

PURDUE AGRICULTURAL ECONOMICS REPORT

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Indiana Farmland Values Continue to Increase

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Statewide Land Values

After several years of increasing values, some people wonder if farmland values may have reached their top. They point to several factors – sharp increases in energy and fertilizer prices used in crop production, continued low crop prices, the high value to cash rent multiple, and more recently, increasing long-term interest rates. Yet, the June 2006 Purdue Land Value Survey found that in most cases farmland values across the state continued to march higher. On a state-wide basis, bare Indiana cropland ranged in value from \$2,509 per acre for poor land to \$3,770 per acre for top land (Table 1). Average bare Indiana cropland had an estimated value of \$3,162 per acre. For the 12-month period ending in June 2006, this was an increase of 6%, 7.4%, and 6%, respectively for poor, average, and top land.

Part of the difference in land values reflects productivity differences. As a measure of productivity, survey respondents provide an estimate of long-term corn yields. The average reported yield was 108, 139, and 170 bushels per acre,

respectively for poor, average, and top land. The value per bushel for different land qualities was very similar, ranging from \$22.14 to \$23.27 per bushel. On a per bushel basis, the most expensive land is the poor land with a value of \$23.27 per bushel. Top quality land was the least expensive at \$22.14 per bushel.

The average value of transitional land, land moving out of agriculture, increased 11% this year. The average value of transitional land in June 2006 was \$9,113 per acre. However, there is a very wide range of values for transitional land – from twice its agricultural value to more than ten times its agricultural value. These values are strongly influenced by what the land is transitioning into and its location. Due to the wide variation in estimates for transitional land, the median value* may give a more meaningful picture than the arithmetic average. The median value of transitional land in June 2006 was \$7,750 per acre. In 2005, the median value for transition land was \$7,000.

This year for the first time we asked survey respondents to indicate the value of rural recreational land. Rural recreational land is used for hunting and other recreational uses. On a state wide basis, the average value of rural recreational land was \$3,059, almost equal to the value of average quality farmland. But as with transitional land, there is a wide range of values for rural recreational land and its value is very sensitive to

the location of the tract. The median value for rural recreational land in June was \$2,775 per acre.

Statewide Rents

On a state wide basis, cash rents increased \$1 per acre (Table 2). The estimated cash rent was \$155 per acre on top land, \$127 per acre on average land, and \$100 per acre on poor land. This was an increase in rental rates of 1% for poor land, 0.8% for average land, and 0.6% for top quality land. The increase from 2005 to 2006 continued the upward trend in cash rent values but it is the smallest percentage increase reported for the past six years. Statewide, rent per bushel of estimated corn yield ranged from \$0.91 to \$0.93 per bushel.

Cash rent as a percentage of value continued to decline. For top quality farmland, cash rent as a percentage of farmland value was 4.1%. For average and poor quality farmland, cash rent as a percentage of farmland value was 4.0%. Over the 32-year history of the survey, rent as a percentage of farmland value has

* The median is the middle observation in data that have been arranged in ascending or descending numerical order.

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Table 1. Average estimated Indiana land value per acre (tillable, bare land) and per bushel of corn yield, percentage change by geographical area and land class, selected time periods, Purdue Land Values Survey, June 2006¹

Area	Land Class	Corn bu/A	Land Value			% Change		Land Value/Bu			Projected Land Value		
			Dollars Per Acre					\$ Amount		% Change		% Change	
			June 2005	Dec 2005	June 2006	6/05-6/06	12/05-6/06	2005	2006	6/05-6/06	Dec.2006	6/06-12/06	
			\$/A	\$/A	\$/A	%	%	\$	\$	%	\$	%	
North	Top	174	3,695	3,763	3,773	2.1%	0.3%	21.33	21.63	1.4%	3,863	2.4%	
	Average	140	2,959	3,007	3,082	4.2%	2.5%	21.11	21.95	4.0%	3,104	0.7%	
	Poor	107	2,354	2,339	2,383	1.2%	1.9%	21.94	22.26	1.5%	2,399	0.7%	
Northeast	Top	164	3,440	3,426	3,469	0.8%	1.3%	20.88	21.12	1.1%	3,498	0.8%	
	Average	135	2,850	2,902	2,936	3.0%	1.2%	21.25	21.71	2.2%	2,983	1.6%	
	Poor	105	2,331	2,343	2,382	2.2%	1.7%	22.46	22.69	1.0%	2,412	1.3%	
W. Central	Top	172	3,677	3,847	4,027	9.5%	4.7%	21.88	23.41	7.0%	4,069	1.0%	
	Average	142	3,105	3,312	3,456	11.3%	4.3%	22.14	24.36	10.0%	3,518	1.8%	
	Poor	112	2,446	2,683	2,777	13.5%	3.5%	22.58	24.81	9.9%	2,846	2.5%	
Central	Top	172	3,938	3,922	4,067	3.3%	3.7%	22.96	23.65	3.0%	4,106	1.0%	
	Average	142	3,355	3,308	3,430	2.2%	3.7%	23.63	24.14	2.2%	3,437	0.2%	
	Poor	112	2,806	2,731	2,794	-0.4%	2.3%	24.85	25.03	0.7%	2,813	0.7%	
Southwest	Top	173	3,114	3,564	3,684	18.3%	3.4%	18.33	21.29	16.1%	3,719	1.0%	
	Average	140	2,492	2,811	2,928	17.5%	4.2%	18.00	20.85	15.8%	2,943	0.5%	
	Poor	106	1,854	1,940	1,986	7.1%	2.4%	17.49	18.78	7.4%	2,018	1.6%	
Southeast	Top	164	2,959	3,157	3,206	8.3%	1.6%	18.43	19.52	5.9%	3,244	1.2%	
	Average	133	2,446	2,690	2,711	10.8%	0.8%	18.40	20.35	10.6%	2,760	1.8%	
	Poor	100	2,017	2,227	2,233	10.7%	0.3%	19.50	22.29	14.3%	2,246	0.6%	
Indiana	Top	170	3,556	3,668	3,770	6.0%	2.8%	21.08	22.14	5.0%	3,815	1.2%	
	Average	139	2,945	3,069	3,162	7.4%	3.0%	21.25	22.69	6.8%	3,197	1.1%	
	Poor	108	2,367	2,453	2,509	6.0%	2.3%	22.01	23.27	5.7%	2,540	1.2%	
	Transition ²		8,207	8,775	9,113	11.0%	3.9%				9,142	0.3%	
	Rural Recreation ³			2,920	3,059		4.8%				3,079	0.7%	

¹ The land values contained in this summary represent averages over several different locations and soil types. If a precise value is needed for a specific property, this value can be determined by a professional appraiser.

