

INTRODUCTION

New Mexico has a vibrant and growing racehorse industry. The state has five racetracks where more than 6,000 quarter horses and thoroughbred horses ran in approximately 3,500 races in 2006 (New Mexico Racing Commission, 2008). It is estimated that approximately 10,000 individuals, including horse owners, breeders, trainers, track owners and managers, are directly involved with New Mexico's racehorse industry (Deloitte, 2005). While some information regarding the number of horses involved in the industry is available, and initial work describing the industry has been conducted, a comprehensive overview of the industry is not available. This report adds to existing information regarding the state's horse-racing industry by providing a brief description of the industry and providing estimates of the economic impact that racehorse ownership, breeding and training have on the state's economy. The research described here, which does not include the economic impacts of racetracks or gaming on the state's economy, updates previous economic impact work by Gutierrez in 2001 and by Deloitte, sponsored by the American Horse Council Foundation, in 2005.

Expenditure data used as a basis for the analysis were obtained from a 2006 survey of racehorse owners, breeders, and trainers conducted by researchers in the Department of Animal and Range Sciences at New Mexico State University. Additional data regarding the number of racehorses in the state were obtained from the Jockey Club, the American Quarter Horse Association, the American Horse Council and the New Mexico Racing Commission. These figures were examined by individuals familiar with the industry; based on their recommendations, modifications were made to more accurately reflect existing conditions. Economic impacts described in the report were estimated using input-output modeling with the software program Impact Analysis for Planning (IMPLAN). The next section provides a brief overview of the racehorse industry

within the state, focusing on horse ownership, breeding and training, followed by a description of input-output modeling as used in economic impact analysis, as well as a description of the IMPLAN software. The explanation of input-output modeling is followed by results and conclusion sections.

**DESCRIPTION OF NEW MEXICO'S
RACEHORSE INDUSTRY****Individuals associated with New Mexico
horse racing**

New Mexico's racehorse industry encompasses several interdependent components or industries. That is, the industry includes horse owners, breeders, and trainers as well as racetrack-related enterprises. Estimating the exact number of horses and individuals associated with each of these industries is difficult. Researchers have reported varying numbers of individuals associated with the industry. For example, Deloitte (2005) estimated that nearly 10,000 jobs were directly associated with the racehorse industry, with 12,000 total jobs generated by horse racing in the state. In their 2006 Annual Report, the New Mexico Racing Commission reported that more than 6,000 new licenses were processed, for a total of 11,000 licensed industry participants in the state. These individuals worked in varied capacities related to the racehorse industry, for example as veterinarians. Wise and Duff estimated that in 2006 there were approximately 4,800 owners, breeders and trainers within the state's racehorse industry.

**Estimated number of racehorses
in New Mexico**

According to the Census of Agriculture in 2002 (most recent census data available) there were 46,686 horses in New Mexico on 7,204 farms (USDA-NASS, 2002). Estimating a significantly larger number, Deloitte

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Table 1. 2006 Estimated Number of Racehorses in New Mexico, by Breed, Age, and Race Status

Horse Age/Use	Thoroughbred	Quarter Horse	Total
Breeding stock			
Stallions	184	150	334
Breeding mares	2,022	1,155	3,177
Registered foals	949	900†	1,849
Racing horses, not racing (training)			
Yearlings	702	866	1,568
Two-year-olds	909	248††	1,157
Three-year-olds (and older) †††	216	231	447
Racing horses, racing			
Two-year-olds	600	992	1,592
Three-year-olds (and older)	2,166	2,311	4,477
Total	7,748	6,853	14,601

†Number of foals is approximated from available aggregate data relative to new registrations.

††Calculated as 20% of total age population based on interviews with industry participants.

†††Calculated as 10% of racing counterparts based on interviews with industry participants.

(2005) suggests that in 2003 there were 147,000 horses within the state, with more than 10,000 horses directly involved in racing. According to the Jockey Club (the breed registry for Thoroughbred horses in the U.S.) and the American Quarter Horse Association, in 2006 6,069 horses made unique racing starts in New Mexico.

Using sources from the Jockey Club, the American Quarter Horse Association, the American Horse Council and the New Mexico Racing Commission, we estimate the current total racehorse population (including both racing horses and horses indirectly associated with racing, e.g., breeding stock) to be 14,601. Table 1 shows these estimates by breed (thoroughbred and quarter horse) and by primary use (breeding stock, horses in training and racing horses). Differences between our estimate of 14,601 horses and Deloitte's 2003 estimate of 10,100 may be attributable to several factors—notably, differences in time period (2003 numbers versus 2006 numbers) and in methodology (our estimates include not only horses owned by New Mexico residents but also horses raced in New Mexico owned by residents outside of the state, since expenditures occurred in New Mexico).

