



THE INFLUENCE OF THE AGRICULTURAL CLUSTER ON THE FAYETTE COUNTY ECONOMY

PREPARED FOR:

THE FAYETTE ALLIANCE, FAYETTE COUNTY FARM BUREAU, AND
KENTUCKY THOROUGHBRED ASSOCIATION-KENTUCKY THOROUGHBRED OWNERS AND BREEDERS, INC.

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Executive Summary

Historically, employment associated with agriculture in Fayette County has been limited to production agriculture. Recently, the Ag Cluster has been extended to include agricultural inputs and food processing and manufacturing. However, there are hundreds of establishments in the county that are service-based (finance, veterinary, recreation), transportation, communications, as well as wholesale and retail businesses that are 100% dedicated to agriculture. These businesses have never been included in an economic impact study exploring the impact of agriculture in Fayette County. Ignoring these businesses underestimates the value of the agricultural sector. This is particularly important in Fayette County because of its competitive advantage in the equine industry.



1 out of every 12 jobs is directly or indirectly associated with the Ag Cluster.

In 2012, CEDIK (Community and Economic Development Initiative of Kentucky) at the University of Kentucky presented findings that highlighted the value of this expanded definition of the Ag Cluster in Fayette County. CEDIK conducted an extensive search of agricultural enterprises within the county and estimated the total number of jobs, output, and labor income associated with this cluster. The purpose of this study is to provide an update of these numbers and to update the Fayette County Ag Cluster Business database.

When the Ag Cluster is defined to include business services, retail, and wholesale trade solely dedicated to agriculture, in addition to the traditional way agriculture has been measured, it is estimated that a **total of 14,091 jobs** are attributed to this cluster. In addition, there are approximately **1,724 jobs** directly and indirectly associated with the hospitality sector in Lexington. Given total employment in the county (approximately 189,946) these results suggest that roughly **1 out of every 12 jobs** is directly or indirectly associated with the Ag Cluster. Employment in the Ag Cluster contributes approximately **\$8.5 million** to the local tax base through the 2.25% occupational tax rate.

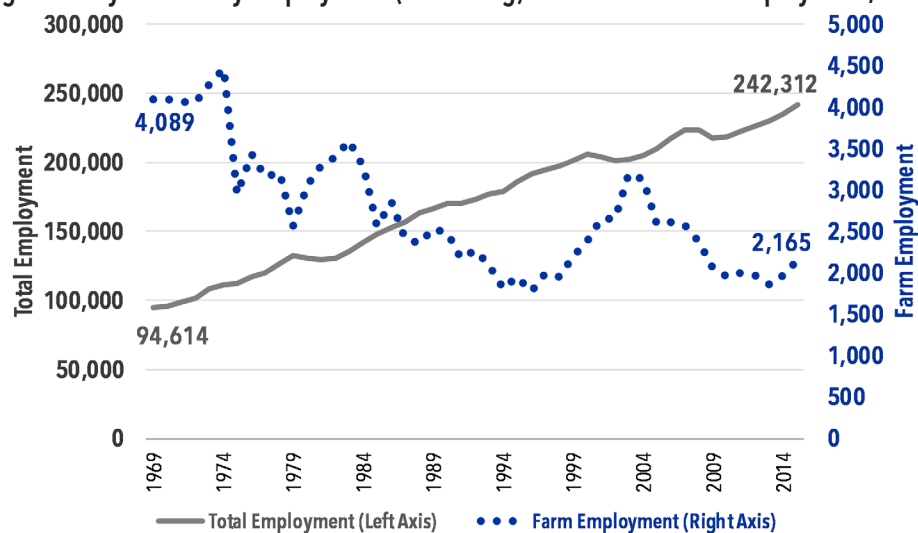
In addition, the Ag Cluster generates approximately **\$2.3 billion in output** annually and **\$1.3 billion dollars in additional income, profits, and dividends**.



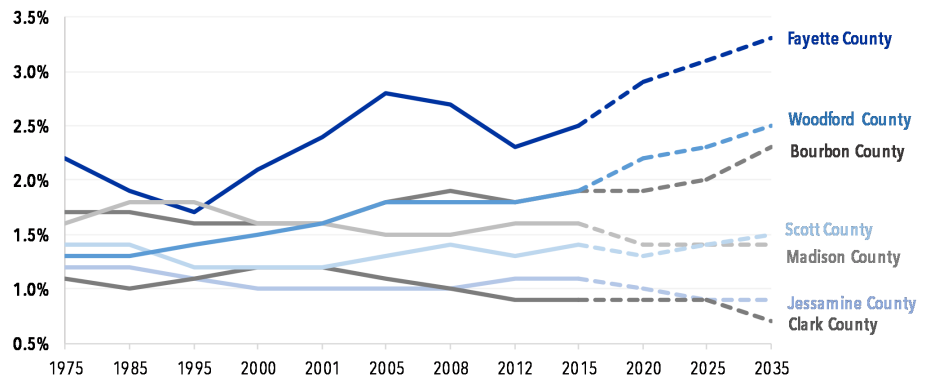
Introduction

The economy of Fayette County is diverse; many industries are well represented through employment opportunities. For example, manufacturing represents just 5.2% of all jobs in Fayette County while the professional services sectors (finance, real estate, administrative, professional, scientific, etc.) contributes a large share of jobs (22.3%). The appendix provides a table detailing employment across all sectors. The county also has a significant government sector. In 2015, government (including public education [K-12 and higher education] and city government) represented 17.5% of all jobs. Production agriculture alone is a smaller industry, 1.8% of all jobs in Fayette County. The share of jobs in on-farm employment has declined steadily over the last 40 years with an expectation that this trend will continue. Figures 1 and 2 provide an overview of the farm employment in Fayette County and how it relates to total employment in the county and Kentucky farm employment, respectively. Figure 2 suggests that a larger share of agricultural activity is occurring in Fayette County than in surrounding counties.

Figure 1. Fayette County Employment (Total vs Ag) Full and Part-Time Employment, 1969-2015.



