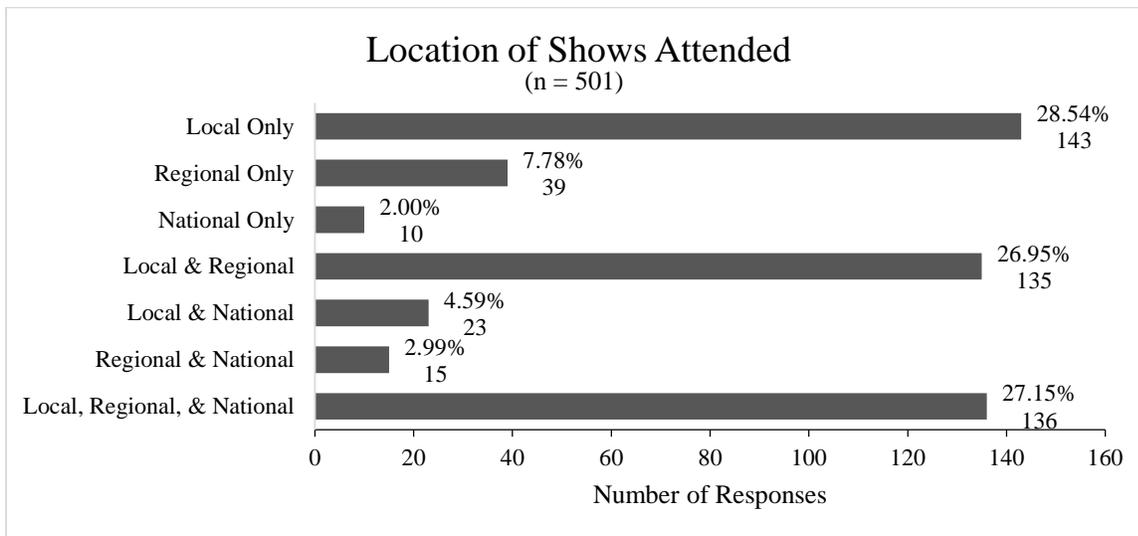


Figure 6. Location of Shows Attended

Interval costs of annual showing expenditures are in figure 7. Annually, 17.1% say they pay less than \$1,000, 32.6% between \$1,000 and \$5,000, 0.6% between \$5,000 and \$10,000, 28.6% between \$10,000 and \$15,000, 0.2% between \$15,000 and \$20,000, 10.2% between \$20,000 and \$25,000, 3.9% between \$25,000 and \$30,000, 1.8% between \$30,000 and \$35,000, 1.6% between \$35,000 and \$40,000, 1.8% between \$40,000 and \$45,000, 0.4% between \$45,000 and \$50,000, 0.8% pay over \$50,000.

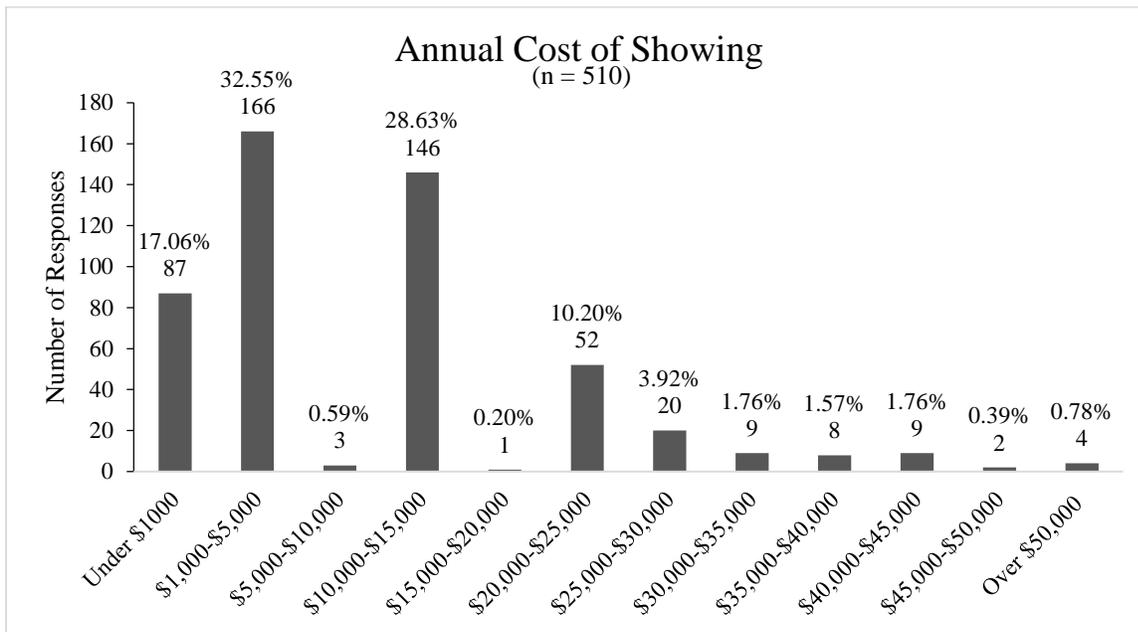


Figure 7. Annual Cost of Showing

Respondents were asked what they do with their horses that are not shown or trained. The responses are in figure 8. There were 221 respondents who said all of their horses were shown or trained, 2.1% said they had horses used for driving, 8.8% said breeding stock, 7.1% said ranch work, 21.5% said recreation, 19.7% said they had a “pasture ornament” or horses they did not ride, 27.5% said trail, and 13.3% said they used their horses for other purposes. There were 506 respondents who chose multiple categories.

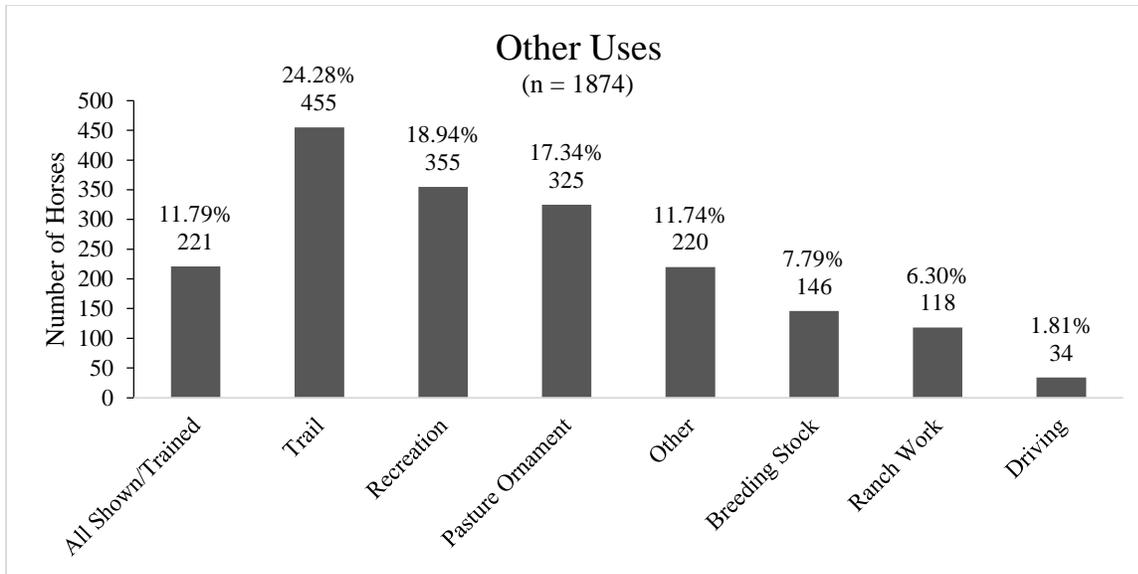


Figure 8. Other Uses for Horses

When asked about club or organizational involvement, 25.7% of respondents said they were not involved with any clubs or organizations. Table 1 shows the responses to each organization listed in the survey, showing the number and percentage of survey responses. The 18.08% of respondents that said they belonged to some other club or organization included local and unrecognized clubs such as drill teams and pony clubs. 265 respondents were involved with more than one club.

Respondents were asked about the number of horses they had insured for mortality or major medical or surgical. Respondents could choose multiple categories. Out of 4,863 horses, 8.2% had mortality insurance and 5.9% had medical or surgical insurance. Figure 9 shows the composition of insured versus not insured and is broken into 4 categories – no insurance, medical or surgical only, mortality only, and both medical or surgical and mortality insurance.

Table 1. Club/Organization Participation

Club/Organization Name	Number of Survey Responses	Percent of Survey Responses
Alabama Arabian Horse Association	29	2.02%
Alabama High School Rodeo Association	29	2.02%
Alabama Horse Council	142	9.87%
Alabama Hunter Jumper Association	43	2.99%
Alabama Junior High School Rodeo Association	15	1.04%
Alabama National Barrel Horse Association	74	5.15%
Alabama Obstacle Challenge	19	1.32%
Alabama Open Horseman Association	104	7.23%
Alabama Palomino Exhibitors Association	25	1.74%
Alabama Quarter Horse Association	145	10.08%
Alabama Reining Horse Association	6	0.42%
Alabama Stock Horse Association	21	1.46%
Alabama Thoroughbred Breeders Racing Association	5	0.35%
American Saddlebred Association of Alabama	13	0.90%
Birmingham Dressage and Combined Training Association	36	2.50%
McCurdy Plantation Horse Association	9	0.63%
Mounted Shooting	8	0.56%
Cutting Horse Association	19	1.32%
Outback Trail Riders	40	2.78%
Racking Horse Breeders Association	23	1.60%
The Equine Enthusiasts Division of the Alabama Farmers Federation	4	0.28%
Other	260	18.08%
Not involved with any clubs/organizations	369	25.66%

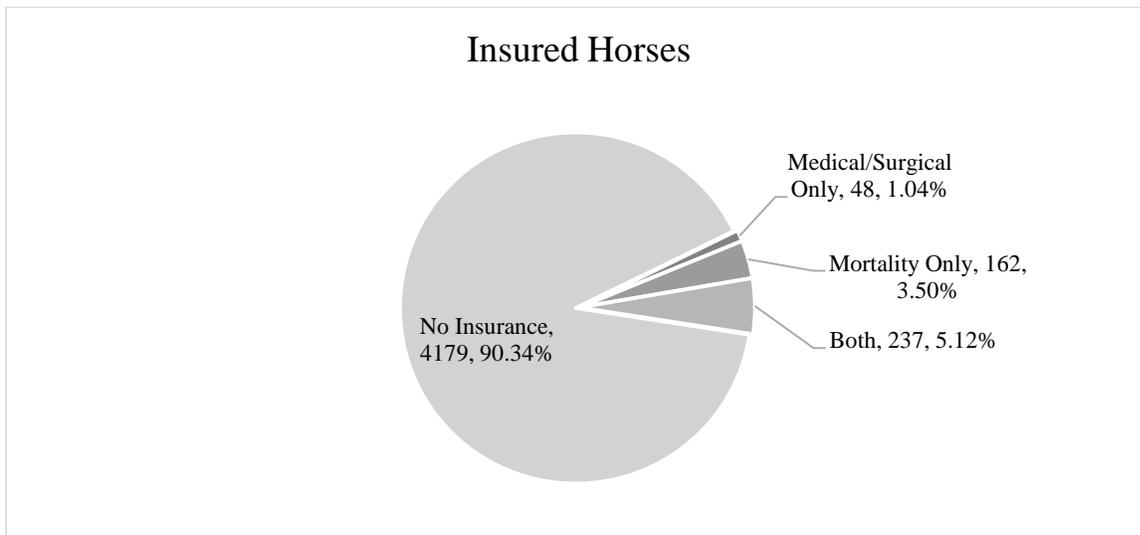


Figure 9. Insured Horses

The question concerning total annual base cost owners incur every year for all of the horses in their household had 1,019 responses. As seen in figure 10, of those responses, 7.4% say they pay less than \$1,000, 38.7% between \$1,000 and \$5,000, 0.5% between \$5,000 and \$10,000, 27.5% between \$10,000 and \$15,000, 0.8% between \$15,000 and \$20,000, 11.0% between \$20,000 and \$25,000, 6.1% between \$25,000 and \$30,000, 2.4% between \$30,000 and \$35,000, 2.0% between \$35,000 and \$40,000, 1.8% between \$40,000 and \$45,000, 0.7% between \$45,000 and \$50,000, 1.4% pay over \$50,000.

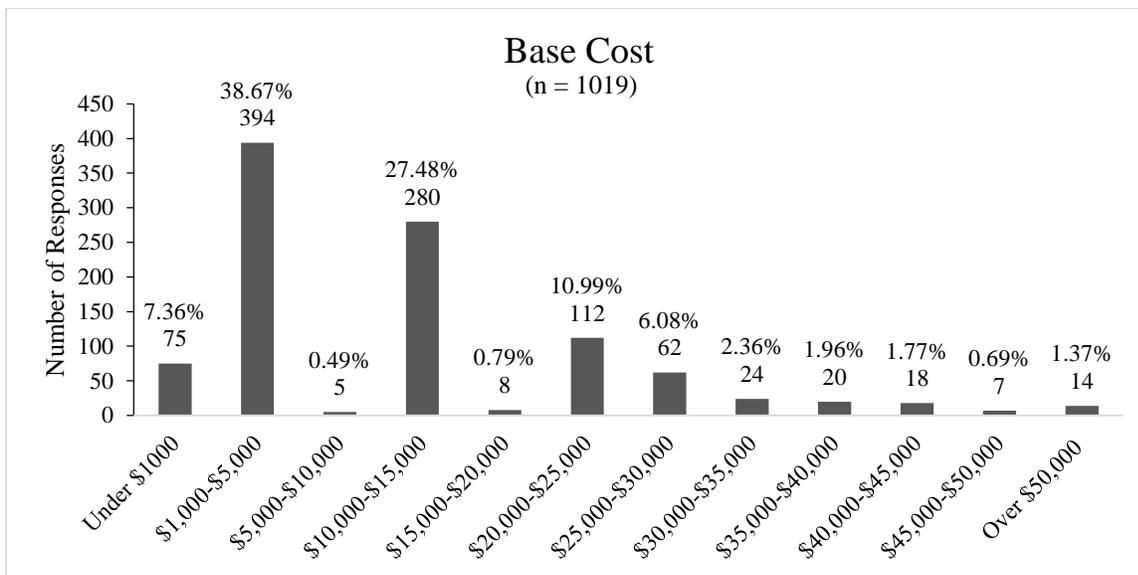


Figure 10. Annual Base Cost for All Horses in Household

From the base cost question, an average base cost per horse was calculated by dividing the base cost by the number of horses the respondent said they had. Figure 11 shows the average base cost per horse. From the responses, 12.97% of horses cost less than \$1,000 a year, 56.79% between \$1,000 and \$5,000, 19.48% between \$5,000 and \$10,000, 5.65% between \$10,000 and \$15,000, 2.16% between \$15,000 and \$20,000, 0.88% between \$20,000 and \$25,000, 0.70% between \$25,000 and \$30,000, 0.56% between \$30,000 and \$35,000, 0.27% between \$35,000

and \$40,000, 0.11% between \$40,000 and \$45,000, 0.23% between \$45,000 and \$50,000, 0.20% cost over \$50,000.

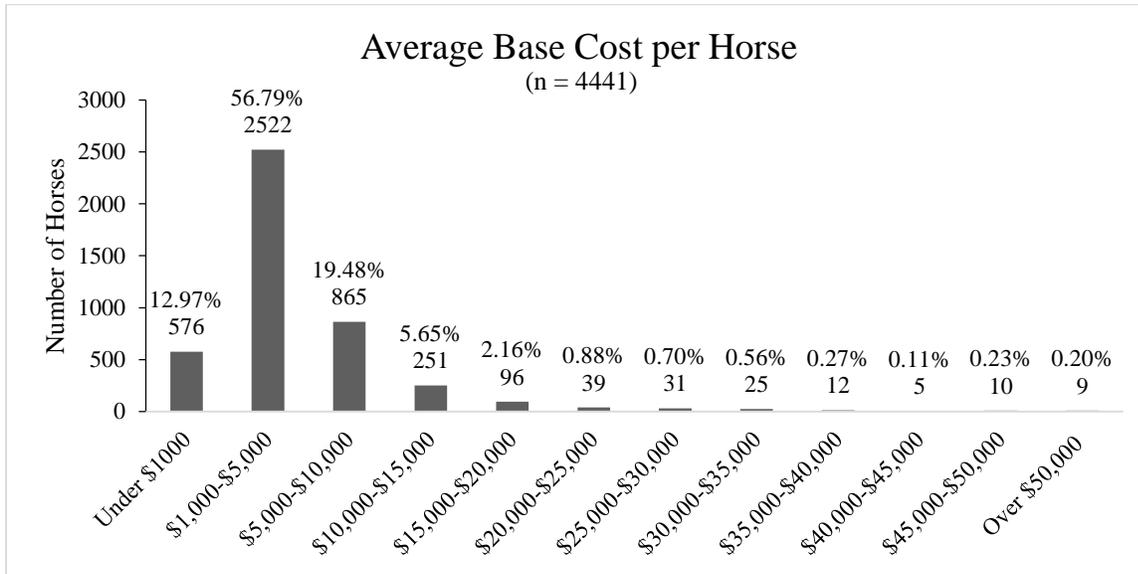


Figure 11. Average Base Cost per Horse

Goods and Services

Following the general form of the 2006 Alabama study (Whiting, Molnar and McCall 2006), budgets were developed for three categories of horse ownership based on level of care. These categories are low cost, moderate cost, and high cost. Goods and services range in price so the categories are based on the amount of money that is spent to procure each good or service. This has to do with what the horse is being used for, owner preferences, and individual horse needs. Each of these three categories is divided into a bottom range, a top range, and a median cost. The bottom range is the minimum cost recorded when gathering data. The top range is the maximum cost recorded when gathering data. The median is the median of the data gathered. The total budget summary and economic impact are based on the median cost in each category.

The prices for goods and services were collected using different methods such as phone questionnaires and online search engines. Some items purchased by horse owners or service providers were priced according to online retailer rates. These online retailers were found online using a search engine by typing in the good or service in question. These prices were put into a spreadsheet and the average prices were used in the budget calculations. Items and services that were priced this way include board, bedding, grooming items, riding lessons, training, and feed.

Farriers were located via a membership list found online after using a search engine to look for “Alabama farriers” (Alabama Professional Farriers Association 2015). From the list, there were thirty located in Alabama who were contacted and asked to participate in a voluntary and confidential survey on Alabama horse costs. From those thirty, twenty-one either did not respond or declined to answer any questions, and nine completed the phone questionnaire. The questions included what was charged for a basic trim, front shoes, all four shoes, whether they did any specialty shoes and what they would cost, and if there were any other miscellaneous charges for performing farrier services. Three farriers claimed to charge a service fee to pay for gas if a client was more than 25-50 miles away, but all three said that they mainly service very local clients and rarely charged that fee. Therefore, this service fee was not included in the farrier budget.