² Transition land is land moving out of production agriculture.

³ Rural recreation land is land located in rural areas used for hunting and other recreational uses.

averaged 6.0%. The values in 2006 are the lowest reported since the Purdue Land Value Survey was

started. It is important to remember that the rent used in this calculation is the gross rent. Subtracting

ownership expenses such as real estate taxes, maintenance, management, etc. will make the net rate of return even lower.

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Area Land Values

Survey responses were organized into six geographic regions of Indiana (Figure 1). As in past years, there are geographic differences in land value changes. This year Southwest, West Central, and Southeast Indiana reported the strongest percentage increases in land value. Bare farmland in these areas was estimated to have increased by 8.3% to 18.3% (Table 1). The increase in estimated values in the other regions were more modest. The survey indicated a slight decline in value for poor quality land in the Central region.

Bare farmland values have consistently been the highest in the Central region. This year, values in West Central and Central Indiana are very similar. While the Central Indiana top and poor quality farmland values are slightly higher than those in West Central Indiana, average quality land values are slightly larger in West Central Indiana than in Central Indiana. Land value per bushel of estimated long-term corn yield (land value divided by bushels) is the highest in the Central and West Central region, ranging from \$23.41 to \$25.03 per bushel. This was followed by the North and Northeast with values ranging from \$21.12 to \$22.69. The Southwest and Southeast had land values per bushel ranging from \$18.78 to \$22.29 per bushel.

Area Cash Rents

All areas of the state except Central Indiana reported an increase in cash rent for at least some land qualities (Table 2). In Central Indiana, cash rents were reported to have declined by 1.4% to 1.8%. Across the three land qualities the strongest percentage increase was in the North region. Increases in this region were 2.4% to 4.1%.

Cash rents are the highest in the West Central region, followed by the Central region. Cash rent per bushel in West Central Indiana ranges in value from \$0.98 to \$1.05. In the Central region, these values ranged from \$0.95 to \$0.99 per bushel. The per bushel rents in these two regions are the highest in the state. The next highest per bushel rent was in the North and Southwest, ranging from \$0.87 to \$0.94. Per bushel rents in the Northeast ranged from \$0.84 to \$0.86. The lowest per bushel cash rents were \$0.73 to \$0.75, reported for the Southeast.

Rural Home Sites

Respondents were asked to estimate the value of rural home sites with no accessible gas line or city utilities and located on a black top or well-maintained gravel road. The median value for five-acre home sites

Table 2. Average estimated Indiana cash rent per acre, (tillable, bare land) 2005 and 2006, Purdue Land Value Survey, June 2006

Area	Land Class	Corn bu/A	Rent/Acre		Change '05-'06 %	Rent/bu. of Corn		Rent as % of June Land Value	
			2005 \$/A	2006 \$/A		2005 \$/bu.	2006 \$/bu.	2005 %	2006 %
North	Top	174	153	158	3.3%	0.88	0.91	4.1	4.2
	Average	140	125	128	2.4%	0.89	0.91	4.2	4.2
	Poor	107	97	101	4.1%	0.90	0.94	4.1	4.2
Northeast	Top	164	141	141	0.0%	0.86	0.86	4.1	4.1
	Average	135	111	114	2.7%	0.83	0.84	3.9	3.9
	Poor	105	87	89	2.3%	0.84	0.85	3.7	3.7
W. Central	Top	172	166	169	1.8%	0.99	0.98	4.5	4.2
	Average	142	140	143	2.1%	1.00	1.01	4.5	4.1
	Poor	112	112	118	5.4%	1.03	1.05	4.6	4.2
Central	Top	172	167	164	-1.8%	0.97	0.95	4.2	4.0
	Average	142	138	136	-1.4%	0.97	0.96	4.1	4.0
	Poor	112	112	110	-1.8%	0.99	0.99	4.0	3.9
Southwest	Top	173	155	158	1.9%	0.91	0.91	5.0	4.3
	Average	140	123	126	2.4%	0.89	0.90	4.9	4.3
	Poor	106	93	92	-1.1%	0.88	0.87	5.0	4.6
Southeast	Top	164	123	124	0.8%	0.77	0.75	4.2	3.9
	Average	133	99	97	-2.0%	0.74	0.73	4.0	3.6
	Poor	100	77	75	-2.6%	0.74	0.75	3.8	3.4
Indiana	Top	170	154	155	0.6%	0.91	0.91	4.3	4.1
	Average	139	126	127	0.8%	0.91	0.91	4.3	4.0
	Poor	108	99	100	1.0%	0.92	0.93	4.2	4.0

ranged from \$5,000 to \$10,000 per acre (Table 3). Estimated per acre median values of the larger tracts (10 acres) ranged from \$6,000 to \$10,000 per acre.

