

Analysis of Hog Production Industry in Jay County, Indiana

Prepared for
Jay County Plan Commission

by

Office of Building Better Communities
Ball State University

March 20, 2007



Highlights for Year 2004

Financial Measures

Total output (sales plus inventory adjustments)	\$ 19,945,806
Employment:	450
Employee compensation:	\$ 1,060,605
Wages per worker (includes proprietors)	\$ 1,597
Proprietary income	\$ (341,105)
Purchases:	\$ 17,201,494
Jay County	\$ 3,307,225
Out of county	\$ 13,894,269
<u>Taxes Paid:</u>	
Federal non-defense	\$ 530,981
Profit and income (includes personal)	\$ 287,828
Social insurance:	\$ 197,042
State and local	\$ 624,798
Profit and income (includes personal)	\$ 97,013
Property	\$ 223,063
Sales	\$ 261,793

Jay County Multipliers:

Output (increase in demand for other services per dollar increase in hog production):

Jay County industries	\$ 0.19
All other goods and services in Jay County	\$ 0.03

Employment (workers hired per \$1 million increase in hog production):

Direct (employed by hog production industry):	22.6
Indirect (industries that service hog production):	2.4
Induced (resulting from increased economic activity not directly related to hog production):	0.3
Multiplier (Direct + Indirect + Induced)/Direct	1.124

Source: IMPLAN 2004 dataset estimates

Highlights for Year 2007

Prices are in 2007 dollars

Financial Measures

Total output (sales plus inventory adjustments)	\$ 38,471,204
Employment:	838
Employee compensation:	\$ 2,045,681
Labor income per worker (includes proprietors)	\$ 1,656
Proprietary income	\$ (657,919)
Purchases:	\$ 33,178,010
Jay County	\$ 6,378,931
Out of county	\$ 26,799,079

Taxes Paid:

Federal non-defense	\$ 1,026,820
Profit and income (includes personal)	\$ 556,607
Social insurance:	\$ 381,044
State and local	\$ 1,208,245
Profit and income (includes personal)	\$ 187,605
Property	\$ 431,363
Sales	\$ 506,260

Hog Production Industry Multipliers:

Output:	
Direct	\$ 38,471,204
Indirect	\$ 7,209,441
Induced	\$ 1,101,114
Total	\$ 46,781,760

Employment:

Direct	838
Indirect	91
Induced	13
Total	942

Source: IMPLAN 2004 dataset, adjusted to 2007 dollars

Table of Contents

Highlights for Year 2004	1
Highlights for Year 2007	2
1. Introduction	4
2. Main Indicators of Current Hog Production Industry in Jay County, 2004	4
2.1 Output, Employment, and Value-added	4
2.2 Jay County’s Hog Production Industry Flowchart	7
2.3 Output Multipliers of Industries in Jay County	10
2.4 Employment Multipliers of Industries in Jay County	11
2.5 Tax Payments by Hog Production Industry	12
3. Impact Analysis.....	13
3.1 Hog Production Industry Output and Employment Impacts.....	13
3.2 Estimates of Hog Production Output and Employment Impacts in 2007	15
3.3 Application to Real Economy	22
3.4 Summary	23

Tables and Figures

Table 1: Top 10 Industries in Jay County for Both Highest Output and Highest Employment (2004).....	5
Table 2: Earnings per Workers of Industries with Both Highest Output and Highest Employment (2004).....	6
Table 3: Output, Employment, Value-added, and Earnings per Worker of Primary Agricultural Sectors in Jay County (2004).....	7
Table 4: Top 10 Industries in Jay County for Highest Output Multipliers (2004)	10
Table 5: Top 10 Industries in Jay County for Highest Employment Multipliers (2004).....	11
Table 6: Tax Payments by Hog Production Industry in Jay County (2004).....	13
Table 7: Jay County’s Hog Production Industry Output and Employment Impacts (2004).....	14
Table 8: Top 10 Industries for Total Employment Impact (2004).....	14
Table 9: Hog Inventories in Jay County (1987-2006)	15
Table 10: Hog Inventories and Production Estimates in Jay County (2003).....	17
Table 11: Hog Inventories and Production Estimates in Jay County (2004).....	18
Table 12: Hog Inventories and Production Estimates in Jay County (2007).....	18
Table 13: Hog Output Estimates in Jay County.....	19
Table 14: Impact Analysis of Hog Production Industry in Jay County	20
Table 15: Top 10 Industries for Total Output Impact (2007 Estimate)	20
Table 16: Top 10 Industries for Total Employment Impact (2007 Estimate).....	20
Table 17: Tax Impacts by the Hog Production Industry in Jay County.....	21
Flowchart 1: Input-Output of Hog Industry in Jay County, Indiana, 2004.....	9

Analysis of Hog Production Industry in Jay County, Indiana

1. Introduction

According to the Indiana Department of Environmental Management (IDEM), Jay County's regulated swine herd totaled 207,197 in December 2006. IDEM also reports January and February 2007 activity that includes pending and newly approved applications to house an additional 46,420 regulated swine in Jay County. When including the county's unregulated herd, estimated at 8,879 based on 2002 data, and the 2007 IDEM permit activity, the total hog inventory in Jay County is projected to exceed 262,000 head this year. A comparison of this number with IDEM's 2002 year-end total of approved CFO/CAFO inventory in Jay County at 95,567 yields a near tripling of the county's inventory during the past five years. To compare, The Star Press cited IDEM sources in an August 2006 report that listed Carroll County as housing the state's largest herd (329,218) with Jay County second (213,193) followed closely by White (210,782). Clinton and Decatur Counties effectively tied for fourth and fifth with approximately 184,500 head each according to the press report. While the rapid growth of the industry statewide may have changed the individual county rankings somewhat from the press report last August, Jay County – by any measure – ranks among the very top hog inventory and production counties in Indiana. These kinds of increases in confined animal feeding operations have generated interest among county residents and appointed and elected leaders in evaluating the county's preparedness for such an influx of livestock operations. To aid the county in a variety of issues surrounding these developments, the Jay County Plan Commission engaged Ball State University's Office of Building Better Communities to provide a number of technical and research services. Among those services is an independent economic impact analysis designed to inform policy-makers and county residents of the economic impacts of swine operations on the county, including the multiplier, or "ripple" effects created by these operations. This document represents the findings of that analysis, recommendations for further study, and identification of the shortcomings of IMPLAN (Impact Analysis for PLANning), the tool used in this analysis, a product of Minnesota IMPLAN Group, Inc.