New Mexico State University survey

To better understand the New Mexico racehorse industry, the Department of Animal and Range Sciences at New Mexico State University conducted a survey of

New Mexico racehorse industry participants. With the help of the New Mexico Horse Breeders Association and the New Mexico Racing Commission, contact information for a total of 3,280 individuals identified as being associated with the New Mexico horse racing industry as owners, breeders, or trainers was obtained. These individuals served as the sample for an in-depth survey that was designed to better understand New Mexico's racehorse industry. The survey included general questions that pertained to the participants' primary role in the industry and to the length of time they had participated in the industry. Each survey included a specialized section pertaining to horse ownership, breeding, and training programs. Participants were invited to complete the general questions and specific sections that pertained to their specialization (e.g., ownership, breeding, or training). Participants could complete survey sections for more than one specialization area (e.g., one participant could fill out information about their horse ownership as well as their efforts as a racehorse breeder). A total of 237 responses were received from the 3,280 surveys that were sent (the 237 responses may have included duplicates and does not necessarily represent 237 different individuals or farms). A total of 7,195 horses were represented in the returned surveys. These included 1,318 horses associated with ownership, 788 horses associated with breeders, and 5,089 horses associated with trainers. Figure 1 shows the breakdown of survey horses represented relative to the estimated population of racehorses participating in New Mexico racing (shown above). Based on the estimated total racehorse population above, it appears that the survey slightly over-sampled individuals associated with young racehorses (yearlings and two-year olds), while under-sampling individuals working with older racehorses.

Racehorse ownership

A total of 201 individuals indicated that their primary involvement with New Mexico's racehorse industry was that of an owner (96 of these respondents also indicated other "primary" business activities related to the New Mexico racehorse industry, e.g., breeding or training). Twenty-two of these respondents indicated that their racehorse activities served as their primary source of household income. Forty-seven percent of those indicating that their primary involvement with the racehorse industry was that of a horse owner living in the state (primary residence in the state). The remaining 53% lived outside of the state but owned horses that were boarded in the state.

Survey respondents indicating that they owned racehorses were asked to disclose the number of horses they owned (that raced in 2006 on a New Mexico track) and