Farmland Supply & Demand

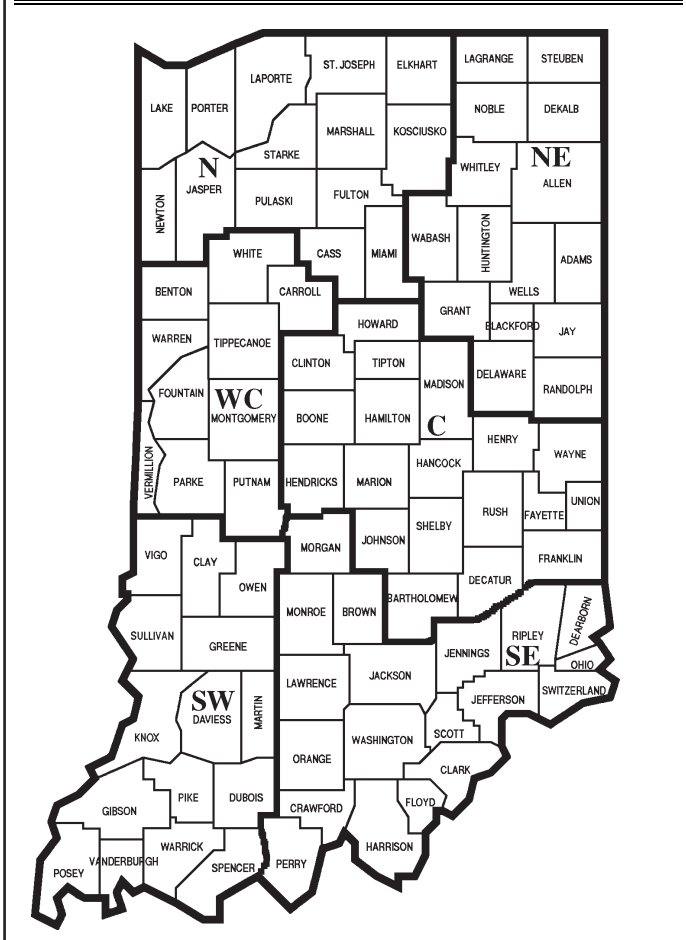
To assess the supply of land on the market, respondents were asked to provide their opinion of the amount of farmland on the market now compared to a year earlier. The respondents indicated either more,

the same, or less land was on the market than one year ago. Only 18.6% of the 2006 respondents indicated more land was on the market now compared to year-ago levels (Figure 2). The remaining 81.4% of the respondents indicated the amount of land on the market at the current time was the same or less than a year ago. Compared to 2004 and 2005, more respondents indicated that there was more or the same amount of land on the market.

Table 3. Median value of five-acre and ten-acre home sites

Area	Median value, \$ per acre							
	5 Acres or less for home site				10 Acres & over for subdivision			
	2003 \$/A	2004 \$/A	2005 \$/A	2006 \$/A	2003 \$/A	2004 \$/A	2005 \$/A	2006 \$/A
North	6,000	6,000	7,250	7,000	5,000	5,000	6,000	7,000
Northeast	6,000	6,000	6,500	7,000	5,000	5,000	5,000	6,000
West Central	6,000	6,000	6,000	7,500	5,000	5,000	6,000	7,500
Central	8,500	8,000	10,000	10,000	7,500	7,900	8,500	10,000
Southwest	5,000	5,000	5,000	5,000	5,000	5,000	5,250	7,000
Southeast	6,000	6,000	7,000	7,000	4,750	5,000	6,000	6,250

Figure 1. Purdue Land Value Survey Geographic Regions



A smaller number of the respondents indicated that there was less land on the market than the previous year. While this might indicate a little more farmland on the market, the quantity of land for sale remains limited.

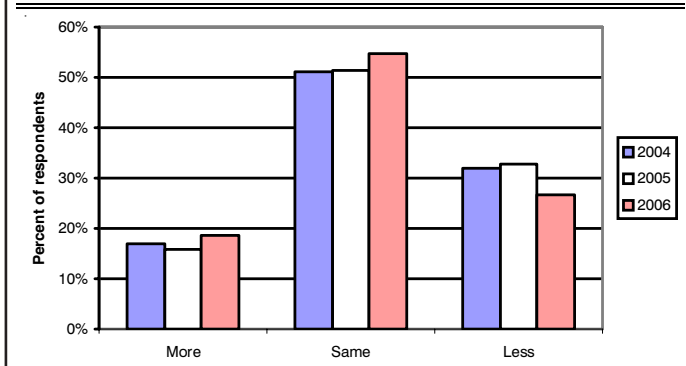
Respondents were also asked to indicate if interest in a farmland purchase by farmers, rural residents, or nonfarm investors had increased, decreased, or remained the same compared to a year earlier. A total of 44.5% of the respondents indicated

increased farmer interest (Figure 3). The number of respondents indicating an increased interest from farmers has declined steadily since 2004. Forty-nine percent of the respondents indicated that farmer interest remained the same. Respondents indicating a decline in farmer interest increased to 6.6%.

The demand for land for rural homes continues to be strong. Sixty-six percent of the respondents indicated an increase in demand for rural residences. Thirty-one percent indicated that demand for rural residences remained the same. Less than four percent of the respondents indicated a decline in the demand for rural residences. These responses are similar to those of past years.

The stock market has shown some recovery from its decline in 2002, but continues to be highly volatile. In addition, interest rates have increased providing increased competition for investor's dollars. Demand for farmland from nonfarm investors seeking good investment opportunities does not appear to be as strong as in the past. This year 41.2% of the respondents indicated an increase in farmland demand from individual investors. This was nearly a 10% reduction from the previous two years (Figure 4). This is the first time in four years that less than 50% of the respondents indicated increased interest from nonfarm investors. The number of respondents indicating the same or a decrease in demand from nonfarm investors increased.

Figure 2. Percentage of respondents indicating more, the same, or less land on the market compared to previous year



Expected Grain Prices, Interest Rates, & Inflation

Making a farmland purchase is a long term commitment. As a result, expectations regarding crop prices over the next few years can have a strong influence on farmland values. In order to gain insight into crop price expectations, respondents were asked to estimate the annual average on-farm price of corn and soybeans for the period 2006 to 2010. This year saw an increase in the expected five-year average price of corn but a decrease in the expected five-year price of soybeans (Table 4). Average five year expected corn price increased

\$0.12 per bushel to \$2.48. However, this was still below the price of \$2.54 that was expected in 2004. The average price for soybeans decreased \$0.14 to \$6.11.