2. Main Indicators of Current Hog Production Industry in Jay County, 2004

2.1 Output, Employment, and Value-added

- To get a glance at industries in Jay County, this section presents output, employment, and value-added of industries in Jay County in millions of dollar values in 2004.
- In 2004, the hog production industry in Jay County (sector 13: Animal production, except cattle, poultry and eggs—see Table 1) had the total output of \$19,945,806, employed 450 workers (employees and owners combined), and paid \$1,060,605 to its employees, \$1,617,575 for rent, interest, and other properties, and \$407,237 for its indirect business taxes (such as property tax, sales tax, excise taxes, and motor vehicle licensing). Note that in 2004, proprietors of hog production industry in Jay County reported a loss in net income. However, IMPLAN data are based on several sources including the national input-output table. If in 2004, proprietors of hog production industry in the United States as a whole lost money, it

could also affect the estimated figure for Jay County's hog production industry's proprietary income. Also, newer facilities qualify for significant non-cash depreciation expense treatment when reporting net income. Since IRS-reported net income forms the basis for proprietary income reported in IMPLAN, the reported figure includes an offset equal to these non-cash expenses, and as a result is not reflective of actual cash flow from operations, estimated to be positive. On-farm net worth increases resulting from the new facilities are also not reflected in this study.

- In 2004, top ten industries in Jay County which produced high value of output and employed a large number of workers are Motor vehicle parts manufacturing, Dog and cat food manufacturing, Soft drink and ice manufacturing, Glass container manufacturing, Iron and steel forging, AC, refrigeration and forced air heating, Tortilla manufacturing, Food services and drinking places, Oilseed farming, and Offices of physicians, dentists, and other health (see Table 1). However, the number of employment includes both full-time and part-time workers, and also proprietors. Therefore, some sectors which had a large number of employment may employ a large number of part-time workers.

Table 1: Top 10 Industries in Jay County for Both Highest Output and Highest Employment (2004)

		Unit: Millions of Dollars						
Sector	Industry	Industry Output	Employment	Value-added				Total
				Employee compensation	Proprietor income	Other property income	Indirect business tax	
13	Animal production, except cattle, poultry and eggs	19.946	450	1.061	(0.341)	1.618	0.407	2.744
350	Motor vehicle parts manufacturing	259.662	853	40.091	0.000	7.140	0.752	47.983
46	Dog and cat food manufacturing	150.021	159	7.460	0.016	7.813	0.764	16.053
85	Soft drink and ice manufacturing	107.066	204	10.845	0.149	4.901	0.648	16.543
189	Glass container manufacturing	102.482	365	22.886	0.640	19.409	0.944	43.879
224	Iron and steel forging	55.744	259	14.466	0.083	5.552	0.298	20.399
278	AC, refrigeration and forced air heating	44.462	165	6.248	0.133	1.213	0.207	7.801
77	Tortilla manufacturing	43.889	252	10.637	0.104	5.906	0.337	16.983
481	Food services and drinking places	41.483	975	12.223	0.566	3.392	2.025	18.206
1	Oilseed farming (soybean farming)	25.778	215	0.055	6.043	10.059	0.624	16.781
465	Offices of Physicians, dentists	19.401	252	10.579	1.042	1.967	0.122	13.710

Note: Excluding federal, state, and local government agencies.
Source: IMPLAN data, 2004

- Table 2 presents earnings per worker of industries with both highest output and highest employment in 2004 (industries from Table 1). Earnings per worker in the hog production industry in Jay County were very low, and it ranked the lowest in the county in 2004. However, this result may be caused by data discrepancy since the employment number includes both full-time and part-time workers, and also proprietors. As a result, reporting of earnings per worker in industries which hire many part-time workers reduces average earnings per worker since the economic modeling software uses employment numbers listed

in Table 1 as the denominators in the formula. Since proprietors are also included in the calculation, this would increase earnings per worker in industries which have very high proprietary income, but the resulting number is again reduced since the 2004 data showed negative income for proprietors in the economic sector that includes swine feeding operations. Another factor appears to be the recent rapid expansion of facilities in Jay County constructed to support the swine industry. Such new facilities qualify for significant non-cash depreciation expense treatment when reporting net income. Since IRS-reported net income in this sector likely includes significant non-cash depreciation expenses, net proprietary income reported are not likely reflective of actual cash flow from operations, estimated to be positive based on interviews and other input received from growers. Increases in on-farm net worth resulting from the new facilities are also not reflected in this study. Hence, the comparisons of earnings per worker in this sector are not directly comparable to sectors that do not hire many part-time workers, are not reduced by significant deductions to proprietary income resulting from non-cash expenses, and do not generate significant new capital investment among multiple proprietors that is expected to increase their net worth.

Table 2: Earnings per Workers of Industries with Both Highest Output and Highest Employment (2004)

Unit: Dollars

Sec tor	Industry	Earn- ings per worker	Sec tor	Industry	Earn- ings per worker
13	Animal production, except cattle, poultry and eggs	1,597			
350	Motor vehicle parts manufacturing	46,975	278	AC, refrigeration and forced air heating	38,563
46	Dog and cat food manufacturing	47,079	77	Tortilla manufacturing	42,540
85	Soft drink and ice manufacturing	53,929	481	Food services and drinking places	13,118
189	Glass container manufacturing	64,379	1	Oilseed farming (ex. soybean farming)	28,318
224	Iron and steel forging	56,103	465	Offices of Physicians, dentists	46,143

Note: Earnings per worker is employment compensation plus proprietary income divided by total number of employment (both full-time, part-time, and proprietors).

Source: IMPLAN data, 2004

- There are nine primary agricultural sectors in Jay County in 2004, including the hog production industry. The hog production industry ranked third from top in output, first in number of employment, fourth in total value-added, and last in earnings per worker among nine primary agricultural sectors in Jay County in 2004.