Veterinarians were found by word of mouth and by an online search for “Alabama equine veterinarians” and contacted via email or phone about voluntarily participating in a confidential survey on Alabama horse costs. Thirty-four veterinarian clinics were contacted. Out of the thirty-four, twenty did not wish to participate, did not offer equine services, or did not respond. Fourteen veterinarians or their assistants participated in the questionnaire and gave the prices they charged for different services they performed on a regular basis. These services included

farm calls, Coggins tests, health papers, deworming, teeth floating, joint injections, and vaccinations. When asked about emergency services such as colic or injury, there was no good idea of an average price or an estimation of how often a horse has an emergency due to the uniqueness or severity of each situation; therefore, emergency services are not included in the budget. Different vaccinations and their importance used to break down the budgets were identified via a resource found from an online search engine (American Association of Equine Practitioners 2012).

For grooming and horse care, three different online retailers were used to calculate prices for common grooming items such as brushes, hoof picks, fly spray, combs, detangler, etc. These retailers were found using an online search engine for “horse care and grooming products.” The prices from each store were averaged together to determine costs to use for calculations.

Boarding facilities were looked up using a search engine online for “Alabama horse boarding” and costs were calculated using the facilities who posted their rates on their website. The facilities were categorized by the level of care offered to clients including pasture board, partial board, and full board. There were seventeen boarding facilities used in calculating the average costs.

Places offering lessons were found online and the nineteen different facilities who posted prices online were used. These facilities were found by using an online search engine for “riding lessons.” Lessons were categorized as private lessons and group lessons.

There were twelve different training facilities identified online who posted rates on their webpage used in calculations. The facilities stated what was included with their monthly training rates such as how many days a week the horse would be worked and the intensity of training.

Feed stores were located from local sources and via an internet search engine. Sixteen different feed stores including chain, co-ops, and smaller more localized stores were contacted via phone and asked for feed prices. They were asked for prices on what the cheapest horse concentrate was, the most common concentrate bought, and the most expensive concentrate, all in fifty pound bags. Hay prices and weights were asked for square bales, round bales, and alfalfa bales. These prices and weights were used to calculate a cost per poundage of feed.

Equipment prices were found using Clemson livestock budgets (Clemson Cooperative Extension 2016), Kentucky horse budgets (Burdine and Coleman 2006), and Virginia Extension horse budgets (Virginia Cooperative Extension 2011). High end trailers in particular were priced using recent sales of trailers sold in Alabama from an online retailer found using a search engine for an online search of “horse trailers in Alabama.” These prices were estimated to use in capital recovery calculations. The purchase prices were not directly used in the budget and were for reference purposes only.

Whiting, Molnar, and McCall completed a horse study for Alabama in 2006 where they collected data on horse ownership expenses. Tack, apparel, and publicity expenses from that study have not changed significantly; however, they were updated by adjusting for an inflation rate of 19.2% which was the total inflation from 2006 to 2016 (United States Bureau of Labor Statistics 2016).

Maintenance and repair costs and electrical utilities were used from a South Dakota State University study (Renelt 2011). The costs for maintenance and repair were inflated by 6.8% to account for the inflation between 2011 and 2016 and adjusted based on the level of care. To account for more equipment, barn or shelter value, and fencing quality increases, the intervals were valued as a percent increase. These percent increases were initial guesstimates at 50%,

250%, and 500% and were deemed satisfactory by ten different Alabama horse experts. The electrical utilities were estimated at \$.10 per day for a 1,100 pound horse on a dry lot (Renelt 2011). This estimate was considered the top range for the low cost horse. The bottom range was estimated at zero since not every horse owner utilizes power for their horse or facilities. Each additional level of care increased the estimated power cost by \$.10 per day based on approximated additions to account for electrical fencing, fans, lights, water heaters, and other items powered by electricity. Ten Alabama horse experts agreed these figures looked accurate.

Water utilities were determined by the amount of water a horse drinks daily, then multiplying the number of gallons by the price per gallon charged. The base cost was from an online provider found when using an online search engine for “Alabama water rates” and then converted into a cost per gallon based on website information (Birmingham Water Works Board 2016). As the level of care increases, the number of gallons used is doubled for each range. This is done to account for water wasted from cleaning troughs and bathing horses. For horses being maintained on well water, while there is no direct charge for the well water, there would be wear and tear on the pump. So while for the purposes of the budget a municipal water source is assumed, it should be noted that maintenance on a pump should be included if well water is utilized.

IMPLAN

To determine the overall economic impact the horse industry has on Alabama, IMPLAN (IMpacts for PLANning) is the input-output analysis software used in this study. Numerous studies on the economic impact of the horse industry in Alabama (Whiting, Molnar and McCall 2006) and other states (Beattie et al. 2001; Rephann 2011; Menard et al. 2010) utilize input-output analysis.

The input-output analysis is about the implications of economy development given certain production practices. To show the computational procedure in conventional input-output analysis, the following system of equations is taken from McCarl and Spreen (2004). When setting up input-output analyses, the sectors involved must be identified, the transaction matrix must be developed, and the final demand vector is established (McCarl and Spreen 2004). Input-Output analysis requires a transaction matrix, T. Matrix T is a square matrix, with element t_{ij} providing the level of spending by sector j on goods and services from sector I. From the transaction matrix, the technical coefficient matrix, A, can be derived. Equation 1 describes the elements in the technical coefficient matrix.

$$(1) a_{ij} = t_{ij} / \sum_k t_{kj}$$

where a_{ij} is an element in the technical coefficient matrix, t_{ij} is the corresponding element in the transaction matrix, and the denominator is the total spending in the j^{th} sector. (Each element of A will be ≤ 1 .) From this technical coefficients matrix the fundamental equation of input-output analysis is formed in equation 2 which states

$$(2) X = Y + AX$$

where X is a vector giving the amount of total activity in the economy, Y is the final demand, and A is the technical coefficients matrix described above. This shows the total economic activity is equal to the amount of final demand plus the value of the necessary intermediate products. By manipulating the equation we get equation 3

$$(3) X - AX = Y$$

showing that the total production minus the intermediate products equals final demand.

Furthermore in equation 4

$$(4) (I - A)X = Y$$

Where I is an identity matrix of equal dimension to A, and I - A is a square matrix with non-negative diagonal elements and non-positive entries for the off-diagonal elements. If I - A is invertible then equation 5 shows the solution as

$$(5) X = (I - A)^{-1}Y$$

giving the final equation in the computational procedure for input-output analysis.

The IMPLAN software uses data from federal agencies on the national and regional levels to estimate total impacts of different industry categories. These categories are set up with multipliers to estimate total effects given dollars spent in that sector. The outcome is an input-output table tailored to the specific region or state being analyzed. There are three different effects analyzed: direct, indirect, and induced. Rephann (2011) created a diagram to show how the three parts of total impact work and that diagram was replicated and modified for the state of Alabama. Figure 12 shows the flow of direct, indirect, and induced spending to demonstrate how the total economic impact is characterized. These three impacts are calculated using total sales, employment, labor income, value-added, and tax revenues. The total sales are the total value of industry output for a given time period. It measures sales of intermediate inputs for use in production and sales as final product. IMPLAN measures employment as a job of one year in length but includes full and part time as well as self-employment. Labor income is just dollars produced from hired labor. Value-added is a subset of total industrial output and to avoid a double counting error from intermediate assets, returns only sales to final consumers. The tax revenue inputs are also estimated through IMPLAN. These estimates include local, state, and federal taxes for employee compensation, proprietor income, tax on production and imports, households, and corporations.

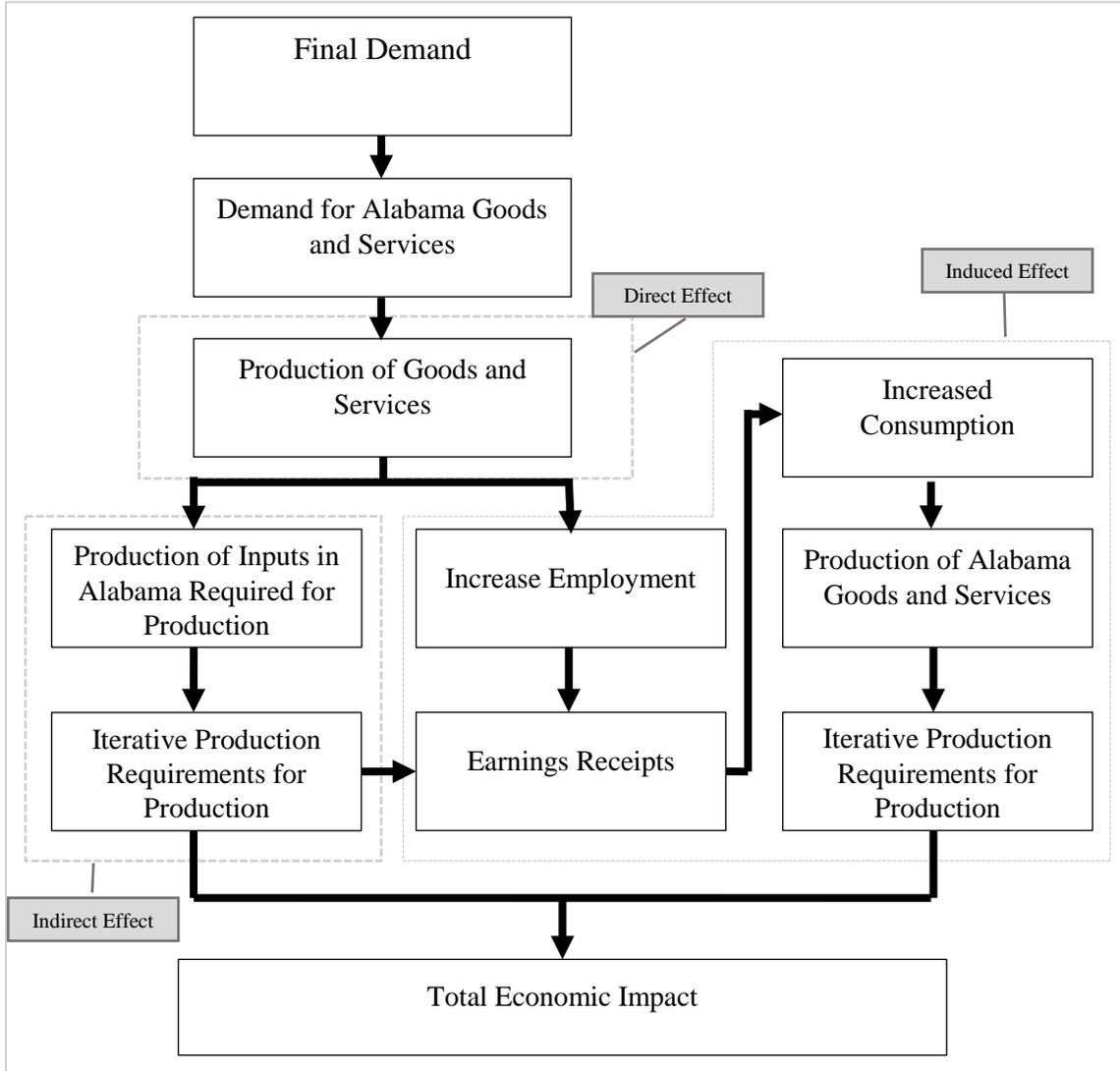


Figure 12. Economic Impact Diagram

Source: Rephann, 2011

The uniform industry classification scheme for federal government industry based data sets is the six digit North American Industry Classification System (NAICS). These codes were used to classify each type of economic activity for the Alabama horse industry. A NAICS keyword search provides the code for an activity (NAICS Association 2015). The code is then translated into a MIG (formerly known as the Minnesota Implan Group) sectoring scheme.

Sectoring schemes provide a means of combining and classifying industrial data, and each database type has a unique format for grouping and classifying industries. In general, an industrial classification scheme allows categorization according to the type of products or services produced by the industry (MIG Inc. 2012).

To get total expenditures for each category to input into IMPLAN, the first step is estimating the number of horses in Alabama and the percentages that participate in each type of expenditure. The estimated number of horses in each category is multiplied and added together based on whether they fall into the low, moderate, or high cost of care category. This produces a total expenditure for each category. Then, each category is matched to its proper IMPLAN sector using a North American Industry Classification System (NAICS) keyword search (NAICS Association 2015) and matching the NAICS codes to IMPLAN codes using MIG sectoring schemes (MIG Inc. 2012). To input the final expenditures into IMPLAN, a new activity is created and the different expenditures in each sector is added. The category and the IMPLAN sector and codes are found in table 2.

Statewide impact results will be run twice, one based strictly on survey data and considered an optimistic approach and again with level of cost percentages based on the previous Alabama study (Whiting, Molnar and McCall 2006) as a conservative approach.

Table 2. IMPLAN Sector Codes

IMPLAN Sector Codes		
Category	Sector	Code
Feed	Other animal food manufacturing	42
Board	Support activities for ag and forestry	19
Farrier	Support activities for ag and forestry	19
Veterinary	Veterinary Services	379
Grooming	Retail - Miscellaneous	330
Bedding	All other wood product manufacturing	103
Tack	Other leather and allied product manufacturing	94
Apparel	Retail - Sporting goods, hobby, book and music	328
Breeding Fees	Animal production, except cattle, poultry and eggs	14
Publicity	Advertising and related services	377
Show	Other amusement and recreation activities	410
Lessons	Other educational services	393
Training	Support activities for ag and forestry	19
Pasture Maintenance	Facilities support services	385
Barn Maintenance	Maintenance and repair construction of nonresidential	39
Machinery Maintenance	Commercial & industrial machinery & equipment repair & maintenance	417
Utilities - Water	Water, sewage, and other systems	33
Utilities - Power	Electric power generateion, transmission, and distribution	31
Horse Insurance	Insurance carriers	357
Barn	Construction of other new nonresidential structures	36
Fence	Retail - Building material and garden supply	323
Tractor/other	Farm machinery and equipment manufacturing	203
Trailer	Truck trailer manufacturing	280
Truck	Light truck and utility vehicle manufacturing	277

Budgets

Budgets were developed for different levels of horse ownership costs: low cost, moderate cost, and high cost. The low cost budget is for horses cared for on a more economical scale, just the basics with little to no extra expense. An example is a typical backyard horse - the horse is kept barefoot on pasture, perhaps fed an inexpensive grain once or twice a day, and ridden occasionally with secondhand tack. The moderate cost budget is for horses that receive a slightly more intensive level of care through additional products or more involved services. For example, the horse is shod, in a stall at night and turned out during the day, the rider takes lessons twice a week and trail rides some weekends. The high cost budget is for horses getting extensive daily care and using higher end products and more intensive services not generally used in the previous budgets. For example, the horse is shown regularly and attends national level shows so is kept in training the majority of the year and the owner utilizes high end tack and show apparel. It gets specialty shoes and is worked and bathed regularly with limited pasture turnout, there is a fan in the stall and the horse gets high quality feed and alfalfa hay twice a day. The difference between the three budgets can be summarized as the level of intensity of care the horses receive on a daily or weekly basis. The higher the intensity, the more expensive horse ownership will be. Owner preferences on brands and items wanted will also play into the amount spent on the horse. These budgets are for the annual care of the horse and do not include the cost of buying or leasing a horse.

Previously developed published budgets for horse ownership were reviewed as a basis for constructing current budgets for Alabama. These previously published budgets included costs such as veterinary and health, farrier, bedding, grooming, supply or horse care costs, training, lessons, machinery and equipment, barns or shelters, shows and/or travel, and boarding with

additional costs varying across different states and different budgets. Studies and budgets were reviewed from Alabama (Whiting, Molnar and McCall 2006), Arizona (Beattie, et al. 2001), Virginia (Rephann 2011), Pennsylvania (Swinker, et al. 2003), Kentucky (Stowe 2013), and Tennessee (Menard, et al. 2010). The costs in these studies established categories of expected expenses that were used to help build the current budgets for Alabama in this study.

To develop accurate budgets, goods were found via an online search and a range of costs were determined. As discussed in the previous chapter on methods, service costs were calculated by using a series of phone interviews to farriers and veterinarians. Horse owners were asked to participate in an online survey via email and social media which helped develop show costs and gave the average frequency of lessons for those that participated. Other costs considered were estimated using a variety of published research and other equine studies.

The expenses in the budgets are on a per horse basis. Expenditures were broken up into their respective high, moderate, or low care cost categories. Then each category of costs was divided into a range of the cheapest, or bottom price, and the most expensive, or the top price. The median of these costs in each category were used in the budget tables. Draft budgets were reviewed by ten Alabama horse owners or experts for accuracy.

Operating Expenses

Expenses that can fluctuate annually depending on level of input use and changing prices are considered variable or operating costs. By contrast, fixed or ownership costs are those that would be incurred in the short run, even if an owner were to sell all horses. Fixed costs involve ownership costs for durable assets, such as machinery, buildings, and equipment. These costs can be changed in the longer run, if the asset is sold or given away, but will be incurred until that happens.

Operating expenses in this study were divided into basic and extra care classifications to distinguish between what is required for ownership and what are additional costs that not every horse owner incurs. There is a difference in the breakdown for horse owners who keep their horses on their own property and horses that are boarded; however, the calculations are the same for each category. The costs that the boarding facility incurs are separated into their own section for later use in calculations of economic impact.

Basic costs include items that the average horse owner needs to care for and maintain a horse. For the horses kept at home, these expenses include feed, farrier, veterinary, bedding, grooming supplies, maintenance, equipment, and utilities. For the boarding budget, these expenses include farrier, veterinarian, medications, and grooming. Feed, bedding, maintenance, equipment, and utilities are considered an expense for the boarding facility, and the costs are reflected in its boarding. Extra costs are ancillary items used by owners who participate in different activities with their horse(s). These items include, but are not limited to, tack, apparel, breeding fees, publicity, show expenses, lessons, and training. Some required costs (e.g. feed, medical care) are variable, while others (e.g. costs of owning land or machinery) are fixed.

Boarding

Horse owners who do not have the facilities to keep their horse(s) or who do not wish to keep their horse(s) on their land may board their horse(s). There are different levels of board associated with different services provided. Additional services come with additional cost.

The lowest form of board is “pasture board” where the horse is simply kept in a pasture at the boarding facility with access to water and hay, and fed grain once or twice a day. Pasture board is the most basic and inexpensive form of boarding a horse. With “partial board” the boarding facility offers more benefits that may include stalling, conditioning, grooming, etc.

This type also can require the horse owners perform certain services for their own horse(s) such as feeding, mucking stalls, or blanketing. “Full board” means an owner is paying for all services to be performed by the boarding facility and is a popular choice for owners who are boarding their horses for show training, or simply do not have time to see their horse every day.

Table 3 shows a range of boarding fees for different levels of boarding care. Dollars per month are the actual prices found online. Dollars per year are the dollars per month multiplied by twelve. The costs were estimated from seventeen Alabama boarding facility websites found using an online search engine for “Alabama boarding facilities.” The boarding fees include all feed expenses. For each level of care, a bottom of the range, a top of the range, and the median cost is presented, based on information gleaned from review of internet sites for facilities. Low cost is pasture board to partial board. Moderate cost is partial barn board to lower end full board. High cost is full board to high end facility full board with more services. The boarding fees in table 3 do not reflect any extra fees such as training or showing costs.