Source: Bureau of Economic Analysis, 2015

Figure 2. County Farm Employment as Percent of Kentucky Farm Employment.*

* Data after 2015 are projected estimates

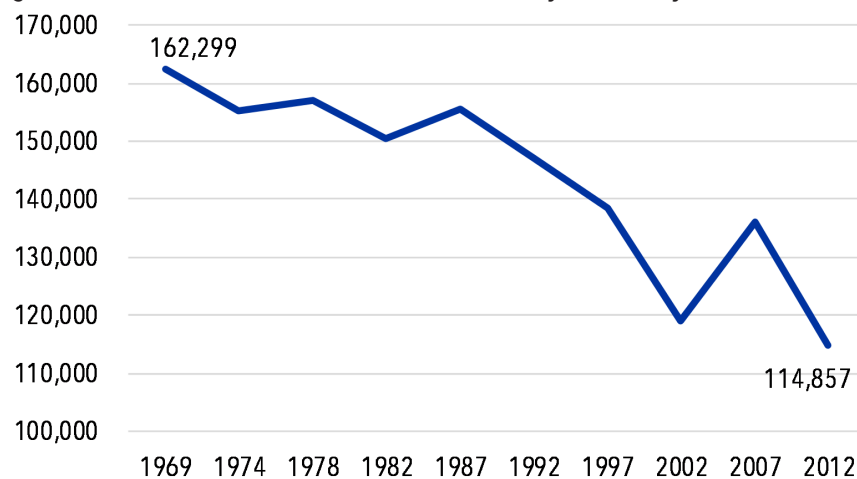
Source: Bureau of Economic Analysis, 2016

In 2012, there were a total of 718 farms in Fayette County, down from 810 in 2007 (49% of the difference comes from a decline in tobacco farming). The total value of all agricultural products sold was \$176 million, the large majority (92.3%) of this rooted in the cattle and equine markets. The total number of farms by crop or livestock is provided in Table 1 below.

Table 1. Number of Farms in Fayette County, 2007 and 2012.

	2007	2012
Total Farms	810	718
Oilseed and grain farming	10	31
Vegetable and melon farming	21	25
Fruit and tree nut farming	25	19
Greenhouse, nursery, and floriculture production	32	26
Tobacco farming	62	17
Hay farming and all other crop farming	112	106
Beef cattle ranching and farming	108	122
Cattle feedlots	5	1
Poultry and egg production	10	10
Sheep and goat farming	7	11
Animal aquaculture and other animal production	418	350

Source: US Census of Agriculture, 2007 & 2012

Figure 3. Total land in farms (acres) 1969 – 2012, Fayette County.

Source: US Census of Agriculture, 2012

Figure 3 highlights long-term trends for production agriculture in Fayette County. Over the last 40 years the total number of farms, and the total land in farms has steadily decreased since 1969. Table 2 details the change in farms, farm size, and farm value between 2007 and 2012. While the number of farms and land in farms has decreased, the median size and value of farms has increased. In addition, it appears that the number of farms that are both very low and high sales declined.

Table 2. Fayette County Farms by Size and Value, 2007-2012.

	2007	2012	Change	Percent Change
Farms	810	718	(92)	-12%
Land in Farms (acres)	135,969	114,857	(21,112)	-17%
Average Size	168	160	(8)	-5%
Median Size	49	59	10	19%
Estimated Market Value of Land & Building	\$1,106,925	\$1,457,640	\$350,715	27%

Farms By Size	2007	2012	Change	Percent Change
1 to 9 acres	66	85	19	25%
10 to 49 acres	341	255	(86)	-29%
50 to 179 acres	196	215	19	9%
180 to 499 acres	140	110	(30)	-24%
500 to 999 acres	51	33	(18)	-43%
1,000 acres or more	16	20	4	22%

Farms by value of sales	2007	2012	Change	Percent Change
Less than \$2,500	351	248	(103)	-34%
\$2,500 to \$4,999	37	67	30	58%
\$5,000 to \$9,999	44	66	22	40%
\$10,000 to \$24,999	87	105	18	19%
\$25,000 to \$49,999	59	74	15	23%
\$50,000 to \$99,000	42	52	10	21%
\$100,000 or more	190	106	(84)	-57%

Source: Census of Ag 2007 and 2012

Table 3 (next page) provides an overview of on-farm employment. In 2012, 375 farms, less than half of the total number of farms, had farm labor on payroll. Approximately 20% of these farms employed 10 or more workers, resulting in the bulk of on-farm labor (1,868 workers). There were 360 migrant workers over 38 farms in Fayette County.





Table 3. Fayette County Farm Employment, 2012.

	Farms	Workers
Hired farm labor	375	2,815
Farms with 1 worker	79	79
Farms with 2 workers	64	128
Farms with 3 to 4 workers	99	338
Farms with 5 to 9 workers	60	402
Farms with 10 or more workers	73	1,868
Workers worked 150 days or more	258	1,800
Total migrant workers	38	360
Unpaid workers	333	702

Source: US Census of Agriculture, 2012

The relative concentration of an industry in a particular location is often measured using a location quotient. A location quotient identifies the relative size of the industry (by employment) relative to employment in that same industry in a base area, in this instance, Kentucky. If the location quotient is greater than 1 then the industry is considered “relatively concentrated” and is usually considered an export sector. In Fayette County, the management, information, education, arts and recreation, transportation, accommodation and healthcare industries are considered export sectors. The LQ for each of these industries is still less than 1.5. In contrast, the equine industry has a location quotient of 4.47. In most instances when a location quotient is large there will likely be supporting industries in close proximity because of the opportunities for horizontal and vertical integration. This is the case for the Fayette County equine industry.¹ All the other industries in the agricultural sector have a LQ less than 1 (see Table 12 in the appendix).

¹ There are hundreds of establishments in surrounding counties but the focus of this research is solely on Fayette County.

The Agricultural Cluster

Today, agriculture is defined in much broader terms and now is often measured more comprehensively including production agriculture, agricultural inputs, and food processing/manufacturing.² Ignoring these related businesses underestimates the value of the agricultural cluster. This is particularly important in Fayette County because of its competitive advantage in the equine industry. It was estimated that there were roughly 4,300 jobs in production agriculture (including breeding operations) in 2015, this reflects 1,200 fewer jobs than when this study was completed in 2012. There are an additional 1,111 jobs in these additional agriculture and food sectors. However, for the purposes of this study, we are only including 319 of those jobs in our analysis. We want to isolate those jobs that are likely to have measurable on-farm impact. Either Fayette County farms are buying goods to operate or other sectors are buying from nearby farms to produce their products. While these establishments are typically included in agricultural economic impact studies, we have chosen to remove them from our analysis. The large percentage of employment in this section can be attributed to breweries and wineries. Wineries and breweries industries grew rapidly in the past years. Table 4 provides employment, output, employee compensation, and value-added for each of the industries included in the production agriculture and food processing cluster. There are a total of 4,641 jobs and \$765 million in output in this cluster with \$124.5 million in employee compensation. These data are primarily provided by IMPLAN (Impact Planning for Analysis) but augmented by Census of Agriculture and ESRI Business Analyst data. IMPLAN uses a combination of Census of Agriculture data, Bureau of Labor Statistics and Bureau of Economic Analysis data to compile a county specific database (see methodology section in Appendix).