Table 3: Output, Employment, Value-added, and Earnings per Worker of Primary Agricultural Sectors in Jay County (2004)

Industry	Industry Output (\$MM)	Employment	Total Value-added (\$MM)	Earnings per Worker (\$)
13 Animal production, except cattle, poultry, and eggs	19.946	450	2.744	1,597
12 Poultry and egg production	45.056	56	21.043	114,490
1 Oilseed farming	25.778	215	16.781	28,318
2 Grain farming	14.821	212	8.583	14,999
11 Cattle ranching and farming	10.835	57	1.793	5,493
18 Agriculture and forestry support activit	2.292	67	1.525	24,679
10 All other crop farming	1.788	4	1.055	95,418
6 Greenhouse and nursery production	1.416	8	1.103	82,248
3 Vegetable and melon farming	0.483	2	0.361	85,771

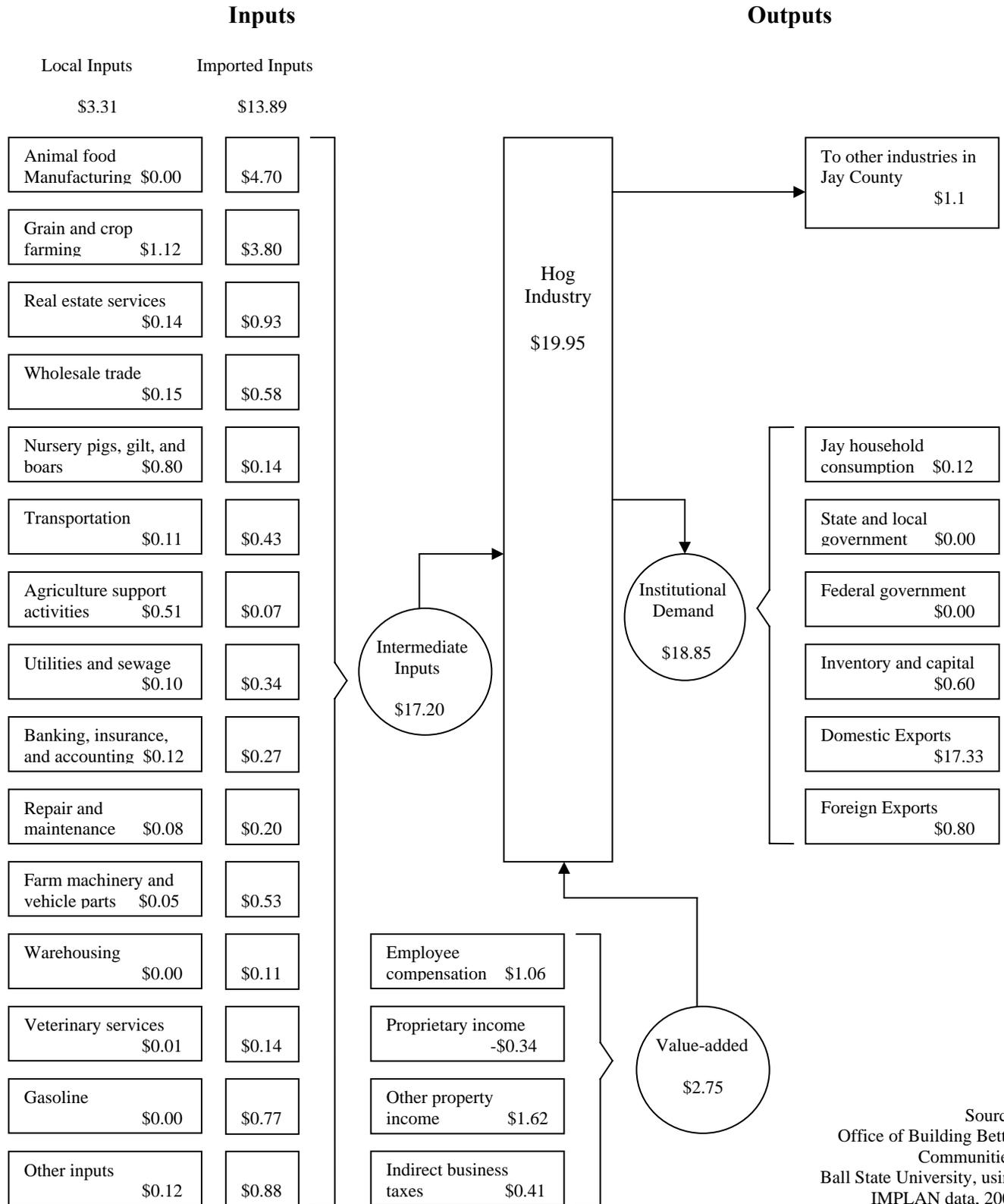
Source: IMPLAN data, 2004

2.2 Jay County's Hog Production Industry Flowchart (Input Demand, Output Supply, Self-sufficiency and Export Ratio)

- The total industry output of the hog production industry in Jay County in 2004 was \$19.95 million. The industry employed 450 people in 2004.
- Flowchart 1 presents the input-output flowchart of the hog production industry in Jay County in 2004. Out of \$19.95 million in the hog production industry's output, \$17.2 million went to inputs for their operations, i.e. intermediate inputs or commodity demand. The rest of \$2.75 million went to labor and capital cost, and indirect business taxes, i.e. the industry's value added which breaks down into employee compensation, proprietary income, property income, and indirect business taxes. The detailed figures are presented in the left side of the flow chart.
- As much as \$13.89 million or 80.8 percent of Jay County's hog production industry's gross inputs in 2004 were purchased out of the county (domestic and foreign imports). The industry spent \$3.31 million buying their inputs locally in 2004. This reflects very high import dependency of the hog production industry in Jay County. However, none of industries in Jay County had an import dependency ratio less than 50 percent in 2004, and only a few industries in Jay County had an import dependency ratio less than 65 percent in 2004, which are Insurance carriers, Cattle ranching and farming, Automotive repair and maintenance, except car washes.
- Where the output of hog production industry from Jay County went in 2004 is shown on the right side of the flow chart. \$1.1 million of output from the hog production industry went to other industries in Jay County as intermediate inputs, mostly to the hog production industry itself. Note that the IMPLAN data set shows no sale from Jay County's hog production industry to animal slaughtering because there was no animal slaughtering industry in Jay County in 2004. The rest of \$18.85 million was consumed by institutions, which comprises

households, the governments, inventory and investment, domestic exports, and foreign exports. Out of \$18.85 million of institutional demand on the hog production industry's output, households in Jay County's demand is estimated at \$0.12 million. \$0.6 million went to the hog production industry's inventory and capital formation. As much as \$18.13 million of output was exported outside of Jay County, including \$0.8 million of output exported to foreign countries in 2004.