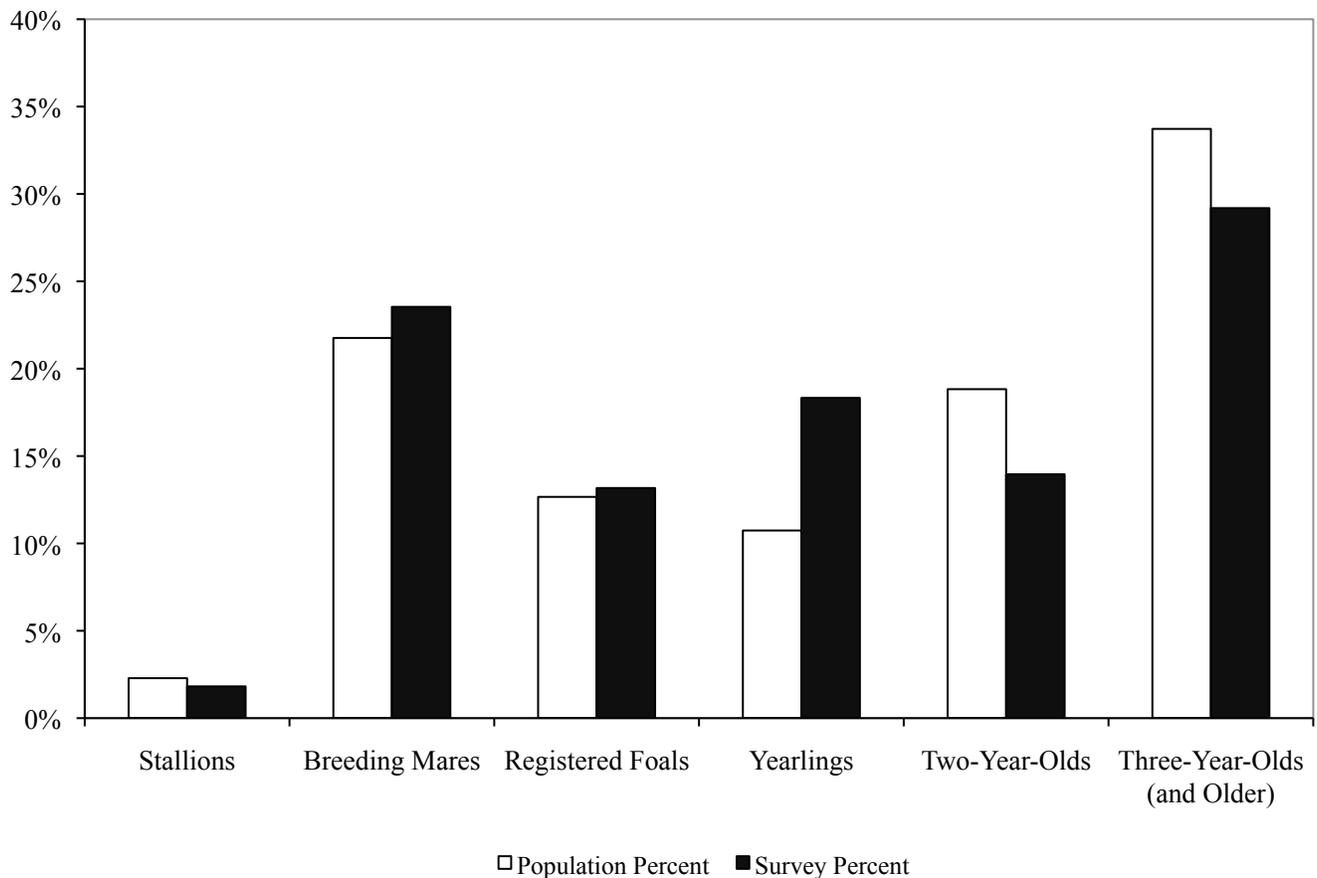


Figure 1. NMSU survey sample and estimated racehorse population.

Table 2. Number of Racehorses, by Breed, 2006

Horse breed/age	Number of respondents	Number of horses	Average horse value
Quarter horse			
Yearlings	46	157	\$ 14,712
Two-year-olds	47	140	16,073
Three-year-olds (or older)	55	190	23,109 [†]
Thoroughbred			
Yearlings	58	216	22,330
Two-year-olds	85	144	19,878
Three-year-olds (or older)	100	404	18,278

[†]Excludes one observation with a value of \$1,000,000.

the value of those horses. Values differed significantly between breeds, with younger thoroughbred horses (yearlings and two-year-olds) being valued more than their quarter horse counterparts. Older quarter horses (three-year-olds and older) were valued higher than their Thoroughbred counterparts. Table 2 shows the number

of horses reported by the survey participants as well as the average value for each horse class.

In addition to requesting information regarding horse numbers and values, the NMSU survey also asked respondents to estimate the total expenditures incurred in 2006 associated with their role as a racehorse owner. These expenditures (along with those disclosed by breeders and trainers) are the basis for calculating the economic impact of the industry on the state's economy. Estimated expenditures associated with horse ownership were provided by 160 survey participants. Average (per-horse) estimated expenditures varied significantly from participant to participant, and the overall distribution of these averages appeared to be skewed upward. After excluding observations with an average per-horse expenditure less than \$1,500 (seven observations) and more than \$50,000 (nine observations) the average expenditure per horse for owners participating in the survey was \$14,363.² The median expenditure reported was \$11,764. The maximum expenditure reported (after

² Researcher-imposed lower and upper limits represented reasonable expenses associated with feeding a horse (lower bound) and approximately two standard deviations above the average for the upper bound. These limits make the estimates in this report more conservative than they would have been without the limits.

Table 3. Estimated Expenditures Associated with Racehorse Ownership, Horses Raced in New Mexico in 2006

Expenditure category	Average expenditure	Percent of total expenditure	Median expenditure†	Percent of total expenditure
Boarding fees paid to others	\$3,015.50	21.0%	\$1,450.00	12.3%
Feed and bedding	1,309.77	9.1	866.67	7.4
Health/veterinarian services	1,284.65	8.9	1,000.00	8.5
Farrier services	386.19	2.7	341.67	2.9
Breeding fees	543.65	3.8	250.00	2.1
Facility maintenance and repair	450.40	3.1	230.30	2.0
Equine insurance premiums	287.18	2.0	0.00	0.0
Utilities	162.83	1.1	50.00	0.4
Property tax and taxes on horses	172.50	1.2	105.56	0.9
Rent and lease of land and buildings	167.65	1.2	0.00	0.0
Fees (e.g., registration & entry)	313.82	2.2	147.92	1.3
Shipping and travel	661.01	4.6	500.00	4.3
Horse purchases	2,133.66	14.9	786.36	6.7
Real estate purchases	2,215.35	15.4	0.00	0.0
Equipment purchases	567.48	4.0	66.67	0.6
Advertisements and marketing	80.73	0.6	0.00	0.0
Miscellaneous expenses	610.26	4.2	288.89	2.5
Total	\$14,362.62		\$11,764.29	

†Total median expenditure based on participant-identified total per-horse expenditures. Sum of median expenditure groups does not equal median of the total.

excluding extreme observations) was \$43,250, and the lowest expenditure was \$1,713. The standard deviation for total average expenditures (again, after excluding extreme observations) was \$9,413.

Table 3 shows the average and median expenditures reported for 17 different expenditure classes participants were asked to estimate. Relative to average expenditures, boarding fees were the largest expense for racehorse owners, accounting for over 20% of their total expenditures associated with horse ownership. Real estate purchases and purchases of new horses also were significant components of the expenditures structure, accounting for 15.4% and 14.9%, respectively. When median expenditures are examined, boarding fees, feed, bedding, and horse purchases account for the largest portion of participants' estimated expenditures.

It should be noted that these values are rough estimates of expenditures observed in the industry and represent both commercial farms as well as smaller personal racehorse owners, breeders, and trainers. For example, a search of breeding fees associated with stallions available through Stallionsearch.com suggests that the average breeding fee for New Mexico stallions on commercial farms is \$2,051, with additional booking fees of \$300. This breeding expense of \$2,351 is significantly higher than the \$543 reported by survey participants.

