



Animal Agriculture Economic Analysis Update

**A report prepared for
United Soybean Board**

December 2005

Promar International
1101 King Street, Suite 444
Alexandria, VA 22314 USA
Tel:(703) 739-9090
Fax:(703) 739-9098

Animal Agriculture Economic Analysis Update

A report prepared for
United Soybean Board

CONTENTS

SECTION 1: INTRODUCTION	1
SECTION 2: ECONOMIC AND ANIMAL PRODUCT DATABASE	2
SECTION 3: SOYBEAN MEAL USE BY STATE	6
SECTION 4: ECONOMIC IMPACTS OF ANIMAL AGRICULTURE	8
4.1 Output, earnings and employment multipliers	8
4.2 Impact estimates for output and earnings	12
4.3 Tax Effects	14
4.4 Reasonableness of estimates	16
SECTION 5: EFFECTS OF RELOCATION OF ANIMAL AGRICULTURE	18

SECTION I: INTRODUCTION

US livestock industries are in a state of flux. Globalization, trade liberalization and environmental regulation have increased competitive pressures on animal product producers in many parts of the country. Domestic livestock industries are by far the major source of demand for US soybean meal, and future soybean demand is tightly linked to the health of those industries. The scale of domestic animal product output is one of the major constraints on US soybean production and profitability. Actions to maintain and expand animal agriculture in the United States by supporting its long-term competitiveness are of critical importance to the soybean industry. In order to act at the state and local levels, one needs data and analysis on the economic importance of animal agriculture at those levels. This report addresses that constraint.

The United Soybean Board has set itself the objective of protecting the interests of US soybean producers by supporting the long-term competitiveness of the domestic livestock industry. In 2004 we identified 23 states that are major current producers of soybeans and animal products as well as states experiencing major relocation of animal agriculture. For the selected states we did the following:

- Compiled data on the breakdown of animal agriculture by species in each state.
- Estimated soy feed consumption in each state by species.
- Analyzed the economic impact of animal agriculture in each state by looking at output, earnings, employment and tax revenue.
- Discussed the main reasons for livestock relocation.
- Identified significant market trends that may change the dynamics of this market.

For the current report, we have added 2004 to the databases for those 23 states and revised historic data as necessary. We have also added four states – Delaware, Maryland, Virginia and South Carolina.

Section 2 of this report reviews describes the economic and animal product database for each state that serves as a basis for the associated analysis and graphic presentations. The database itself is in the form of an Excel file for each state. Section 3 details our estimates of soybean meal use by species in each state. Sections 4 and 5 present the impacts of animal agriculture on output, earnings, employment and tax revenue at the state, regional and national levels based on multiplier analysis. Section 6 analyzes the state economic impacts of relocation of animal agriculture.

SECTION 2: ECONOMIC AND ANIMAL PRODUCT DATABASE

A separate Excel file was created for each of the 27 states selected for study in this project. These files will be provided on a CD. This section describes the database, using Missouri as an example. Each state database contains information such as: livestock production and value data, economic impact calculations, characteristics of farm operations and operators, agricultural and economic census data, taxation data, and computation of meal use by livestock animals. The three tables below display most of the data we gathered. A fourth sheet in each Excel file contains information on state income tax structure. A fifth sheet calculates production indexes by species and a sixth sheet contains our calculation of meal use by species.

Annually-released publications from USDA's National Agricultural Statistics Service (NASS) served as the sole source for inventory, quantity of output, and value of production data in the first table. The number of farms, value of sales, and input purchase information came from NASS' 1997 and 2002 Census of Agriculture.

Calculated economic impacts are presented in the lower part of the table along with the multipliers we obtained from the Bureau of Economic Analysis in the Department of Commerce. We applied these multipliers to the value of production to calculate the following indicators of economic impact: output and earnings measured in dollars, and employment measured in number of jobs. Tax revenue effects were separately calculated using methods described in Section 4. The change in economic impact from 1997 to 2004 was computed by applying the multipliers and tax factors to the change in over that period in the value of production (at 2004 prices).

Looking more closely at the uses of the livestock products under evaluation, we collected information from the manufacturing series of the 2002 Economic Census. The industries presented in Census results and which are relevant to our analysis are: fluid milk; creamery butter; cheese; dry, condensed and evaporated dairy products; ice cream and frozen desserts; animal (except poultry) slaughtering; meat processed from carcasses; rendering and meat byproducts; and poultry. As demonstrated in the second table below, state-level data is not always available for all the industries selected. For example, in Missouri, data was available for only three of the manufacturing industries: ice cream and frozen desserts, meat processed from carcasses, and poultry. Nevertheless, this information can be useful in communicating the importance of the related processing industries to a state economy. For example, poultry processing in Missouri in 2002 was responsible for:

- ✓ 10,569 direct employees with a \$234 million payroll
- ✓ Purchases of \$687 million of poultry and other inputs
- ✓ Capital expenditures of \$34 million, and
- ✓ Total sales of \$1.3 billion of finished product.