Flowchart 1: Input-Output of Hog Industry in Jay County, Indiana, 2004 (Millions of Dollars)



Source:
Office of Building Better Communities,
Ball State University, using
IMPLAN data, 2004

2.3 Output Multipliers of Industries in Jay County

- An output multiplier of an industry is the total of direct, indirect, and induced effects of that industry. In this model, a one dollar increase in demand on output (goods and services) of an industry is considered the “Direct Effects”. A portion of that one dollar increase in output is used by the industry to create a new round of demand for output from other industries. This new round of demand is termed the “Indirect Effects.” Finally, the combined direct and indirect effects of that one dollar increase in the new demand also results in increases household incomes. As a result, spending by households on goods and services also increases due to increases in production. This household spending increase is known as the “Induced Effects.”
- This analysis uses IMPLAN sector 13: Animal production, except cattle, poultry and eggs to represent the hog production industry in Jay County. Note that sectors used in this analysis are categorized under IMPLAN sectors and one IMPLAN sector can include more than one 4-6 digit NAICS sector. Thus, IMPLAN sector 13 also includes sheep, horse and other animal production except cattle and poultry, but hog production appears to dominate sector 13 in Jay County.
- The hog production industry (sector 13) ranked 78 out of 118 industries existing in Jay County in 2004 in terms of the size of output multipliers (see Table 4 along with the top ten industries in Jay County for highest output multipliers). Its output multiplier effect results can be interpreted in this way: if there is an increase in demand on Jay County’s hog production industry’s output by one dollar, it will create demand on output of other industries in Jay County by 18.5 cents, and it will increase the spending of Jay households on all goods and services in Jay County by 2.8 cents.

Table 4: Top 10 Industries in Jay County for Highest Output Multipliers (2004)

Rank	IMPLAN Sector	Industry	Units			
			Direct Effects	Indirect Effects	Induced Effects	Total
78	13	Animal production, except cattle, poultry and egg	1.000000	0.185111	0.028377	1.213488
1	492	Grantmaking and giving and social advocacy	1.000000	0.161074	0.363460	1.524534
2	11	Cattle ranching and farming	1.000000	0.416937	0.035467	1.452405
3	427	Insurance carriers	1.000000	0.305412	0.111236	1.416648
4	497	State and local government passenger transit	1.000000	0.087206	0.316075	1.403281
5	493	Civic- social- professional and similar organizations	1.000000	0.144405	0.224073	1.368478
6	426	Securities- commodity contracts- investments	1.000000	0.249887	0.110394	1.360281
7	483	Automotive repair and maintenance, except car wash	1.000000	0.223833	0.129416	1.353250
8	441	Custom computer programming services	1.000000	0.126403	0.217822	1.344225
9	454	Employment services	1.000000	0.043631	0.297364	1.340994
10	494	Private households	1.000000	0.000000	0.339839	1.339839

Note: Sector 494 Private households includes private households that engage in employing workers on or about the premises in activities primarily concerned with the operation of the household. These private households may employ individuals, such as cooks, maids, and butlers, and outside workers, such as gardeners, caretakers, and other maintenance workers.

Source: IMPLAN model, 2004 data

2.4 Employment Multipliers of Industries in Jay County

- Results shown in Table 5 provide an estimate of how many additional jobs are generated in other industries for each job created in hog production in Jay County. The employment multiplier of an industry is derived by multiplying the level of employment per million dollars of output of a given industry by that industry's output multiplier.
- The hog production industry ranked 100 out of 116 industries existing in Jay County in 2004 in terms of the size of employment multiplier (see Table 5 along with the top ten industries in Jay County for highest output multipliers) (Two of 118 sectors are not included in the employment multipliers, Sector 508: Inventory valuation adjustment, and 509: Owner-occupied dwellings).
- A job created by the hog production industry in Jay County will create another 0.124 job in Jay County. The information in the columns of direct, indirect, and induced effects allows us to interpret the results in another way which is based on one million dollars of output, that is: if there is an increase in demand on Jay County's hog production industry's output by one million dollars, the hog production industry itself will hire 22.6 workers. All other industries in Jay County combined will need to hire 2.4 workers in order to respond to the one million dollar increase in output of hog production industry, and 0.3 Jay County workers will be employed due to the increase in household expenditures. The significance of a sector with a higher multiplier is that it can create more indirect and induced effects of employment than a sector with a lower multiplier even though it might have a higher number of workers employed per one million dollars of output.

Table 5: Top 10 Industries in Jay County for Highest Employment Multipliers (2004)

Rank	IMPLAN Sector	Industry	Workers per one million dollars of output				Multiplier [@]
			Direct Effects*	Indirect Effects*	Induced Effects*	Total*	
100	13	Animal production, except cattle, poultry and egg	22.581	2.447	0.348	25.377	1.124
1	450	All other miscellaneous professional and tech	3.438	3.525	0.563	7.526	2.189
2	10	All other crop farming	2.448	1.554	1.213	5.214	2.130
3	427	Insurance carriers	5.281	4.352	1.366	10.998	2.083
4	12	Poultry and egg production	1.251	0.535	0.717	2.503	2.000
5	85	Soft drink and ice manufacturing	1.904	1.180	0.596	3.680	1.933
6	46	Dog and cat food manufacturing	1.059	0.683	0.289	2.031	1.918
7	161	Paint and coating manufacturing	1.622	0.735	0.668	3.024	1.865
8	391	Air transportation	4.934	2.700	1.505	9.138	1.852
9	3	Vegetable and melon farming	3.805	1.550	1.627	6.983	1.835
10	30	Power generation and supply	1.969	0.631	0.940	3.540	1.798

Note: * Workers per one million dollars of output

[@] Type SAM multiplier = (Direct + Indirect + Induced)/Direct

Source: IMPLAN model, 2004 data

2.5 Tax Payments by Hog Production Industry

- The numbers in Table 6 are the tax implications of the 450 jobs in Sector 13. These 450 jobs yielded a total regional value-added activity (direct, indirect and induced effects) of \$4,836,432, and a total indirect business tax of \$559,831. Thus, payments to government as a proportion of value-added in this scenario is approximately 23.82 percent ($\$1,152,143 \div \$4,836,432$ (\$1,152,143 is the grand total of federal, state, and local tax payments from tax impact table)).
- The tax rates are derived from the industry-by-industry social accounts or Social Accounting Matrix (SAM) of Jay County. In value-added part of SAM, there is a detailed distribution of expenditures by Employment Compensation, Proprietary Income, Other Property Income, Indirect Business Taxes, and Enterprises. This detailed distribution is used in any impact analysis of Jay County, no matter what the mix of affected industries. The distribution is derived from the base year social accounts (1997). For example, of all of the Indirect Business Taxes paid by industries in Jay County in 2004, 39.8 percent was property taxes.