Table 3. Boarding Fees

		Boarding Fees		
		Bottom Range	Top Range	Median
Low	\$/month	\$150.00	\$250.00	\$200.00
	\$/year	\$1,800.00	\$3,000.00	\$2,400.00
Moderate	\$/month	\$215.00	\$425.00	\$320.00
	\$/year	\$2,580.00	\$5,100.00	\$3,840.00
High	\$/month	\$450.00	\$950.00	\$700.00
	\$/year	\$5,400.00	\$11,400.00	\$8,400.00

Feed

To get an accurate estimation on feed expenses, different types of feed commonly used needed to be identified and priced. Sixteen different Alabama feed stores who sold horse feed were

identified through personal knowledge and an online search. These feed stores were contacted via phone to ask prices on horse feed – concentrate and hay. Each store was also asked the weight of their hay bales. To get the cost per pound, the price for each 50 pound bag of concentrate, round baled hay, square baled hay, and alfalfa hay was divided by the poundage of each item. The median cost and poundage for each item was used to calculate the feed costs on a per pound basis in table 4. The cost is the average price of contacted feed stores, pounds are the average weight of the item as advertised by feed stores, and the price per pound is the cost divided by pounds. The cheap feed included a basic sweet feed mix, the average was a pelleted low non-structural carbohydrate feed, and the expensive feed included a mixture of senior feeds and name brand feeds.

Table 4. Average Feed Costs

Average Feed Costs			
Item	lbs	cost	Price per lb
Grain - Cheap Bag	50	\$9.00	\$0.18
Grain - Average Bag	50	\$16.25	\$0.33
Grain - Expensive/Senior	50	\$21.00	\$0.42
Hay - Square Bale	55	\$6.50	\$0.12
Hay - Round Bale	800	\$55.00	\$0.07
Hay - Alfalfa	60	\$15.50	\$0.26

The amount of feed an individual horse needs is determined by the size of the horse and the amount of activity the horse assumes. The classifications for activity are maintenance, light, moderate, and heavy. A horse is considered maintenance when it is mature and idle or not being worked at all, light work is 1-3 hours per week, moderate work is 3-5 hours per week; and heavy work is more than 4-5 hours per week (National Research Council 2007). The first step was to determine a ration for how much feed a horse needs to consume each day based on its body weight to satisfy total daily nutritional requirements. This is called dry matter intake. The dry

matter intake for the following tables was estimated for air-dry feed or 90% dry matter (National Research Council 2007; Chiba 2014). After the total ration was calculated, the amount of hay and concentrate needed in a diet was calculated based on the average level of activity for a horse. The total daily consumption started with hay, and then as the work level increased, more concentrate was added into the percentage of daily feed since concentrate has a higher density of nutrients for harder working animals. According to the 1989 National Research Council, a maintenance level horse was on a forage diet only, light work is 35% concentrate and 65% forage, moderate work is 50% concentrate and 50% forage, and heavy work is 65% concentrate and 35% forage. The amount of total dry matter intake and concentrate per hundredweight that a horse is suggested to consume based on activity level was converted into a poundage basis for ease of calculations in table 5 (National Research Council 1989; Albert and Kline 1987).

Table 5. Total Daily Feed Requirements Based on Activity Level

Feed Consumption per Pound Body Weight				
	Maintenance	Light	Moderate	Heavy
Concentrate	0	0.007	0.01125	0.01625
Forage	0.02	0.013	0.01125	0.00875
Total	0.02	0.02	0.0225	0.025

Total daily intake for each class of horse is given in table 6. This table shows the calculated total daily dry matter consumption of both hay and concentrate for horses weighing 400 to 1600 pounds with 200 pound increments. Total consumption is the total pounds of feed needed to be consumed each day, hay and concentrate, according to weight and workload. Maintenance and light workloads require the same total daily feed intake and were combined in table 6. Since the total concentrate and hay intake are different, they are separated in other tables.

Table 6. Total Daily Feed Consumption for Weight and Workload

Total Daily Feed Intake Requirement According to Weight		400	600	800	1000	1200	1400	1600
Total Consumption (lbs)	Horse Weight (lbs)							
	Maintenance/ Light	8	12	16	20	24	28	32
	Moderate	9	13.5	18	22.5	27	31.5	36
	Heavy	10	15	20	25	30	35	40

The amount of concentrate to be fed depends mainly on the activity level of the horse. The concentrate is calculated as a percentage of bodyweight and the remaining total daily intake requirement should be fed as hay. The total pounds consumed is dependent on the level of work expected and broken down into the necessary daily consumption of concentrate and hay. These calculations were based on the percentage to be fed based on body weight from table 5.

The average weight of a horse varies due to differences in breeds and purpose of the horse. This study is using 1,000 pounds as an “average” size horse for the simplicity of calculations, though horse owners will adjust feed intake for factors such as size of horse, workload performed, environmental considerations, and individual animal variation. Table 7 provides estimates of feed cost for a 1,000 pound horse by level of activity. Concentrate is the amount needed based on workload multiplied by bodyweight. Hay is the total pounds of feed required minus concentrate required. Feed cost per day is the amount of concentrate required multiplied by the price of feed per pound. Hay cost per day is the amount of hay required multiplied by the prices of hay per pound. The total cost per day is the total daily feed cost plus the total daily hay cost. Total annual cost is the total cost per day multiplied by three hundred and sixty five days. Costs in table 7 were determined by multiplying the amount of concentrate

and hay to be fed by their respective prices per pound as shown in table 4. Portions of concentrate and hay required were calculated based on the level of work expected. The feed was sorted into low, moderate, and high cost categories. Low cost was calculated using cheap feed and rolled hay only, moderate cost used an average cost feed and square baled hay, and high cost used an expensive feed with an estimated $\frac{3}{4}$ square bale and $\frac{1}{4}$ alfalfa hay mixture. For a low cost, maintenance horse on pasture, it was presumed for the budget to only need hay for 6 months out of the year so the daily feed cost could be cut in half to \$0.69 per day for a total of \$251.85 per year.

Table 7. Feed Costs Based on Work Level

Body Weight (lbs)	Work Expected	Maintenance (idle)	Light Work (1-3 hrs/week)	Moderate Work (3-5 hrs/week)	Heavy Work (>5 hrs/week)
		Concentrate (lbs)	Hay (lbs)	Total (lbs)	Concentrate (lbs)
1000	Concentrate (lbs)	0	7	11.25	16.25
	Hay (lbs)	20	13	11.25	8.75
	Total (lbs)	20	20	22.5	25
	Total Cost (\$/year)	\$501.88	\$786.12	\$1,021.43	\$1,287.20
Low Cost	Cheap Feed (\$/day)	\$0.00	\$1.26	\$2.03	\$2.93
	Roll Hay (\$/day)	\$1.38	\$0.89	\$0.77	\$0.60
	Total Cost (\$/day)	\$1.38	\$2.15	\$2.80	\$3.53
Moderate Cost	Avg Feed (\$/day)	\$0.00	\$2.28	\$3.66	\$5.28
	Square Bale (\$/day)	\$2.36	\$1.54	\$1.33	\$1.03
	Total Cost (\$/day)	\$2.36	\$3.81	\$4.99	\$6.32
	Total Cost (\$/year)	\$862.73	\$1,391.15	\$1,819.82	\$2,305.10
High Cost	Expensive Feed (\$/day)	\$0.00	\$2.94	\$4.73	\$6.83
	3/4 square 1/4 alfalfa (\$/day)	\$3.06	\$1.99	\$1.72	\$1.34
	Total Cost (\$/day)	\$3.06	\$4.93	\$6.45	\$8.17
Total Cost (\$/year)	\$1,118.50	\$1,800.13	\$2,353.78	\$2,980.47	

For the final budget summary, a 1,000 pound horse is assumed. It should be taken into account that for horses of different sizes, feed costs would need to be adjusted. Table 8 provides a summary of annual feed costs for horses of various weights. Maintenance level is the total annual cost of hay consumed based on bodyweight. Light, moderate, and heavy workloads are

the annual total cost of concentrate and hay consumed based on bodyweight. This table uses the same method of cost valuation as seen in table 7.

Table 8. Annual Feed Costs According to Weight

		Total Annual Feed Costs According to Weight						
Horse Weight (lbs)		400	600	800	1000	1200	1400	1600
Low Cost	Maintenance	\$200.75	\$301.13	\$401.50	\$501.88	\$602.25	\$702.63	\$803.00
	Light	\$314.45	\$471.67	\$628.90	\$786.12	\$943.34	\$1,100.57	\$1,257.79
	Moderate	\$408.57	\$612.86	\$817.14	\$1,021.43	\$1,225.72	\$1,430.00	\$1,634.29
	Heavy	\$514.88	\$772.32	\$1,029.76	\$1,287.20	\$1,544.63	\$1,802.07	\$2,059.51
Moderate Cost	Maintenance	\$345.09	\$517.64	\$690.18	\$862.73	\$1,035.27	\$1,207.82	\$1,380.36
	Light	\$556.46	\$834.69	\$1,112.92	\$1,391.15	\$1,669.38	\$1,947.61	\$2,225.84
	Moderate	\$727.93	\$1,091.89	\$1,455.85	\$1,819.82	\$2,183.78	\$2,547.74	\$2,911.70
High Cost	Heavy	\$922.04	\$1,383.06	\$1,844.08	\$2,305.10	\$2,766.12	\$3,227.14	\$3,688.16
	Maintenance	\$447.40	\$671.10	\$894.80	\$1,118.50	\$1,342.20	\$1,565.91	\$1,789.61
	Light	\$720.05	\$1,080.08	\$1,440.10	\$1,800.13	\$2,160.15	\$2,520.18	\$2,880.20
	Moderate	\$941.51	\$1,412.27	\$1,883.03	\$2,353.78	\$2,824.54	\$3,295.30	\$3,766.05
	Heavy	\$1,192.19	\$1,788.28	\$2,384.38	\$2,980.47	\$3,576.56	\$4,172.66	\$4,768.75

Farrier

Horses require maintenance on their hooves every 6 to 8 weeks on average. The wear of the hoof and what the horse is being used for determines the amount of maintenance and whether the horse needs just trims or shoes. Shoes may just be needed on the front feet, on all four, or may be a specialty shoe such as for show or therapeutic to treat an existing condition. To calculate average farrier prices for these different types of shoe, Alabama farriers were contacted by phone and asked to provide information about what they charged clients for specific services. These farriers were found after an online search using a search engine for “Alabama farriers” turned up a membership directory for farriers in Alabama (Alabama Professional Farriers Association 2015). Out of the thirty farriers that were contacted from the directory based on an Alabama location, nine of them agreed to answer the questions. The other twenty-one either did not wish

to participate or did not respond. The questions and the average responses can be seen in table 9. For trims, farriers responded that they charged a range of \$40 to \$50 with an average of \$43.89. For front shoes, the range was \$60 to \$130 for an average of \$93.13. For shoes applied to all four feet, the range was \$75 to \$195, for an average price of \$135.56. For specialty shoes such as therapeutic uses or show, the range was \$100 to \$275, for an average of \$196.43. The range of charges may reflect differences in quality of services that could not easily be captured by telephone interview.

Table 9. Farrier Questions and Average Responses

Question	Average
How much is a general trim?	\$ 43.89
How much are front shoes?	\$ 93.13
How much are all four shoes?	\$135.56
How much are specialty shoes? (bar or show)	\$196.43

For the purposes of the budgets, it was estimated that the farrier came every 7 weeks (midpoint of the 6-8 week range). Given this, the farrier would see each horse 7.4 times a year. Low cost horses were assumed to get trims only. Moderate cost horses were estimated as the average cost of getting a trim and getting front shoes. High cost horses were calculated as the average cost of front, full, and specialty shoes. Table 10 shows the average cost per visit and cost per year. The average price per visit for the low cost horse is the average cost for a trim. The average price per visit for the moderate cost horse is the average price of a trim, front shoes only, and all shoes on all four feet. The average price per visit for the high cost horse is the average price of front shoes only, shoes on all four feet, and specialty shoes. The total annual cost is the price per visit multiplied by 7.4, the estimated number of times the farrier would work on feet each year.

Table 10. Farrier Costs

Farrier Costs		Average
Low Cost	\$/visit	\$43.89
	\$/year	\$326.93
Moderate Cost	\$/visit	\$90.86
	\$/year	\$676.79
High Cost	\$/visit	\$141.70
	\$/year	\$1,055.54

Veterinary

To calculate veterinary costs, different veterinary clinics in Alabama were contacted by phone or email and asked about their prices for a certain set of services. Veterinarians were found either by word of mouth or by an internet search engine for “Alabama equine veterinarians.” Fourteen veterinarians responded to the questions out of thirty-four contacted. The twenty who did not participate did not wish to, did not perform equine services, or did not respond. The questions and average prices from the veterinary survey can be found in table 11. Prices ranged from \$35 to \$65 for a farm call for an average of \$52.81. Vaccinations ranged between \$17.50 and \$24 each for an average of \$20.58. A Coggins test ranged between \$20 and \$35 for an average of \$27.06. Deworming ranged between \$7.95 and \$25 each for an average of \$16.96. Teeth floating ranged between \$50 and \$125 for an average of \$85.71. Health papers ranged between \$10 and \$45 each for an average of \$26.37. Joint injections ranged from \$50.46 to \$82.67 each for an average of \$66.09.

Table 11. Veterinary Questions and Averages

Question	Average
How much do you charge for a farm call?	\$52.81
How much do you charge for vaccinations?	\$20.58
How much do you charge for a Coggins test?	\$27.06
How much does it cost to deworm?	\$16.96
How much do you charge to float teeth?	\$85.71
How much do you charge for health papers?	\$26.37
How much do you charge for joint injections?	\$66.09

Table 12 breaks down the costs into low, moderate, and high categories, with each category building on the previous one. According to the American Association of Equine Practitioners Vaccination Guidelines, there are five core vaccines (American Association of Equine Practitioners 2012). The core vaccines are tetanus, Eastern equine encephalomyelitis (EEE) and Western equine encephalomyelitis (WEE), West Nile virus (WNV), and rabies. There are some risk based vaccines for horses that travel such as equine herpesvirus type 1 & 4 and equine influenza. The vaccines were broken down into “core” and “additional” categories. The core vaccines include a 4-way vaccine for tetanus, EEE, WEE, and WNV given twice a year in addition to a yearly rabies vaccine. The additional vaccines are for horses who travel and include equine herpesvirus type 1 & 4 and equine influenza. Low cost included two farm calls, core vaccinations, a Coggins test, and a yearly deworming rotation. Moderate cost included items in the low cost category along with additional vaccines, dental care and two sets of health papers. High cost included the items in the low and moderate cost categories with the addition of four yearly joint injections. The price is the average price charged for the item, the number is how many times a year an item is purchased, the annual cost is the price charge multiplied by the number, and the total is the sum of the annual costs.

Table 12. Veterinary Costs

Average Annual Veterinary Costs				
		\$/Each	Number	\$/Year
Low Cost	Farm Call	\$52.81	2	\$105.61
	Core Vaccinations	\$20.58	3	\$61.75
	Coggins	\$27.06	1	\$27.06
	Deworming	\$16.96	4	\$67.82
Total				\$262.25
Mod Cost	Teeth Floating	\$85.71	1	\$85.71
	Additional Vaccinations	\$20.58	4	\$82.32
	Health Papers	\$26.37	2	\$52.75
Total				\$483.03
High Cost	Joint Injections	\$66.09	4	\$264.37
Total				\$747.40

Yearly expenses associated with colic, injury, or other emergency services are not calculated in this budget. Not all horse owners incur such expenses. However, owners should be aware that depending on the severity of the emergency, expenses could range from hundreds to thousands of dollars. It would be advisable for horse owners to keep an emergency fund should such a situation arise. Similarly, veterinary expenses associated with breeding and reproduction are discussed elsewhere in this document

Bedding

Bedding costs are not incurred by every horse owner. For example, horses kept on pasture will not require bedding. The amount of bedding used each week depends on how often the stalls receive a full cleaning and how much bedding material is used in each stall. A range of the number of bags of pinewood shavings used is developed for this reason. This is reflected in the low cost budget by zeroing out the bottom range. A per bag cost of pinewood shavings was estimated based on online prices found using a search engine for “horse bedding.” There were four different websites used in the cost calculation. The number of bags used in each stall is

variable due to the size of the stall so estimates were used based on previous experience. In table 13, for the low cost horses, it was estimated either none or two bags per week used on average. For moderate cost horses, the shavings ranged from an average of two to four bags per week. High cost horses were estimated at four to seven bags per week. Cost per bag is based on prices found online, the bags per month are the number of bags used in the stall each month, the annual cost is the cost of the bag multiplied by the bags per month times twelve. Higher cost horses may have more shavings for deeper bedding in the stall or have stalls completely cleaned out and changed more often.

Table 13. Bedding Costs

		Bedding Costs		
		Bottom Range	Top Range	Median
	<i>\$/bag</i>	<i>\$4.88</i>	<i>\$6.00</i>	<i>\$5.44</i>
Low Cost	bags/month	0	8	4
	\$/year	\$0.00	\$576.00	\$288.00
Moderate Cost	bags/month	8	16	12
	\$/year	\$468.48	\$1,152.00	\$810.24
High Cost	bags/month	16	28	22
	\$/year	\$936.96	\$2,016.00	\$1,476.48

Grooming

The grooming expenditures were based on typical items used by horse owners and costs found from three different online retailers. Table 14 gives the annual estimated initial expense for grooming supplies, rate of replacement, and annualized expense. The rate of replacement is an estimate based on the durability and expected amount of use in each of the categories. Low cost includes a curry comb, dandy brush, soft brush, hoof pick, mane comb, sweat scraper, and two buckets for feed and water for an initial purchase total of \$68. With a 25% rate of replacement, meaning one quarter of the items would need to be replaced annually, the total annualized

expense would be \$17. Moderate cost includes the items listed in low cost plus the addition of a tote box, fly spray, spray bottle, shedding comb, face brush, bot knife, grooming block, bath sponges, muck barrel, manure fork, detangler, shampoo, and conditioner for a total of \$282. Some of these items will last more than one year, while others (e.g. fly spray, shampoo) will be used up more quickly. For the moderate cost budget, it was thus assumed that the annualized total is half of this amount, or \$141 per year. High cost includes the items listed for low and moderate cost with the addition of tail wraps, clippers, clipper blades, hair polish, hoof polish, a wash wand, braiding bands, and braiding tape for a total of \$632. A higher rate of replacement is used for the high cost horses at 75% since many of the items included are easily used up (e.g. fly spray, hoof polish, hair polish) and the annualized total expense is thus \$474. It is anticipated that more items are used than the items listed. The top range is adjusted to reflect the variation in grooming items purchased. Since grooming items potentially have a longer lifespan than one year, the costs could be prorated over that lifespan; however, since the level of use, care taken, and quality of the item varies in each household, the expenses in this budget should be used as a reference for the initial purchase of items. The actual total yearly cost will fluctuate between households.