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic and animal product database

Basic Livestock and Economic Impact Data

NASS	Missouri	1997	1998	1999	2000	2001	2002	2003	2004
Inventories									
Jan 1('98 - '04)	cattle & calves (1,000 head)	4,350	4,400	4,350	4,250	4,350	4,500	4,350	4,450
Dec 1('97 - '03)	hogs & pigs (1,000 head)	3,550	3,300	3,150	2,900	2,950	2,950	2,950	2,900
Quantity of output									
	cattle & calves (1,000 lbs)	1,164,535	1,128,940	1,152,178	1,187,853	1,186,399	1,186,349	1,154,676	1,194,794
	hogs & pigs (1,000 lbs)	1,411,364	1,420,725	1,237,548	1,214,626	1,204,376	1,159,851	1,100,499	1,141,877
	broilers (1,000 head)	250,000	255,000	258,800	withheld	withheld	withheld	withheld	withheld
	turkeys (1,000 head)	21,000	22,000	22,000	23,000	24,000	25,500	23,500	21,500
	eggs (mil eggs)	1,719	1,732	1,690	1,614	1,791	1,841	1,861	1,865
	milk (mil lbs)	2,362	2,367	2,237	2,258	1,949	1,946	1,886	1,847
Value of prdxn									
	cattle & calves	825,886	778,616	837,454	1,003,986	999,260	909,313	991,244	1,212,128
\$1,000	hogs & pigs	712,923	480,286	378,189	503,176	523,240	358,757	386,330	551,601
	broilers	403,125	416,670	430,902	withheld	withheld	withheld	withheld	withheld
	turkeys	225,120	293,360	277,200	272,228	270,600	281,826	253,330	279,930
	eggs	84,804	76,636	72,677	69,975	75,688	76,176	99,989	101,395
	milk	323,594	369,252	328,839	273,218	290,401	239,358	237,636	302,908
	other	8,454	7,727	8,636	8,690	7,767	6,257	7,822	8,881
	sheep & lambs	4,429	4,002	3,953	3,605	3,034	3,329	3,878	4,886
	catfish	2,022	1,908	2,854	3,117	2,840	1,070	1,954	1,358
	trout	2,003	1,817	1,829	1,968	1,893	1,858	1,990	2,637
	mink	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Total	2,583,906	2,422,547	2,333,897	2,131,273	2,166,956	1,871,687	1,976,351	2,456,843
Census of AG									
		1997	2002						
Number of farms	Beef cattle ranching and farming (112111)	49,947	48,441						
(NAICS classification)	Cattle feedlots (112112)	2,024	3,029						
	Dairy cattle and milk production (11212)	2,599	2,664						
	Hog and pig farming (1122)	2,444	1,469						
	Poultry and egg production (1123)	1,162	1362						
	Sheep and goat farming (1124)	646	922						
	Animal aquaculture and other animal prdxn (1125,1129)	3,859	8,047						
Value of sales									
	cattle & calves	1,143,320	1,285,288						
\$1,000	hogs & pigs	841,644	570,551						
	poultry & eggs	755,708	784,986						
	milk & other dairy products	293,411	300,460						
	aquaculture (first Census, 1998)	5,374	11,107						
	other (calculated)	36,613	38,417						
	Total (livestock, poultry & their products)	3,076,070	2,990,809						
Input purchases									
	Livestock and poultry purchased.....farms	29,162	30,120						
	\$1,000	574,610	546,196						
	Breeding livestock purchased.....farms	n/a	19,512						
	\$1,000	n/a	97,217						
	Other livestock and poultry purchased.....farms	n/a	14,508						
	\$1,000	n/a	448,979						
	Feed purchased.....farms	61,570	69,368						
	\$1,000	1,056,896	1,136,939						
Economic impacts									
		Output (\$000)	Earnings (\$000)	Employment (jobs)	Tax (\$000)				
2004 animal ag	Cattle & calves and milk	4,127,261	619,347	26,438	141,211				
	Poultry & eggs	1,061,761	160,957	6,129	36,698				
	Hogs & pigs and other	1,598,775	241,960	10,461	55,167				
	Total impact	6,787,797	1,022,264	43,028	233,076				
Change from '97-'04	Cattle & calves and milk	(146,458)	(21,978)	(1,403)	(5,011)				
	Poultry & eggs	22,102	3,350	612	764				
	Hogs & pigs and other	(371,338)	(56,199)	(2,150)	(12,813)				
	Total impact	(495,695)	(74,826)	(2,941)	(17,060)				
		Output (\$)	Earnings (\$)	Employment (jobs)		Tax rates	Fed. inc.	10.4%	
Multipliers	Cattle & calves and milk	2.7242	0.4088	20.5		Fed. SS	8.4%		
	Poultry & eggs	2.7844	0.4221	17.7		State inc.	4.0%		
	Hogs & pigs and other	2.8525	0.4317	19.7		Total	22.8%		

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic and animal product database

Data from the 2002 Economic Census

commodity	State	E ¹	All establishments ²		All employees		Production workers			Value added	Total cost of materials (\$1,000)	Total value of shipments (\$1,000)	Total Capital expenditures (\$1,000)
			Total	With 20 employees or more	Number ³	Payroll (\$1,000)	Number ³	Hours (1,000)	Wages (\$1,000)				
icfrz	MO	–	8	3	853	27,753	737	1,024	23,544	165,489	86,575	251,843	10,689
mfc	MO	2	26	10	1,599	47,263	1,333	2,626	34,151	193,673	212,214	404,875	24,464
pou	MO	–	22	18	10,569	234,282	9,695	19,208	201,879	620,258	687,164	1,317,376	34,003
fm	Fluid milk												
bu	Creamery butter												
ch	Cheese												
dce	Dry, condensed, & evaporated dairy product												
icfrz	Ice cream & frozen dessert												
as	Animal (except poultry) slaughtering												
mfc	Meat processed from carcasses												
r&m	Rendering & meat byproduct												
pou	Poultry												
¹ Some payroll and sales data for small single establishment companies with up to 20 employees (cutoff varied by industry) were obtained from administrative records of other government agencies rather than from census report forms. These data were then used in conjunction with industry averages to estimate statistics for these small establishments. This technique was also used for a small number of other establishments whose reports were not received at the time data were tabulated. The following symbols are shown where estimated data account for 10 percent or more of the figures shown: 1–10 to 19 percent; 2–20 to 29 percent; 3–30 to 39 percent; 4–40 to 49 percent; 5–50 to 59 percent; 6–60 to 69 percent; 7–70 to 79 percent; 8–80 to 89 percent; 9–90 percent or more.													
² Includes establishments with payroll at any time during the year.													
³ Number of employees figures represent average number of production workers for pay period that includes the 12th of March, May, August, and November plus other employees for payroll period that includes the 12th of March.													
Note: The data in this table are based on the 2002 Economic Census. To maintain confidentiality, the Census Bureau suppresses data to protect the identity of any business or individual. The census results in this table contain nonsampling errors. Data users who create their own estimates using data from American FactFinder tables should cite the Census Bureau as the source of the original data only. For explanation of terms, see Appendix A. For full technical documentation, see Appendix C. For geographical definitions, see Appendix D.													