Table 6: Tax Payments by Hog Production Industry in Jay County (2004)

Unit: Dollars						
	Employee Compensa- tion	Propriet- ary Income	Household Expendit- ures	Enterprises (Corporat- ions)	Indirect Business Taxes	Total
Enterprises (Corporations)						
Transfers	-3,636					-3,636
Total	-3,636	0	0	0	0	-3,636
Federal Government NonDefense						
Corporate Profits Tax				176,844		176,844
Indirect Bus Tax: Custom Duty					8,983	8,983
Indirect Bus Tax: Excise Taxes					27,528	27,528
Indirect Bus Tax: Fed NonTaxes					9,600	9,600
Personal Tax: Estate and Gift Tax						0
Personal Tax: Income Tax			110,983			110,983
Personal Tax: NonTaxes (Fines- Fees)						0
Social Ins Tax- Employee Contribution	92,751	7,970				100,721
Social Ins Tax- Employer Contribution	96,321					96,321
Total	189,072	7,970	110,983	176,844	46,111	530,981
State/Local Govt NonEducation						
Corporate Profits Tax				30,592		30,592
Dividends				30,011		30,011
Indirect Bus Tax: Motor Vehicle Licen					5,065	5,065
Indirect Bus Tax: Other Taxes					6,897	6,897
Indirect Bus Tax: Property Tax					223,063	223,063
Indirect Bus Tax: S/L NonTaxes					16,879	16,879
Indirect Bus Tax: Sales Tax					261,793	261,793
Indirect Bus Tax: Severance Tax					22	22
Personal Tax: Estate and Gift Tax						0
Personal Tax: Income Tax			36,410			36,410
Personal Tax: Motor Vehicle License			2,261			2,261
Personal Tax: NonTaxes (Fines- Fees)			6,761			6,761
Personal Tax: Other Tax (Fish/Hunt)			428			428
Personal Tax: Property Taxes			1,103			1,103
Social Ins Tax- Employee Contribution	813					813
Social Ins Tax- Employer Contribution	2,700					2,700
Total	3,513	0	46,963	60,602	513,719	624,798
Grand Total	188,950	7,970	157,946	237,447	559,831	1,152,143

Source: IMPLAN model, 2004 data

3. Impact Analysis

3.1 Hog Production Industry Output and Employment Impacts

- The purpose of this analysis is to see the contribution of Jay County's hog production industry to the rest of the economy. In other words, how much other economic activity is supported by the hog production industry.

- Table 7 presents the output multipliers, employment multipliers, and labor income which are created by Jay County's hog production industry in 2004.
- Table 8 presents the top 10 industries which received the total employment impact from Jay County's hog production industry in 2004.
- Values of average earnings per worker in Table 7 are the average earnings of full-time and part-time employees and also proprietors due to the limitation of employment data which combines all categories. Note that in 2004, the proprietary income of hog production industry was negative. This resulted in the lower average earnings per worker in this industry.
- The importance of household spending also shows here with an impact on Food services and drinking places, and possibly more services from monetary authorities and depository credit are requested by the households.

Table 7: Jay County's Hog Production Industry Output and Employment Impacts (2004)

	Unit: Dollars		
	Output	Employment	Labor Income
Direct effects	19,945,806	450.4	719,500
Indirect effects	881,518	19.9	31,799
Induced effects	473	0.0	17
Total	20,827,797	470.3	751,316

Source: IMPLAN model, 2004 data

Table 8: Top 10 Industries for Total Employment Impact (2004)

		Unit: Dollars,		Employment Unit: Persons	
	Industry	Employment*	Labor Income[♣]	Average Earnings per Worker[⊛]	Total Output Multipliers
13	Animal production- except cattle and poultry and e	470.3	751,316	1,597	20,827,797
18	Agriculture and forestry support activities	11.8	291,570	24,679	405,767
2	Grain farming	3.1	46,825	14,999	217,946
10	All other crop farming	2.5	237,427	95,418	1,016,649
481	Food services and drinking places	1.8	23,674	13,118	76,789
390	Wholesale trade	1.7	69,465	41,217	184,908
431	Real estate	1.5	26,004	17,489	149,533
483	Automotive repair and maintenance- except car wash	1.2	21,806	17,564	69,180
394	Truck transportation	1.2	42,030	35,535	129,685
430	Monetary authorities and depository credit interme	1.0	26,629	25,487	110,653
	Total impact	506.2	1,809,788	-	24,203,998

Notes: * Employment includes full-time and part-time employees, and proprietors.

♣ Labor income comprises employee compensation and proprietary income.

⊛ Average earnings per worker is the average earnings of part-time and full-time employees, and also of proprietors.

Source: IMPLAN model, 2004 data

3.2 Estimates of Hog Production Output and Employment Impacts in 2007

- The IMPLAN software allows users to analyze the economic impacts of hog operations at the county level, with attention to how these impacts are affected by the underlying economic structure of the region. IMPLAN can be used to investigate the economic impacts of any specific assumption. Therefore, current local economic impact of hog production industry in Jay County can be investigated based on the existing and future investment plans of this industry.
- The analysis in this section uses the records of Jay County’s hog CFO/CAFO permits and inventories issued by Indiana Department of Environmental Management (IDEM) to estimate the annual production of hog industry in Jay County. However, the numbers must be adjusted to include non-CFOs/CAFOs into the analysis. Table 9 presents the numbers of year-end total inventory of hog CFOs/CAFOs in Jay County from 1987-2006, the numbers of total hog inventory in Jay County from the Census of Agriculture years 1997 and 2002, and the numbers of total inventory of small hog farms of less than 500 head in Jay County from the 1997 and 2002 censuses.

Table 9: Hog Inventories in Jay County (1987-2006)

Year	Year-end total inventory of CFOs/CAFOs*	Total hog inventory from Census of Agriculture	Differences (non-CFOs/CAFOs)	Unit: head
				Total inventory of small hog farms of less than 500 head**
	A	B	C = B-A	D
1987	1,958			
1990	2,808			
1991	4,863			
1992	5,883			
1993	5,883			
1994	10,580			
1995	18,268			
1996	19,468			
1997	24,414	52,055	27,641	13,061
1998	36,677			
1999	44,357			
2000	53,557			
2001	81,967			
2002	95,567	91,245	(4,322)	8,879
2003	97,567			
2004	104,883			
2005	153,133			
2006	207,197			

Notes: * Data of year-end total inventory of CFOs/CAFOs in Jay County are from IDEM.

**Data of total inventory of small hog farms which have inventory less than 500 head in Jay County are from the Census of Agriculture, 1997 and 2002.