Increasing long-term interest rates have been a topic of discussion for a number of years. The respondents expected interest rate has been increasing for the last three years. This year's survey reported an increase to 7.6%. This is the highest expected interest rate since 2002, but is still low relative to historical expectations.

Survey respondents are also expecting the inflation rate over the next five years to be higher. The average expected rate of inflation in the 2006 survey is 3.2%. Expected inflation rates have not been this high since 1998 to 2000.

Expected Future Land Values

Another important expectation that influences current farmland price is the expected future change in farmland values. Table 1 indicates that for the six-month period from June to December 2006, survey respondents expect values to continue to increase. On a state wide basis this increase is expected to range from 1.1% to 1.2%, a fairly modest increase. The expected change in farmland values for each region is similar to the state wide average. If these expectations are realized, they indicate a slowing in the rate of increase.

Respondents were also asked to project farmland values five years from now. Seventy percent of the respondents expect farmland values to be higher, 16% of the respondents expect farmland values to be the same, and 14% expect farmland values to be lower. For those expecting land values to increase, the average expected increase for the period was 10.8%. For those expecting land values to decline over the next five years, the average decline was 10.3%. Combining all estimated expected change responses provided an expected total increase in farmland values over five years of 2.5%. Again these expectations indicate a significant slowing of the change in farmland values. It appears that many

Figure 3. Percentage of respondents indicating increased, the same, or decreased interest by farmers in a farmland purchase

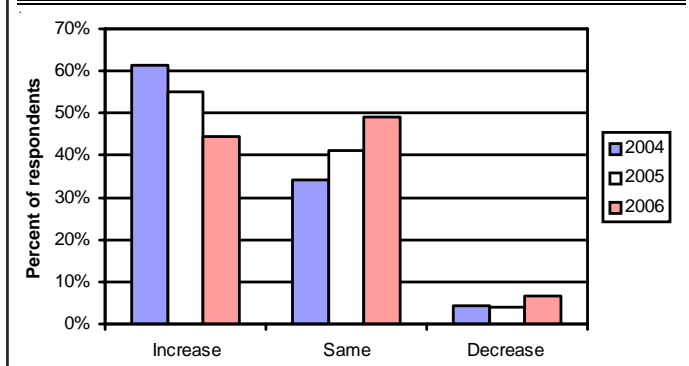


Figure 4. Percentage of respondents indicating increased, same, or decreased interest by nonfarm investors

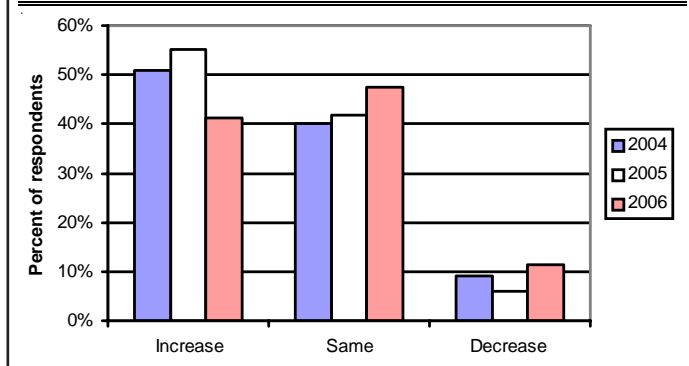
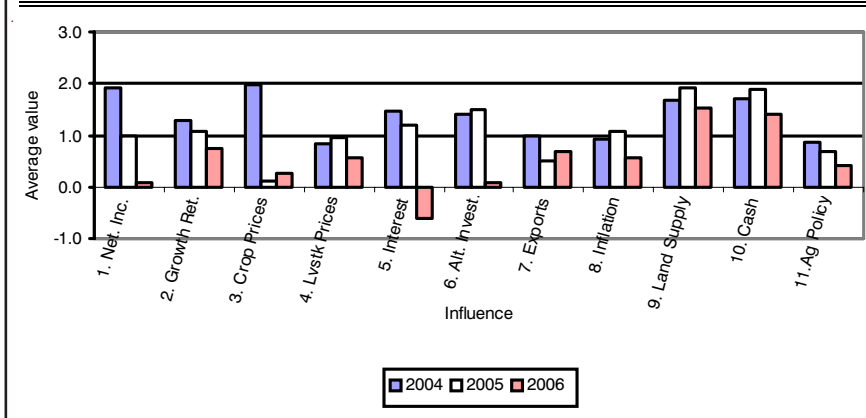


Table 4. Projected five-year average corn and soybean prices, mortgage interest, and inflation

Year	Prices, \$ per bu.		Rate, % per year	
	Corn	Beans	Interest	Inflation
1985	2.70	6.13	12.3%	5.1%
1986	2.32	5.43	11.0%	4.2%
1987	2.16	5.62	10.7%	4.5%
1988	2.50	6.82	10.9%	4.6%
1989	2.48	6.55	11.0%	4.7%
1990	2.61	6.22	11.0%	4.6%
1991	2.47	6.07	10.4%	4.2%
1992	2.52	6.04	9.5%	3.8%
1993	2.35	5.96	8.7%	3.8%
1994	2.48	6.18	8.9%	3.8%
1995	2.50	6.02	9.2%	3.9%
1996	3.01	6.63	9.1%	3.7%
1997	2.72	6.81	9.0%	3.4%
1998	2.54	6.34	8.6%	3.1%
1999	2.31	5.57	8.4%	2.9%
2000	2.28	5.56	9.1%	3.2%
2001	2.12	5.07	8.1%	2.9%
2002	2.10	4.97	7.6%	2.7%
2003	2.27	5.42	6.5%	2.3%
2004	2.54	6.40	6.9%	2.8%
2005	2.36	6.25	7.0%	2.9%
2006	2.48	6.11	7.6%	3.2%
Average	\$2.45	\$6.01	9.2%	3.7%

Figure 5. Influence of selected factors on Indiana farmland values

of the survey respondents are expecting farmland values to plateau for the next few years.