In Fayette County, based on available 2016 data, 57 thoroughbreds covered 6,585 mares. (See appendix)

Table 4. The Agricultural Production and Food Processing Cluster.*

Industry	Direct Employment from Ag	Output	Employee Compensation	Value Added	Proprietor Income	Other Property Type Income	Indirect Business Tax
All Production Agriculture	4,322	\$544.6 M	\$108.4 M	\$453.3 M	\$181.9 M	\$155.6 M	\$7.4 M
Food Products	132	\$52.5 M	\$6.1 M	\$16.4 M	\$1.3 M	\$8.4 M	\$0.6 M
Beverage & Tobacco	179	\$162.6 M	\$9.7 M	\$49.9 M	\$0	\$14.9 M	\$25.3 M
Fertilizer Mixing	8	\$4.9 M	\$0.3 M	\$1.2 M	\$0.5 M	\$0.3 M	\$0.1 M
Total Ag and Food	4,641	\$764.8 M	\$124.5 M	\$520.8 M	\$183.7 M	\$179.3 M	\$33.4 M

* Does not include Smucker's, cola companies and baked goods

Sources: IMPLAN (2014), Census of Agriculture (2012), ESRI Business Analyst (2015), Business Websites, BEA (2015)

² Deller, Steven C. and David Williams. 2009. The Contribution of Agriculture to the Wisconsin Economy. UW Cooperative Extension.

Table 5. Comparison between 2012 and 2017 Fayette County Studies.

Industry Classification	Earlier Study (2012)	Current Study
All Production Agriculture	5,556 (Based on estimates from Census of Ag 2007)	4,322 (Based on estimates from BEA 2015*)
Food Products	407 (included Jif)	132
Beverage and Tobacco	273 (included Coke, Pepsi, Snapple, Ice)	179

**Used these data as it captured the 22.2% decline in equine from 2007 Census of Ag.*

Table 5 provides an overview of the differences between the numbers we reported in the 2012 study and this current study. The decline in production agriculture employment explains the majority of the differences. In addition, by not including some of the food and beverage processing/manufacturing in this study, these numbers fell a bit but were offset by increases in employment in wineries, breweries, etc.

Our study is unique in that it also includes the other sectors that are a byproduct of production agriculture. There are hundreds of establishments in the county that are in the transportation, communications, wholesale and retail businesses, and service-based (finance, veterinary, recreation) sectors, that are 100% dedicated to agriculture (or have individuals on staff that are dedicated to serving the agricultural sector). After an extensive search, we updated the Fayette County agriculture business directory.

World Renowned Equine Veterinarians

Lexington is home to both Rood and Riddle Equine Hospital and Hagyard Equine Medical Institute.

- Over 44,000 horses seen per year.
- More than 10,000 surgeries each year.
- Approximately 2,000 patients at the internal medicine hospital (Hagyard).
- 112 full-time DVMs and Employ over 440 people in Lexington.
- 46.7% of horses travel from outside Kentucky for services (Rood and Riddle).
- 2.42% of horses travel from outside the United States for services (Rood and Riddle).
- DVMs have traveled to 29 states and 20 countries to perform specialized equine services.
- Over \$400,000 of feed purchased each year from Hallway Feeds (local supplier).
- Over 600 tons of straw and hay purchased per year (Hagyard).
- Offer educational opportunities domestic and internationally.
- Acts as a tourist destination, offering tours and equine healthcare education.

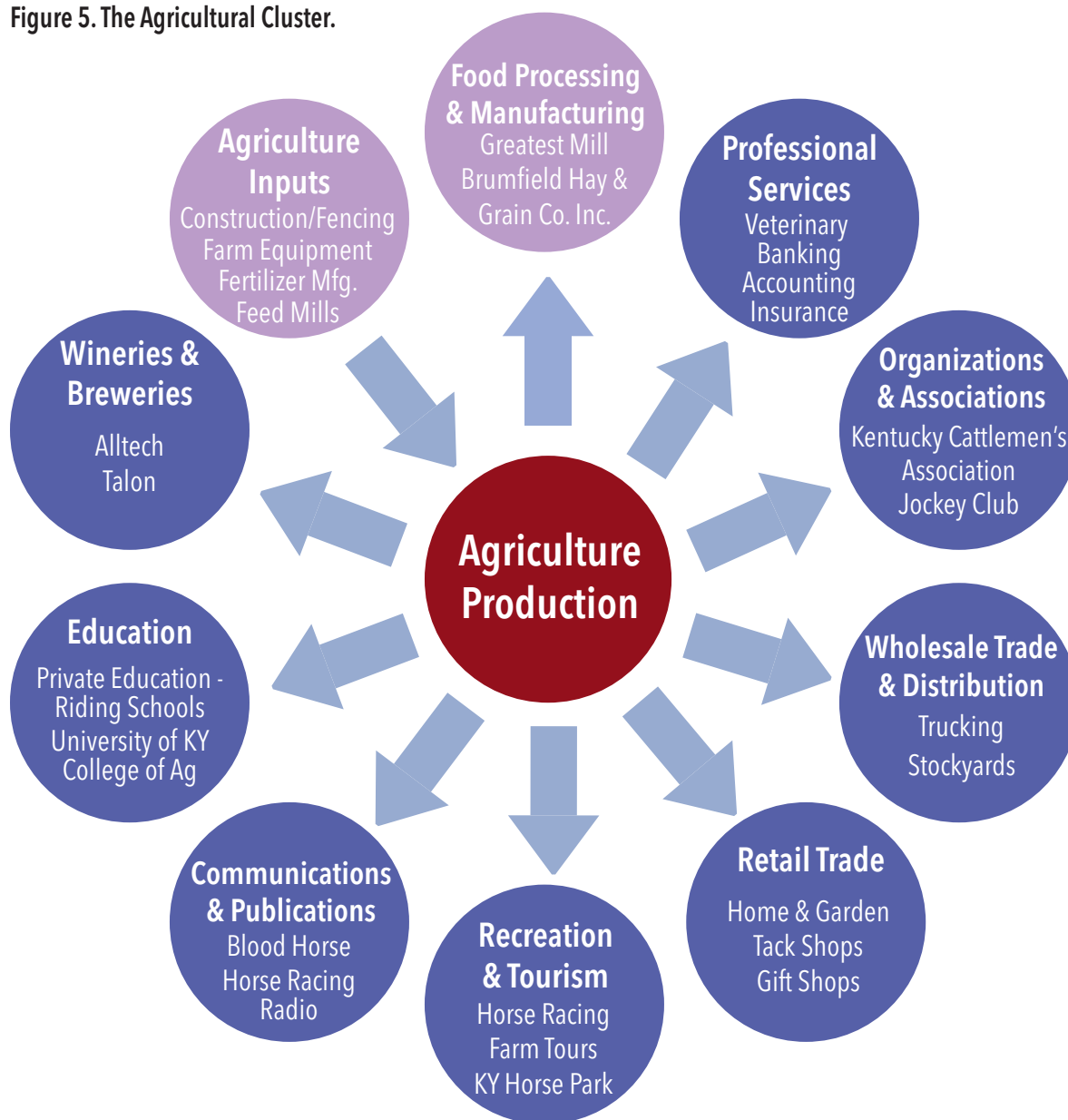
Figure 5. The Agricultural Cluster.