- The differences (column C) between the reported CFO/CAFO inventories in 1997 and 2002 from IDEM in column A and the total hog inventories from the 1997 and 2002 censuses in column B give an estimation of non-CFO/CAFO inventories of those years, i.e. inventories of small hog farms of less than 600 head. However, it can be noticed from column D that the differences above and the numbers of small hog farm inventory (less than 500 head) reported in the 1997 and 2002 censuses are different by a large number (Hog farms in Indiana with less than 600 head are not classified; CFOs are controlled by the State of Indiana with the number of hogs between 600-2,500 head; CAFOs are controlled by the Federal Government with the number of hogs exceeds 2,500 head), particularly in 2002 the difference was in negative due to the larger number of inventory reported in the CFO/CAFO permits than the total number of inventory of all types of hogs, including inventory of small hog farms, reported by the census. The 2002 census reported the inventory of small hog farm of less than 500 head to be as high as 8,879 head. Since the 2007 Census of Agriculture is not yet released, it is difficult to estimate the current number of inventory of small hog farms in Jay County. Thus, to avoid overestimating the economic impact of CFOs/CAFOs, this analysis will assume that the total inventory of non-CFOs/CAFOs in Jay County has stayed constant over the years at 8,879 head during the period of 2002-2006.
- Table 10, 11, and 12 show the hog inventories and production estimates in Jay County as of 2003, 2004, and 2007 for the IMPLAN impact analysis. For the calculation purposes, hog CFO/CAFO production output as of 2007 is estimated based on the year-end total inventory of CFOs/CAFOs permitted in 2006. This is because many of the CFOs/CAFOs which received the permits in 2006 will not be able to start their operations until at least early 2007. Likewise, the inventory data used for 2003 and 2004 impact analysis are from year 2002 and 2003, respectively.
- It can be noticed that in 2003 and 2004, the sow units in Jay County produced more piglets than the number of nursery pigs raised in the county when applying the statistics of the average pigs per litter of Indiana. Therefore, it is assumed that these extra piglets are sold to nurseries out of the county at 1/10 of the top-hog value (full-grown pigs). However, in 2007 Jay County will have to import piglets for their nursery farms production.
- In all three years, a number of pigs at 11-week old is needed to be shipped from nurseries out of Jay County since the numbers of pigs produced in Jay County's finishing farms are higher than the numbers for nursery pigs produced in Jay County (by 178,198 head in 2003, 183,598 head in 2004, and 307,730 head in 2007). This implies that the capacity of pig nurseries in Jay County was lower than the capacity of the county's production of finishing hogs.
- The numbers of total pig production from CFOs/CAFOs in the 3rd row from bottom of Table 10, 11, and 12 are estimated under an assumption that every piglets (from birth to 3 week-old) born in the county will be shipped to the nurseries (3-11 week-old) in the county first. Also, every nursery pig raised in the county will be shipped to the finishers (11-26 week-old) in the county first. Therefore, to avoid double-counting the number of top hogs, the numbers of pigs raised by the finishers have to be subtracted by the numbers of pigs raised by the local nurseries, which also must not be double-counted with the piglets born within the county. Piglets which are exported are counted at 1/10 of the top-hog value. On the contrary, the value of finishing pigs from piglets which are imported must be counted at 9/10 of the top-hog value. One sow is counted as one top hog. Thus, the number of total pigs produced by CFOs/CAFOs in a particular year is the total pig outputs by CFOs/CAFOs that the production takes place within the county and converted into the top-hog value.

- The estimated value of nursery pigs at 1/3 of the top-hog value is based on an estimate cost of raising a pig by Iowa State University, University Extension. The estimation states that a pig weighing around 40 - 50 pounds (about 11-week old) costs \$80, and the cost for growing a market pig (approximately 12 weeks) is estimated at \$200 (in 1992 price). The estimated value of piglets at 1/10 of the top-hog value is, however, estimated by the author.
- The numbers of net total pigs for IMPLAN calculation purposes in the last row of Table 10, 11, and 12 are the numbers of total pig production from CFOs/CAFOs plus the number of pig production from non-CFOs/CAFOs, i.e. small hog farms. The latter is derived from column D in Table 9 which is the number of inventory of small hog farms of less than 500 head reported by the Census of Agriculture in 2002. Due to lack of data, it is difficult to estimate the number of pig production from small farms at top-hog value since their inventory data are not broken down into different types of hogs. For simplicity, this analysis will estimate that all types of hog production in small farms in Jay County are totaled to 8,879 head at top-hog value, which is the number of inventory of hog farms with less than 500 head in 2002, and this number for small hog farm production has stayed constant over the years during the period of 2002-2006 to avoid any overestimation of CFO/CAFO production.
- In the 2007 estimates (Table 12), the capacity of nursery farms in Jay County will surpass the capacity of piglet production by sow units in the county; therefore, approximately 60,739 piglets will need to be imported into the county. In all three years, the capacity of finishing farms in Jay County is more than the capacity of nursery pig production in the county, thus a large number of pigs at 11-week old is imported into the county for finishing farms.

Table 10: Hog Inventories and Production Estimates in Jay County (2003)

2003 Estimates	Nursery			Unit: head
	Sows	Pigs	Finishers	Total
Total inventory	4,997	8,965	81,605	95,567
Cycle per year	1.00	4.70	2.70	
Total production	4,997	42,136	220,334	
Estimate of piglets per sow per year (8.9 per litter, 2 litters/year)*	17.8			
Total piglets produced	88,947			
Piglets exported out of Jay County (88,947 – 42,136)	46,811			
Converting exported piglets at 1/10 of top hogs value	4,681			
Finishing pigs produced from import of 11-week pigs (220,334 – 42,136)			178,198	
Top hogs at reduced value of 2/3 due to import of 11-week pigs			118,799	
Total pigs from CFOs/CAFOs at top-hog value	9,678[♠]	42,136	118,799	170,612
Plus: non-CFO/CAFO production at top-hog value				8,879
Net total pigs for IMPLAN calculation purpose				179,491

Notes: * annual average of Indiana's pigs per litter in 2003

♠ from 4,997 + 4,681

Sources: Inventory data are from Indiana Department of Environmental Management (IDEM)'s CFO/CAFO approvals/permits. Data of Indiana's pigs per litter are from *Quarterly Hogs and Pigs* by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture (USDA). <<http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1086>>. Other estimates are calculated by Ball State University's Office of Building Better Communities.