Market Influences

To obtain a more comprehensive assessment of the relative strength that various influences exert on farmland values, survey respondents were asked to assess the influence of 11 different items on farmland values. These items included:

1. Current net farm income,
2. Expected growth in returns,
3. Crop prices and outlook,
4. Livestock prices and outlook,
5. Current and expected interest rates,
6. Returns on competing investments,
7. U.S. agricultural export sales,
8. U.S. inflation/deflation rate,
9. Current inventory of land for sale,

10. Current cash liquidity of buyers, and

11. Current U.S. agricultural policy.

Respondents were asked to use a scale from -5 to +5 to indicate the effect of each on farmland values. If the item had a major negative influence, it would be given a -5. A positive influence was indicated by assigning a positive weight between 1 and 5 to the item. An average for each item was calculated.

In order to provide a perspective on the changes in these influences, data from 2004, 2005 and 2006 are presented in Figure 5. The horizontal axis of the chart indicates the influence in the above list.

In 2004 and 2005, all factors were positive. In 2006, the positive influence of all factors declined. Interest rates became a negative influence in the market. The factors given the most positive influence in 2006 were the current inventory of land for sale (9) and the current cash liquidity of buyers (10). These were both important influences in 2004 & 2005. The availability of farmland for sale was discussed previously. As in the past, the liquidity of buyers continues to be enhanced through the use of the 1031 or tax free exchanges. Section 1031 of the IRS regulations provides a process by which sellers of real estate can reinvest the revenue back into real estate without paying capital gains tax. This is often advantageous to individuals selling farmland for

development. Comments from survey respondents also indicate that in certain regions of the state, the cash liquidity of Amish buyers is also having an influence on local markets.

Over this three year period the most notable changes in market influences is the reduction in the positive influence of current net farm income, crop prices, the influence of alternative investments and the influence of interest rates. The influence of current farm program is also viewed as declining in importance.

Final Comment

The Purdue Farmland Value and Cash Rent Survey indicates that over the past year Indiana farmland values and cash rents continued to move higher. The limited supply of land for sale or rent combined with strong demand for farm expansion, country residences, and nonfarm development provide strength to Indiana's farmland market.

Land values continue to increase more rapidly than rents. This means that the market is willing to capitalize current income, rent, into farmland values at a lower rate of return**. The rent to value percentage can be used as an estimate of the capitalization rate. As noted earlier, this value is at a historic low. What reasons might there be for why the market is willing to capitalize current income at such a low rate?

One possible reason is that long-term interest rates are historically low. Competing investments have lower rates of return, thus the rate of return required for a farmland investment is also lower.

Another may be that market participants have concluded that there is less risk in owning a farmland investment than in the past. Government programs and crop insurance may have reduced the risk premium required to get people to own farmland. This would lower the capitalization rate that market participants require.

Finally, market participants may be anticipating more of the expected total return in the form of increased value. If a total return of 10% is expected on an investment

** Income capitalization is a common method used to estimate the value of farmland. This approach to estimating farmland value divides an estimate of annual income by the capitalization rate. If estimated income (rent) is \$127 per acre and the capitalization rate (rent ÷ value) is 4%, this provides an estimated value of \$3,175 per acre.

in farmland and 4% is obtained from the annual rent, there needs to be a 6% growth in farmland values. Since 1990, the increase in value for average quality farmland averaged 6.1% per year. What does an annual 6% increase in farmland values mean for future values? It means that in five years average quality farmland in Indiana will increase 34% or have a value of \$4,231. In ten years, average quality farmland in Indiana will increase 79% or have a value of \$5,663.

Will a 6% rate of increase in farmland values be achieved in the future? The survey provides some indicators that the farmland market may be cooling. Sharp increases in fertilizer and energy prices, increased interest rates combined with stable corn and soybean prices seem to have slowed the increase in cash rents. Over time, this may also slow the increase in farmland values. Higher interest rates may act to reduce the development demand, an important factor in the Indiana farmland market, and also provide more attractive alternative investments. This will likely increase the capitalization rate required for farmland.

There is the hope that biofuels will lift corn and soybean prices thereby providing better returns to crop production. Over time, some portion of these better returns will be bid into farmland values. Such a scenario could help to lift farmland values. However, part of this hope may already be reflected in current farmland values.

The survey provides a broad look at Indiana's farmland market. Values have continued to move higher and it is expected that this trend will continue, but there is increased uncertainty associated with the farmland market. It is important to recognize that each local market and each individual farm has its own factors that make it unique. The increased uncertainty also makes it important to carefully watch for factors that could derail the upward trend in farmland values. The possibility of continued high fertilizer and energy prices, increasing long-term interest rates, changes in government programs, and maybe

Pasture Rent, Irrigated Farmland, & Grain Storage Rent

Occasionally we include extra questions in our survey to obtain information about a particular topic. This year, we asked about pasture rent, the value and cash rent of irrigated farmland, and the rental of on-farm grain storage.

Table 5. Pastureland: Number of Responses, Annual Cash Rent, and Carrying Capacity

Region	Number of responses	Annual rent (\$ per acre)	Carrying Capacity (acres per cow)
North	21	\$51	1.4
Northeast	13	\$47	1.4
West Central	21	\$48	1.5
Central	26	\$52	1.8
Southwest	15	\$37	1.7
Southeast	32	\$37	1.8
State	128	\$45	1.6

Table 6. Irrigated Farmland: Number of Responses, Estimated Market Value, and Annual Cash Rent

Region ⁴	Number of responses	Corn Yield (bu per acre)	Market Value (\$ per acre)	Cash Rent (bu per acre)
North	21	190	\$3,831	\$174
Northeast	10	187	\$3,745	\$166
Southwest	12	189	\$3,493	\$178
State	62	190	\$3,723	\$175

⁴ There was an insufficient number of responses for the West Central, Central, and Southeast regions to report values for these regions.