The third table, which appears on the next page, presents state-level data on the number of farms and market value of sales for selected products that was collected by the 2002 Census of Agriculture. Data is cross-tabulated by numerous farm-type categories and is presented first for all farms, then for farms with \$50,000 or more in sales of the listed product. Note that not all cattle or hogs are produced on cattle or hog farms. For Census purposes, farms are classified by their primary product but may also be producing other products.

The Census collects and reports farm production expenses for 15 different types of related expenses – we have chosen four for use in our analysis: hired farm labor, contract labor, customwork and custom hauling, and property taxes paid. These expenses are also cross-tabulated by farm-type. Such information may prove useful in any closer examination that USB Board members and others make of the animal agriculture situation in their respective states. We do not explicitly analyze or discuss all of this information in this report. But it can be used to provide some detail on how animal agriculture ripples through the state economy. For example, dairy farms in Missouri did the following in 2002:

- ✓ Employed 3,491 hired laborers
- ✓ Spent \$1.7 million on contract labor and \$6.1 million on customwork, and
- ✓ Paid \$5 million in property taxes.

The last section of this chart shows the primary occupation of principal operators as farming or other. The number of days worked off-farm is also reported for all principal operators, regardless of primary occupation.

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic and animal product database

Data from the 2002 Census of Agriculture

Missouri: Market Value of Agricultural Products Sold and Government Payments, 2002														
Item	Total	Olsead and grain farming (1111)	Vegetable and melon farming (1112)	Fruit and tree nut farming (1113)	Greenhouse, nursery, and floriculture production (1114)	Total Other Crop Farming (1119)	Beef cattle ranching and farming (112111)	Cattle feedlots (112112)	Dairy cattle and milk production (11212)	Hog and pig farming (1122)	Poultry and egg production (1123)	Sheep and goat farming (1124)	Animal aquaculture and other animal production (1125, 1129)	
Cattle and calves	farms 57,957	4,926	65	85	66	1,723	43,613	3,029	2,395	611	545	76	823	
	\$1,000 1,285,288	112,278	494	582	533	20,108	932,071	128,106	45,588	13,004	13,808	234	18,483	
Sales of \$50,000 or more	farms 4,733	520	1	1	3	69	3,248	500	162	63	68	-	98	
	\$1,000 701,042	51,489	(D)	(D)	(D)	5,799	501,247	101,157	16,420	5,614	6,471	-	12,515	
Milk and other dairy products from cows	farms 3,233	33	10	-	2	23	422	7	2,587	53	62	1	33	
	\$1,000 300,460	1,166	(D)	-	(D)	485	8,539	(D)	284,601	894	2,464	(D)	770	
Sales of \$50,000 or more	farms 1,833	5	2	-	-	2	34	2	1,770	3	11	-	4	
	\$1,000 271,151	735	(D)	-	(D)	3,318	(D)	262,931	320	1,613	-	-	528	
Hogs and pigs	farms 3,752	550	7	5	5	175	804	117	138	1,453	52	21	425	
	\$1,000 570,551	19,375	15	11	(D)	(D)	4,871	2,642	1,462	524,240	992	19	15,724	
Sales of \$50,000 or more	farms 897	116	-	-	-	7	21	17	6	630	4	-	96	
	\$1,000 545,586	14,147	-	-	-	614	1,738	1,572	681	514,955	692	-	11,186	
Poultry and eggs	farms 3,103	98	55	28	34	176	698	83	131	76	1,337	113	274	
	\$1,000 784,986	554	43	(D)	(D)	825	812	38	(D)	(D)	777,794	28	3,554	
Sales of \$50,000 or more	farms 866	2	-	-	-	1	3	-	1	2	849	-	8	
	\$1,000 781,534	(D)	-	-	-	(D)	403	-	(D)	(D)	775,586	-	3,236	
Total farm production expenses	farms 106,749	17,702	412	936	909	20,478	49,264	3,076	2,749	1,356	1,424	1,008	7,435	
	\$1,000 4,578,834	1,242,513	27,338	17,204	77,854	287,442	1,050,666	140,931	281,719	581,577	740,863	6,976	123,752	
Average per farm	dollars 42,893	70,191	66,355	18,380	85,647	14,037	21,327	45,816	102,480	428,892	520,269	6,921	16,645	
Hired farm labor	farms 22,168	5,303	112	201	448	2,342	9,440	688	1,281	428	578	104	1,243	
	workers 66,201	14,394	1,497	1,565	3,785	7,010	22,864	1,847	3,491	3,236	2,944	183	3,385	
	\$1,000 287,744	73,696	3,960	4,013	26,473	18,019	35,565	6,479	18,868	60,708	32,533	109	7,321	
Farms with expenses of-														
\$1 to \$4,999		16,174	3,005	38	166	178	1,846	8,174	504	634	186	274	1,065	
\$5,000 to \$24,999		3,850	1,414	49	17	119	296	927	116	481	110	184	137	
\$25,000 to \$99,999		1,795	786	14	9	91	172	316	56	145	84	94	28	
\$100,000 to \$249,999		248	90	6	4	32	28	19	11	16	27	8	7	
\$250,000 or more		101	8	5	5	28	-	4	1	5	21	18	6	
Workers by days worked:														
150 days or more	farms 6,169	2,342	49	43	228	456	1,400	179	743	233	315	-	181	
	workers 15,340	4,128	290	124	1,497	935	2,352	394	1,682	1,949	1,494	-	495	
Less than 150 days	farms 18,836	4,083	94	190	365	2,172	8,657	588	727	323	401	104	1,132	
	workers 50,861	10,266	1,207	1,441	2,288	6,075	20,512	1,453	1,809	1,287	1,450	183	2,890	
Contract labor	farms 8,584	1,465	62	125	62	1,342	3,824	188	402	102	225	71	716	
	\$1,000 37,297	6,666	947	285	691	4,132	10,908	573	1,714	2,632	5,472	153	3,123	
Farms with expenses of-														
\$1 to \$999		3,565	414	2	55	-	645	1,744	64	150	22	60	372	
\$1,000 to \$4,999		3,552	729	19	66	39	480	1,604	95	175	31	85	204	
\$5,000 to \$24,999		1,289	282	32	2	18	197	425	28	69	39	67	121	
\$25,000 to \$49,999		109	28	3	2	3	14	42	1	6	2	6	2	
\$50,000 or more		69	12	6	-	2	6	9	-	2	8	7	17	
Customwork and custom hauling	farms 24,826	6,331	77	125	57	2,799	11,308	877	1,296	325	379	127	1,125	
	\$1,000 66,851	28,756	916	196	123	5,121	16,276	1,856	6,129	3,036	2,782	118	1,540	
Farms with expenses of														
\$1 to \$999		12,910	1,993	49	73	35	1,650	7,276	508	199	91	166	765	
\$1,000 to \$4,999		8,788	2,852	20	50	13	959	3,403	285	591	167	130	296	
\$5,000 to \$24,999		2,881	1,354	4	1	8	174	597	79	499	44	60	61	
\$25,000 to \$49,999		169	99	2	1	1	7	23	3	6	7	9	1	
\$50,000 or more		88	33	2	-	-	9	9	2	1	16	14	2	
Property taxes paid	farms 101,982	16,833	400	878	867	19,294	47,409	3,013	2,727	1,307	1,396	910	6,948	
	\$1,000 144,577	42,144	478	1,534	1,486	19,726	54,400	3,719	5,035	4,984	3,034	574	7,464	
Farms with expenses of														
\$1 to \$4,999		98,186	15,170	388	850	809	18,928	46,425	2,931	2,567	1,172	1,282	909	
\$5,000 to \$9,999		2,553	1,059	4	4	46	242	731	65	98	80	81	143	
\$10,000 to \$24,999		978	457	7	3	6	115	213	14	59	39	17	47	
\$25,000 or more		265	147	1	21	6	9	40	3	3	16	16	3	
PRINCIPAL OPERATOR CHARACTERISTICS														
Primary Occupation:														
Farming		61,035	12,738	282	373	360	9,137	27,907	1,691	2,332	1,052	947	420	3,796
Other		45,762	5,458	183	489	523	11,320	20,534	1,338	332	417	415	502	4,251
Days worked off farm														
None		46,248	9,143	198	380	442	8,890	19,901	1,207	1,753	678	694	308	2,654
Any		60,549	9,053	267	482	441	11,567	28,540	1,822	911	791	668	614	5,393
1 - 49 days		5,386	1,287	47	61	65	1,019	1,994	129	218	80	98	48	340
50 - 99 days		2,837	548	17	14	23	473	1,295	75	81	43	40	21	207
100 - 199 days		7,031	1,133	29	62	79	1,141	3,321	203	139	104	104	84	632
200 days or more		45,295	6,085	174	345	274	8,934	21,930	1,415	473	564	426	461	4,214
- represents zero														
(D) Withheld to avoid disclosing data for individual farms.														