Table 14. Annual Grooming Expenses

Grooming Expenses			
	Initial Purchase	Rate of Replacement	Annualized Total
Low Cost	\$68.00	25%	\$17.00
Moderate Cost	\$282.00	50%	\$141.00
High Cost	\$632.00	75%	\$474.00

Maintenance

Pasture, barn, and machinery maintenance was calculated based on a South Dakota State University study and horse budget (Renelt 2011). In this study, it was estimated that \$200 per year should be budgeted for maintenance and repairs of fences and a shelter for a 1,100 pound mare kept on a dry lot or pasture with no grass. A 6.8% inflation rate was used to adjust the expenses from 2011 to 2016 (United States Bureau of Labor Statistics 2016). Table 15 shows the breakdown of maintenance expenses. Ranges were developed for each level of care based on an estimated amount of facility use. For the purposes of this study, it was estimated that for the bottom range of the low cost horse, there were no maintenance of the field, no barn, and no machinery used. For the top range of the low cost horse the yearly \$200 expenditure was broken up between pasture, barn, and machinery. In this scenario, \$40 went towards pasture maintenance, \$60 went to barn maintenance, and \$100 went towards machinery maintenance. To adjust for additional or newer machinery, nicer fencing, bigger barns, and a more aesthetically pleasing facility, base expenses were adjusted for different levels of care. The higher the adjusted percent, the more maintenance, fencing or machinery is estimated to be used and considered additional, higher end, and new machinery, fences, and barns. For the moderate cost horse, 150% of the base expense used for the bottom range and 250% is used for the top range. This is the addition of a tractor or other equipment, more expensive fencing such as field fence, and better quality barn. The high cost horse has an increase of 250% from the base expense for the bottom range and 500% for the top range. This is to account for the addition of a bigger or newer tractor, additional equipment and implements, wood fencing, and a newer and more expensive barn. These ranges are an estimated guess that was reviewed by the industry experts.

Table 15. Maintenance Expenses

		Maintenance (\$/year)		
		Bottom Range	Top Range	Median
Pasture Maintenance	Low Cost	\$0.00	\$42.72	\$21.36
	Moderate Cost	\$64.08	\$106.80	\$85.44
	High Cost	\$106.80	\$213.60	\$160.20
Barn Maintenance	Low Cost	\$0.00	\$64.08	\$32.04
	Moderate Cost	\$96.12	\$160.20	\$128.16
	High Cost	\$160.20	\$320.40	\$240.30
Machinery Maintenance	Low Cost	\$0.00	\$106.80	\$53.40
	Moderate Cost	\$160.20	\$267.00	\$213.60
	High Cost	\$267.00	\$534.00	\$400.50

Utilities

Each owner will spend a different amount on utilities depending on what they do with or where they keep their horse. For example, if a horse owner utilizes electric fencing in their pasture they will use more power than an owner who has wood fencing. Other example are water heaters, lighting in barns, fans, etc. The same applies for water utilities, if an owner bathes their horse once a week, they are utilizing more water than an owner who just maintains a water trough. To get the minimum cost for water, the marginal charge for water usage from a municipal source was determined. It was estimated that a horse needs at least 10 gallons of water daily or 310 gallons per month. An additional cubic foot of water costs \$2.27 (Birmingham Water Works Board 2016). Using the conversion factor of 748.1 gallons for every cubic foot of water charged for, the price per gallon of water is approximately \$0.003. This works out to approximately \$0.03 per day per horse in drinking water or \$0.94 per month. The total annual cost for a horse utilizing the minimum amount of water from a municipal source is \$11.29. This logic is displayed in table 16. If there is well water used, there may not be monthly expense, but there would be extra wear and tear on the pump that needs to be figured into the total expenses.

Table 16. Base Water Expenses

Base Water Expenses	
\$/cubic foot	\$2.27
1 Cubic Foot (gal)	748.1
\$/gal	\$0.003
10 gal/day	\$0.03
310 gal/month	\$0.941
Total Cost (\$/year)	\$11.29

There were no published works to determine how much water the average horse owner uses to bathe a horse. Therefore, increments were estimated to account for water consumption due to drinking, bathing, and changing out water. To determine these increments in water use, the top range in gallons is doubled from the bottom range. For example, the low cost horse will use a minimum of 310 gallons each month, so the top range will be twice as many gallons at 620. By doubling the water usage, this estimate takes into account water being changed out or the horse getting hosed off periodically. The moderate cost horse is assumed to have water changed out and get bathed hence the range from 620 to 1240 gallons per month. The high cost horse will get frequent water changes and baths and ranges from 1240 to 2480 gallons per month. Table 17 breaks down water usage and costs for each of the three levels of care.

Table 17. Water Utility

Utility Costs - Water				
		Bottom Range	Top Range	Median
	gal/mo	310	620	465
Low	\$/month	\$0.94	\$1.88	\$1.41
	\$/year	\$11.29	\$22.58	\$16.93
	gal/mo	620	1240	930
Moderate	\$/month	\$1.88	\$3.76	\$2.82
	\$/year	\$22.58	\$45.15	\$33.86
	gal/mo	1240	2480	1860
High	\$/month	\$3.76	\$7.53	\$5.64
	\$/year	\$45.15	\$90.30	\$67.73

To account for power usage, ranges were estimated based on items assumed to be used by the different levels of care. Power usage was determined to not be used for every horse in the state, therefore, the bottom range for the low cost horse was determined to be zero. From there the top range was valued to be \$0.20 per day for an electric fence from the South Dakota State University horse budget (Renelt 2011). The range for each level of care from there went up by an increment of \$0.10 per day as seen in the monthly expenditure in table 18. The first increment up to \$0.30 per day is for an electric fence with the addition of the occasional use of lights. At \$0.40 per day the usage includes running an electric fence, frequent lights, and fans. At \$0.50 per day the usage includes extensive lights, fans, a water heater, and a radio in the barn. For \$0.60 per day the usage includes extensive lights, fans, a water heater, a radio in the barn, and a grooming blower/dryer. These increments are guesstimates reviewed by industry experts. The cost per month is the cost per day multiplied by thirty-one and the cost per year is the cost per day multiplied by three hundred sixty-five.

Table 18. Power Utility

		Utility Costs - Power		
		Bottom Range	Top Range	Median
Low	\$/month	\$0.00	\$6.20	\$3.10
	\$/year	\$0.00	\$74.40	\$37.20
Moderate	\$/month	\$9.30	\$12.40	\$10.85
	\$/year	\$111.60	\$148.80	\$130.20
High	\$/month	\$15.50	\$18.60	\$17.05
	\$/year	\$186.00	\$223.20	\$204.60

Tack and Apparel

Both tack and apparel are considered extra care costs because not every horse owner wishes to participate in additional activities such as riding or showing their horse. This category covers the

cost and maintenance of accessories for equine activities. Tack is estimated to last for at least ten years if properly maintained. There is much variation in the amount and styles of tack and apparel available for purchase. These items can require a large amount of initial investment, but properly taken care of have the potential to last a long time. The annualized range of costs for tack and apparel in tables 19 and 20 are from the previous Alabama horse study completed, which also had ranges within levels, (Whiting, Molnar and McCall 2006) and adjusted by an inflation rate of 19.2% from 2006-2016 (United States Bureau of Labor Statistics 2016). Tack includes items such as saddles, bridles, and other equine strappings. Table 19 lays out the annualized tack expenditure.

Table 19. Annualized Tack Expenditures

Annualized Tack Expenditures (\$/year)			
	Bottom Range	Top Range	Median
Low	\$59.60	\$596.00	\$327.80
Moderate	\$59.60	\$1,192.00	\$625.80
High	\$178.80	\$5,364.00	\$2,771.40

Apparel includes human riding or showing accessories such as breeches, helmets, and coats. There is no estimate for the lifespan of apparel since usage varies and show styles change frequently. The apparel costs in table 20 are considered a yearly expense. The high cost range for apparel is considered to be a very conservative number based on budget reviews from experts in the industry.

Table 20. Apparel Expenditures

Apparel Expenditures (\$/year)			
	Bottom Range	Top Range	Median
Low	\$35.76	\$417.20	\$226.48
Moderate	\$71.52	\$953.60	\$512.56
High	\$596.00	\$5,960.00	\$3,278.00

Breeding Fees

In the event that a horse owner wishes to breed a horse, a stud fee is charged to breed to a specific stallion. The stud fee can vary greatly based on the value of the genetic merits the stallion possesses such as quality, confirmation, breed standard, success in show, and/or pedigree. Horses can be bred either naturally with live cover, or artificially with cooled or frozen semen and artificially inseminated by a veterinarian. The itemized list in table 21 is based off of the University of Kentucky Extension budget for breeding mares (Burdine and Coleman 2006). The fees for services have been verified by local breeders who incur these costs on a yearly basis. These prices were verified from personal sources as accurate costs for the 2015 breeding season.

Table 21. Itemized Breeding Fees

Itemized Breeding Fees			
	Bottom Range	Top Range	Median
Pre-Breeding Exam	\$20.00	\$40.00	\$30.00
Ovulation Check	\$30.00	\$50.00	\$40.00
Pregnancy Check	\$40.00	\$60.00	\$50.00
Pregnancy Follow up	\$30.00	\$50.00	\$40.00
Breeding and Foaling Supplies	\$10.00	\$20.00	\$15.00
Stud Fee	\$500.00	\$7,500.00	\$4,000.00
Shipping and Collection Fee	\$200.00	\$500.00	\$350.00

For the level of care breakdown in table 22, a low cost option for a horse owner was to forego any veterinary visits and the stallion to perform a live cover at a \$500 stud fee only for the bottom range. The top range for the low cost horse was estimated to be a live cover stud fee of \$500 plus veterinary costs. The moderate cost horse was estimated at the bottom range with a \$1000 live cover stud fee plus veterinary costs and the top range was a \$2500 stud fee, plus the median shipping for artificial insemination, and veterinary fees. For the high cost horse, the

bottom range includes a \$2500 stud fee, fees for shipping and collection, and veterinary costs and the top range includes a \$7500 stud fee, fees for shipping and collection, plus veterinary fees. The high cost range for breeding fees and stallion service is considered to be a very conservative number.

Table 22. Breeding Costs

Breeding Costs			
	Bottom Range	Top Range	Median
Low	\$500.00	\$630.00	\$565.00
Moderate	\$1,130.00	\$3,070.00	\$2,100.00
High	\$3,220.00	\$8,220.00	\$5,720.00

Publicity

Sometimes a horse owner wishes to advertise a horse to let it be known that a stallion is available for stud service or that a horse is for sale. The price for advertisement varies depending on the detail (i.e. picture or no picture, color versus black and white) and location of the advertisement. Some examples would include an ad in a local newspaper or bulletin, ad placement in the directory at a show or event, posted flyers, websites, or even presentations at certain events. The range of annual expenditures for publicity comes from the Alabama bulletin (Whiting, Molnar and McCall 2006) and are adjusted for a 19.2% inflation rate from 2006 to 2016 (United States Bureau of Labor Statistics 2016) in table 23. Based on expert budget reviews, the high cost range for publicity is considered to be a very conservative number.

Table 23. Publicity Expenditures

Publicity Expenditures			
	Bottom Range	Top Range	Median
Low	\$35.76	\$119.20	\$77.48
Moderate	\$89.40	\$357.60	\$223.50
High	\$715.20	\$5,960.00	\$3,337.60

Shows

Showing a horse covers a variety of different events from breed shows (Arabian, Quarter Horse, Tennessee Walking Horse, etc.), rodeos, dressage, hunter/jumper, competitive trail, and the list goes on. Since not everybody who owns a horse shows, this is an extra care item. Horse shows fluctuate in cost depending on the type of show, location, and level of competition. For example, a local show will typically cost a significant amount less than a regional level show, but some owners do not care to participate at that level and thus do not spend the money to do so. For those that choose to show, table 24 estimates the yearly expenditure of showing a horse based on the category of care. This annual cost includes the cost of all travel and lodging, food and beverage purchases, association fees, dues, and entry fees. The 2016 Alabama Horse Owner Survey provided data for this category based on what the respondents said they spent annually on showing their horse. Horses were grouped into an appropriate level of care and then the respondents who said they showed were selected. These respondents were used to estimate the show expenditures based on how much they said they spent showing annually and a range of total show expenditures was developed. The total show cost was divided by the number of horses the respondent said they showed. Given the variability of responses, the best estimate for each level of care is in table 24.

Table 24. Yearly Show Expenditures

Yearly Show Expenditures			
	Bottom Range	Top Range	Median
Low	\$100.00	\$5,000.00	\$2,550.00
Moderate	\$5,000.00	\$20,000.00	\$12,500.00
High	\$20,000.00	\$100,000.00	\$60,000.00

Lessons

Some owners decide to participate in riding lessons to enhance their own or their horses' skills. Based on the survey method, more people that take lessons may have been found than is generally the case among all Alabama horse owners. This is an extra care item and not incurred by every owner. The range in costs for lessons is the range among people who take lessons at all. These lessons can be private or in a group setting and are priced accordingly. If a rider is looking for a more personalized or detailed lesson, for example to prepare for a show, they will more likely elect for a private lesson. If a rider wants to get a few pointers and their horse is comfortable in a group setting, they may decide that a group lesson will suffice. The number of lessons per month was calculated based on responses from the 2016 Alabama Horse Owner Survey which had an average response of 4.5 lessons monthly. Lesson prices in table 25 came from nineteen different facilities offering lessons found online via a search for "Alabama riding lessons." Lessons ranged from \$25 an hour for a group lesson to \$80 an hour for a private lesson. To get the average of 4.5 monthly lessons as found in the survey, each level has a bottom range of one lesson per month and a top range of eight lessons per month for people who participate. The median of 4.5 lessons per month is taken from the collected survey data.

Table 25. Lesson Expenditure

Lesson Expenditure				
		Bottom Range	Top Range	Median
	# per month	1	8	4.5
Low	\$/lesson	\$25.00	\$25.00	\$25.00
	\$/month	\$25.00	\$200.00	\$112.50
	\$/year	\$300.00	\$2,400.00	\$1,350.00
Moderate	\$/lesson	\$32.50	\$45.00	\$38.75
	\$/month	\$32.50	\$360.00	\$174.38
	\$/year	\$390.00	\$4,320.00	\$2,092.50
High	\$/lesson	\$40.00	\$80.00	\$60.00
	\$/month	\$40.00	\$640.00	\$270.00
	\$/year	\$480.00	\$7,680.00	\$3,240.00

Training

Owners may elect to have their horse(s) trained to perform a certain discipline or merely to begin breaking their horse(s) to ride. This is an extra care item that is not incurred by all horse owners. Training costs vary from trainer to trainer and generally require the horse to be sent to the trainer's facility. The costs are determined by the type of training, the experience or notability of the trainer, the length of time in training, and the intensity of the training. Fees are usually quoted on a monthly basis. The data for this expenditure comes from prices from online training advertisements. There were twelve different Alabama training facilities identified from an online search and prices were taken from facility websites. Table 26 shows the monthly and annual expenditures based on the level of care for owners who pay to train their horse(s). For a low cost horse on the bottom range, the owner may pay for a trainer to come out once a month and give the horse a tune up, while on the top range is paying for the horse to be worked with once or twice a week. The moderate level includes board and low intensity training up to three times a week on the bottom range and board with slightly higher intensity training four or five times a week. High cost includes board and medium intensity training four to six times a week on the bottom side and board with high intensity training six days a week on the top side. These fees do not include additional training at shows or lessons.

Table 26. Training expenditure

Training Expenditure				
		Bottom Range	Top Range	Median
Low	\$/Month	\$50.00	\$300.00	\$175.00
	\$/Year	\$600.00	\$3,600.00	\$2,100.00
Moderate	\$/Month	\$500.00	\$850.00	\$675.00
	\$/Year	\$6,000.00	\$10,200.00	\$8,100.00
High	\$/Month	\$850.00	\$1,350.00	\$1,100.00
	\$/Year	\$10,200.00	\$16,200.00	\$13,200.00

The 2016 Alabama Horse Owner Survey helped to divide the data into the appropriate level of care category based on what the respondents said they spent annually on their horse. Horses in each respective level of care were selected based on whether the respondent said they had a horse in training. These respondents were used to categorize the training expenditures found online based on how much they said they spent training annually. The best estimate is given in table 26 due to the variability of responses.

Insurance

Horses can be insured for a variety of different things such as mortality, major medical, and/or surgical. If the horse is a high value animal, it is likely the owner will want to insure it. Insurance premiums fluctuate depending on the age, value, and number of horses on the policy. Table 27 shows the current estimated insurance premiums for mortality and medical insurance. To insure for mortality, the yearly premium will be between 3% and 5.5% of the insurable value of the horse. The initial value of the horse is determined by what the horse is bought or sold for at a certain time which would be the initial insurable value. To increase the insured value, some sort of proof of additional value must be presented whether through training or show value. Major medical insurance premiums range from \$200 to \$450 depending on previous health and risk of injury or sickness (Star H Equine Insurance 2016).

Table 27. Yearly Horse Insurance Premiums

Yearly Insurance Premiums		
	Minimum	Maximum
Mortality	3%	5.5%
Medical	\$200.00	\$450.00

Given the premium estimates in table 27, the total expenditure estimate for each category of horse care must be calculated. Since no data was collected from the survey regarding

purchase price or estimated value of horses, the values of the horses were estimated from \$1,000 to \$30,000 as a general range to calculate mortality insurance. It was estimated that a moderate cost horse would not cost more than \$10,000 and a high cost horses no more than \$30,000.

These estimates are conservative and are used for calculation purposes only. Table 28 shows the estimated annual insurance fees. It is assumed that the low cost horse will not be insured. The moderate cost horse will be insured for at least major medical (bottom range) up to an additional \$10,000 mortality (top range). The high cost horse will have at least major medical plus \$15,000 (bottom range) to major medical plus \$30,000 mortality (top range); however, it is considered to be a conservative range based on budget reviews from industry experts. These premiums do not include deductibles.

Table 28. Annual Horse Insurance Expenditures

Annual Equine Insurance Fees			
	Bottom Range	Top Range	Median
Low	\$0.00	\$0.00	\$0.00
Moderate	\$200.00	\$1,000.00	\$600.00
High	\$650.00	\$2,100.00	\$1,375.00

Ownership Expenses

The fixed costs or annual ownership costs associated with this budget includes capital recovery for barns and shelters, fences, trucks, trailers, tractors, and other equipment. These are costs that do not typically change quickly even if all horses are removed from a property.

Owners are most likely to have a truck and trailer regardless of whether the horse is kept at home or boarded. Other equipment such as tractors and manure spreaders are more likely to be owned by boarding facilities and owners who keep their horse(s) at home. Additional machinery such as golf carts and utility vehicles are not a necessity and may or may not be

included in an annual budget. For example, golf carts are commonly seen at horse shows and may not be considered useful for an owner not showing. This should be taken into account when developing individual budgets.

Capital Recovery

Capital recovery is a method of computing annual depreciation and interest on a durable item resulting in a single value (Kay, Edwards and Duffy 2012). Equation 6 is the formula used for capital recovery

$$(6) \text{ capital recovery} = [\text{amortization factor} \times (\text{beginning value} - \text{salvage value})] + (\text{interest rate} \times \text{salvage value})$$

where beginning value is the item's worth on the day of purchase or the purchase price, salvage value is the item's value at the end of its useful life, and the amortization factor depends on the ownership life and the interest rate.

Table 29 breaks down the factors used for capital recovery. The opportunity interest rate of 5.5% comes from the current Alabama Cooperative Extension rates. The percent salvage value comes from the machinery standards of the American Society of Agricultural and Biological Engineers and is estimated based on the Modified Accelerated Cost Recovery System (MACRS) life of the machinery or equipment (American Society of Agricultural and Biological Engineers 2012). Tractors have different percent salvage values depending on horsepower which is where the two numbers come from in table 29. It is assumed no salvage value exists for barns or fences. The useful life is determined as the MACRS class life and is from the United States Internal Revenue Service (U.S. Internal Revenue Service 2015). The amortization factor is based off of the MACRS life of the machinery and opportunity interest rate for equal total payments. The percent to horse for the individual items is a measure of how much of each item

can be attributed to the ownership of the horse(s). To get the annual expenditure per horse, the total capital recovery with the exception of fencing, was divided by an average of 2.4 horses per household (American Veterinary Medical Association 2012).