Table 7. On-farm Grain Storage: Number of responses and annual per bushel rent

Region	Number of responses	Rent (\$/bu)
North	28	\$0.15
Northeast	26	\$0.17
West Central	38	\$0.14
Central	32	\$0.13
Southwest	18	\$0.13
Southeast	23	\$0.10
State	165	\$0.14

even climate changes need to be accounted for when making a decision about buying, selling, or renting farmland.

For each average in the report, there is a distribution of values around the average. Some tracts are more valuable than the average, but other tracts are less valuable than the average. If one is considering the sale of farmland, it is recommended that an appraisal be obtained to better establish the value of a specific tract. If a new rental is being made, budgeting through the expected return under alternative yields,

commodity prices, and production costs is always prudent.

Purdue Land Value and Cash Rent Survey

The Purdue Land Value and Cash Rent Survey is conducted each June. The survey was made possible through the cooperation of numerous professionals that are knowledgeable of Indiana's farmland market. These professionals include farm managers, appraisers, land brokers, bankers, Purdue Extension educators, farmers, and persons representing the Farm Credit System, the Farm Service Agency (FSA) county offices, and

insurance companies. Their daily work requires that they stay well informed about land values and cash rents in Indiana.

These professionals are asked to provide an estimate of the market value for poor, average, and top quality farmland in December 2005, June 2006, and the expected value for December 2006. They are also asked to provide an estimate of the current cash rent for each land quality. To assess the productivity of the land, respondents provide an estimate of long term corn yields. Respondents are also asked to provide a market value estimate for land transitioning out of agriculture.

Responses from 313 professionals are contained in this year's survey representing all but three Indiana counties. There were 51 responses from the North region, 52 responses from the Northeast region, 69 responses from the W. Central region, 70 responses from the Central region, 33 responses from the Southwest region, and 38 responses from the Southeast region. Figure 1 illustrates the counties in each region.

Appraisers accounted for 14% of the responses, farm loan professionals represented 58% of the responses, farm managers or farm operators provided 14% of the responses, and other professionals provided 14% of the responses.

The data reported here provide general guidelines regarding farmland values and cash rent. To obtain a more precise value for an individual tract, contact a professional rural appraiser or other professionals in your area that have a good understanding of the local situation.

We express appreciation to Carolyn Hunst of the Department of Agricultural Economics for her help in conducting the survey.

Thanks to Professor Chris Hurt, Department of Agricultural Economics, Purdue University and Professional Appraiser, Jay Luse, Frankfort, Indiana, for valuable suggestions to improve the discussion.

Economic Importance of the Indiana Poultry Industry

Carlos D. Mayén, Graduate Student and Kevin T. McNamara, Professor

The Indiana poultry industry is an important part of the state's agricultural sector. The industry is represented by firms devoted to the production and processing of ducks, turkeys, broilers and eggs. Total poultry product sales at processor level were \$806.6 million in 2004 (processor survey). The industry paid \$142 million in salary and wages to the 5,031 persons employed by the industry. Additionally, the industry had growing contracts with 651 farmers.

Industry production stimulates additional income and employment in the Indiana economy. Other economic activity associated with the poultry industry includes spending and employment of poultry industry suppliers, such as grain farmers. Also included is any firm selling goods or services used by the poultry industry to support their production and marketing

activities. Business activity is also associated with households spending money earned from the poultry processors on household consumption. This paper documents the size and structure of the Indiana poultry industry, explains industry structure, presents income impact estimates, and discusses the industry outlook.

Overview of Indiana's Poultry Industry

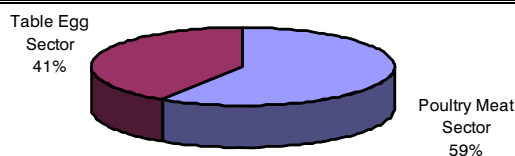
Size, Location and Rankings

Indiana's poultry industry is composed of two sectors: poultry meats and table eggs. The poultry meat sector is devoted to the production and processing of the three most common avian species: ducks, turkeys and broilers. This sector represents 59% of the total output value of the Indiana poultry industry (Figure 1). In 2004, the total output of poultry

meat products was estimated at 607 million pounds with an approximate monetary value of \$475 million dollars. Approximately \$38.5 million of the total sales were due to exports to Mexico, Russia and Asian countries. The value of production for the turkey sector was higher than that of the broiler and duck sectors. At the national level, Indiana can boast about two rankings in this sector: 1st in duck production, with the two Indiana duck companies producing 73% of ducks consumed in the U.S. (Ammeson), and 7th in the production of turkeys (Indiana Agricultural Statistics Services).

Turkeys, broilers and ducks have been raised in Indiana for more than 50 years. Official data for duck and broiler production in the state are not published to avoid disclosure of the activities of individual firms. The production of turkeys on the other hand is monitored by Indiana Agricultural Statistics. Figure 2 shows the production volume and farm gate value of turkey production in the state. In 1984, approximately 116 million pounds of turkey (6.3 million turkeys) were produced in the state. By 2004, production had increased by 253% to 410 million pounds (13.3 million turkeys). The increase in poundage has occurred

Figure 1. Share of Indiana's Poultry Sector by Value of Production



Source: Poultry Firm Survey

due to an increasing number of turkeys raised in the state and mostly because of the ever increasing body weight of turkeys. The farm gate value for turkeys raised in Indiana in 2004 was \$172 million.