SECTION 3: SOYBEAN MEAL USE BY STATE

The reason for soybean growers to be concerned about the future of animal agriculture in the United States is that domestic consumption of soybean meal by livestock, poultry and other species is the single largest source of demand for US soybeans. While animals do move around and cross state borders, the state production figures are still a good guide for estimating how much soybean meal is consumed in each state. The meal consumed in each state may come from soybean crushing facilities within the state, but often comes from facilities in neighboring states or even from imports because meal is readily transported.

To calculate soybean meal use by species in 2003/04 in each state, we began with 2004 production data published by NASS. Since most animals are fed for prolonged periods before they are slaughtered, fiscal year meal disappearance should roughly correspond to calendar year production or marketings. Comparing the live/slaughter weight production data for beef, pork and poultry to carcass/ready-to-consume production data in USDA's World Agricultural Supply and Demand Estimates, we calculated a three-year average product yield per pound of animal production for each livestock product (except for eggs and milk, which we assigned a yield ratio of 1.00). The figures we calculated for beef, pork and poultry are close to the official conversion factors USDA last published in 1992, which are now a bit out of date.

Using the new product yield estimates, we then applied feed conversion ratios to estimate protein meal used in feed per unit of meat, egg or milk production. The factors usually cited for the number of pounds of meal needed to produce a pound of chicken or some other meat assume a ration built around corn and soybean meal. However, there are many other protein sources going into the national feed mix including meat and blood meal, fish meal, urea, synthetic amino acids, corn gluten meal and other oilseed meals. We attempted to reconcile our estimates to that total disappearance of protein feeds by adjusting downwards the calculated amount of soybean meal. For poultry, swine, and egg production, consumption is estimated at 85% of the amount calculated for a straight corn-SBM ration. For beef cattle we used a factor of 32% and for dairy 42% because of the heavy use of cottonseed, gluten feed, distillers' grains and urea to meet cattle protein requirements.

In addition to the main species, other outlets for soybean meal as feed include aquaculture and petfood, plus much smaller markets like mink, goats, sheep, horses, ducks, geese, etc. In the past we have estimated that this "other" category accounts for about 5% of total soybean meal used nationally in domestic feeding. We have used the same figure in our state estimates.