Figure 5 provides a mapping of the industries that are considered part of the Ag Cluster. Agriculture production is the center of the cluster. Historically, employment associated with agriculture has been limited only to production. Each of the industries provided in Figure 5 consists of businesses that are solely dedicated to agriculture. When appropriate, examples of specific firms are included. There were 19 additional aggregated IMPLAN sectors that are included in the Ag Cluster. These sectors range from retail, transportation, communications and publishing, civic and professional organizations, racing and track operations, wholesale trade, construction of nonresidential properties (fencing), etc. In total, there are 4,597 jobs associated with including these additional establishments that directly support agriculture. These establishments are estimated to generate approximately \$754 million in sales.

Table 6. Industry Detail for Businesses that DIRECTLY Support Agriculture.

Industry	Direct Employment	Output	Employee Compensation	Value Added
Construction	51	\$11,585,515	\$2,589,702	\$6,712,329
Wholesale trade	444	\$158,980,816	\$29,195,602	\$34,204,685
Retail trade	149	\$51,955,377	\$18,176,459	\$20,007,053
Truck transportation	135	\$42,404,649	\$9,647,526	\$12,418,287
Warehousing & storage	38	\$16,329,228	\$4,393,639	\$5,734,025
Publishing and broadcasting	49	\$15,668,696	\$5,185,731	\$6,266,456
Credit intermediation, securities & other financial	31	\$19,155,344	\$2,434,068	\$3,751,208
Insurance carriers & related	97	\$59,937,684	\$7,616,277	\$11,737,649
Real estate	12	\$3,273,539	\$844,113	\$1,109,622
Professional- scientific & tech services	547	\$112,707,119	\$27,642,089	\$28,448,632
Horse farm tours and equine landscaping	81	\$7,059,621	\$3,654,658	\$4,736,396
Educational services	1,034	\$86,425,739	\$32,743,245	\$38,017,851
Labs and diagnostics	38	\$3,624,804	\$1,680,450	\$1,982,772
Performing arts & spectator sports	1,054	\$48,468,064	\$36,755,168	\$40,175,959
Museums & similar	26	\$1,713,846	\$532,752	\$566,051
Recreation, stables, and equine misc.	270	\$16,261,375	\$5,379,194	\$7,919,691
Non-veterinary pet care*	8	\$1,179,886	\$438,349	\$604,907
Religious, grant making & other organizations	412	\$60,764,119	\$22,574,964	\$31,152,711
Government & non NAICS	121	\$36,157,776	\$4,676,809	\$18,791,806
Total	4,597	\$753,653,197	\$216,160,795	\$274,338,090

*Does not include small sized pets.

Sources: IMPLAN (2014), Census of Ag (2012), ESRI/Business Analyst (2015), and Business Websites

The numbers found in Table 6 from this study aren't easily comparable to the previous study (2012) as we used different databases to verify employment data for each establishment. In the end, there is only a difference of approximately 250 jobs between the two studies. We did find that a few business had closed over the 5-year time period. For a brief overview of the methodology used in this report, please see the appendix.





Economic Impact of the Ag Cluster

To estimate the value of agriculture in Fayette County we used an input-output (IO) model with 2014 IMPLAN data. The full economic impact of agriculture includes the “multiplier effect” which summarizes the total impact that can be expected from a change in a given economic activity. For example, a new manufacturing facility, or an increase in exports by a local firm, are economic changes which can spur ripple effects or spin-off activities.

Multipliers measure the economic impact of these new exports, including the resulting spin-off activities. While there are several types of multipliers, the Type II multiplier is most widely used in IO analysis. A Type II multiplier includes the effect of direct or initial spending, indirect spending or businesses buying and selling to each other as well as including household spending based on the income earned from the direct and indirect effects. Essentially, these latter induced effects represent employees spending on goods and services.

The output multiplier estimates the total change in local sales resulting from a \$1 increase in sales outside of the study area. Multiplying the increase in sales of the industry by the output multiplier provides an estimate of the total increase in sales for the study area, including the initial \$1. The output multiplier is used to assess the interdependence of sectors in the local economy. Separate multipliers were estimated for each of the agriculture sectors identified in Tables 4 and 6. As a result, the final economic impact from the Ag Cluster is almost \$2.3 billion. This includes the direct effect of \$1.57 billion and an additional \$0.7 billion in output because of indirect and induced effects.

The employment multiplier measures the total change in employment resulting from an initial change in employment in the Ag Cluster. In Fayette County, there are 9,238 individuals who work directly for the Ag Cluster. However, total employment associated with the Ag Cluster is 14,091 individuals after including indirect and induced effects.

The value added multiplier provides an estimate of the additional value added to the product as a result of the Ag Cluster. Value added includes employee compensation, indirect business taxes, proprietary and other property income. Value added is often interpreted as new income paid to workers or profits and dividends. The total value added of the Ag Cluster is \$795 million. The full impact is \$1.3 billion, meaning that this is the “value” that is added to products in other industries affected by the Ag Cluster.

Table 7. The Economic Impact of the Agricultural Cluster.

	Total Employment with Multiplier	Total Output with Multiplier	Total Value Added with Multiplier
The Traditional Ag & Food Processing Cluster	6,853	\$1.1 Billion	\$695.1 Million
Secondary Ag & Equine Businesses	7,238	\$1.2 Billion	\$577.2 Million
Total Ag Cluster Impact	14,091	\$2.3 Billion	\$1.3 Billion

Source: IMPLAN (2014)

Table 7 provides an overview of the economic impact of the entire Ag Cluster. In summary, there are a total of 14,091 jobs associated with the Ag Cluster. Of the 14,091 workers, 4,853 jobs were created as a result of business (indirect effect) and household (induced effect) spending. In total, there are approximately \$2.3 billion in sales associated with Ag Cluster including direct, indirect, and induced effects. Total value added is approximately \$1.3 billion. Based on total estimated employee and self-proprietor income, approximately \$8.5 million in occupational taxes is generated through the Ag cluster.