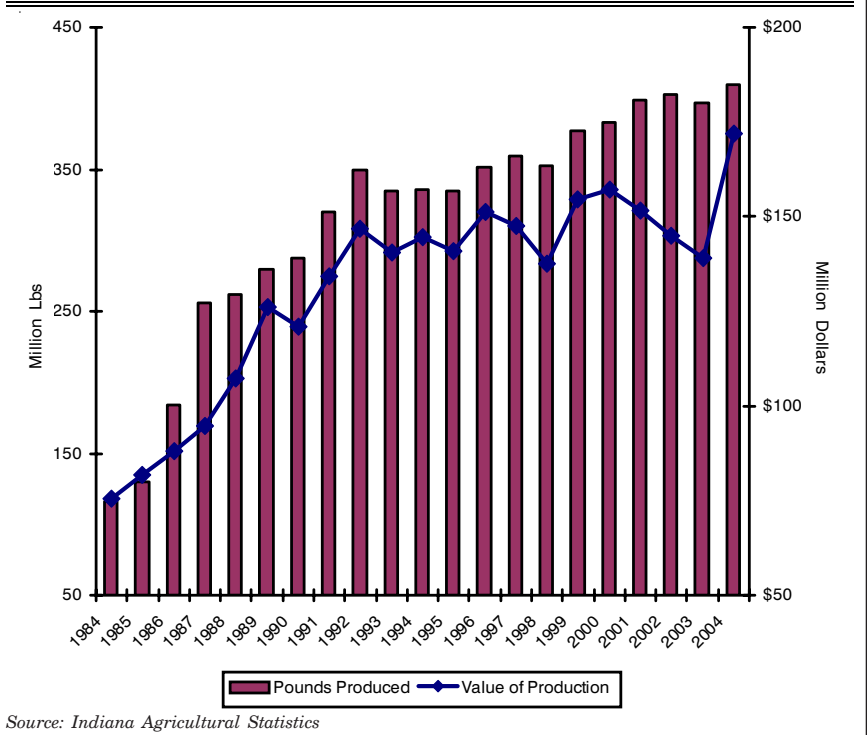
The table egg sector is devoted to the production of table eggs and processing of egg products. In 2004 the total output for the Indiana table egg industry was valued at \$331 million, representing 41% of the total value of the Indiana poultry industry. Approximately 6.1 billion eggs were produced by the 22.7 million hens under production in the state. Historically, Indiana has played an important role as an egg supplier in the nation. Since 1985 Indiana's egg production has increased by 9% and has represented 7% to 8% of the total table egg production of the nation (Figure 3). Currently Indiana's egg production represents 8% of total U.S. production. In terms of number of commercial layers under table egg production, Indiana ranks third in the U.S. behind Iowa and Ohio.

Indiana poultry production is centered in the northeast and southern counties of the state. Most bird production occurs in the counties closest to a poultry processing facility. Duck production occurs in the northeast region of the state, mainly in Elkhart and Kosciusko counties. Turkey production is centered in the southwest region. Dubois and Daviess counties are ranked first and second in turkey production in the state. Broiler production occurs in counties of the northeast and south region, mainly in Harrison and Steuben counties. Some of the top egg producing counties in the state include: Dubois, Jackson, Kosciusko, Newton, Pulaski and Wabash.

Major Poultry Companies in the State and Their Organization

There are fourteen companies in Indiana that account for most of the commercial poultry production in the state. Six of the companies represent the poultry meat sector and eight represent the table egg producing sector. For the poultry meat sector, there are two companies for each of the avian species. For

Figure 2. Indiana Turkey Production (Lbs) and Its Monetary Value



the egg sector, there are six egg producing companies of which five have more than one million layers under production. The egg sector also has three commercial layer hatcheries operating in the state. Two of the hatcheries are owned by egg producing firms. The other is an exclusive breeder/ hatchery that supplies one day old female chicks to in-state and out-of-state egg producing firms. Indiana also has one of the five spent hen processing

facilities in the nation. Every company, except the spent hen processing facility, is vertically integrated.

Under vertical integration, the production, processing and marketing of poultry products are organized and coordinated by a single firm (Martinez). The poultry production stages may include breeding the parent stock of birds, producing eggs for hatching, hatching eggs, milling the feed, raising the birds to be slaughtered, and maintaining the hens

Figure 3. Historical Indiana Egg Production and Share of National Production

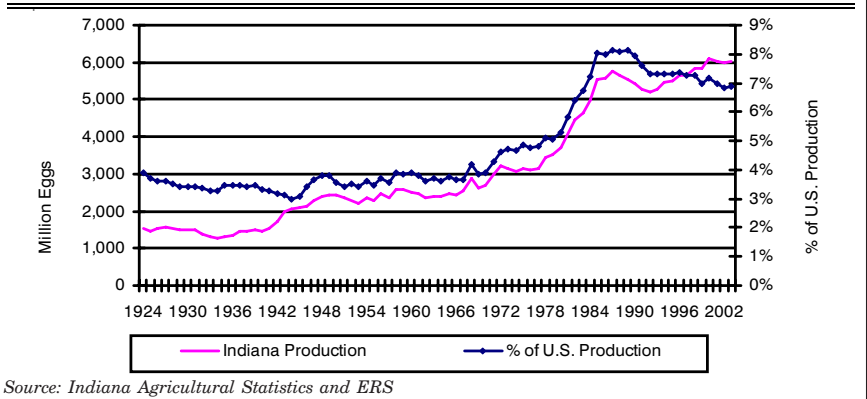
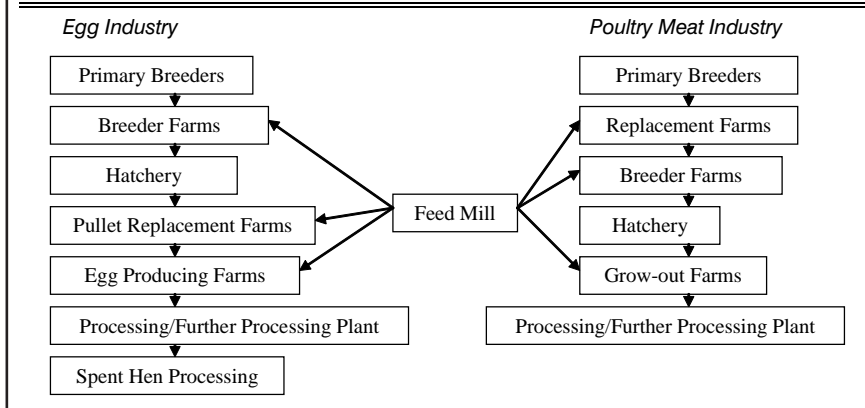