The table on the next page presents the results of these calculations. In total, the 27 states we are examining accounted for an estimated 23.5 million tons of SBM consumption for feed in 2003/04. This is 75% of the 31.4 million tons of domestic meal disappearance during that season.

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

The other 25% is mostly accounted for by feed use in the 23 states not covered by this study. However, a small portion also goes into production of soy flour, concentrate and isolate for human and animal consumption.

Swine accounted for 7.7 million tons of soybean meal use, broilers 6.8 million and beef cattle 3.1 million. Within each state it is easy to see which animal production sectors are responsible for most of the local demand for soybean meal. By state, Iowa was the leader at 3.0 million tons, followed closely by North Carolina with 2.9 million, and then Arkansas at 2.0 million tons.

Soybean Meal Use by Species in 2003/04 (1,000 short tons)

State	Beef Cattle	Hogs & Pigs	Broilers	Turkeys	Eggs	Dairy Cattle	Other	Total
Arizona	56	21	0	0	0	61	7	145
Arkansas	52	39	1,564	148	96	5	100	2,005
Colorado	185	110	0	0	30	37	19	380
Delaware	1	2	376	0	0	2	20	401
Idaho	102	3	0	0	6	153	14	278
Illinois	54	545	0	25	28	33	36	721
Indiana	25	452	0	115	168	50	43	853
Iowa	156	2,262	0	91	313	65	152	3,038
Kansas	377	237	0	0	0	37	34	686
Kentucky	58	63	395	0	33	24	30	604
Maryland	8	6	344	4	23	20	21	425
Michigan	35	151	0	53	54	106	21	420
Minnesota	103	974	58	345	79	136	89	1,785
Mississippi	27	35	1,105	0	43	6	64	1,281
Missouri	116	359	0	187	50	31	39	782
Nebraska	425	432	6	0	85	18	51	1,017
N. Mexico	58	0	0	0	0	113	9	180
N. Carolina	29	1,210	1,143	301	68	17	146	2,913
N. Dakota	74	21	0	7	0	9	6	117
Ohio	39	242	57	62	198	77	35	709
S. Carolina	17	32	299	130	36	5	27	547
S. Dakota	150	198	0	42	25	23	23	460
Tennessee	54	26	252	0	9	19	19	378
Texas	710	64	797	0	130	101	95	1,896
Utah	37	98	0	0	22	27	9	188
Virginia	45	44	338	122	20	29	31	630
Wisconsin	101	65	38	0	32	371	32	639
Total	3,094	7,691	6,772	1,632	1,548	1,575	1,172	23,478

SECTION 4: ECONOMIC IMPACTS OF ANIMAL AGRICULTURE**4.1 Output, earnings and employment multipliers**

To estimate the impact of livestock production on the overall economy of any given geographic area, it is necessary to quantify the relationship between the livestock industry and each of the other major components of the area's economy. So-called input-output (I-O) models are commonly used for this purpose. Given the great amount of detailed information that is required to build and maintain a national I-O model, there are comparatively few of them in operation. One of the most elaborate of these models is the Regional Industrial Multiplier System (RIMS II) operated by the Bureau of Economic Analysis in the US Department of Commerce. This is the model used in this analysis.

RIMS II is based on a benchmark I-O table developed by BEA in 1997. It is comprised of approximately 500 industries. The model traces the interaction between and among these industries so that the effect of a given level of output in one industry on all other industries can be measured. These measures take the form of multipliers or factors that can be applied to output measured in dollars. They indicate the total economic activity in the state associated with a dollar of sales in that industry. In addition to measuring the value of output, multipliers are also derived for measuring impacts on earnings and employment. The employment multiplier is the number of total jobs in the state associated with one million dollars of sales in that industry.

Given the complexity of tracing these effects throughout the economy, some simplification in methodology is required to keep the task manageable. The first simplifying step in constructing RIMS II was to collapse the nearly 1,200 industries identified in the Census Bureau's North American Industry Classification System (NAICS) to a smaller number of industries. (NAICS replaced the old Standard Industrial Classification system). For purposes of this analysis, unique multipliers are available for three sets of livestock production:

- Cattle and dairy farming
- Poultry and egg production
- Swine, aquaculture, and other animal production

A second important step in estimating multipliers is in defining the geographic region of interest. The RIMS II model permits the region of enquiry to be as small as an individual county or as large as the entire nation. The choice of region can have an important effect on the outcome, depending on whether the associated industries are located within the region. As a general rule, the more broadly the region is defined the greater the likelihood that associated industries are represented within the region and the larger the multipliers. For this analysis, we have defined

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

individual states as the regions of principal interest. While there are variations in the degree to which associated industries are represented (and, correspondingly, in the size of the multipliers), states are generally of sufficient size to capture most of the impact of livestock production.

For comparative purposes, we have also developed multipliers for a single 17-state region in the central United States comprised of the major soybean producing states, for Delmarva, and for the nation as a whole. Multipliers for these larger regions can be compared to individual state multipliers as a basis for judging the relative importance of impacts that cross state borders and the impact of animal agriculture in states not studied in detail.

The first table below presents the multipliers for beef and dairy cattle (officially described as Industry 112100 Cattle ranching and farming). Leaving aside Delaware which has low multipliers due to its small size, state output multipliers ranged from about 1.9 in Mississippi to almost 3.1 in Texas. For the 17-state region and the United States, output multipliers were 2.9 and 3.9 respectively. Earnings multipliers were within the 0.3-0.5 range, rising to over 0.7 for the country as a whole. Employment multipliers were as low as 12.2 in North Carolina and over 28 in Kansas and Texas.