Table 29. Factors Used for Capital Recovery

Factors used in Capital Recovery					
	Opportunity Interest Rate	Salvage Value (%)	MACRS Class Life	Amortization Factor	Percent to Horse
Barn/Shelter	5.50%	0%	20	0.08371	100%
Fencing	5.50%	0%	7	0.17598	100%
Truck	5.50%	30%	5	0.23419	15%
Trailer	5.50%	30%	7	0.17598	100%
Tractor	5.50%	38%, 44%	7	0.17598	75%
Equipment	5.50%	42%	7	0.17598	75%

To calculate the capital recovery, purchase prices or costs for the items needed to be estimated. The following six headings (Barn/Shelter, Fencing, Truck, Trailer, Tractor, and Equipment) are indirectly used in the budget through capital recovery. It should be noted that purchase prices or costs are not directly involved in the budget and are for reference purposes only.

Barn/Shelter

There is variability in cost when building a barn or shelter. The type of material used, size, and other amenities to be added to the structure all vary in cost. These prices are to be used as a reference and have been calculated as such. The estimated average cost to build a barn or shelter for each level of care is based from the University of Kentucky horse budget (Burdine and Coleman 2006) and evaluated by horse industry experts. The values in table 30 show the estimated cost to build a barn or shelter. Note the cost to build is on a per household basis.

Table 30. Barn or Shelter Prices

Barn/Shelter per Household			
	Bottom Range	Top Range	Median
Low	\$2,000	\$8,000	\$5,000
Moderate	\$12,000	\$30,000	\$21,000
High	\$32,000	\$60,000	\$46,000

Table 31 shows the capital recovery of a barn or shelter. The salvage value for a barn is 0. The amortization factor is 0.08371, based on a useful life of 20 years and an interest rate of 5.5%. The annual capital recovery is fully attributed to the horse and assumed to be on a per household basis so is divided by the average number of 2.4 horses per household to get the annual total per horse.

Table 31. Capital Recovery - Barn or Shelter

Capital Recovery - Barn/Shelter				
	Purchase Price	Salvage Value	Annual Capital Recovery	Annual Total per Horse¹
Low	\$5,000.00	\$0.00	\$418.55	\$174.40
Moderate	\$21,000.00	\$0.00	\$1,757.91	\$732.46
High	\$46,000.00	\$0.00	\$3,850.66	\$1,604.44

¹ Per horse average calculated using an estimated 2.4 horses per household (AVMA, 2012)

Fencing

Fencing costs will vary based on the type of fence, acreage to be fenced, and cost of labor. The costs in this valuation assume the fence is built by the owner and labor is not considered in the calculations. The fencing costs are calculated for a two acre square lot (416 foot perimeter).

Low cost is estimated for a four strand electric poly-tape fence, moderate cost is estimated for field wire fence, and high cost is a full wooden fence with four boards. The blueprints came

from the University of Florida Extension (Barber 2014) and current costs were found from an online search of each item. The equipment used to build the fences such as a post hole digger, come-along, or drill was not included in these budgets. The item refers to materials needed to build each particular fence, the number is how many of each item is needed, the cost each is how much each item costs, and the total cost is the cost each multiplied by the number. The total is the sum of the total cost.

Table 32 is the low cost option for fencing. It consists of four six by six inch corner posts, nine t-posts (three on each side) spaced twelve feet apart, four packs of five hundred foot two inch poly-tape ribbon (four strands at 416 feet per acre is 1,664 total feet), sixteen wood insulators, thirty-six t-post insulators, and one plug-in electric fence charger.

Table 32. Low Cost Fencing Expense

Low Cost - Electric Tape (4 strands)			
Item	Number	Cost Each	Total Cost
6x6" × 8' wood posts	4	\$20.27	\$81.08
6½' T-post	9	\$4.59	\$41.31
2 Inch Ribbon (500 ft)	4	\$75.99	\$303.96
Wood Insulator (50 pk)	1	\$9.52	\$9.52
T-Post Insulator (50 pk)	1	\$10.79	\$10.79
Fence Charger	1	\$74.95	\$74.95
Total			\$521.61

Table 33 is the moderate cost field wire fence option. It could be upgraded for electric wire or a wood board on top, but for the purposes of this budget is just a basic field wire fence. It would require twelve six by six inch posts (three on each corner for bracing), eight four by four inch posts for braces, nine t-posts spaced twelve feet apart (three on each side), one roll of 9 gauge brace wire, two rolls of field fence (each roll is 330 feet and 416 feet need to be fenced), one pound of 1½ inch fence staples, and 1 pound of wood nails.

Table 33. Moderate Cost Fencing Expense

Moderate Cost - Field Wire			
Item	Number	Cost Each	Total Cost
6x6" × 8' wood posts	12	\$20.27	\$243.24
4x4" × 8' wood posts	8	\$7.77	\$62.16
6½' T-post	9	\$3.89	\$35.01
9 ga. brace wire	1	\$16.95	\$16.95
Field fence (330ft)	2	\$129.95	\$259.90
1½" fence staples	1 lb.	\$2.11	\$2.11
16d × 3½" l. nails	1 lb.	\$2.99	\$2.99
Total			\$622.36

Table 34 is the high cost option for fencing with a four board wood fence. This fence would require a minimum of four six by six inch wood corner posts, thirty-five four by four inch posts spaced twelve feet apart, one hundred forty two by four inch wood boards, and one pound of 3½ inch Philips head screws.

Table 34. High Cost Fencing Expense

High Cost - Full Wood Board (4 Boards)			
Item	Number	Cost Each	Total Cost
6x6" × 8' wood posts	4	\$20.27	\$81.08
4x4" × 8' wood posts	35	\$7.77	\$271.95
2x4" x 12' wood boards	140	\$6.17	\$863.80
#10 x 3 1/2" Philips screws	1 lb	\$8.47	\$8.47
Total			\$1,225.30

Table 35 shows the capital recovery for fences. The amortization factor for a 7 year life and 0 salvage value is 0.17598. Since all the tables are for fencing two acres of land, the annual capital recovery is considered for a single horse. If a larger area were to be fenced it might be cheaper per horse but is not reflected in this budget.

Table 35. Capital Recovery - Fencing

Capital Recovery - Fencing				
	Purchase Price	Salvage Value	Annual Capital Recovery	Annual Total per Horse¹
Low	\$521.61	\$0.00	\$91.79	\$91.79
Moderate	\$622.36	\$0.00	\$109.52	\$109.52
High	\$1,225.30	\$0.00	\$215.63	\$215.63

¹ Per horse average calculated using an estimated two square acres per horse

Truck

Table 36 gives estimated truck prices. The average purchase price for a truck is based off of the Clemson livestock budget for a 1.5 ton pickup (Clemson Cooperative Extension 2016). This is the truck used for the moderate cost level. For ease of calculations, it is estimated that the low cost level is 70% of the price given by Clemson which takes into account an older model truck or not as many features. The high cost level is 150% of the Clemson price which considers a newer model truck with more amenities and features. The percent to horse comes from an Arizona study on the horse industry (Beattie, et al. 2001).

Table 36. Estimated Truck Prices

Estimated Truck Prices		
	Average Purchase Price	Percent to Horse
Low	\$25,362.43	15%
Moderate	\$36,232.05	15%
High	\$54,348.07	15%

Table 37 shows the capital recovery for trucks. The salvage value is estimated as 30% of the purchase price. The amortization factor is 0.23419. The truck has an estimated 15% of use

attributed to the horse so the total capital recovery per horse is calculated by multiplying the total capital recovery by 15% and then dividing the annual capital recovery due to horses by an average 2.4 horses per household.

Table 37. Capital Recovery - Truck

Capital Recovery - Truck				
	Purchase Price	Salvage Value	Annual Capital Recovery	Annual Total per Horse¹
Low	\$25,362.00	\$7,608.60	\$4,576.05	\$286.00
Moderate	\$36,232.05	\$10,869.61	\$6,537.33	\$408.58
High	\$54,348.07	\$16,304.42	\$9,805.99	\$612.87

¹ Per horse average calculated using an estimated 2.4 horses per household (AVMA, 2012)

Trailer

There are many different types and brands of trailers available for hauling horses. Several different resources were used to collect purchase prices. Table 38 shows the estimated trailer prices. The low cost trailer comes from a Clemson livestock budget assumed to be a stock trailer (Clemson Cooperative Extension 2016). Moderate cost trailer prices are from a Virginia horse budget (Eberly 2011). The high cost trailer is an average from recently purchased trailers gooseneck horse trailers with living quarters advertised on an Alabama trailer company found online after searching “Alabama horse trailer prices.” The percent to horse assumes the only use of the trailer is directly related to hauling horses.

Table 38. Estimated Horse Trailer Prices

Estimated Trailer Prices		
	Average Purchase Price	Percent to Horse
Low	\$2,946.45	100%
Moderate	\$11,270.55	100%
High	\$43,678.00	100%

Table 39 shows the capital recovery for trailers. The total depreciation is calculated by subtracting the 33% salvage value from the purchase price. The amortization factor of 0.17598. The annual per horse total is the annual capital recovery divided by an average 2.4 horses per household.

Table 39. Capital Recovery - Horse Trailer

Capital Recovery - Trailer				
	Purchase Price	Salvage Value	Annual Capital Recovery	Annual Total per Horse¹
Low	\$4,500.00	\$1,350.00	\$628.59	\$261.91
Moderate	\$11,270.55	\$3,381.17	\$1,574.34	\$655.97
High	\$43,678.00	\$13,103.40	\$6,101.21	\$2,542.17

¹ Per horse average calculated using an estimated 2.4 horses per household (AVMA, 2012)

Tractor

Table 40 gives estimated prices for a tractor. Tractor prices are from a Clemson livestock budget (Clemson Cooperative Extension 2016). The low cost tractor is 50-60 horsepower, moderate cost is 70-80 horsepower, and high cost is 95-105 horsepower. The percent to horse is assuming the use of the tractor is strictly for work related to horses.

Table 40. Estimated Tractor Prices

Estimated Tractor Prices		
	Average Purchase Price	Percent to Horse
Low	\$22,364.53	100%
Moderate	\$29,429.98	100%
High	\$54,548.33	100%

Table 41 shows the annual capital recovery of tractors. The salvage value of the tractor is 38% of the purchase price for the low and moderate cost (30-79 horsepower tractor) and 44% of the purchase price for the high cost (80-149 horsepower tractor). The amortization factor is 0.17598. The annual per horse total is the annual capital recovery divided by an average 2.4 horses per household.

Table 41. Capital Recovery - Tractor

Capital Recovery - Tractor				
	Purchase Price	Salvage Value	Annual Capital Recovery	Annual Total per Horse¹
Low	\$22,364.00	\$8,498.32	\$2,907.49	\$908.59
Moderate	\$29,429.98	\$11,183.39	\$3,826.12	\$1,195.66
High	\$54,548.33	\$24,001.27	\$6,695.74	\$2,092.42

¹ Per horse average calculated using an estimated 2.4 horses per household (AVMA, 2012)

Equipment/Implements

Other costs horse owners incur include equipment and implements such as golf carts, utility vehicles, manure spreaders, augers, hay spears, or any piece of equipment not a truck, trailer, or tractor. The estimated average expenditure in table 42 is simply considered an allotted budget for items useful for the facility and are for purchase price references only. This is due to the fact that the number and prices of items is variable for each operation and that variability should be

taken into account when developing individual budgets. The percent to horse(s) comes from the University of Kentucky horse budget (Burdine and Coleman 2006).

Table 42. Estimated Implement and Equipment costs

Estimated Implement and Equipment Costs		
	Average Expenditure	Percent to Horse
Low	\$5,000.00	75%
Moderate	\$10,000.00	75%
High	\$20,000.00	75%

Table 43 shows the capital recovery for equipment and implements. The amortization factor is 0.17598. Since an estimated 75% of the use will be attributed to the horse, the annual capital recovery per horse is 75% of the calculated total capital recovery divided by an average 2.4 horses per household.

Table 43. Capital Recovery – Equipment and Implements

Capital Recovery - Equipment and Implements				
	Purchase Price	Salvage Value	Annual Capital Recovery	Annual Total per Horse¹
Low	\$5,000.00	\$2,100.00	\$625.84	\$195.58
Moderate	\$10,000.00	\$4,200.00	\$1,251.68	\$349.30
High	\$20,000.00	\$8,400.00	\$2,503.37	\$647.42

¹ Per horse average calculated using an estimated 2.4 horses per household (AVMA, 2012)

Total Capital Recovery

The total capital recovery in table 44 shows how much is allotted based on where the horse is kept. The total capital recovery for a horse kept at home is the sum of the capital recovery for a barn or shelter, fencing, truck, trailer, tractor, and other equipment or implements. The total

capital recovery for the owner of a horse boarded is the sum of capital recovery for a truck and trailer. For the boarding facility the total capital recovery is the sum of the capital recovery for a barn or shelter, fences, tractor, and other equipment or implements.

Table 44. Total annual capital recovery per horse

Total Annual Capital Recovery per Horse			
	Horse at Home	Horse Boarded	Boarding Facility
Low	\$1,918.27	\$547.91	\$1,370.36
Moderate	\$3,451.50	\$1,064.56	\$2,386.94
High	\$7,714.95	\$3,155.04	\$4,559.91

Total Budgets

The final budgets include the median cost to keep a horse in each category. The tables are broken into horses kept at home and horses boarded. Each section has a total for basic care variable costs, extra care variable costs, fixed costs, and the total of all expenses for each level of care. The total budget for horses kept at home is shown in table 45 and horses boarded in table 46.

Table 45. Annual Budget Summary - Horse Kept at Home

Annual Budget - Horse Kept at Home			
Item	Low Cost	Moderate Cost	High Cost
Operating Expenses (Basic Care)			
Feed	\$769.07	\$1,583.91	\$2,049.49
Farrier	\$326.93	\$676.79	\$1,055.54
Vet	\$322.40	\$437.40	\$703.66
Bedding	\$288.00	\$810.24	\$1,476.48
Grooming	\$17.00	\$141.00	\$474.00
Facility Expenses ¹	\$160.93	\$591.26	\$1,073.33
Total Basic Expense	\$1,884.33	\$4,240.60	\$6,832.50
Ownership Expenses			
Capital Recovery ^{2,3}	\$1,918.27	\$3,451.50	\$0.00
Total Ownership Expense	\$1,918.27	\$3,451.50	\$0.00
Total Expense (Basic Care)	\$3,802.60	\$7,692.11	\$6,832.50
Operating Expenses (Extra Care)			
Tack	\$327.80	\$625.80	\$2,771.40
Apparel	\$226.48	\$512.56	\$3,278.00
Breeding Fees	\$565.00	\$2,100.00	\$5,720.00
Publicity	\$77.48	\$223.50	\$3,337.60
Show Expenses	\$2,550.00	\$12,500.00	\$60,000.00
Lessons	\$1,350.00	\$2,355.00	\$4,080.00
Training	\$2,100.00	\$8,100.00	\$13,200.00
Horse Insurance	\$0.00	\$600.00	\$1,375.00
Total Extra Expense	\$4,495.00	\$26,697.50	\$79,915.00
Total Expense (Basic + Extra)	\$8,297.60	\$34,389.61	\$86,747.50

¹ Includes maintenance and utilities

² Capital recovery for barns/shelters, fencing, truck, trailer, tractor, and equipment

³ Per horse value calculated using an average 2.4 horses per household (AVMA, 2012)

**Budgets are not for the actual cost of the horse, just its care

Table 46. Annual Budget Summary - Horse Boarded

Annual Budget - Horse Boarded			
Item	Low Cost	Moderate Cost	High Cost
Operating Expenses (Basic Care)			
Board	\$2,400.00	\$3,840.00	\$8,400.00
Farrier	\$326.93	\$676.79	\$1,055.54
Vet	\$322.40	\$437.40	\$703.66
Grooming	\$17.00	\$141.00	\$474.00
Total Basic Expense	\$3,066.33	\$5,095.19	\$10,633.20
Ownership Expenses			
Capital Recovery ^{1,3}	\$547.91	\$1,064.56	\$0.00
Total	\$547.91	\$1,064.56	\$0.00
Total Expense (Basic Care)	\$3,614.24	\$6,159.75	\$10,633.20
Operating Expenses (Extra Care)			
Tack	\$327.80	\$625.80	\$2,771.40
Apparel	\$226.48	\$512.56	\$3,278.00
Breeding Fees	\$565.00	\$2,100.00	\$5,720.00
Publicity	\$77.48	\$223.50	\$3,337.60
Show Expenses	\$2,550.00	\$12,500.00	\$60,000.00
Lessons	\$1,350.00	\$2,355.00	\$4,080.00
Training	\$2,100.00	\$8,100.00	\$13,200.00
Horse Insurance	\$0.00	\$600.00	\$1,375.00
Total Extra Expense	\$7,196.76	\$26,416.86	\$92,387.00
Total Expense (Basic + Extra)	\$10,811.00	\$32,576.61	\$103,020.20

¹ Truck and trailer² Tractor, Barn, Fence, and Equipment³ Per horse value calculated using an average 2.4 horses per household (AVMA, 2012)

**Budgets are not for the actual cost of the horse, just its care

Economic Impact

An economic impact analysis studies the effect of an industry on the economy of a specific region. This chapter focuses on the economic contribution of the horse industry on the Alabama economy. Since input-output analysis is widely used in regional economics, this is the utilized method of choice. Input-output analysis is based on models constructed from an input-output table that displays the flows of purchases and sales between segments of the economy of a region. The economic impacts are produced from mathematical manipulations of the table. The total impact is comprised of the direct, indirect, and induced effects as explained in the methods chapter. Direct effects represent the actual expenditures by industry consumers within the region. Direct expenditures produce multiplier effects known as indirect and induced effects. Indirect effects are the inter-industry purchases made as a result of direct spending. The induced effects are the additional wages received by employees and how they spend those additional dollars. When analyzing the regional results of the model, the value added is the value of the gross, or total, output minus the intermediate inputs, which are the semi-finished goods. Value added is an expansive measure of income and is the amount by which the value of an article is increased at each stage of production, exclusive of initial costs. It is a measure frequently used to determine the contribution of an industry to a regional economy since it avoids double counting intermediate assets.

The components of the economic impact of the Alabama horse industry begin with the annual budgets for Alabama horse owners. These budgets were worked up on a per horse basis and then multiplied by the number of horses involved in each cost level as determined by the 2016 Alabama Horse Owner Survey (Appendix A). Horse owner and boarding facility expenditures are the main sources of impact.