Table 11: Hog Inventories and Production Estimates in Jay County (2004)

2004 Estimates	Unit: head			
	Sows	Nursery Pigs	Finishers	Total
Total inventory	4,997	8,965	83,605	97,567
Cycle per year	1.00	4.70	2.70	
Total production	4,997	42,136	225,734	
Estimate of piglets per sow per year (8.9 per litter, 2 litters/year)*	17.8			
Total piglets produced	88,947			
Piglets exported out of Jay County (88,947 – 42,136)	46,811			
Converting exported piglets at 1/10 of top hogs value	4,681			
Finishing pigs produced from import of 11-week pigs (225,734 – 42,136)			183,598	
Top hogs at reduced value of 2/3 due to import of 11-week pigs			122,399	
Total pigs from CFOs/CAFOs at top-hog value	9,678[♣]	42,136	122,399	174,212
Plus: non-CFO/CAFO production at top-hog value				8,879
Net total pigs for IMPLAN calculation purpose				183,091

Notes: * annual average of Indiana's pigs per litter in 2004

♣ from 4,997 + 4,681

Sources: same as Table 10.

Table 12: Hog Inventories and Production Estimates in Jay County (2007)

2007 Estimates	Unit: head			
	Sows	Nursery Pigs	Finishers	Total
Total inventory	5,261	32,915	169,021	207,197
Cycle per year	1.00	4.70	2.70	
Total production	5,261	154,701	456,357	
Estimate of piglets per sow per year (8.93 per litter, 2 litters/year)*	17.86			
Total piglets produced in Jay County	93,961			
Piglets imported into Jay County by nursery (154,701 – 93,961)		60,739		
Piglets above worth 9/10 of top hog value		54,665		
Value of pigs grown in Jay County from birth to finishing and from nursery to finishing (93,961 + 54,665)		148,627		
Finishing pigs produced from import of 11-week pigs (456,357 – 148,627)			307,730	
Top hogs at reduced value of 2/3 due to import of 11-week pigs			205,153	
Total pigs from CFOs/CAFOs at top-hog value	5,261	148,627	205,153	359,041
Plus: non-CFO/CAFO production at top-hog value				8,879
Net total pigs for IMPLAN calculation purpose				367,920

Notes: * 3-quarter average of Indiana's pigs per litter in 2006

Sources: same as Table 10.

- For the IMPLAN impact analysis, all of the head-count pigs have to be converted into dollar value. Therefore, the number of 367,920 head is converted into \$34,126,988 in 2003 dollars as proportionate to the 2003 base year data as shown in Table 13. To double check the accuracy of the estimation, data of year 2004 head-count estimates from Table 11 (183,091 head) are also converted into dollar value of output (\$16,982,889 in 2003 dollars) as proportionate to the 2003 base year data. This dollar amount of 2004 output (\$16,982,889) is short by over three million dollars when compared to the number of output reported in the IMPLAN 2004 data at \$19,945,806 in 2004 dollars. Thus, the average of \$34,126,988 (2003) and \$40,080,948 (2004) is chosen as the estimated dollar amount of hog output for 2007, which is \$37,103,968. This new 2007 output will be analyzed by the IMPLAN 2004 base year, then the results will be adjusted to 2007 dollars.

Table 13: Hog Output Estimates in Jay County

	2003	2004	2007
Net total pigs for IMPLAN calculation purpose (head)	179,491	183,091	367,920
IMPLAN output (\$) 2003 base	16,648,965*	16,982,889	34,126,988
IMPLAN output (\$) 2004 base		19,945,806*	40,080,948
Average hog output in 2007 for the calculation (\$)			37,103,968

Note: * from IMPLAN data set.

- In the impact analysis, the \$37,103,968 estimate of hog production industry output in 2007 will be used to calculate the multiplier effects which allow us to see the contribution of Jay County's hog production industry to the rest of the economy. The results are adjusted by 2007 deflators and shown in Table 14.
- In 2007, it is estimated that there will be a total direct effects (increase in demand on output) of the hog production industry in Jay County by \$38,471,204 (in 2007 dollars), and that direct output demand will create the next rounds of demand on output of other industries, the indirect effects, by \$7,209,441. The direct and indirect demands will increase the household spending on all goods and services as their incomes increase due to the changes in production, the induced effects, by \$1,101,114. And, the total effect of direct, indirect, and induced effects combined will be \$46,781,760. The top ten industries affected by this output impact are shown in Table 15.
- It is estimated that around 942 persons are/will be employed by the hog production industries and by other industries affected by the indirect and induced effects in 2007. The top ten industries affected by this employment impact are shown in Table 16.
- It should be noted that although the results show a negative proprietary income in the direct effect, which may be caused by the significant non-cash depreciation expense treatment in reporting net income as explained in Section 2.1, industries which are affected by the indirect effect altogether receive positive proprietary income, and the household spending also helps to increase the proprietary income of affected industries altogether.

**Table 14: Impact Analysis of Hog Production Industry in Jay County
(2007 Estimate)**

Unit: 2007 Dollars, Employment Unit: Persons

	Direct effect	Indirect effect	Induced effect	Total effect
Output	38,471,204	7,209,441	1,101,114	46,781,760
Employment	838	91	13	942
Value-added	5,293,194	3,405,334	679,583	9,378,111
Labor income	1,387,762	1,831,479	322,882	3,542,122
Employee compensation	2,045,681	820,157	283,074	3,148,912
Proprietary income	-657,919	1,011,322	39,808	393,211
Other property type income	3,119,959	1,349,781	283,638	4,753,378
Indirect business taxes	785,474	224,074	73,063	1,082,610

Source: IMPLAN model based on 2004 data, adjusted to 2007 dollars

Table 15: Top 10 Industries for Total Output Impact (2007 Estimate)

Unit: 2007 Dollars

	Industry	Total output effect
1	13 Animal production, except cattle, poultry, and eggs	40,172,380
2	10 All other crop farming	1,960,899
3	18 Agriculture and forestry support activities	808,759
4	2 Grain farming	420,372
5	390 Wholesale trade	368,780
6	431 Real estate	298,139
7	509 Owner-occupied dwellings	271,011
8	394 Truck transportation	252,113
9	430 Monetary authorities and depository credit intermediation	219,130
10	1 Oilseed farming	155,415
	Total impact	46,781,760

Source: IMPLAN model based on 2004 data, adjusted to 2007 dollars

Table 16: Top 10 Industries for Total Employment Impact (2007 Estimate)

Unit: Persons

	Industry	Employment*
1	13 Animal production, except cattle, poultry, and eggs	874.9
2	18 Agriculture and forestry support activities	22.0
3	2 Grain farming	5.8
4	10 All other crop farming	4.6
5	481 Food services and drinking places	3.4
6	390 Wholesale trade	3.1
7	431 Real estate	2.8
8	483 Automotive repair and maintenance- except car wash	2.3
9	390 Truck transportation	2.2
10	430 Monetary authorities and depository credit intermediation	1.9
	Total impact	942

Note: * Employment includes full-time and part-time employees, and proprietors.