Industries Impacted by a Loss in Agriculture

With the increasing pressures on land use in a growing county, it is interesting to explore what happens to the overall Fayette County economy when there is a loss in production agriculture. Because of the linkages between agriculture and the other industries, a \$1 loss in production agriculture will reverberate throughout the rest of the economy. For example, if we expect production agriculture in Fayette County to decline by 10% (\$54.5 million), there will be an overall additional decrease of \$26.5 million in output.

Tables 8 and 9 provide detail about those industries that would be most affected with a decrease in production agriculture. Table 8 suggests that wholesale trade, production agriculture, real estate, and refineries would be most affected by a loss in agriculture due to indirect effects. In essence, if there was a decline in production agriculture then producers would need fewer agricultural products and would not need the same level of real estate services, banking,

Table 8. Top 15 Industries with a Loss in Sales (indirect effect)

Industry
Wholesale trade
Production agriculture (in addition to the 10% loss)
Real estate
Petroleum refineries
Truck transportation
Maintenance and repair construction of nonresidential structures
Other local government enterprises
Insurance carriers
Monetary authorities and depository credit intermediation
Insurance agencies, brokerages, and related activities
Electric power transmission and distribution
Accounting, tax preparation, bookkeeping, and payroll services
Warehousing and storage
Management of companies and enterprises
Employment services

*Source: IMPLAN (2014)***Table 9. Top 15 Industries with a Loss in Sales (induced effect)**

Industry
Owner-occupied dwellings
Real estate
Hospitals
Wholesale trade
Offices of physicians
Limited-service restaurants
Wireless telecommunications carriers (except satellite)
Other local government enterprises
Monetary authorities and depository credit intermediation
Insurance carriers
Full-service restaurants
Educational services
Petroleum refineries
Retail - General merchandise stores
Other financial investment activities

Source: IMPLAN (2014)

etc. to support their enterprise. There would be a \$3.5 million reduction in sales from business spending in addition to the direct loss of \$54.5 million in agriculture sales.

Table 9 suggests that the induced effects, a reduction in household spending, associated with the ripple effects of a decrease in production agriculture would most affect rental activity, visits to the doctor and hospital, going to restaurants, real estate, and wireless communications. Thus, if workers have less money in their pocket to spend, Table 9 reflects those sectors that will be affected the most. The total reduction in sales from a decrease in household spending would be over \$23 million.



Horse Country Kentucky is a relatively new tourism initiative for the equine industry similar to the bourbon trail.

Some tour experiences include horse farms in the morning and bourbon in the afternoon.

There are currently twenty different tour options that include horse farms, equine clinics, and training facilities.

Since its inception, Horse Country has sold 38,000 total tickets, including Breeder's Cup and Meet the Neighbors. Fayette County attractions account for 22% of total ticket sales.

Sixty percent of individual ticket purchases are from out of state.

visithorsecountry.com

The Hospitality Sector

Conducting the comprehensive tourism aspects associated with the Ag Cluster would entail a much larger study and one largely outside the objectives of this study. However, tourism is still a significant driver of economic activity in Fayette County. In 2016, Certec Inc conducted an estimate of Kentucky's travel and tourism industry for the state as well as all regions and counties within the state.¹ The total travel expenditures in Fayette County were estimated at approximately \$1.3 billion resulting in a total economic impact of over \$2 billion. Furthermore, the study estimates that there are just over 15,399 jobs associated with the travel industry. Within the report, it is not clear if these are full-time equivalent or seasonal jobs though.

To better understand the impacts associated with Ag Cluster tourism, we rely heavily on a 2015 study that estimates the economic impact of Keeneland's two race meets and several horse sales across the year.² This is a useful study because the author intercepts a sample of visitors at Keeneland during the Fall Meet to understand their travel expenditures and most importantly two key items: 1) residential location (thus excluding Fayette County residents from the analysis) and 2) purpose for visit. We have used these findings to extrapolate the employment impacts from Keeneland and further estimate the impact of the Kentucky Horse Park, as these are the two largest tourism opportunities related to the Ag Cluster in Fayette County. Certainly, there are other tourism experiences related to breweries, wineries, other horse-related tours, but we feel most comfortable focusing on Keeneland and the Kentucky Horse Park. A list of other agricultural related events are provided below. Because we don't have access to

¹ <http://www.kentuckytourism.com/userfiles/Industry/2016%20Kentucky%20Tourism%20Expenditures.pdf>

² Bollinger, Chris, "A Measure of the Economic Impact of Keeneland Racing and Sales on Lexington-Fayette County." Center for Business and Economic Research, University of Kentucky, April 2015.

detail about participant residence and spending, these events are excluded from our analysis. As a result, our final tourism number will certainly be an underestimate of the true impact.

Bollinger estimated spending on accommodations, food, gasoline, and retail across the Fall and Spring meets as well as the four largest equine sales. These findings are provided in the first column of Table 10. We used the most conservative estimates, only those individuals from outside Fayette County that noted that Keeneland was the only reason they were in town. The second column is a rough estimate of annual food, lodging, gas, and retail spending for Kentucky Horse Park visitors (non-Fayette County). This estimate is based on an average of 250,000 tourists to the KHP every year.

Table 10. Hospitality Sector Sales Estimates.

	Keeneland	Kentucky Horse Park ESTIMATES
Accommodations	\$19,494,923	\$9,053,967
Food & drinking places	\$19,610,569	\$11,687,778
Gasoline	\$7,729,076	\$6,878,877
Other retail	\$4,209,618	\$3,746,560

Source: Bollinger (2015) and Author's calculations

Table 11. Hospitality Sector Employment Impact.