Table 4. Number and Estimated Value of Breeding Stock, by Breed, 2006

Horse breed/age	Number of respondents	Number of horses	Average horse value
Quarter horse			
Broodmares	37	186	\$ 14,279
Stallions	8	10	84,938†
Foals	28	107	13,727
Thoroughbred			
Broodmares	49	293	9,378
Stallions	17	27	45,892
Foals	35	161	11,355

†Excludes four horses with values in excess of \$1,000,000.

Horse breeders

A number of individuals associated with the New Mexico horse industry serve as horse breeders. These specialists house and care for stallions, breeding mares and foals. In some cases they may own the horses that they use in their breeding program, but many times they do not. In the NMSU survey a total of 116 participants indicated that their association with the racehorse industry was primarily in the context of a horse breeder. Sixty-three percent of these individuals also listed other

Table 5. Estimated Expenditures Associated with Racehorse Breeding, 2006

Expenditure category	Average expenditure	Percent of total expenditure	Median expenditure†	Percent of total expenditure
Feed and bedding	\$1,577.47	15.4%	\$1,366.46	17.5%
Health care	968.80	9.4	732.14	9.4
Farrier services	409.26	4.0	238.33	3.1
Breeding fees	1,052.81	10.3	866.67	11.1
Maintenance and repair	638.11	6.2	297.06	3.8
Equine insurance	239.37	2.3	82.43	1.1
Utilities	216.13	2.1	142.28	1.8
Taxes (property and horse)	245.08	2.4	141.71	1.8
Land rent/lease	234.84	2.3	0.00	0.0
Registrations and membership fees	256.39	2.5	181.82	2.3
Breeding horse purchases	701.05	6.8	377.27	4.8
Real estate purchases	2,399.26	23.4	0.00	0.0
Equipment purchases	488.45	4.8	244.05	3.1
Advertising/marketing	118.67	1.2	1.58	0.0
Miscellaneous expenses	706.26	6.9	250.00	3.2
Total	\$10,251.97		\$7,791.67	

†Total median expenditure based on participant-identified total per-horse expenditures. Sum of median expenditure groups does not equal median of the total.

activities as “primary activities” (these additional primary activities were usually horse ownership). Sixteen of these survey participants indicated that their racehorse business served as their primary source of household income. Sixty percent of the participants who indicated that they were primarily horse breeders resided in the state.

Participants specializing in horse breeding were asked similar questions regarding the number of horses they worked with, the value of the horses they worked with (regardless of ownership) and expenses associated with their breeding programs. Seventy participants provided estimates of expenditures associated with their breeding business. Expenditures reported by breeders also varied widely. After removing extreme observations (one per-horse expenditure below \$1,500 and one per-horse expenditure above \$50,000), the average expenditure associated with horse breeding was \$10,252. Like expenditures for horse owners, breeding expenditures were skewed upward, as the median expenditure associated with breeding was \$7,792. The maximum per-horse breeding expenditure was \$44,950 and the minimum per-horse expense was \$1,500 (after removal of extremes). The standard deviation for per-horse expenditures reported by the participants was \$7,783. Tables 4 and 5 provide a summary of the participants’ responses related to horse numbers, values, and expenses (both average and median) associated with their breeding businesses.

Horse trainers

Another specialty business associated with racing horses is that of the trainer. Racehorse trainers specialize in working with upcoming and currently racing horses, preparing them for the demands of track racing. These specialists do not usually own the horses with which they work but do have a number of expenditures associated with housing, care, and training. In the NMSU survey a total of 38 participants indicated that their association with the racehorse industry was primarily in the context of a horse trainer. Seventy-six percent of the participants who indicated they were horse trainers were residents of New Mexico. Eighteen of the trainers indicated that their primary source of household income was derived from their racehorse activities. Sixty-eight percent of those who indicated that training was their primary racehorse activity also listed other primary racehorse activities; again, these other activities were primarily horse ownership.

Trainers also had the opportunity to report the number of horses they worked with, the value of those horses and their expenditures associated with training these horses. While 38 participants indicated that they worked primarily as trainers, significantly fewer (seven participants) provided responses to questions regarding the number of horses they trained and their expenditures associated with training those horses. Without removing extreme observations (which was done for owner and breeder expenditures), the average per-horse

Table 6. Number and Estimated Value of Trainer Horses, by Breed, 2006

Horse breed/age	Number of respondents	Number of horses	Average horse value
Quarter horse			
Yearlings	10	2,012	\$ 8,583
Two-year-olds	8	1,812	4,444
Three-year-olds (and older)	11	1,426	7,173
Thoroughbred			
Yearlings	11	1,833	17,639
Two-year-olds	14	1,630	16,736
Three-year-olds (and older)	15	1,470	23,289