The total impact of direct, indirect, and induced effect was calculated using the Impacts for Planning (IMPLAN) software, a model that has been used in many economic impact studies. The IMPLAN software is an industry standard input-output model. The model consists of a 440 sector input-output table based off of available national and regional economic data from federal government agencies and is customized for the particular region of study. The impacts of interest that are measured within IMPLAN are total sales, value-added, employment, and labor income. The total sales is also known as the industry output. It is the total production value of an industry at a given time. This measures intermediate input sales as well as final product sales. The value added is equivalent to the gross domestic product consisting of labor income, taxes on production and imports, and gross operating surplus but does not include intermediate inputs. This is a more complete measure of economic impact because it looks at more than just revenue and accounts for costs of production. Employment measures the total change in employment (jobs) resulting from sector changes of full-time, part-time, and self-employed workers.

In order to uniformly identify each category of expenditure, sectoring schemes were used. A sectoring scheme is a means of categorization according to the type of products or services provided by an industry. The sectoring scheme used was the North American Industry Classification System (NAICS). The NAICS sectoring scheme is a six digit code used by the federal government to classify businesses. Since the IMPLAN software does not recognize these NAICS codes directly, they must be converted into MIG (formerly known as the Minnesota Implan Group) sectoring schemes that are coded specifically to work with the IMPLAN software. The conversion was done with a table provided by MIG that has both the NAICS codes and the MIG codes (MIG Inc. 2012).

Expenditures

The main expenditures from the horse industry come from horse owners. A representative sample of percentages for cost levels of low, moderate, and high care horses came from the breakdown of the 2016 Alabama Horse Owner Survey (Appendix A). Since the total number of horses kept at home and boarded was deemed heavily biased towards boarded horses in the survey, the percentages from the 1998 National Animal Health Monitoring System (NAHMS) report were used. The report stated that 85% of horses were kept at home and 15% of horses were boarded. After looking at survey data from the Alabama Horse Council (2016), it was decided these percentages were a better fit for this study.

The total number of horses in Alabama is estimated at 153,904 and since all horses will not utilize every category in the budgets, the percentage of horses involved in each category was estimated. The total estimated population was multiplied by 85% to give an estimated 130,895 horses kept at home and the remaining 15% gives an estimated 23,099 horses boarded in Alabama. This allows a valuation of total expenditures in each category.

Horses kept at home have many direct expenditures for the owner while boarded horses pay a monthly rate to keep horses at facilities that provide services for the horse. There were 14.1% of horses who were insured, so the insurance total was out of 14.1% of the population. There were 16.6% of horses being used for breeding purposes, so the breeding fees were out of 16.6% of the population. Out of the horses being used for breeding, an estimated 75% of them are advertised so 12.5% of the population was counted for publicity. There were 23.7% of horses from the total population considered to be shown. Lessons were 24.1% of the population. Training totaled 16.9% of the population.

Total expenditures were calculated twice, the first for an “optimistic” and the second as a conservative sensitivity analysis. For the optimistic scenario, it was assumed that the survey participants were an accurate representative sample of the Alabama horse industry at 78.01% low cost horses, 18.19% moderate cost horses, and 3.79% high cost horses. The conservative expenditure is based on the numbers from the previous Alabama horse study (Whiting, Molnar and McCall 2006) of 90% low cost horses, 9.9% moderate cost horses, and 0.1% high cost horses.

The population compositions in tables 47 and 48 were calculated by multiplying the total estimated population of 153,994 by the respective percentage of horses estimated to be in each level of care. For the optimistic approach (table 47) there would be 120,131 low cost horses, 28,019 moderate cost horses, and 5,844 high cost horses. Thus, based on a boarding percentage of 15%, under the “optimistic” assumption there would be 18,020 low cost horses, 4,203 moderate cost horses, and 877 high cost boarded horses, with the rest kept at home. For the conservative approach (table 48) this is 138,594 low cost horses, 15,245 moderate cost horses, and 154 high cost horses. Using the same 15% boarding rate, the boarded horse figures would be 20,789 low cost, 2,287 moderate cost, and 23 high cost horses, with the rest kept at home.

The two expenditure columns in table 49 represent the total estimated optimistic and the conservative expenditures for each category. The expenditures were calculated by multiplying the number of horses in each level of care by the estimated cost for the respective level of care found in the budgets chapter. The total low, moderate, and high cost expenditures were then added together to get the total expenditure for each category. The expenditures for the barn, fence, tractor/other, trailer, and truck categories all come from the annual capital recovery of

those items as discussed in the budgets chapter. The expenses due to buying or leasing a horse and major medical procedures are not included.

Table 47. Optimistic Alabama Horse Population Categories

Optimistic Population		
Total		153994
Low	78.01%	120131
Moderate	18.19%	28019
High	3.79%	5844
Horses Kept at Home	85.00%	130895
Low	78.01%	102111
Moderate	18.19%	23816
High	3.79%	4967
Horses Boarded	15.00%	23099
Low	78.01%	18020
Moderate	18.19%	4203
High	3.79%	877

Table 48. Conservative Alabama Horse Population Categories

Conservative Population		
Total		153994
Low	90.00%	138594
Moderate	9.90%	15245
High	0.10%	154
Horses Kept at Home	85.00%	130895
Low	90.00%	117805
Moderate	9.90%	12959
High	0.10%	131
Horses Boarded	15.00%	23099
Low	90.00%	20789
Moderate	9.90%	2287
High	0.10%	23

To see the distribution of total spending in the industry, a percent of total expense is calculated. This is what percent of total expenditure each category makes up. This is found by dividing the total category expense by the total expense as seen in the following equation

$$(7) \text{ Percent Expense} = \frac{\text{Category Expense}}{\text{Total Expense}} \times 100$$

The percent total columns in table 49 show the percent of total expense of each of the expense categories.

Table 49. Alabama Horse Expenditures

Alabama Total Expenditures				
Category	Optimistic Expenditure	Percent of Total	Conservative Expenditure	Percent of Total
Feed	\$134,565,970	9.77%	\$118,313,117	11.10%
Board	\$66,749,299	4.85%	\$58,869,324	5.52%
Farrier	\$64,405,766	4.68%	\$55,791,105	5.23%
Vet	\$49,406,020	3.59%	\$43,825,429	4.11%
Grooming	\$19,763,566	1.44%	\$13,820,934	1.30%
Bedding	\$65,928,116	4.79%	\$52,494,946	4.92%
Tack	\$73,108,844	5.31%	\$55,398,552	5.20%
Apparel	\$60,724,819	4.41%	\$39,707,803	3.72%
Breeding Fees	\$26,583,347	1.93%	\$18,459,519	1.73%
Publicity	\$4,366,770	0.32%	\$1,825,120	0.17%
Show	\$238,606,259	17.33%	\$131,058,370	12.29%
Lessons	\$60,632,229	4.40%	\$53,806,217	5.05%
Training	\$93,914,810	6.82%	\$70,316,734	6.60%
Pasture Maintenance	\$5,896,122	0.43%	\$4,287,609	0.40%
Barn Maintenance	\$8,844,183	0.64%	\$6,431,414	0.60%
Machinery Maintenance	\$14,740,304	1.07%	\$10,719,023	1.01%
Utilities - Water	\$3,378,384	0.25%	\$2,873,083	0.27%
Utilities - Power	\$9,312,591	0.68%	\$7,172,164	0.67%
Horse Insurance	\$3,495,929	0.25%	\$1,316,807	0.12%
Barn	\$50,849,715	3.69%	\$35,584,551	3.34%
Fence	\$15,355,561	1.12%	\$14,424,452	1.35%
Tractor/other	\$191,944,319	13.94%	\$177,007,105	16.60%
Trailer	\$64,699,164	4.70%	\$46,691,226	4.38%
Truck	\$49,386,942	3.59%	\$45,961,309	4.31%

Total Economic Impacts

The total economic impacts of the Alabama horse industry are calculated twice: once with an optimistic approach, and again with a conservative approach. The impacts include the collective

effects of direct, indirect, and induced spending are reflected as explained in the methods section. When directly affected industries have changes in their demands, other industries react to it and these transactions within the industry are the indirect effects. Local expenditure fluctuations resulting from affected industry sector income changes are the induced effects. The economic impact analysis conducted here exclude horse sales. It is important to recognize the impact includes both the agricultural and the recreational industries.

An Optimistic Approach

The total optimistic economic impacts of the Alabama horse industry are shown in table 50. There are 23,959 jobs associated with the Alabama horse industry with a total labor income of \$706.9 million. The total value added sits at \$969.6 million which includes total revenue minus the cost of inputs. The horse industry has a total sales impact of \$2.084 billion on Alabama.

Table 50. Optimistic Total Alabama Horse Impact

Optimistic Horse Industry Total, Direct, Indirect, and Induced Impacts for Alabama				
Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	18,138	\$472,853,224	\$565,349,419	\$1,293,703,645
Indirect Effect	2,599	\$111,316,440	\$177,678,003	\$391,771,154
Induced Effect	3,222	\$122,711,225	\$226,530,354	\$398,534,837
Total Effect	23,959	\$706,880,889	\$969,557,775	\$2,084,009,636

The direct effect includes horse operation expenses such as those listed in the optimistic column of table 49 for the Alabama horse expenses. These direct effects include 18,138 jobs with \$472.9 million in labor income. The total value added or a measure of the dollar value of goods and services provided from the industry is \$565.3 million. The total value of the direct output is \$1.294 billion. The indirect effects for the horse industry include 2,599 jobs with \$111.3 million in labor income. The total value added is about \$177.7 million. The indirect

effect output is \$391.8 million. The induced effects are associated with 3,222 jobs and \$122.7 million in labor income. The total value added is \$226.5 million and the total output is \$398.5 million.

Figure 13 shows the amount of direct, indirect, and induced impacts each category of horse care has on Alabama in an optimistic approach. The total impact low care horses have is \$1.626 billion, moderate care horses have \$379.2 million, and high care have \$79.09 million.

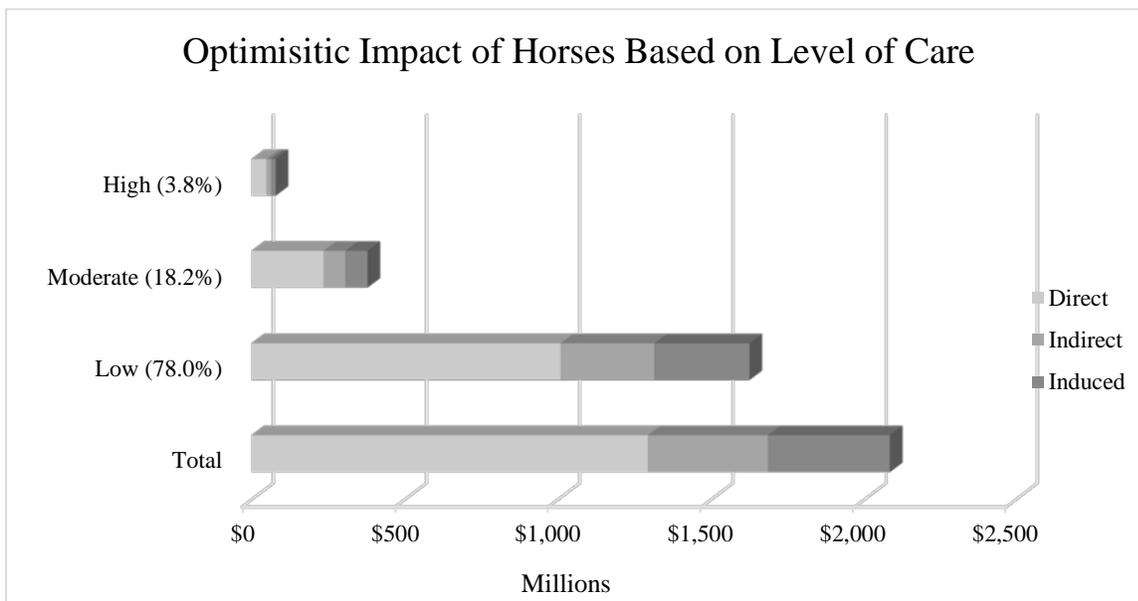


Figure 13. Optimistic Impact of Horses on Alabama Based on Care Level

Since the horse industry is measured for both the recreational and agricultural industries, table 51 shows how the Alabama horse industry impacts each of the aggregated major sectors in this scenario. The top three major sectors directly impacted are: the manufacturing sector with a \$570.7 million direct effect, the service sector with a \$367.0 million direct effect, and the agricultural sector with a \$246.9 million direct effect. The agricultural sector only makes up a portion of the total impact with the majority of the impact falling in the service and manufacturing sectors.

Table 51. Alabama Horse Industry Impact by Major Sector - Optimistic

Alabama Horse Industry Impact by Major Sector - Optimistic				
	Direct	Indirect	Induced	Total
Agriculture	\$246,877,544.00	\$11,753,137.00	\$1,305,147.00	\$259,935,828.00
Mining	\$0.00	\$3,979,595.00	\$1,586,841.00	\$5,566,436.00
Construction	\$58,931,508.00	\$11,182,984.00	\$4,750,729.00	\$74,865,221.00
Manufacturing	\$570,711,800.00	\$111,788,631.00	\$22,744,102.00	\$705,244,533.00
TIPU*	\$12,432,022.00	\$42,964,017.00	\$18,736,064.00	\$74,132,103.00
Trade	\$37,765,047.00	\$30,898,219.00	\$62,140,358.00	\$130,803,624.00
Service	\$366,985,725.00	\$171,770,049.00	\$278,799,716.00	\$817,555,490.00
Government	\$0.00	\$7,434,522.00	\$8,471,880.00	\$15,906,402.00

**Transportation, Information, and Public Utilities*

Table 52 shows the top ten industries affected by output. This table breaks down the total employment and output for each of the industries. The recreation industry has \$232.7 million in output versus the support activities for agriculture with \$221.2 million.

Table 52. Top Ten Industries Affected by Output - Optimistic

Top Ten Industries Affected by Output - Optimistic		
Description	Employment	Output
Other amusement and recreation industries	4,240	\$232,693,513
Support activities for agriculture and forestry	7,594	\$221,201,927
Farm machinery and equipment manufacturing	304	\$188,714,724
Other animal food manufacturing	131	\$143,999,573
Other leather and allied product manufacturing	712	\$71,905,715
All other miscellaneous wood product manufacturing	315	\$65,080,059
Truck trailer manufacturing	213	\$64,024,730
Other private educational services	1,194	\$61,946,959
Imputed rental activity for owner-occupied dwellings	0	\$57,396,329
Construction of other new nonresidential structures	460	\$50,200,280

A Conservative Approach

The total conservative economic impacts of the Alabama horse industry are shown in table 53.

In this scenario there are 17,949 jobs associated with the Alabama horse industry with a total

labor income of \$538.9 million, total value added sits at \$732.8 million, and the horse industry has a total sales impact of \$1.615 billion on Alabama.

Table 53. Conservative Total Alabama Horse Impact

Conservative Horse Industry Total, Direct, Indirect, and Induced Impacts for Alabama				
Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	13,509	\$359,551,311	\$423,501,914	\$1,005,954,298
Indirect Effect	1,982	\$85,763,394	\$136,505,013	\$305,210,343
Induced Effect	2,458	\$93,605,228	\$172,803,484	\$304,004,457
Total Effect	17,949	\$538,919,932	\$732,810,411	\$1,615,169,098

The direct effect includes horse operations expenses such as those listed in the conservative column of table 49 for Alabama horse expenses. These direct effects include 13,509 jobs with \$359.6 million in labor income. The total value added is \$423.5 million. The total value of the direct output is about \$1.006 billion. The indirect effects for the horse industry include 1,982 jobs with about \$85.76 million in labor income. The total value added is \$136.5 million. The indirect effect output is \$305.2 million. The induced effects account for 2,458 jobs and about \$93.61 million in labor income. The total induced value added is \$172.8 million with a total induced output of \$304.0 million.

Figure 14 shows the amount of direct, indirect, and induced impacts that each category of horse care has on Alabama in a conservative approach. The total impact low care horses have is about \$1.454 billion, moderate care horses have \$159.9 million, and high care have \$1.615 million.

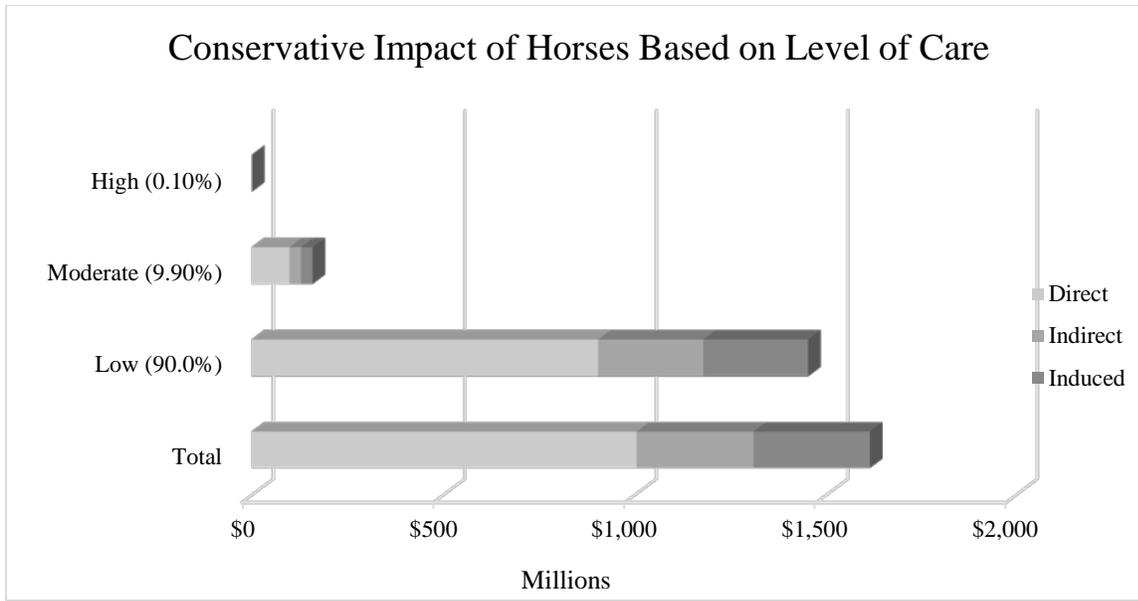


Figure 14. Conservative Impact of Horses on Alabama Based on Care Level

Table 54 shows each of the aggregated major sectors in this conservative scenario. The top three major sectors directly impacted are: the manufacturing sector with a \$488.2 million direct effect, the service sector with a \$240.4 million direct effect, and the agricultural sector with a \$199.5 million direct effect.

Table 54. Alabama Horse Industry Impact by Major Sector - Conservative

Alabama Horse Industry Impact by Major Sector - Conservative				
	Direct	Indirect	Induced	Total
Agriculture	\$199,534,421.00	\$9,224,211.00	\$995,220.00	\$209,753,853.00
Mining	\$0.00	\$3,014,437.00	\$1,209,776.00	\$4,224,212.00
Construction	\$41,479,352.00	\$8,732,903.00	\$3,623,504.00	\$53,835,759.00
Manufacturing	\$488,210,055.00	\$91,694,076.00	\$17,344,756.00	\$597,248,888.00
TIPU*	\$9,840,009.00	\$33,605,907.00	\$14,285,875.00	\$57,731,790.00
Trade	\$26,522,008.00	\$25,378,785.00	\$47,409,327.00	\$99,310,120.00
Service	\$240,368,454.00	\$128,095,027.00	\$212,676,122.00	\$581,139,603.00
Government	\$0.00	\$5,464,997.00	\$6,459,877.00	\$11,924,874.00

*Transportation, Information, and Public Utilities

Table 55 shows the top ten industries affected by output for this scenario. This table breaks down the total employment and output for each of the industries. In this scenario, the support activities for agriculture have the highest output at \$181.7 million versus the recreation industries at \$128.0 million.