The second table below presents the RIMS-II multipliers for poultry and egg production. Output multipliers range from 1.6 for Arizona to 2.8 for Missouri, and the soy region and national multipliers are about 3.1 and 3.5, respectively. The earnings multipliers are marginally lower than those for cattle. The employment multipliers are quite a bit lower in most cases, ranging from 8.1 in Arizona to 24.7 in Minnesota.

Finally, the multipliers for Industry 112A00 Animal production, except cattle, poultry and eggs (i.e. swine and the smaller sectors like aquaculture) are shown in the third table below. They are broadly similar to those for cattle.

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

Beef and Dairy Cattle

State	Final-demand multiplier		
	Output (\$)	Earnings (\$)	Employment (jobs)
Arizona	2.5738	0.4192	14.6
Arkansas	2.0228	0.3110	15.0
Colorado	2.8869	0.4762	21.3
Delaware	1.5955	0.1964	6.5
Idaho	2.7297	0.4339	17.9
Illinois	2.3062	0.3753	20.8
Indiana	2.2357	0.3427	22.8
Iowa	2.2341	0.3455	20.2
Kansas	2.7607	0.4140	28.1
Kentucky	2.3512	0.3591	25.9
Maryland	2.2233	0.3291	12.6
Michigan	2.4027	0.3777	19.2
Minnesota	2.4775	0.3936	19.1
Mississippi	1.9293	0.2951	13.7
Missouri	2.7242	0.4088	20.5
Nebraska	2.6066	0.4055	18.8
New Mexico	2.4940	0.3835	15.2
North Carolina	2.1317	0.3417	12.2
North Dakota	2.2925	0.3377	19.1
Ohio	2.5059	0.4006	20.2
South Carolina	1.9794	0.3089	14.4
South Dakota	2.5273	0.3824	16.3
Tennessee	2.6935	0.4220	20.5
Texas	3.0584	0.5135	28.8
Utah	2.7512	0.4455	22.7
Virginia	2.5210	0.3786	26.0
Wisconsin	2.4666	0.3911	20.2
17 Soy States	2.9032	0.4935	22.7
Delmarva	2.4273	0.3826	16.6
United States	3.8698	0.7162	29.9

Source: RIMS-II, BEA, Department of Commerce

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

Poultry and eggs

State	Final-demand multiplier		
	Output (\$)	Earnings (\$)	Employment (jobs)
Arizona	1.6063	0.2582	8.1
Arkansas	2.5719	0.3956	16.2
Colorado	2.1844	0.3641	15.2
Delaware	1.7098	0.2116	6.2
Idaho	2.2475	0.3581	13.6
Illinois	2.7283	0.4542	21.4
Indiana	2.7067	0.4231	23.5
Iowa	2.4927	0.3828	17.9
Kansas	2.4512	0.3685	24.4
Kentucky	2.5921	0.3925	21.8
Maryland	2.1961	0.3282	10.7
Michigan	1.7259	0.2751	12.3
Minnesota	2.7032	0.4386	24.7
Mississippi	2.4207	0.3688	15.4
Missouri	2.7844	0.4221	17.7
Nebraska	2.4933	0.3859	17.7
New Mexico	1.7154	0.2587	9.2
North Carolina	2.4661	0.4009	12.5
North Dakota	2.1166	0.3092	15.2
Ohio	2.6857	0.4386	24.4
South Carolina	1.7758	0.2740	11.5
South Dakota	2.3047	0.3445	14.5
Tennessee	2.7260	0.4314	17.3
Texas	2.3534	0.3955	19.8
Utah	2.2839	0.3806	15.8
Virginia	1.9290	0.2944	17.7
Wisconsin	2.1999	0.3523	15.4
17 Soy States	3.0842	0.5338	20.7
Delmarva	2.1919	0.3446	12.4
United States	3.5120	0.6508	23.6

Source: RIMS-II, BEA, Department of Commerce

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

State	Swine and other		
	Final-demand multiplier		
	Output (\$)	Earnings (\$)	Employment (jobs)
Arizona	2.0310	0.3306	11.1
Arkansas	2.4220	0.3748	16.2
Colorado	2.6432	0.4392	19.4
Delaware	1.6887	0.2084	9.8
Idaho	2.5364	0.4058	16.9
Illinois	2.8344	0.4689	22.1
Indiana	2.6906	0.4180	24.1
Iowa	2.5313	0.3920	19.8
Kansas	2.6307	0.3965	20.6
Kentucky	2.5078	0.3827	22.8
Maryland	2.2697	0.3383	12.3
Michigan	2.1502	0.3408	16.3
Minnesota	2.6926	0.4329	24.6
Mississippi	2.2495	0.3446	15.8
Missouri	2.8525	0.4317	19.7
Nebraska	2.6326	0.4099	18.1
New Mexico	2.0514	0.3143	12.0
North Carolina	2.4919	0.4038	13.7
North Dakota	2.3188	0.3419	23.3
Ohio	2.7575	0.4473	26.6
South Carolina	1.9703	0.3077	13.8
South Dakota	2.5005	0.3776	15.6
Tennessee	2.6079	0.4122	18.1
Texas	2.6687	0.4505	24.4
Utah	2.5490	0.4206	17.9
Virginia	202087	0.3348	19.5
Wisconsin	2.3216	0.3711	17.5
17 Soy States	3.0560	0.5265	22.4
Delmarva	2.3477	0.3740	15.0
United States	3.8032	0.7080	27.4

Source: RIMS-II, BEA, Department of Commerce

4.2 Impact estimates for output and earnings

Impact estimates were derived as follows. The 2004 value of production estimates (as reported by NASS) were aggregated into the three livestock categories described above (i.e. beef/dairy, broiler/turkey/eggs, and hogs/other) for each of the 27 states under study. Each of these values was multiplied by its respective output multiplier to yield the dollar value impact of that sector

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

on each state's economy. The sums of the livestock category impacts represent the overall impact of the livestock industry on the economy of each state.