Table 7. Estimated Expenditures Associated with Racehorse Training, 2006

Expenditure category	Average expenditure	Percent of total expenditure	Median expenditure [†]	Percent of total expenditure
Feed and bedding	\$1,974.77	30.1%	\$2,000.00	32.4%
Health care	964.72	14.7	833.33	13.5
Farrier services	364.57	5.6	288.46	4.7
Breeding fees	288.33	4.4	375.00	6.1
Maintenance and repair	496.59	7.6	269.23	4.4
Equine insurance	153.89	2.3	0.00	0.0
Utilities	382.24	5.8	115.38	1.9
Property tax	169.20	2.6	100.00	1.6
Land rent/lease	87.14	1.3	0.00	0.0
Registrations and membership fees	89.11	1.4	55.56	0.9
Real estate purchases	0.00	0.0	0.00	0.0
Equipment purchases	523.16	8.0	500.00	8.1
Advertising/marketing	13.05	0.2	0.00	0.0
Jockey fees	573.37	8.7	173.08	2.8
Miscellaneous expenses	475.62	7.3	263.89	4.3
Total	\$6,555.76		\$6,166.67	

[†] Total median expenditure based on participant-identified total per-horse expenditures. Sum of median expenditure groups does not equal median of the total.

Table 8. Estimated Total Expenditures Associated with Racehorse in New Mexico, 2006

Expenditure category	Ownership expenditure	Breeding expenditures	Training expenditures	Total expenditures
Stallions		\$10,251.97		\$10,251.97
Breeding mares		10,251.97		10,251.97
Registered foals		10,251.97		10,251.97
Yearlings	\$14,362.62		\$6,555.76	20,918.38
Two-year-olds	14,362.62		6,555.76	20,918.38
Three-year-olds (and older)	14,362.62		6,555.76	20,918.38

Table 9. Adjusted total expenditures estimates associated with racehorse in New Mexico, 2006

Expenditure category	Ownership expenditure	Breeding expenditures	Training expenditures	Total expenditures
Stallions		\$10,251.97		\$10,251.97
Breeding mares		5,125.99		5,125.99
Registered foals		2,562.99		2,562.99
Yearlings	\$14,362.62		\$6,555.76	20,918.38
Two-year-olds	14,362.62		6,555.76	20,918.38
Three-year-olds (and older)	14,362.62		6,555.76	20,918.38

Table 10. Estimated Expenditures for New Mexico Racehorse Industry, 2006

Horse age/use	Horses estimated	Estimated expense (per horse) [†]	Total expenditures
Breeding stock			
Stallions	334	\$10,251.97	\$3,424,158
Breeding mares	3,177	5,125.99	16,285,270
Registered foals	1,849	2,562.99	4,738,969
Racing horses in training			
Yearlings	1,568	20,918.38	32,800,020
Two-year-olds	1,157	20,918.38	24,202,566
Three-year-olds (and older)	447	20,918.38	9,350,516
Racing horses racing			
Two-year-olds	1,592	20,918.38	33,302,061
Three-year-olds (and older)	4,477	20,918.38	93,651,587
Total	14,601		\$217,755,146

[†]Based on adjusted average expenditures reported in NMSU racehorse survey. Includes ownership, breeding, and training expenditures. When median expenditures are used the total estimated expenditures are \$184,281,207.

training expenditure reported in the survey was \$6,556. The median expenditure was \$6,167. The highest expenditure reported was \$11,260 and the lowest was \$556. Tables 6 and 7 summarize their responses.

TOTAL RACEHORSE EXPENDITURES

Estimated expenditures associated with New Mexico race horses

Estimated expenditures shown above were used as a basis of calculating the racehorse industry's economic impact on New Mexico's economy. Expenditures for breeding stock, that is, stallions, brood mares, and foals, was assumed to equal the expenditures identified by breeders. Total expenditures for racing horses was determined to equal expenditures related to ownership plus training

expenditures. Table 8 summarizes these expenditures.

In the NMSU survey, no effort was made to distinguish ownership, breeding, or training expenditures between breeds and/or age and horse use. Interviews with individuals knowledgeable about the New Mexico racehorse industry suggested that while some expenditure differences between breeds may exist, these differences are likely minor. Industry participants did suggest that expenditures between age and use categories do occur. To account for these differences we discounted mare overall breeding expenditures by 50% and ownership expenditures for foals by 75%. Table 9 shows the estimated expenditures associated with racehorses in New Mexico with these adjustments. Discounting expenditures for breeding mares and foals, the estimated average expenditure for a horse associated with New Mexico racing is \$14,913.71. Table 10 shows the estimated total expenditures associated with racehorses in New Mexico with these adjustments.