	Direct Employment	Total Employment
Accommodations	385 jobs	604 Jobs
Food and Drinking Places	289 Jobs	458 Jobs
Gasoline	252 Jobs	481 Jobs
Other retail	103 Jobs	180 Jobs
Total Hospitality Jobs	1,029 Jobs	1,724 Jobs

Source: IMPLAN (2014) and Author's calculations

Average Annual Attendance at Equine Events in Fayette County

American Saddle Horse Museum – 27,164

Keeneland (Track Attendance) – 515,711

Kentucky Horse Park – 805,000

The Thoroughbred Center – 20,280

Average Attendance at Recent or Upcoming Agricultural Conferences

Kentucky Association FFA – 1,800

US Dressage Federation – 500

Kentucky Forest Industries Association – 350

Kentucky Cattlemen's Association – 1,200

US Pony Club – 2,400

US Equestrian Federation Annual Conference – 500

USEF 2017 Pony Finals – 1,700

American Angus Association – 40

Intercollegiate Horse Show Association – 2,500

Southern Sustainable Ag Working Group – 1,200

Split Rock Jumping Tour – 500

Using output-per-employee ratios for each of the four tourism categories, we estimate the potential employment impacts from Keeneland and the Kentucky Horse Park. In total, there are just over 1,000 jobs directly associated with tourism and a total of 1,724 jobs when including the multiplier effect (Table 11). This estimate is just over 10% of the proposed impacts in the Certec study.

Conclusion

This report provides an overview of the economic impact of the Ag Cluster in Fayette County. By broadening the definition of the cluster to include businesses that strictly support the Ag Cluster, we can now capture a more accurate value of agriculture in the County. After combining employment from the Ag Cluster and a conservative estimate of agricultural-related tourism, we find that there are 15,815 jobs attributed to agriculture. In total, there are 189,946 total full-time equivalent jobs in Fayette County. These results suggest that nearly one in twelve workers in Fayette County is either directly or indirectly associated with the Ag Cluster.

The perfect analysis would incorporate employment within all industries that support the Ag Cluster even if the business also serves other industries. Including all employment overstates the importance of agriculture and excluding all employment understates the value of agriculture. There are service industries including legal, accounting, insurance, banking, retail, food and drinking places, and accommodations that clearly support the Ag Cluster but without having specific information detailing the distribution of employment devoted to the Ag Cluster, the authors felt uncomfortable including these non-agriculture specific industries in the analysis and assumed that a percentage of the real employment associated with agriculture would be picked up in the multiplier impact. These are likely conservative numbers, as the analysis does not fully account for businesses that partially support agriculture. Undoubtedly, there are many important economic clusters in Fayette County, including healthcare, public education and research, management and professional services, to name a few. These results suggest that agriculture is also an important component to this diverse, growing economy.

Appendix

Table 12. Industry Detail for Fayette County.

Industry	Employment	Annual Average Earnings	LQ
Agriculture, Forestry, Fishing and Hunting*	1,681	\$41,533	1.01
Mining, Quarrying, and Oil and Gas Extraction	340	\$84,113	0.34
Utilities	232	\$78,593	0.21
Construction	8,401	\$54,655	0.96
Manufacturing	12,201	\$70,179	0.74
Wholesale Trade	5,961	\$60,986	0.76
Retail Trade	21,214	\$27,100	1.02
Transportation and Warehousing	9,153	\$46,877	1.24
Information	5,103	\$43,810	1.32
Finance and Insurance	5,431	\$73,552	0.71
Real Estate and Rental and Leasing	2,725	\$36,982	0.96
Professional, Scientific, and Technical Services	11,034	\$66,304	0.95
Management of Companies and Enterprises	2,127	\$120,474	0.73
Administrative and Support and Waste Management and Remediation Services	15,250	\$27,022	1.29
Educational Services	21,517	\$54,340	1.31
Health Care and Social Assistance	32,499	\$54,960	1.20
Arts, Entertainment, and Recreation	3,646	\$21,238	1.08
Accommodation and Food Services	19,957	\$17,181	1.15
Other Services (except Public Administration)	5,039	\$35,356	0.87
Public Administration & Non-NAICS	6,434	\$55,764	0.66
Total - All Industries	189,946	\$46,304	1.02

*Does not include farm employment.

Source: JobsEQ, 2015

Table 13. Sales by Commodity.

Commodity	Sales
Crops Totals	\$13,576,000
Corn, soybean & wheat	\$3,399,000
Other field crops, including hay	\$1,072,000
Tobacco	\$5,325,000
Fruit & tree nuts	\$156,000
All other crops, nursery & greenhouse	\$3,624,000
Livestock Totals	\$528,483,764
Cattle & calves	\$10,576,000
Equine, dairy, poultry & hogs*	\$374,358,818
All other animals & animal products*	\$143,548,946
Forestry and Fishing	\$2,570,812

* Values calculated based on a 22.2% decrease in the equine industry, from 2007 to 2015.

Source: Census of Ag, 2012 & Authors' Calculation

Table 13. Breeding and Stud Fees, 2016.

	Number of Times Bred	Listed Stud Fee		Number of Times Bred	Listed Stud Fee
Into Mischief	218	\$45,000	Paddy O'Prado	104	\$5,000
Goldencents	190	\$15,000	New Year's Day	92	\$5,000
Wicked Strong	190	\$10,000	Maclean's Music	90	\$6,500
Archarcharch	176	\$7,500	Medal Count	90	\$5,000
Tapiture	176	\$7,500	Girolamo	82	\$15,000
Temple City	172	\$12,500	Sky Kingdom	82	\$5,000
Race Day	155	\$7,500	Itsmyluckyday	76	\$6,500
Animal Kingdom	153	\$35,000	Midnight Lute	76	\$25,000
Oxbow	153	\$17,500	Shakin It Up	74	\$10,000
Flat Out	151	\$8,500	Tizway	73	\$7,500
Hard Spun	151	\$45,000	Jimmy Creed	72	\$7,500
Tapizar	148	\$15,000	Jersey Town	69	\$10,000
Violence	145	\$15,000	To Honor and Serve	67	\$15,000
Curlin	141	\$100,000	Secret Circle	63	\$5,000
Medaglia d'Oro	141	\$150,000	Hampton Court	56	\$5,500
Bayern	139	\$15,000	Elusive Quality	55	\$40,000
Shackleford	138	\$20,000	Run Away and Hide	52	\$7,500
Street Sense	137	\$45,000	Smarty Jones	51	\$7,500
Bernardini	135	\$100,000	Raison D'Etat	48	\$7,500
Palace	134	\$6,000	Dominus	46	\$3,500
Can the Man	133	\$3,500	Tale of Ekati	42	\$15,000
Empire Maker	130	\$100,000	Power Broker	41	\$5,000
Danza	129	\$4,000	Red Rocks	39	\$12,500
Midshipman	129	\$8,500	Hat Trick	38	\$7,500
Tapit	125	\$300,000	Stormy Atlantic	34	\$25,000
English Channel	123	\$25,000	Real Solution	33	\$7,500
Warrior's Reward	123	\$10,000	Musketier	31	\$7,500
Liaison	118	\$6,500	Ready's Image	29	\$7,500
Street Boss	116	\$12,500	Grey Swallow	25	\$7,500
Flashback	115	\$7,500	Perfect Soul	13	\$7,500
Karakontie	113	\$15,000	Point Given	11	\$7,500
Malibu Moon	111	\$95,000	Snapy Halo	11	\$7,500
Cross Traffic	106	\$10,000	Eye of the Leopard	1	\$7,500
Dialed In	105	\$7,500			