Table 55. Top Ten Industries Affected by Output - Conservative

Top Ten Industries Affected by Output - Conservative		
Description	Employment	Output
Support activities for agriculture and forestry	6239	\$181,742,409
Farm machinery and equipment manufacturing	280	\$174,019,506
Other amusement and recreation industries	2333	\$128,027,053
Other animal food manufacturing	115	\$126,378,346
Other private educational services	1052	\$54,568,699
Other leather and allied product manufacturing	539	\$54,486,860
All other miscellaneous wood product manufacturing	251	\$51,816,509
Truck trailer manufacturing	154	\$46,205,874
Light truck and utility vehicle manufacturing	19	\$45,665,097
Imputed rental activity for owner-occupied dwellings	0	\$43,806,763

2006 Alabama Study

Since the previous study's published bulletin (Whiting, Molnar and McCall 2006) used a different method of estimating economic impact than the one used here, it seemed reasonable to redo the bulletin using the IMPLAN software to see what differences, if any, there were. The data from the bulletin was extracted and input into an Excel file to generate totals to do the comparison. There were slight inconsistencies in the annualized results between individual tables provided and the complete budget published in the bulletin. These were evaluated based on the text and appropriate adjustments were made.

The summary results for the previous study from the IMPLAN model concluded that there was a direct impact of \$904,951,467, an indirect effect of \$283,500,509, and an induced

effect of \$339,176,321 for a total impact of \$1,527,628,297 for 2005. These numbers are different than the bulletin study and it is notable that the direct effect is higher using IMPLAN and the indirect effect is much lower due to the table inconsistencies. In the 2006 study, the estimated direct effects were \$801,227,824 and the estimated indirect effects were \$1,522,332,866 for a total estimated impact of \$2,323,560,691.

Cluster Analysis

A cluster analysis is used to group a set of similar observations together into clusters by using quantitative comparisons of various characteristics. Ideally, observations within a cluster are similar to each other, and each cluster is dissimilar from all others. For this thesis, a cluster analysis was run in order to determine similarities between groups of Alabama horse owners relating to base cost of ownership per horse, cost of showing, cost of training, number of horses, and levels of discipline. The software used for this analysis was SAS (Statistical Analysis System).

The data for this analysis came from the 2016 Alabama Horse Owner Survey. There were 1090 usable observations from the survey. The questions of interest included the number of horses owned, annual care costs, annual show costs, annual training costs, and what the respondents did with their horses. Only observations with no missing values for the variables used in this analysis were retained. This step assumes that the values are missing at random rather than in a systematic way. Additionally, to remove unrealistic base cost estimates, an average base cost was calculated by dividing the total annual base cost by the number of horses owned. If the average annual base cost was less than \$500, the observation was deleted. There were 865 observations in the final data set.

Measures

Box plots for all the variables used in the cluster analysis are shown in figure 15. The measures are discussed below.

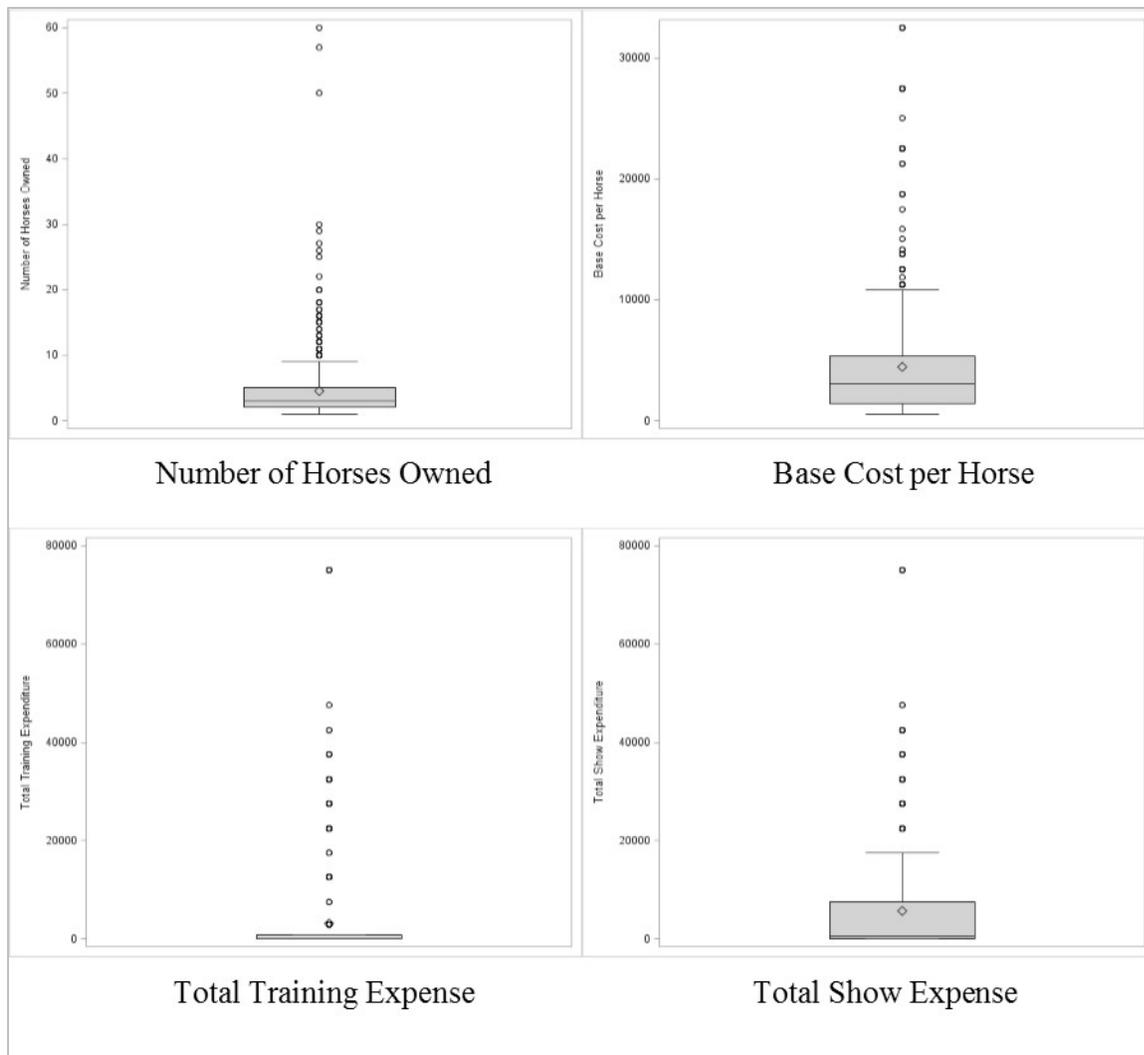


Figure 15. Box Plots of Continuous Variables

Number of Horses

Respondents were asked to provide the number of horses they owned or paid bills on. The mean response was 4.48 with a standard deviation of 5.01. Horse numbers in the survey have a minimum value of one. Thus, the high standard deviation relative to the mean indicates that the responses for this measure are highly skewed, and not normally distributed. (See figure 15.)

Costs

In the survey, all items relating to cost information were collected by intervals. In this analysis, the midpoint of each interval was used, as shown in table 56.

Table 56. Cost Intervals for Survey

Intervals Used in Data	
Interval	Median
Under \$1000	\$550
\$1,000-\$5,000	\$3,000
\$5,000-\$10,000	\$7,500
\$10,000-\$15,000	\$12,500
\$15,000-\$20,000	\$17,500
\$20,000-\$25,000	\$22,500
\$25,000-\$30,000	\$27,500
\$30,000-\$35,000	\$32,500
\$35,000-\$40,000	\$37,500
\$40,000-\$45,000	\$42,500
\$45,000-\$50,000	\$47,500
Over \$50,000	\$75,000

Annual Base Cost

The survey asked respondents about the annual expenditures for basic care of their horses (i.e. no showing or training expenses). This was an interval question and the median of those intervals was used (table 56). The mean response for total base cost was \$13,600.58 with a standard deviation of \$13,203.94. Then the responses were divided by the number of horses owned to get an average cost per horse to make sure the respondents were being grouped by how much they spent on average for each horse. This was so the number of horses would not skew results. The mean response for the average per horse cost was \$4,433.75 with a standard deviation of \$5,286.23. As with horse numbers, responses are skewed (figure 15).

Annual Show Expenses

The next expense item included was annual show expenses. The respondents were asked how much they spent annually on the total costs of showing their horse(s) (e.g. travel, lodging, entry fees). This was also an interval question with the median of those intervals used (table 56).

Non-show responses were entered as a zero value, indicating no money was spent showing. The mean response was \$5,585.20 with a standard deviation of \$10,254.12. As with other variables, this one was also highly skewed (figure 15).

Annual Training Expenses

Another expense item was annual training expenses. Respondents were asked how much they spent on training their horse(s) annually. This question was also in intervals with the medians of the intervals used (table 56). If a respondent did not have a horse in training, the value was zero, indicating no money was spent on training. The mean response was \$3,175.43 with a standard deviation of \$8,641.70. As with other variables, this one was also highly skewed (figure 15).

Level of Discipline

Respondents were asked about what they did with their horses such as if they had horses in training, if they showed, if they were work horses (e.g. ranch work), not ridden or “pasture ornaments,” if they used their horses for recreation or trail, or if they participated in some other sort of activities. Three levels of discipline were created based on responses to the questions concerning what the horse was being used for to distinguish respondents’ horses as low, moderate, or high utility respectively. Level 1 was for horses who are not ridden or shown (n=137). Level 2 was for horses used for recreational or trail riding (n=402). Level 3 was for horses used more extensively, such as those in training and those being shown (n=326).

Individual Relationships

The individual relationships between variables were analyzed first. Pearson correlations coefficients were calculated between all the expenditure variables and the number of horses. The results are shown in table 57. The following correlations were significant at the 0.05 level: base cost per horse and total show expenditure ($p < .0001$), base cost per horse and total training expenditures ($p = .0006$), base cost per horse and number of horses ($p < .0001$), total show and training expenditures ($p < .0001$), total show expenditures and number of horses ($p < .0001$), and total training expenditures and number of horses ($p < .0001$). The highest correlation, 0.46, was between total cost of showing and total cost of training, indicating that people who participated in shows were also likely to spend more on training. The number of horses was negatively related to base cost per horse ($\rho = -0.24$), indicating there may be some “economies of scale” in horse ownership.

Table 57. Pearson Correlation Coefficients

Pearson Correlation Coefficients				
	Base Cost per Horse	Total Cost of Showing	Total Cost of Training	Number of Horses
Base Cost per Horse	1	0.19935 ($< .0001$)	0.11617 ($< .0001$)	-0.23757 ($< .0001$)
Total Cost of Showing	-	1	0.45811 ($< .0001$)	0.34804 ($< .0001$)
Total Cost of Training	-	-	1	0.21607 ($< .0001$)
Number of Horses	-	-	-	1

A one-way ANOVA was run to test the significance between the categorical (discipline level) and continuous variables (base cost, show cost, training cost, number of horses). Table 58 shows the means for each variable by level of discipline. There was significance between discipline

level and average base cost ($p < .0001$), between discipline level and show expenditure ($p < .0001$), between discipline level and training expenditure ($p < .0001$), and moderate significance between discipline level and number ($p = 0.0302$).

Table 58. Variable Means by Level of Discipline

Variable Means by Level of Discipline								
Level of Discipline	Number of Horses		Base Cost per Horse		Total Show Expenditure		Total Training Expenditure	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
1 (n=137)	5.51	4.46	\$3,543.67	\$3,344.51	\$8,650.00	\$11,721.22	\$5,246.35	\$12,355.12
2 (n=402)	4.23	3.85	\$3,278.71	\$3,484.39	\$2,468.03	\$6,719.45	\$1,728.23	\$6,272.17
3 (n=326)	4.37	6.29	\$6,232.10	\$7,028.48	\$8,141.10	\$11,991.55	\$4,089.72	\$8,993.15

Because there is a significant correlation between the variables, a MANOVA analysis would be more appropriate to determine differences between the groups. Wilks' Lambda shows overall significance in the model ($p < .0001$). The Bonferroni method for multiple comparisons was used to test for significant differences in means of the variables across the level of disciplines. For base cost per horse, there were significant differences comparing discipline levels 3 and 2, but discipline levels 1 and 2 were not significantly different. For show expenditure there were significant differences comparing discipline levels 1 and 2 and discipline levels 3 and 2, but there was no significant difference between discipline levels 1 and 3. For training expenditure, there was a difference between discipline levels 1 and 2 and discipline levels 3 and 2, but no significant difference between levels 1 and 3. The Bonferroni method for number of horses owned showed there was no significant difference in any of the discipline levels at the 0.05 level.

Cluster Analysis

A distance matrix was created using Gower's coefficient, a similarity matrix, because of the mixed variables. The discipline level was entered as nominal and the base cost per horse, total cost of showing, total cost of training, and number of horses were entered as ordinal. Although these variables were transformed to interval data for the correlation analysis and ANOVA, they performed better in the cluster analysis when treated as ordinal variables.

There are many different methods available for determining the number of clusters to retain. If the measures have the same scale, the root-mean-square total sample standard deviation (RMSSTD) can be used. For this method the ideal value would be small. Larger values indicate that the new cluster may not be homogenous. To measure how much the groups differ from each other, the R-square values can be looked at. These values are ideally large. Also available are some statistics for the number of clusters known as cubic clustering criteria (CCC). Peaks in this plot with values above two or three indicate good clusters. Negative values indicate outliers. There is also pseudo-F available to test cluster means. An attempt to use these measures was employed in this analysis; however, these methods did not perform well. Thus, a dendrogram, or a "tree" diagram showing how the clusters were merged was used to guide this decision.

A centroid hierarchical cluster analysis was the method used. Figure 16 is the resulting dendrogram. From the dendrogram, I decided to retain three clusters. The three clusters were identified at about a distance of 0.8 between the centroids. The clusters appear to represent low, moderate, and high levels of horse utility as shown by examining observations in each group.

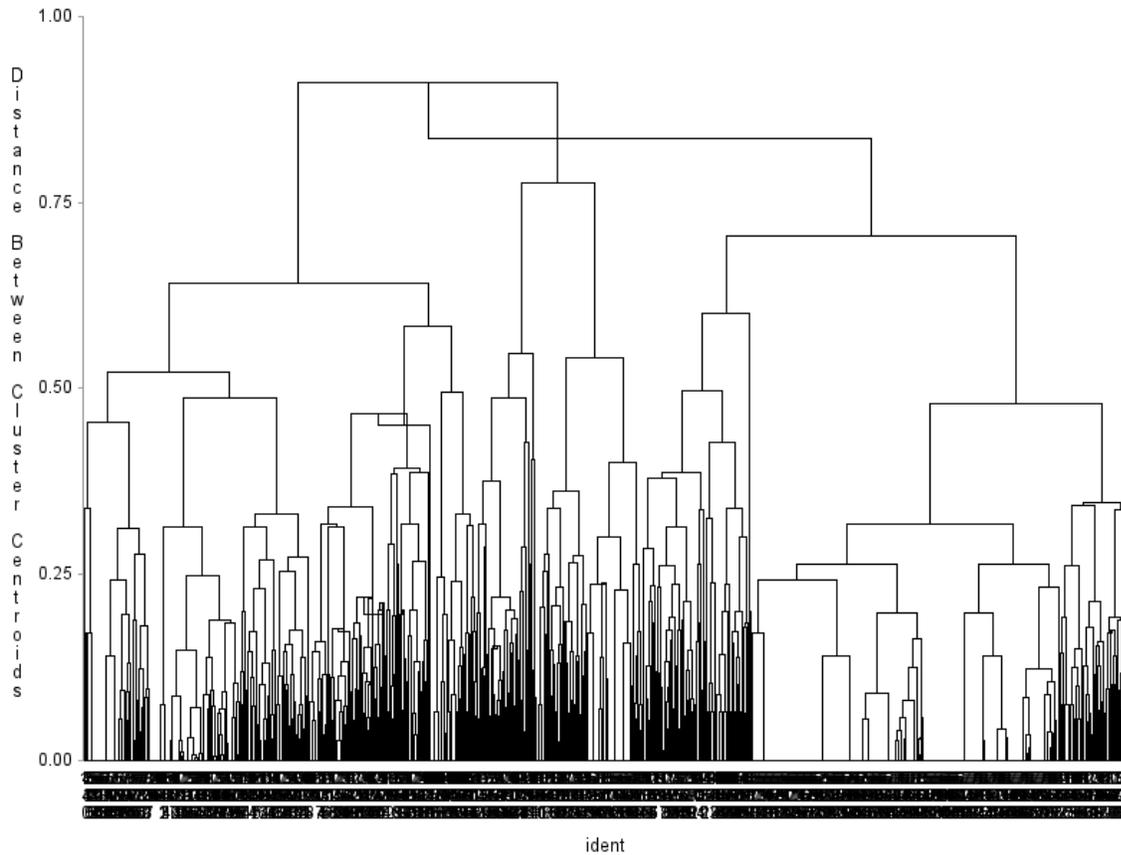


Figure 16. Dendrogram of All Clustered Variables

Frequency was checked on the categorical variable, level of discipline, to see if there were significant differences in the variables between clusters. The clusters appeared to be grouped initially by level of discipline with cluster 1 having all level 2, cluster 2 having all level 3, and cluster 3 having all level 1 as seen in table 59.

Table 59. Frequency of Discipline Level by Cluster

Frequency of Discipline Level by Cluster			
Cluster	Discipline Level		
	1	2	3
1 (n=402)	0	402	0
2 (n=326)	0	0	326
3 (n=137)	137	0	0

Table 60 shows the cluster means and standard deviations for the variables as described. The main distinct difference between clusters was the discipline level. Cluster 1 had 402 observations. This was defined as the moderate utility group. Members of this group owned an average of about 4 horses (mean = 4.23, standard deviation = 3.85), had an average base cost per horse of \$3,278.71 (standard deviation = \$3,484.39), with an average show expenditure of \$2,468.03 (standard deviation = \$6,719.45), and an average training expenditure of \$1,728.23 (standard deviation = \$6,272.17). Cluster 2 had 326 observations. It was defined as the high utility group. Members of this group owned about an average of 4 horses (mean = 4.37, standard deviation = 6.29), had an average base cost per horse of \$6,232.10 (standard deviation = \$7,028.48), with an average show expenditure of \$8,141.10 (standard deviation = \$11,721.22), and an average training expense of \$4,089.72 (standard deviation = \$8,993.15). Cluster 3 had 137 observations. It was defined as the low utility group. Members of this group had on average between 5 and 6 horses (mean = 5.51, standard deviation = 4.46), an average base cost per horse of \$3,543.67 (standard deviation = \$3,344.51), with an average show expenditure of \$8,650.00 (standard deviation = \$11,721.22), and an average training expenditure of \$5,426.35 (standard deviation = \$12,355.12).