The impact on earnings has been calculated in a similar manner. That is, the value of production estimate for each category was multiplied by its respective earnings multiplier. The resulting value represents the dollar value of earnings of households employed by all industries throughout the state associated with the production of each category of livestock.

Employment impacts were calculated in similar fashion, using the employment multipliers generated through the RIMS II model. The resulting estimate represents the number of jobs in each state attributable to livestock production. Because the employment multipliers are based on 2001 data, production levels for 2001 were used in deriving employment estimates.

Economic Impact of 2004 Animal Agriculture in Selected States

States	Output (\$mil.)	Earnings (\$mil.)	Employment (jobs)	Income and sales tax (\$mil.)	Property Tax (\$mil.)
Arizona	2,992	487	12,761	111	13
Arkansas	9,978	1,535	54,384	350	35
Colorado	7,138	1,179	43,865	276	38
Delaware	1,222	151	4,061	34	3
Idaho	6,232	991	32,467	226	32
Illinois	4,766	784	35,663	171	46
Indiana	4,636	718	38,124	159	54
Iowa	14,285	2,209	95,547	504	102
Kansas	9,678	1,455	81,563	332	73
Kentucky	4,138	629	34,098	144	47
Maryland	2,111	615	9,995	72	19
Michigan	38,338	604	25,887	138	53
Minnesota	11,525	1,846	84,434	421	59
Mississippi	6,379	973	34,515	222	30
Missouri	6,788	1,022	43,028	233	79
Nebraska	12,125	1,886	68,145	430	106
New Mexico	3,765	579	18,988	132	16
North Carolina	12,836	2,082	58,637	475	56
North Dakota	1,934	285	13,136	65	22
Ohio	5,169	834	39,894	190	62
South Carolina	1,895	293	10,315	67	20
South Dakota	5,325	805	29,304	151	68
Tennessee	3,200	504	20,145	115	60
Texas	26,215	4,402	210,131	828	262
Utah	2,286	372	15,693	85	15
Virginia	3,530	534	32,398	125	49
Wisconsin	11,791	1,870	85,288	426	141
Total	220,278	29,645	1,232,466	6,482	1,560
National Total	396,659	73,493	2,525,627	16,756	2,350

The output impact of animal agriculture ranges from \$1-38 billion at the state level and totals \$220 billion for the 27 states taken together. The effect on household earnings in that region is \$29.6 billion, and the sector creates almost 1.2 million jobs. The employment impacts range from about 4,000 in Delaware, to 210,000 in Texas.

4.3 Tax Effects

As shown in the preceding table, we estimate that animal agriculture in these 27 states results in \$6.5 billion in federal and state income and employment tax payments, plus \$1.6 billion in property tax payments. The methodology behind these estimates is described below.

The economic activity associated with the production of livestock also generates tax revenue for local, state, and federal governments. These taxes are applied in many different forms, depending on jurisdiction. Nationally, about 60 percent of all tax revenues are collected at the federal level with the remaining 40 percent spread among the several thousand state and local jurisdictions.

The USDA's Economic Research Service reports that farm households paid nearly \$40 billion in taxes in 1996, the most recent year for which this information is available. Of this total, most was paid in the form of federal income taxes (48 percent), federal Social Security/self-employment taxes (26 percent), local property taxes (13 percent), and state and local income taxes (12 percent). For this analysis, we will focus on income taxes, Social Security/self-employment taxes, and property taxes.

In calculating federal income taxes, farm households include income from all sources (farm and non-farm). Given the several adjustments, deductions, and exemptions that are allowed for farming enterprises, the average effective tax paid on farm income is relatively low. In 1996 (the most recent year for which information is available), the combined reported income of the 2.2 million farm households was entirely from non-farm sources. That is, farm income losses more than matched farm income gains when netted out across all farm households. Even among farms with annual sales in excess of \$250,000, two-thirds of reported income was from non-farm sources.

Based on the distribution of farm households with sales above \$250,000 among the federal tax brackets in 1996, adjusted for the lower tax rates adopted in 2001 and 2002, we estimate an average federal income tax rate of about 14 percent for these households. This should be considered an upper bound, however, since much of the income generated through the farming enterprises of these households is either taxed at a low rate or not taxed at all.

The other important federal tax is the self-employment (Social Security) tax. This tax has two components: the old age, survivor, and disability (OASDI) portion and the Medicare hospital

insurance (HI) portion. While self-employed farmers are required to pay both the employer and employee shares of this tax (15.3 percent of net farm profit), they also receive an income tax deduction for one-half of the tax as well as a 7.65 percent exclusion of self-employment income. The Economic Research Service (ERS) reports that the average effective Social Security tax rate for all farmers was 10 percent in 1994. As with the estimate of the federal income tax rate, this should probably be considered an upper bound. According to ERS, a combination of higher self-employment taxes and reduced retirement benefits has provided farmers with an incentive to adopt changes in farm business operations designed to minimize their self-employment taxes. Thus, the effective rate could be lower than 10 percent, though we have no basis on which to estimate it.

While the incomes of livestock and crop producers are most directly impacted by the economic activity associated with livestock production, the earnings of workers in many other industries are impacted too, though to a lesser extent. Since the workers in these industries also pay taxes, the indirect impact of the livestock industry on the tax revenues originating in these industries should also be considered. This includes workers across a diversified array of input, service, manufacturing, and distribution industries. Given the diversity of industries and occupations represented, we have used the most recent (2001) average effective federal tax rates for all households, as estimated by the Congressional Budget Office. CBO estimates that the average effective individual income tax rate was 10.4 percent in 2001 and that the average effective social insurance tax rate was 8.4 percent the same year.¹

State and local income tax rates are highly variable ranging from no tax in seven states to as high as 11 percent for the highest income bracket in one state. Typically they are in the 3 to 6 percent range. Most state income taxes are progressive, though a few are flat. ERS estimates the average rate for farm households at 4 percent. We have used that rate in estimating the state and local tax effects with two exceptions. First, a value of zero has been assigned to the two states (South Dakota and Texas) that have no state income tax. Second, for those five states (Colorado, Illinois, Indiana, Michigan, and Tennessee) that have a flat tax, their actual rates have been used.