Source: BloodHorse, 2016

A 2011 Research Report, "The Kentucky Thoroughbred Breeding Industry and State programs that Assist the Equine Industry" explored the economic importance of Kentucky's breeding industry on employment as well as contribution to the breeders incentive fund (BIF).¹ Kentucky provides assistance to the horse industry by allocating sales tax revenue generated from stud fees to BIFs. The BIFs are available for Thoroughbred, Standardbred and nonrace breeds and are allocated based on how their horses perform in races, shows and contests. Kentucky levies a 6% sales tax on all stud fees in the state. By statute, the tax revenue is then redistributed to the Thoroughbred BIF (80%), the Standardbred BIF (13%), and Horse BIF (7%). In FY

¹ Perry Nutt, Mike Clark, Rick Graycarek, Christopher Hall, Jonathan Roenker, "The Kentucky Thoroughbred Breeding Industry and State Programs that Assist the Equine Industry." Research Report NO. 406. Legislative Research Commission, 2011.

2016, the total BIF was equal to \$14.1 million reflecting total stud fees of approximately \$235 million.² These sales tax revenues are highly dependent on individual terms between the stud and mare owners.

In 2016, Kentucky Stallions covered 17,750 mares in North America. This represents 16% of all stallions and 52.6% of all mares bred (Bloodhorse, 2016). In Fayette County, available data suggest that 67 stallions covered 6,585 mares. Nationally, Into Mischief (Sprendthrift Farm) was the second stallions in the United States with 218 mares bred in 2016. Furthermore, 8 of the top 20 stallions, as measured by breeding activity, are located in Fayette County. Table 13 provides an overview of stallions in Fayette County, number of mares bred, and listed stud fee. The total estimated stud fees for 2016 would have been approximately \$192 million if the listed stud fees reflected actual negotiated price.

² Commonwealth of Kentucky Tax Expenditure Analysis, Fiscal Years 2016-2018, Governor's Office for Economic Analysis.

Methodology

A direct industry comparison with our previous study is not recommended due to changes in industry classification after 2012. Prior data had many businesses classified as wholesale trade while this time they are classified under the agricultural sector (largely equine breeding operations).

Production Ag: To determine employment in the production agriculture sector, we used 2014 IMPLAN employment and sales data, which coincided well with Census of Ag 2012 data, except in the equine sector. The 2012 Census measured horse production very differently than in the past and only measured the sale of horses owned by Kentucky Horse Farms and didn't include any activity by out-of-state owners, although a large share of the revenue received from the sale of the horse was used to fund local horse farm activities including boarding, feed, training, etc. We have provided a copy of both the 2007 and 2012 Census of Ag Reporting form for equine production to better highlight the differences in the questions asked. To determine the change in overall horse production in the state between 2007 and 2015, we asked Dr. Kenny Burdine, the state's livestock production economist, to provide an estimate of the drop in equine receipts. His calculation was based on statewide receipts over the 8 years, and found an estimated decline of 22.5%. We applied this reduction to the 2007 Census of Ag market value. In addition, the decline in employment as reported by Bureau of Economic Analysis (BEA) for all of agriculture in this time-period fell by roughly 22.2%. Thus, we feel quite comfortable with Dr. Burdine's estimate of reduction in equine receipts. In summary, we reported BEA numbers for employment and use 2012 Census of Ag receipts for all but the equine sector. For the equine sector, we impose a 22.5% reduction from Census of Ag 2007.

Food Products, Beverage and Tobacco: In recent studies similar to this one, food and beverage manufacturing numbers have been included in the Ag Cluster. In the 2012 study, we included these industries regardless of on-farm impact. For the current study, we chose to only include those establishments that we expected to have on-farm impacts in the County or surrounding region. For example, we included Brumfield Hay and Grain, Conboy Enterprises, and Greatest Mill. We excluded Jif, Snapple, Coca-Cola, all bakeries, and ice manufacturing. For the beverage industry we included all local wineries, breweries, and distilleries.

Agricultural Support Industries: We used ESRI's Business Analyst to identify all additional establishments related to agriculture in the County. The majority of the establishments were identified by searching through a national business database (ESRI Business Analyst) using the following keywords: equine, horse, agriculture, farm, grain, hay, tobacco, cattle, fertilizer, fence, racing, tack, bridle, and thoroughbred. We also downloaded the entire database of all registered businesses and identified likely NAICS industry codes where agricultural businesses might reside. We then verified that each of these businesses was in fact related to agriculture by going online to their website to verify business purpose and employment, when applicable.

Input Output (IO) Modeling: The input-output methodology relies on national transaction matrices that suggest the ratio at which one industry purchased from another. We hypothesize that while this serves as a good starting point that the agriculture industry is unique and there is likely a different transaction matrix that if modeled accurately would result in larger indirect effects than what is provided in Table 3. However, without having more specific information about the transactions associated with the Agricultural Cluster in the county, we are limited to these findings.

IO analysis is only relevant when it is assumed that household dollars would not be used on a substitute product within the service area. For example, if a household spends \$30 on movies a month and the movie theatre closes, we would likely expect those dollars to be spent locally on similar entertainment activities, thus conducting an economic impact analysis of a closed movie theatre is futile. We assume that the equine industry is specialized and that the substitutes within the service area do not exist. This is a simple assumption and understates the complexity of situation. However, if the equine industry were to leave Fayette County then we would generally not expect those dollars to be used for other local goods and services. We would expect those dollars to leave the region.

The *indirect effects* capture the degree to which there are transactions between agriculture and other industries. To avoid double counting, the indirect effects were reduced by the direct employment attributable to the agriculture. For example, the results suggested that there would be an additional 646 jobs in religious, grant making and other organizations industry as a result of indirect effects from production agriculture. However, there were 412 jobs included in the business directory and these jobs were included as direct agriculture-related employment. Thus, there is the potential for double counting. As a result, we have subtracted the direct employment from the indirect effects and in this example the indirect effects would result in 234 new jobs, not 646 jobs.

The input-output methodology relies on national transaction matrices that suggest the ratio at which one industry purchases from another. We hypothesize that while this serves as a good starting point that the agriculture industry, specifically the equine industry in Fayette County, is unique and there is likely a different transaction matrix that if modeled accurately would result in larger indirect effects than what are provided in Table 3. However, without having specific information about the transactions associated with the Ag Cluster in Fayette County, we are limited to these findings. By compiling the directory of businesses related to agriculture and including them in this analysis, we are able to minimize the impact of this limitation.