Table 60. Cluster means of variables

Cluster Means								
Cluster	Average Base Cost		Show Expenditure		Training Expenditure		Number	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
1 (n=402)	\$3,278.71	\$3,484.39	\$2,468.03	\$6,719.45	\$1,728.23	\$6,272.17	4.23	3.85
2 (n=326)	\$6,232.10	\$7,028.48	\$8,141.10	\$11,991.55	\$4,089.72	\$8,993.15	4.37	6.29
3 (n=137)	\$3,543.67	\$3,344.51	\$8,650.00	\$11,721.22	\$5,246.35	\$12,355.12	5.51	4.46

Cluster 2 had the highest level of utility (level 3) and the average base cost was the highest of the three clusters as would be expected from the high level of use. Since cluster 3 had the lowest level of utility (level 1) it was expected that it would have the lowest average base cost, but this was not the case. It was less than cluster 2, but the total show expenditure and training expenditure was the highest of all the clusters which indicates that there was some kind of anomaly of respondents in this group, possibly for horses not being ridden. This could be due to some respondents who answered they did not ride, but had breeding animals or showed halter horses and incorrectly filled out the survey.

To see if the differences between cluster means were significantly different, ANOVA analyses and a Tukey's Studentized Range Test for significance were run on the cost variables and horse numbers. Table 61 shows the Tukey Test for base cost per horse showed significant differences comparing clusters 2 and 3 and clusters 2 and 1, but clusters 3 and 1 were not significantly different.

Table 61. Tukey Studentized Range Test - Base Cost per Horse

Tukey Studentized Range Test - Base Cost per Horse				
Cluster Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		Significant at 0.05 Level
2-3	2688.4	1468.7	3908.2	Yes
2-1	2953.4	2060.5	3846.3	Yes
3-1	265	-920.2	1450.1	No

The Tukey Test for show expenditure (table 62) showed that there was a significant difference comparing clusters 3 and 1 as well as comparing 2 and 1, but there was no significant difference between clusters 3 and 2.

Table 62. Tukey Studentized Range Test - Total Show Expenditure

Tukey Studentized Range Test - Total Show Expenditure				
Cluster Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		Significant at 0.05 Level
3-1	6182	3895.7	8468.2	Yes
2-1	5673.1	3950.6	7395.5	Yes
3-2	508.9	-1844.1	2861.9	No

The Tukey Test for training expenditures (table 63) also showed a difference between clusters 3 and 1 and clusters 2 and 1, but no significant difference between clusters 3 and 2.

Table 63. Tukey Studentized Range Test - Total Training Expenditure

Tukey Studentized Range Test - Total Training Expenditure				
Cluster Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		Significant at 0.05 Level
3-1	3518.1	1535.3	5500.9	Yes
2-1	2361.5	867.7	3855.3	Yes
3-2	1156.6	-884	3197.3	No

The Tukey Test for horse numbers (table 64) showed that there was a slight significant distance between clusters 3 and 1, but there was no significant difference between clusters 3 and 2 and clusters 2 and 1.

Table 64. Tukey Studentized Range Test - Number of Horses

Tukey Studentized Range Test - Number of Horses				
Cluster Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		Significant at 0.05 Level
3-1	1.2846	0.1248	2.4444	Yes
3-2	1.1398	-0.0539	2.3335	No
2-1	0.1448	-0.729	1.0186	No

The show cost and training cost were significantly different between the low and moderate levels of utility and the moderate and high levels of utility, but not significant between high and low levels of utility. Outliers may have skewed the data, and I would need to look at the survey data again to explain this unexpected result. The number of horses was significantly different between cluster 3 and clusters 1 and 2 which is another distinction.

Sensitivity Analysis

To see if there was any distinct difference between the discipline level and the average base cost spent per horse, the analysis was rerun using the base cost per horse and discipline level instead of the total costs of showing, total costs of training, and the number of horses. As seen in figure 17, when the discipline level and the average base cost were the only variables, there were still three distinct clusters at about a distance of 0.50 between the centroids.

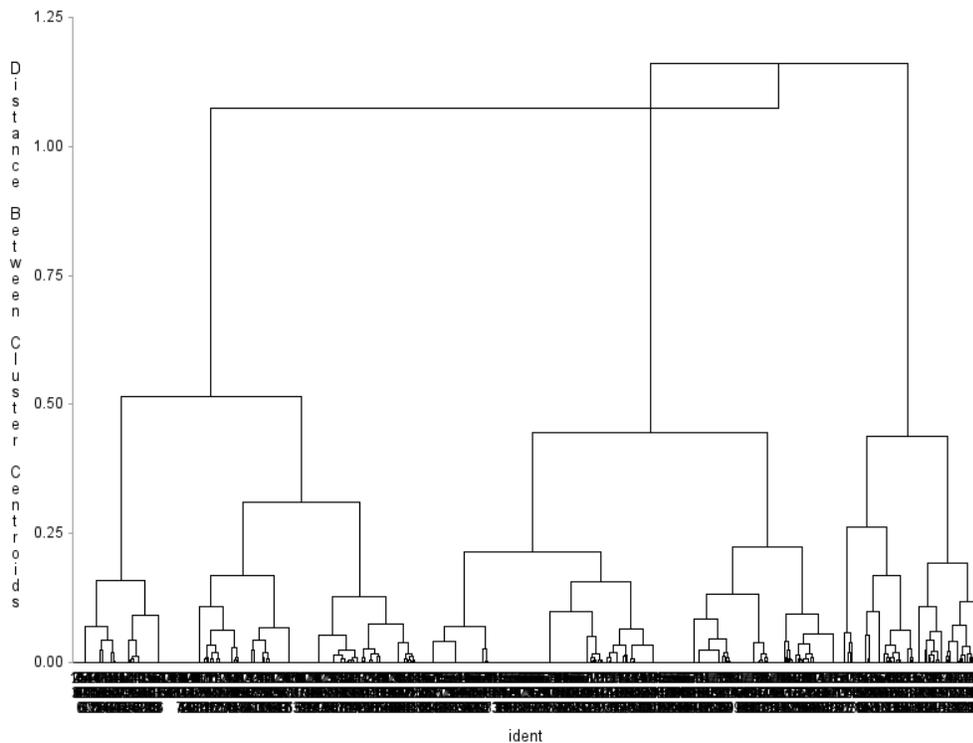


Figure 17. Dendrogram of Discipline Level and Average Base Cost

This cluster analysis shows that there are significant differences between some aspects of the clusters; however, the model needs further investigation. There are outliers that need to be evaluated and the data could potentially be further refined. A principle components analysis of the entire data set might also be useful in discovering patterns in the responses.

Discussion

The purpose of this thesis was to collect information on horse ownership within the state of Alabama and to estimate how horses impact the state economy. Budgets for horse ownership costs were developed to get an estimate of expenses for goods, services, and activities involved with the horse industry. Data used in developing the budgets came from previously published research, a survey generated specifically for this study (2016 Alabama Horse Owner Survey), public data, and information gleaned from phone calls to service providers. The Alabama horse population was also estimated and used in conjunction with the 2016 Alabama Horse Owner Survey to get total numbers of low, moderate, and high cost horses in Alabama. An economic impact analysis was then conducted using IMPLAN software. Finally, a cluster analysis was run to classify different groups of respondents from the 2016 Alabama Horse Owner Survey.

This study estimated the total Alabama horse population to be 153,904 based off of USDA and AVMA surveys. Based on these population estimates by level of cost, the total sales impact was \$2.084 billion dollars in 2015. This includes an estimated total of 23,959 jobs, \$706.9 million in labor income, and \$969.6 million in gross domestic product.

The cluster analysis identified three clusters that were linked to low, moderate, and high levels of utility. The clusters show there are significant differences between groups of horse owners. The three clusters had significant differences when it came to the annual base cost per horse versus the level of utility. Cluster 1 had the lowest average cost per horse, show expense, and training expense, indicating that these owners use their horses more recreationally. Cluster 2 had the highest average cost per horse, suggesting that owners who are extremely active with their horses (i.e. have the highest level of utility) spend more on basic care. Cluster 3 had the highest average number of horses owned.

It should be noted that a study of this type has limitations due to the values used to estimate the economic impacts of the industry. Due to caution in these evaluations, these calculations are considered to be conservative. Additionally, expenses such as the purchase price of the horse, surgery or major illness are not included and would have further effect on the economic impact.

There is little information on the expenditures of the Alabama horse industry, and some of the information used had to be a judgement call. The most recent directly related information on horse ownership came from the survey conducted in 2006 by Whiting, Molnar, and McCall. Because of the lack of information, other studies had to be referenced in order to estimate certain expenditures. In addition, the ability to produce an exactly accurate model of the industry for the scenario to be analyzed can be a subjective process. Because of these limitations in an input-output analysis, not all net effects may be captured.

Increasing the awareness of the current condition of Alabama's existing horse industry will aid in benefitting the future of the industry and the implications that future holds. Horses make a significant contribution to the Alabama economy and are an important part of both the recreational and agricultural sector. Many agricultural commodities and services are directly influenced by horse recreation, production, and maintenance. Horse events add another level to the industry due to additional expenditures and tourism that accompany these events. Participants attending the shows are spending money for travel, hotels, as well as food and beverages. These expenses help inject new spending in other parts of the state through purchases at gas stations and convenience stores, restaurants, hotels, and show or event facilities. These economic impacts that are stimulated in areas hosting these events would not necessarily happen

otherwise. This \$2.084 billion industry contributes to almost 24,000 jobs and is a crucial part of the Alabama economy.

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Appendix A: Survey

The survey for Alabama horse owners was conducted during the spring of 2016 by the Auburn University Department of Agricultural Economics and Rural Sociology. The survey was created online using Qualtrics software and distributed through social media and email. There were 1,271 total surveys started and 1,091 completed over a four week period.

This is a survey for horse owners in Alabama. There are 10 questions which should take no more than 5-10 minutes to complete. Please read the following Letter of Information before proceeding. Your answers are voluntary and confidential. Thank you for your response!



The Auburn University Institutional Review Board has approved this Document for use from 03/03/2016 to 03/02/2019 Protocol # 16-030 EX 1603

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COLLEGE OF AGRICULTURE

DEPARTMENT OF AGRICULTURAL ECONOMICS & RURAL SOCIOLOGY

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

INFORMATION LETTER

for a Research Study entitled
"Economic Impact Study of the Equine Industry on Alabama"

You are invited to participate in a research study to determine the economic impact of the equine industry on Alabama. The study is being conducted by Darcey Richburg, Masters Student under the direction of Dr. Patricia Duffy, Professor in the Auburn University Department of Agricultural Economics. You are invited to participate because you are involved in the Alabama equine industry either through ownership or are a provider of goods and/or services and are age 19 or older.

If you decide to participate in this research study, you will be asked to complete a survey. Your total time commitment will be approximately 5 minutes.

There are no risks associated with this study.

There are no compensations for participation but we do thank you for your time.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the Department of Agricultural Economics, or the researchers conducting this study.

Any data obtained in connection with this study will remain anonymous. We will protect your privacy and the data you provide by keeping records for contact separate from responses and destroying these records immediately after the survey is completed.

If you have any questions about this study, please ask them now or contact Darcey Richburg at dmh0008@auburn.edu or Dr. Patricia Duffy at duffypa@auburn.edu.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or email at IRBadmin@auburn.edu or IRBchair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. THIS LETTER IS YOURS TO KEEP.

Darcey Richburg 3/23/2016
 Investigator/signature Date

Darcey Richburg
 Printed Name

Patricia Duffy 3/23/2016
 Co-Investigator Date

Patricia Duffy
 Printed Name

By checking yes, I certify that I am 19 years of age or older.

- Yes
- No

Please verify you are an Alabama resident by entering your zip code.

How many horses are you currently paying bills on due to ownership or leasing?

Do you board them or keep them at home? Select all that apply. (The total should equal the number above.)

- Board (how many?) _____
- Home (how many?) _____

What breed(s) do you have? Select all that apply.

- Appaloosa
- Arabian
- Paint
- Quarter Horse
- Racking Horse
- Saddlebred
- Spotted Saddle Horse
- Tennessee Walking Horse
- Thoroughbred
- Grade or unregistered
- Pony (if registered, please indicate breed) _____
- Other (please describe) _____
- Other (please describe) _____
- Other (please describe) _____

How many riding lessons do you pay for each month? Please type in a number for each. If none, please enter "0."

Private Lessons

Group Lessons

Do you have any horses in training?

- Yes
- No

Answer If Do you have any horses in training? Yes Is Selected

How many horses do you have in training? Please type in a number for each discipline you select.

- Barrel Racing _____
- Cutting _____
- Dressage _____
- Driving _____
- English Pleasure _____
- Eventing _____
- Gaited Training _____
- Halter _____
- Hunter/Jumper _____
- Racing _____
- Recreational Riding _____
- Reining _____
- Roping _____
- Starting Under Saddle/Breaking/Backing _____
- Team Penning _____
- Western Pleasure _____
- Other (Please describe) _____
- Other (Please describe) _____
- Other (Please describe) _____

Answer If Do you have any horses in training? Yes Is Selected

In a typical year, approximately how much do you spend on training your horse(s)?

- Under \$1,000
- \$1,000 - \$5,000
- \$5,000 - \$10,000
- \$10,000 - \$15,000
- \$15,000 - \$20,000
- \$20,000 - \$25,000
- \$25,000 - \$30,000
- \$30,000 - \$35,000
- \$35,000 - \$40,000
- \$40,000 - \$45,000
- \$45,000 - \$50,000
- Over \$50,000

Do you show your horse(s)?

- Yes
- No

Answer If Do you show your horse? Yes Is Selected

Where do you show your horse(s)? Please select all that apply and type how many horses you show for each selection.

- 4-H Shows _____
- Breed Shows _____
- Dressage Shows _____
- Endurance, Competitive, or Obstacle Trail _____
- Eventing or Horse Trials _____
- Gaited Events _____
- Hunter/Jumper Shows _____
- Racing _____
- Rodeos _____
- Other (Please Describe) _____

Answer If Do you show your horse(s)? Yes Is Selected

In a typical year, how many shows do you attend at a local, regional, or national level? Please select all that apply and type a number for each selection.

- Local _____
- Regional _____
- National _____

Answer If Do you show your horse(s)? Yes Is Selected

Approximately how much do you spend showing your horse(s) each year?

- Under \$1,000
- \$1,000 - \$5,000
- \$5,000 - \$10,000
- \$10,000 - \$15,000
- \$15,000 - \$20,000
- \$20,000 - \$25,000
- \$25,000 - \$30,000
- \$30,000 - \$35,000
- \$35,000 - \$40,000
- \$40,000 - \$45,000
- \$45,000 - \$50,000
- Over \$50,000

How many horses are not shown or in training? Please select all that apply and type how many horses for each selection.

- All of my horses are shown or in training
- Breeding Stock _____
- Driving _____
- Pasture Ornament / Do Not Ride _____
- Ranch Work _____
- Recreational Riding _____
- Trail Riding _____
- Other (Please describe) _____
- Other (Please describe) _____
- Other (Please describe) _____

Are you involved with any Alabama clubs or organizations? Please select all that apply.

- Alabama Arabian Horse Association
- Alabama High School Rodeo Association
- Alabama Horse Council
- Alabama Hunter Jumper Association
- Alabama Junior High School Rodeo Association
- Alabama National Barrel Horse Association
- Alabama Obstacle Challenge
- Alabama Open Horseman Association
- Alabama Palomino Exhibitors Association
- Alabama Quarter Horse Association
- Alabama Reining Horse Association
- Alabama Stock Horse Association
- Alabama Thoroughbred Breeders Racing Association
- American Saddlebred Association of Alabama
- Birmingham Dressage and Combined Training Association
- Cutting Horse Association
- The Equine Enthusiasts Division of the Alabama Farmers Federation
- McCurdy Plantation Horse Association
- Mounted Shooting
- Outback Trail Riders
- Racking Horse Breeders Association
- Other _____
- Other _____
- Not involved with any clubs/organizations

How many horses do you have insured? Please type in a number for each. If none, please enter

"0."

Mortality Insurance
Medical or Surgical Insurance
Not Insured

Excluding training and show costs, approximately how much in total do you spend on your horse(s) each year?

- Under \$1,000
- \$1,000 - \$5,000
- \$5,000 - \$10,000
- \$10,000 - \$15,000
- \$15,000 - \$20,000
- \$20,000 - \$25,000
- \$25,000 - \$30,000
- \$30,000 - \$35,000
- \$35,000 - \$40,000
- \$40,000 - \$45,000
- \$45,000 - \$50,000
- Over \$50,000

Appendix B: SAS Code

```
data horse.test;
set horse.contdata;
if zipcode=. then delete;
if number=0 or . then delete;
if basecost=. then delete;
if DiscpLvl =0 or . then delete;
AvgBaseCost=BaseCost/number;
AvgShowCost=costshow/number;
AvgTrainCost=costtraining/number;
run;
data horse.test2;
set horse.test;
if AvgBaseCost LT 500 then delete;
keep number avgbasecost costshow costtraining discplvl;
run;
data horse.cluster;
set horse.test2;
num = _n_;
ident = put(num,4.);
run;
proc sgplot data=horse.cluster;
label number = "Number of Horses Owned";
vbox number;
run;
proc sgplot data=horse.cluster;
label avgbasecost = "Base Cost per Horse";
vbox avgbasecost;
run;
proc sgplot data=horse.cluster;
label costshow = "Total Show Expenditure";
vbox costshow;
run;
proc sgplot data=horse.cluster;
label costtraining = "Total Training Expenditure";
vbox costtraining;
run;
proc means data=horse.cluster n mean std;
var number avgbasecost costshow costtraining;
run;
proc freq data=horse.cluster;
table discplvl;
run;
proc glm data= horse.cluster alpha = .05 ;
class discplvl;
model avgbasecost costshow costtraining number = discplvl / ss3;
manova h=_all_;
lsmeans discplvl/ cl adjust=bon pdiff;
means discplvl/bon alpha=.0125 cldiff;
run;
quit;
ods graphics on;
title 'Correlation Between Number of Horses, Average Base Cost, Total Show Cost, Total Training Cost, and Discipline Level';
```

```

proc corr data=horse.test2 sscp cov plots(maxpoints=50000)=matrix;
var avgbasecost costshow costtraining number;
run;
title;
ods graphics off;
proc glm data=horse.test2;
class disclvl;
model number avgbasecost costshow costtraining = disclvl;
means disclvl;
run;
proc sort data=horse.cluster;
by ident;
run;
proc distance data = horse.cluster out=horse.dist method=dgower;
var nominal(disclvl);
var ordinal(avgBaseCost CostShow CostTraining Number);
id ident;
run;
proc cluster data=horse.dist method=CENTROID pseudo outtree=horse.tree ;
id ident;
run;
proc tree data=horse.tree nclusters=3 out=horse.clustnum;
id ident;
run;
proc sort; by ident;
run;
data horse.combine;
merge horse.cluster horse.clustnum;
by ident;
run;
Proc means data=horse.combine n mean std;
class cluster;
var avgBaseCost CostShow CostTraining Number;
run;
Proc freq data=horse.combine;
tables cluster*disclvl;
run;
ods graphics on;
proc glm data=horse.combine manova;
class cluster;
model avgBaseCost CostShow CostTraining Number = cluster;
means cluster / tukey;
run;
ods graphics off;
quit;

```