In estimating tax impacts, we have opted to use CBO's estimated average rates for federal taxes and to apply these rates across the board to earnings in all industries. While this yields a somewhat lower estimate than that derived from using the average rates estimated by ERS for farmers, the CBO estimates are more recent and if anything, are probably still higher than the rates currently in use for farm production. The estimates are calculated by multiplying the sum of the federal and state tax rates by the total earnings impact estimate for each state.

¹ Congressional Budget Office, *Effective Federal Tax Rates: 1979 – 2001*, April 2004.

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Economic impacts of animal agriculture

In the case of property taxes, we have used the figures collected in the most recent Census of Agriculture. These were for 2002 but would have been at comparable levels in 2004. The property taxes paid in each state by each type of livestock operation are shown in the database.

4.4 Reasonableness of estimates

In order to test whether the estimates of output impact are plausible, we compared them to the total economic output for each state. The Department of Commerce periodically estimates not just the national gross domestic product (GDP) but also the gross state product (GSP) for each state. The most recent data available are for 2004 and are shown in the table below, along with the output impact estimates calculated above, and the ratio of the impact estimate to gross state product.

Share of Output Impact on Gross State Product, 2004			
	Output (\$mil.)	Gross State Product (\$mil.)	Share (%)
Arizona	2,992	199,953	1%
Arkansas	9,978	80,902	12%
Colorado	7,138	199,969	4%
Delaware	1,222	54,274	2%
Idaho	6,232	43,571	14%
Illinois	4,766	521,900	1%
Indiana	4,636	227,569	2%
Iowa	14,285	111,114	13%
Kansas	9,678	98,946	10%
Kentucky	4,138	136,446	3%
Maryland	2,111	227,991	1%
Michigan	38,338	372,169	10%
Minnesota	11,525	223,822	5%
Mississippi	6,379	76,166	8%
Missouri	6,788	203,294	3%
Nebraska	12,125	68,183	18%
New Mexico	3,765	61,012	6%
North Carolina	12,836	336,398	4%
North Dakota	1,934	22,687	9%
Ohio	5,169	419,866	1%
South Carolina	1,895	136,125	1%
South Dakota	5,325	29,386	18%
Tennessee	3,200	217,626	1%
Texas	26,215	884,136	3%
Utah	2,286	82,611	3%
Virginia	3,530	329,332	1%
Wisconsin	11,791	211,616	6%
Total	220,278	5,577,064	4%

We find the estimates to be quite plausible. For most states the impact of totally eliminating animal agriculture in the state as a percentage of total economic activity is in the single digits – typically 1-6 percent. But in states where livestock and poultry industries are a bigger part of the state economy, the impacts are in the 10-18 percent range, which seems reasonable.

SECTION 5: EFFECTS OF RELOCATION OF ANIMAL AGRICULTURE

In the database for each state, we also calculate the economic impacts of the change in output between 1997 and 2004. This can be a bit misleading because one has to work with dollar sales figures and these are influenced by price changes as well as by animal numbers. We therefore used 2004 unit values to calculate the output changes. Also, our multipliers are for categories that aggregate beef and dairy production, poultry and egg production, and swine and “other”. Thus, for example, a decline in dairy can be masked by an increase in beef cattle.

Nevertheless, it is instructive to examine the magnitude of changes that can occur in a state economy over this brief six-year period. In the table below we apply our multipliers to the change in value of production between 1997 and 2004. The table shows the total impact for each state and region calculated in the database. (The impact for each of the three separate livestock segments is shown in the Excel database for each state.)

Economic Impact of Change from 1997 to 2004

States	Output (\$mil.)	Earnings (\$mil.)	Employment (jobs)	Tax (\$mil.)
Arizona	643	105	3,228	24
Arkansas	150	23	19	5
Colorado	420	69	2,049	16
Delaware	-7	-1	-18	0
Idaho	1,864	296	9,604	68
Illinois	-269	-44	-611	-10
Indiana	87	13	1,042	3
Iowa	2,226	344	11,863	78
Kansas	831	125	9,435	28
Kentucky	-448	-69	2,735	-16
Maryland	-113	-17	-445	-4
Michigan	389	61	2,486	14
Minnesota	740	120	5,644	27
Mississippi	-120	-18	1,283	-4
Missouri	-496	-75	-2,941	-17
Nebraska	804	125	6,204	28
New Mexico	655	101	2,393	23
North Carolina	267	44	-1,073	10
North Dakota	617	91	4,009	21
Ohio	14	2	183	1
South Carolina	-40	-6	-202	-1
South Dakota	723	109	3,038	21
Tennessee	68	11	-531	3
Texas	1,923	323	21,985	61
Utah	293	48	2,013	11
Virginia	-202	-30	-2,287	-7
Wisconsin	-318	-51	-995	-12
Total	10,701	1,700	80,106	371
National Total	17,908	3,320	116,696	757

ANIMAL AGRICULTURE ECONOMIC ANALYSIS

Effects of relocation

Overall, the increased value of animal agriculture production in the 23-state region resulted in \$10.7 billion in total economic output when one sums up the state numbers. Over 93% of this was in states west of the Mississippi. This produced a \$1.7 billion increase in household incomes and 80,000 jobs. At the national level, where multipliers are higher and animal production in all 50 states is included, the positive impact on economic output was \$18 billion by the end of the period. This resulted in \$3.3 billion in additional incomes and 117,000 jobs.