The estimated employment *multipliers* for this analysis ranged from 1.12 to 9.04 (oilseed farming). There were only two employment multipliers larger than 4 associated with the agricultural sector (oilseed farming and grain farming). The output multipliers ranged from 1.14 to 1.58 (tree nut farming) and the value added multipliers ranged from 1.26 to 4.38 (wineries).

Occupational tax estimate: We found that total compensation for the Ag Cluster was approximately \$532 million. The Bureau of Economic Analysis suggests that in the South, on average, non-taxable benefits comprise 29% of total employee compensation. As a result, the local payroll tax was calculated as 2.25% of taxable income (\$378 million). This resulted in a contribution of roughly \$8.5 million. This estimate does not include any multiplier effects.

Comparison of Ag Census Survey Reporting Forms

Figure 6. Ag Census Form, 2007.

SECTION 19 OTHER ANIMALS AND LIVESTOCK PRODUCTS

1. Did you or anyone else have any horses, goats, other livestock, or livestock products on this operation in 2007?

1257 1 ☐ Yes - Complete this section 3 ☐ No - Go to SECTION 20

	None	Number on December 31, 2007	Total number sold in 2007
2. Horses and ponies. 0630	☐		
a. How many of these were owned by this operation? 0672	☐		
3. Mules, burros, and donkeys. 0633	☐		
4. Milk goats. 0643	☐		
5. Angora goats. 0647	☐		
6. Meat goats and other goats. 0651	☐		
7. Alpacas. 0676	☐		
8. Llamas. 0674	☐		
9. Bison. 0686	☐		
10. Deer in captivity. 0688	☐		
11. Elk in captivity. 0690	☐		
12. Rabbits, including pelts. 0654	☐		
13. Mink, including pelts. 0636	☐		
14. Other livestock. Report emus and ostriches in section 15. Specify below →		Number on December 31, 2007	Total number sold in 2007
	☐		
LIVESTOCK AND ANIMAL PRODUCTS			
15. Mohair. 0649	☐	Pounds clipped in 2007	
16. Other livestock products - Include semen, embryos, worm castings, manure sold, etc. Specify below →		Quantity produced in 2007	Unit reported

Figure 7. Ag Census Form, 2012.

4. Report gross value of sales for hogs and pigs sold from this operation in 2012. Include the value of your landlord's share, marketing charges, taxes, hauling, etc. Exclude value of items produced under production contracts 1341

None ☐ Value of Sales (Dollars) \$.00

TYPE OF OPERATION AND PRODUCER

5. Mark the one item which best describes this operation -

1241 ☐ Farrow to wean 1242 ☐ Farrow to finish 1243 ☐ Finish only 1118

1244 ☐ Farrow to feeder 1245 ☐ Nursery 1246 ☐ Other, specify →

6. Mark the one item which best describes this producer -

1214 ☐ Independent grower 1216 ☐ Contract grower (contractee) 1215 ☐ Contractor or integrator

SECTION 15 EQUINE

1. Did you or anyone else have any horses, ponies, mules, burros or donkeys on this operation in 2012? Report gross value of sales in 2012. Include the value of your landlord's share, marketing charges, taxes, hauling, etc. Exclude value of items produced under production contracts.

1247 1 ☐ Yes - Complete this section 3 ☐ No - Go to SECTION 16

	None	Number on this operation December 31, 2012	Total Number Sold in 2012	Value of Sales (Dollars)
2. Horses and ponies OWNED by this operation. 0672	☐			\$.00
3. Horses and ponies NOT owned by this operation. 0622	☐			\$.00
4. Mules, burros, and donkeys 0633	☐			\$.00
5. Horse breeding or stud fees, semen, and other equine products (Exclude income from boarding, training, or riding facilities which are included in SECTION 22, ITEM 7). 1406	☐			\$.00
6. For the horses and ponies NOT OWNED BY YOU reported in item 3 above, mark the one item which best describes why they are on this operation:				
1191 ☐ Operation is a race track	1192 ☐ Operation is a boarding, training or riding facility (Including recreational places)	1193 ☐ Operation is a breeding service place		
1194 ☐ Operation is not a boarding facility but horses are being kept for others' personal use	1195 ☐ Other - specify →	1115		

Glossary of Terms

Direct Effects are the set of expenditures applied to the predictive model (i.e., IO multipliers) for impact analysis. It is a series (or single) of production changes or expenditures made by producers/consumers as a result of an activity or policy. These initial changes are determined by an analyst to be a result of this activity or policy. Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond, economically to these initial changes.

Employee Compensation is the total payroll cost of the employee paid by the employer. This includes wage and salary, all benefits (e.g., health, retirement) and payroll taxes (both sides of social security, unemployment taxes, etc.). We assume based on research that on average 71% of employee compensation is salary/wages and 29% of compensation is nontaxable benefits.

Input Output Analysis is a type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy. More particularly, it measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands.

Indirect Effects result from the impact of local industries buying goods and services from other local industries. The cycle of spending works its way backward through the supply chain until all money leaks from the local economy, either through imports or by payments to value added. The impacts are calculated by applying Direct Effects to the Type I Multipliers.

Induced Effects are the response by an economy to an initial change (direct effect) that occurs through re-spending of income received by a component of value added. IMPLAN's default multiplier recognizes that labor income (employee compensation and proprietor income components of value added) is not a leakage to the regional economy. This money is recirculated through the household spending patterns causing further local economic activity

A **job** is the annual average of monthly jobs in that industry (this is the same definition used by QCEW, BLS, and BEA nationally). Thus, 1 job lasting 12 months = 2 jobs lasting 6 months each = 3 jobs lasting 4 months each.

Other Property Income represents Gross Operating Surplus minus Proprietor Income. OPI includes consumption of fixed capital (CFC), corporate profits, and business current transfer payments (net). It may also be referred to as Other Property Type Income (OPTI).

Output represents the value of industry production. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales. For Retail and wholesale trade, output = gross margin and not gross sales.

Proprietor Income consists of payments received by self-employed individuals and unincorporated business owners. This income also includes the capital consumption allowance and is recorded on Federal Tax form 1040C.

Value Added for an individual industry is equal to gross output (sales or receipts plus other operating income and inventory change) less intermediate inputs (consumption of goods and services purchased from other industries or imported). The difference between an industry's or an establishment's total output and the cost of its intermediate inputs. It equals gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported).