New Mexico racehorse expenditures compared to estimates from other regions

Estimated expenditures on racehorses within the United States and Canada vary significantly. For example, researchers in Pennsylvania estimated total expenditures by racehorse owners in the state in 2001 to be \$238,050,186 for 26,365 horses, an average annual per-horse expenditure of \$9,029.03 (Swinker et al., 2003). Researchers in Michigan estimated annual average expenses for racehorses running in Michigan in 2001 to be \$7,028 (Public Sector Consultants, 2002). McNamara and Knudson (2001) estimated total expenditures on Indiana thoroughbred racehorses to be \$10,446. On the other end of the scale, researchers in Alberta, Canada estimated the 2000 annual average expenditure for active thoroughbred racehorses to be \$23,140 (Econometric Research Limited, 2001). The same researchers found that 2004 annual average expenditures for active thoroughbred racehorses in Ontario, Canada was \$55,484

Table 11. Selected Estimated Annual Horse/Racehorse Expenditures, Various Years

Study authors	Location	Year†	Horse breed/activity	Estimated annual expenditures	Estimated annual expenditures (2006 \$)†††
Econometric Research Limited	Alberta	2004	Racing thoroughbred	\$55,484	\$59,214
			Racing standardbred	51,584	55,052
			Farm horse	15,607	16,656
Deloitte	New Mexico	2003	Racehorses	3,299	3,615
Beattie et al.	Arizona	2001	Pleasure horses	6,861	7,810
Swinker et al.	Pennsylvania	2001	Standardbreds and thoroughbreds	9,029	10,278
Public Sector Consultants Inc.	Michigan	2001	Racing breeds††	7,028	\$8,000
McNamara and Knudson	Indiana	2001	Standardbreds	4,340	4,940
			Thoroughbred	10,446	\$11,891
			Quarter horse	1,372	1,562
Econometric Research Limited	Alberta	2000	Racing thoroughbred	23,140	27,091
			Racing standardbred	21,425	\$25,083

†Year expenditures were estimated.

†† Racing breeds included quarter horses, Arabians, standardbreds, thoroughbreds, and appaloosas.

†††Converted to 2006 dollars using the CPI-U series (U.S. Department of Labor, 2008). Canadian locations in Canadian dollars.

(Econometric Research Limited, 2005).³ Table 11 summarizes estimated racehorse expenditures from various regions of the U.S. and Canada.⁴

While possibly on the upper end of estimates observed by other researchers examining racehorse industries in other parts of the U.S. and Canada, the estimated \$14,913.71 per horse (average of all horses associated with racing) and a \$20,918.39 expenditure per horse for racing horses in New Mexico does not appear unreasonable, given geographical differences and resulting differences in production practices (e.g., drylot feeding in New Mexico vs. pasture in other regions), the time lapse between studies, and increasingly expensive real estate and energy.

ECONOMIC IMPACT ANALYSIS: METHODS AND TOOLS

Input-Output Analysis. Input-output analysis was originally developed by the economist Wassily W. Leontief in the 1930s. Founded in general equilibrium analysis, input-output analysis was initially used as a tool to help analysts model national economies. The analysis is a method of quantifying the interrelationships between sectors of a complex economic system; that is,

input-output models detail the movement of dollars between producers and consumers of goods and services within an economy. The approach uses structural coefficients that represent the relationship between factors of production used as inputs in the production process and the resulting outputs produced by each sector. The interdependence between sectors is modeled using a set of linear equations that balance a sector's total input use to the sector's total output.

While input-output modeling is often used to assess the impacts of policy changes on a particular economy, the analysis can be expanded to estimate the overall impact that a particular sector has on a regional economy. In this case, the use of the modeling procedure assumes that if the particular sector being analyzed did not exist, inputs used by the sector would not be used by another sector for some other economic activity. While this is a strong assumption, input-output modeling is widely used for these purposes. Governmental and nongovernmental agencies using this procedure include the Bureau of Labor Statistics, the Bureau of Economic Analysis of the U.S. Department of Commerce and numerous universities (Chase, Bourque, and Conway, 1993; MIG, 2008).

³Using Federal Reserve estimates for foreign exchange rates (<http://www.federalreserve.gov/releases/>), estimated Canadian racehorse expenditures in U.S. dollars for 2000 and 2004 were \$15,577 and \$42,624, respectively.

⁴Per-horse expenditures estimated in this report are significantly higher than those reported by Deloitte in 2005 (annual per-racehorse expenses reported as \$3,299). While specific information regarding the methodology used to estimate their expenditures is not provided, differences may have occurred for a variety of reasons including timing, survey methodology and error.

A number of assumptions are required to quantify the complex relationships existing within an economic system by using input-output analysis. Simplifying assumptions used in the analysis include: (1) each sector produces homogeneous outputs (e.g., underlying product value differences within a sector are not considered; rather, the analysis examines total output and input usage in terms of dollar amounts), (2) linear production functions (the analysis does not allow for factor substitution or economies of size), (3) time is treated statically within the model, and factors of production within the sectors are assumed to be fully utilized (Leatherman, 1994).