Source: IMPLAN model based on 2004 data

- The tax impacts by the hog production industry estimated for 2007 are shown in Table 17.

**Table 17: Tax Impacts by the Hog Production Industry in Jay County
(2007 Estimate)**

Unit: 2007 Dollars

	Employee Compensa- tion	Propriet- ary Income	Household Expendit- ures	Enterprises (Corporat- ions)	Indirect Business Taxes	Total
Federal Government NonDefense						
Corporate Profits Tax				341,985		341,985
Indirect Bus Tax: Custom Duty					17,372	17,372
Indirect Bus Tax: Excise Taxes					53,234	53,234
Indirect Bus Tax: Fed NonTaxes					18,565	18,565
Personal Tax: Estate and Gift Tax						0
Personal Tax: Income Tax			214,622			214,622
Personal Tax: NonTaxes (Fines- Fees						0
Social Ins Tax- Employee Contribution	179,364	15,412				194,776
Social Ins Tax- Employer Contribution	186,268					186,268
Total	365,631	15,412	214,622	341,985	89,171	1,026,820
State/Local Govt NonEducation						
Corporate Profits Tax				59,159		59,159
Dividends				58,035		58,035
Indirect Bus Tax: Motor Vehicle Licen					9,795	9,795
Indirect Bus Tax: Other Taxes					13,338	13,338
Indirect Bus Tax: Property Tax					431,363	431,363
Indirect Bus Tax: S/L NonTaxes					32,641	32,641
Indirect Bus Tax: Sales Tax					506,260	506,260
Indirect Bus Tax: Severance Tax					42	42
Personal Tax: Estate and Gift Tax						0
Personal Tax: Income Tax			70,411			70,411
Personal Tax: Motor Vehicle License			4,372			4,372
Personal Tax: NonTaxes (Fines- Fees			13,075			13,075
Personal Tax: Other Tax (Fish/Hunt)			827			827
Personal Tax: Property Taxes			2,133			2,133
Social Ins Tax- Employee Contribution	1,572					1,572
Social Ins Tax- Employer Contribution	5,222					5,222
Total	6,794		90,818	117,194	993,439	1,208,245
Grand Total	365,394	15,412	305,439	459,179	1,082,610	2,228,034

Source: IMPLAN model based on 2004 data, adjusted to 2007 dollars

3.3 Application to Real Economy

- Since IMPLAN data are based on several sources including the national input-output table, econometric equations and estimations, there are shortcomings not adjusting the original IMPLAN data before using.
- These shortcomings are:
 - a) The number of employment includes both full-time and part-time workers, and also proprietors, which appears to result in a misleading representation of earnings per worker compared to other industries that employ fewer part-time workers. To solve this problem, types of workers can be observed from a survey questionnaire for more accurate results.
 - b) Some IMPLAN sectors are aggregated from several NAICS sectors, which is difficult to re-disaggregate. For example, we cannot run simulations exclusively on the hog production industry by using IMPLAN since the hog production industry and other animal production, except cattle, poultry and eggs are aggregated into IMPLAN sector 13.
 - c) Each IMPLAN sector's production technology or production function is based on the national input-output table (IMPLAN uses the US Bureau of Economic Analysis' Benchmark I-O accounts for year 1997 and updated it based on US final demand, value-added, and output), therefore it may not present the real input requirement and output supply of that sector in the county level, or present the up-to-date production technology of that sector. A survey-based IMPLAN analysis can help address this potential problem.
 - d) The Regional Purchase Coefficients (RPC) and Local Purchase Coefficients (LPC), which present trade flows of each industry and institution buying from regional or local sources, are derived from a set of econometric equations. Moreover, for the county level's service sectors, RPCs are the observed value for the state as constrained by the supply/demand pool ratio. Therefore, the LPCs used in county level analysis are not perfectly accurate, and it is recommended that more accurate LPCs for Jay County be derived from a survey questionnaire.
 - e) IMPLAN assumes that tax rates on employee compensation, proprietary income, and other property type income are similar across all industries. Also, the indirect business taxes are based on the all industry average for the region (Indiana).
 - f) IMPLAN assumes that production functions, trade relations, and relative prices do not change; there is no input substitution or supply constraints; and the economy remains in general equilibrium throughout the analysis. Hog production at current rate and continued expansion of this production clearly affects a number of production relationships in broad areas of the Jay economy, including the corn and soybean production and processing, rail and truck transportation, and the currently booming ethanol production. The ultimate effect of these changes in underlying production relationships is unknown and beyond the capacity of IMPLAN or any Input-Output analysis to quantify. A much more complicated and expensive analysis using a Computable General Equilibrium (CGE) model could tackle these shortcomings of I-O analysis and deal with the issue of relative price changes.

3.4 Summary

1. The hog production industry in Jay County has expanded very rapidly since 2005. The total number of hog inventories as measured by CFO and CAFO construction permits at the end of 2006 increased by more than 7 times from the number of hog inventories which received the permits in 2004 (54,064 against 7,316 head). If all the CFOs and CAFOs which received the operation permits in 2006 start their operations in 2007, the value of the hog production industry's output in 2007 is estimated to be \$38,471,204, which is a 93 percent growth from the output in 2004.
2. In order to capture the real benefits from the rapid expansion of hog operations through more positive local economic impacts being created in Jay County, hog producers should consider substituting some imported inputs to inputs produced by local suppliers, or by building new production plants and facilities locally. The list of items which are heavily dependent on import is shown in the Flowchart 1. For example, since almost 100 percent of animal food used in the hog operations in Jay County is imported from the nearby counties, the positive local economic impacts would increase even if a modest percentage of the growth in demand for animal feed can be supplied by an animal food plant in Jay County. This example (animal feed) represents only one supplier's sector opportunity. While Jay County may encounter barriers to expansion of any specific hog industry supplier's sector, a review of the range of opportunities to supplant imported inputs can provide Jay County with highly-targeted economic development opportunities.
3. The production of piglets and nursery pigs seems to generate higher value-added through employment than the production of finishing farms. Moreover, the former tends to use more local inputs than the latter.