Input-output models generally subdivide the economic impact of a particular sector into three related effects. These effects include direct effects, indirect effects, and induced effects. Direct effects are estimates of dollar impacts to the economy resulting from production by businesses within the sector under consideration. That is, a particular sector's direct effect on the economy is the amount of money generated by the sector through sales of its products and/or services. Indirect effects are impacts to the economy as the result of industry businesses purchasing inputs from other sectors within the economy, that is, the production in other industries resulting from input demands generated by the primary industry. Finally, induced effects are the value of increased spending by households resulting from increased incomes that were generated through the direct and indirect effects discussed above.⁵

IMPLAN. Impact Analyses and Planning (IMPLAN) is a combination software program and informational database. The program was first used in 1979 by the U.S. Forest Service in cooperation with the Federal Emergency Management Agency and the U.S. Department of Interior's Bureau of Land Management (BLM) to facilitate land resource management (Mulkey and Hodges, 2000; MIG, 2008). In 1993 the program and its associated databases was privatized. Today, exclusive development of the program and its associated database is under the control of the Minnesota Implan Group, Inc (MIG).

IMPLAN Professional 2.0 (released in 1999) software with the updated 2006 database was used for this research. The software program makes several implicit assumptions that should be identified. First, IMPLAN identifies and measures backward linkages only. That is, the program only examines the economic impact of goods and services purchased by the industry under analysis in order to produce its product. The program does not estimate forward linkages. In the case of race-

horse ownership, for example, the model will account for input industries such as hay production and farrier services in estimating the economic impact of the racehorse ownership sector, but it will not include racetrack impacts in the calculation of the sector's overall impact on New Mexico's economy. Second, the program treats employment broadly. While accounting for seasonal employment levels, the program treats all employment as full-time employment.

While input-output analysis requires rather strong assumptions, and the IMPLAN modeling software is limited in its treatment of labor and forward linkages, the method and the software are commonly used in estimating economic impacts. IMPLAN has been used for measuring economic impacts of a variety of agricultural industries on regional economies, including horse and racehorse industries impacts in other states. Examples include Beattie et al. (2001), who examined the impact of horses, including racehorses, on Arizona's economy; Swinker et al. (2003), who used IMPLAN to examine the impact of Pennsylvania's racehorse industry on the state's economy; and McNamara and Knudson (2001), who used IMPLAN and input-output modeling to estimate the economic impacts of Indiana's pari-mutuel horse industry on Indiana's state economy.

Two additional considerations regarding the use of IMPLAN to estimate the economic impact of the racehorse industry on the state's economy should be discussed. First, agricultural employment data are based on national output employment ratios and as such will not necessarily model New Mexico's racehorse industry accurately. There are two possible approaches to handling the problem of adapting national production relationships to regional relationships. First, because input-output analysis is only an estimate of production and production relationships, national ratios and relationships can be maintained and readers reminded of possible discrepancies in the final estimates; for example, see Hall and Skaggs (2002). Second, IMPLAN offers flexibility in adjusting its databases so that the model can estimate regional or local impacts more accurately. This paper uses the first approach, that is, national production relationships are maintained with the caution that final estimates may not fully reflect the impact of New Mexico's racehorse industry on the state's economy.

Second, with changes in national accounting systems, IMPLAN's 2006 database condenses agricultural animal production into three categories: (1) cattle ranching and farming, (2) poultry and egg production, and (3) animal production except cattle and poultry. In this analysis we

⁵Estimation of induced effects requires that the economic system be treated as a closed system, so that consumers are considered part of the production process. In the IMPLAN software used for this analysis, closing the system requires the use of the SAM (Social Accounting Matrix) multiplier. Closing the system effectively means that the analysis accounts for commuting, social security and income taxes and savings by households (Mulkey and Hodges, 2000). It is common for analysts to use SAM multipliers (and thus incorporate induced effects) in economic impact studies (Hall and Skaggs, 2002).

Table 12. Racehorse Employment Impacts

Sector or industry	Employment associated with Initial expenditures	Total effects
Agriculture	5,235.8	5,583.8
Mining		30.8
Construction		0.1
Manufacturing		473.9
Transportation, communications, & utilities		41.3
Retail and wholesale trade		58.8
Finance, insurance, & real estate		32.1
Services		296.9
Total employment		6,517.6

Table 13. Output Impacts

Sector or industry	Employment associated with Initial expenditures	Total effects
Agriculture	\$217,755,152	\$264,167,184
Mining		8,133,795
Construction		44,363
Manufacturing		76,279,936
Transportation, communications, & utilities		4,399,854
Retail and wholesale trade		4,225,250
Finance, insurance, & real estate		2,260,893
Services		26,508,684
Total		\$386,019,959

use the third production category to estimate the impacts of racehorse ownership, breeding, and training on the state's economy. Again, we issue the caution that this aggregation may result in some distortion of the actual impacts of the industry on the state's economy.

RESULTS

Two sets of economic impacts associated with the New Mexico racehorse industry were developed in association with this research. The first set, provided in the body of the report, uses the average expenditures described above to estimate the economic impacts and provides an upper estimate of the economic impact of the race-

horse industry on the state's economy. The second set of impacts uses the median expenditures, also described above, to estimate the impacts. This second set of impacts provides a lower impact estimate. They are shown in Appendix A.

Employment Impact. IMPLAN analysis estimates that employment associated with initial racehorse expenditures⁶ accounts for 5,236 jobs in the state. Total employment associated with expenditures related to racehorse ownership, breeding and training is 6,518. A majority of the industry's employment impacts, outside of agriculture, occur in the manufacturing sector, where a total of 474 jobs are created in response to spending by horse owners, breeders, and trainers. A breakdown of how the IMPLAN model allocates the total employment impact between sectors is shown in Table 12.

Economic Impact. Economic (dollar) impact estimates from the IMPLAN model are provided in Table 12. As indicated above, initial expenditures associated with ownership, breeding and training of horses associated with the racehorse industry were estimated to be \$217,755,152.⁷ The total effect, including subsequent rounds of economic activity resulting from the initial expenditures made by racehorse owners, breeders, and trainers, was estimated to be \$386,019,959. Table 13 shows a more detailed breakdown of the sector's effects.

Using median expenditures from the NMSU survey, direct economic impacts were estimated at \$184,281,207 with a total economic impact (including subsequent rounds of economic activity related to initial expenditures made by horse owners, breeders, and trainers) of \$326,679,850 (Table A2)

Multipliers. Multipliers are the ratios of the dollar of input to the final dollar of economic output. Multipliers can be used as a predictive or descriptive tool to describe how a change in one sector will affect the regional economy. The estimated multiplier associated with initial expenditures in the racehorse industry was equal to 1.79, suggesting that a one-dollar increase in expenditures associated with owning, breeding, or training racehorses will result in an additional \$0.79 of economic activity within the state's economy.⁸ The estimated multiplier is similar to those estimated in other studies referenced above. For example, in the 2004 Alberta study researchers estimated an output multiplier of 2.31. In the 2001 study of the economic impacts of horse racing on Michigan's economy, researchers estimated an output multiplier of 1.58.

⁶In this report we are careful in the language used to describe the impacts of horse racing on the state's economy. In similar studies, researchers refer to initial expenditures made by horse owners, trainers, and breeders as "direct effects." In reality these expenditures are associated with the initial round of indirect expenditures or effects caused by the racehorse industry.

⁷Differences between IMPLAN-identified initial expenditures and those reported earlier are a result of rounding.

⁸Information on economic multipliers and their interpretation is available from the New Mexico State Cooperative Extension Service, e.g., "Income Multipliers in Economic Impact Analysis," New Mexico State Cooperative Extension Service Guide Z-108 (http://cahe.nmsu.edu/pubs/_2/Z-108.pdf).

CONCLUSION

The New Mexico racehorse industry continues to grow and develop. Research regarding the industry and its impacts on the state and regional economy has been limited. Two prior reports varied widely in their approach to estimating the economic impacts of the industry. Resultant estimates also varied significantly, from \$214 million (in 2003) to \$791 million (in 2000).

This research has attempted to provide additional information and analysis on the size and economic value of the industry, specifically on the value that ownership, breeding, and training of racehorses has on the state's economy. Using the methodology described above we estimate that the total number of horses associated with the state's racehorse industry is 14,601 (including breeding stock and horses in training). Our research suggests that the racehorse industry's impact on the state's economy is significant, providing \$386,019,959 dollars to the overall economy, not including the effects of the tracks themselves or associated gaming.⁹ While it is believed that the results accurately represent the industry's economic impact on the state, caution should be exercised when interpreting the results. As described previously, factors that should be accounted for include:

- Limitations of the input-output analysis and the IMPLAN program
- Aggregate method in which horse production was handled within the analysis
- Low response rate, limited observations and wide variability in expenditure responses for some specialty areas used to project ownership, breeder, and trainer expenditures¹⁰
- Assumption that if the industry were to dissolve all expenses associated with the industry would move out of the state.

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⁹Total economic impact calculated from median expenditure values is equal to \$326,679,850.

¹⁰Research using individual case studies, i.e., in-depth reviews of individual owner, breeder, and trainer expenditure information may provide additional insights that could be used to refine the current analysis.

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APPENDIX A—ECONOMIC IMPACTS DERIVED FROM MEDIAN EXPENDITURES

Table A1. Employment Impacts, Using Median Expenditures

Sector or industry	Employment associated with Initial expenditures	Total effects
Agriculture	4,431.0	4,725.4
Mining		26.0
Construction		0.0
Manufacturing		401.0
Transportation, communications, & utilities		35.0
Retail and wholesale trade		49.8
Finance, insurance, & real estate		27.2
Services		251.3
Total employment		5,515.7

Table A2. Output Impacts, Using Median Expenditures

Sector or industry	Employment associated with Initial expenditures	Total effects
Agriculture	\$184,281,200	\$223,558,640
Mining		6,883,445
Construction		37,544
Manufacturing		64,553,960
Transportation, communications, & utilities		3,723,496
Retail and wholesale trade		3,575,732
Finance, insurance, & real estate		1,913,342
Services		22,433,692
Total		\$326,679,850

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