Figure 4. Production Stages for the Egg and Poultry Meat Industries

under table egg production. Typically the processor coordinates these stages. The processor may also own the feed mill, the hatchery, the farms that raise birds for slaughter, the farms that house the hens for the production of eggs, and the processing facility. Due to high levels of integration, poultry firms are able to have better control of production inputs, the quantity and quality of output, and are able to perceive consumer preferences and respond quickly with products that cater to their needs.

In the state, five of the six poultry meat firms own their own feed mill, all breed their own stock, have their own hatchery, own some grow-out houses (place where birds are fed to market weight) and do their own processing. Since high capital investments are necessary to build grow-out houses, poultry meat firms usually contract with individual farmers for the raising of birds for slaughter. Under a typical contract, farmers agree to provide housing, equipment, labor, utilities, manure and mortality disposal and procurement of litter material for growing birds destined for processing. The processor on the other hand agrees to provide the farmer with one-day old birds, feed, medicine, expert supervision to monitor farmer operations, and a pre-established payment for their services and output on a per pound basis for live birds. In 2004 the poultry meat sector had contractual

arrangements with 596 farmers in the state.

The egg firms in the state are also vertically integrated but do less contracting with individual farmers. The egg firms in the state own their own feed mill, pullet replacement farms, egg production houses and processing facility. In 2004 the egg industry had contractual arrangements with 55 farmers for the production of eggs and for raising replacement pullets. The contract arrangements are similar to the poultry meat sector

The production stages for each poultry sector are presented in Figure 4. Following is a description of each of the different production stages and relevant information to Indiana's production.

Primary Breeders

Primary breeders are responsible for maintaining pure blood lines and developing cross-bred blood lines of chickens, turkeys and ducks. Each line of birds has different genetic characteristics. To provide an adequate gene pool for future desirable characteristics, several diverse lines of birds need to be maintained. Primary breeders offer any of the first three generations (grandparent, parent, or day-old birds) for lines of birds which poultry firms ultimately market as fifth generation. Typically day-old chicks are purchased as "parent stock" by the poultry firms from primary breeders. *Both duck*

firms in the state have their own primary breeding flocks.

Replacement Farms

The day-old birds which are bought from the primary breeders are raised in the replacement farms. In these farms, birds are kept until they reach the age of sexual maturity. These mature birds are known as "parent stock". Historically broilers, turkeys and ducks raised for meat consumption have had white feathers. The white feathers give birds a cleaner look when raised indoors and any white pinfeathers look less unappetizing if the birds are not completely plucked at the time of slaughter (Bugos). *Each of the poultry meat producing companies in Indiana has its own replacement farms.*

Breeder Farms

Sexually mature birds from replacement farms are moved to breeder farms. Male and female birds are kept together for the production of fertile eggs from which the commercial layers, broilers, turkeys and ducks (fifth generation birds) will hatch. *Poultry meat companies may own their own breeder farms or contract with independent farms for this stage of production. There are two egg producing firms in the state that have their own breeding farms. There is also a commercial hatchery with its own layer breeding farms that produce the eggs to be hatched.*

Hatchery

Fertilized eggs obtained from breeder farms are sent to the hatchery. Eggs are placed in large-scale incubators. At the time of hatching, chicks (males and females for broilers and only females for pullets), ducklings (one-day old ducks) and poults (one-day old turkeys) are vaccinated and prepared for transport to the next stage. *The poultry meat companies typically own a hatchery. There are also three commercial hatcheries in the egg sector, one of which is devoted exclusively to providing one day old chicks to in-state and out-of-state egg producing firms. The other two hatcheries belong to*

egg producing firms and may also sell to other egg producing firms.

Pullet Replacement Farms

The day-old female chicks arriving from the hatchery are raised in the pullet replacement farms. In these farms, young hens are kept until they reach the age of egg production. These hens will replace hens that have already outlived their production period. Pullets typically start laying eggs at 20 weeks of age, but are sent to egg producing farms at 16 weeks of age for acclimation to the new facility. *Each Indiana egg producing firm has several pullet replacement farms. Most of the farms are owned by the processor, yet some are independently owned and under contract with the integrating firm.*

Grow-out Farms

Grow-out farms raise the newly hatched birds up to market weight or egg production age. The market weight for all birds may vary, yet the average live weights of broilers, ducks and turkeys are 5.3, 6.7, and 27.1 pounds respectively (National Agricultural Statistics Service). *The Indiana poultry meat companies generally contract out this stage of production. The grow-out farms supply the processors with birds that have reached the adequate market weight.* Grow-out farms are typically within a 30 mile radius of the processor.

Egg Producing Complex

A typical egg producing complex may consist of one or several layer houses with a capacity for 100,000 hens. The complex may be of two types: in-line or off-line. An in-line complex refers to an egg collection system that conveys eggs directly from the layer houses into the processing plant. An off-line complex consists of independent layer houses whose production must be transported to a processing facility. *Both types of complexes are used in Indiana. The egg producing complexes are typically owned by the egg producing company, and just a small portion of egg production is contracted to independent farmers.*

Feed Mills

A feed mill operation is responsible for the formulation of the different feeds utilized during the distinct stages of production. Each feed mill has a grain receiving operation, an ingredient storage area, a grinding and mixing system and a pellet-making operation. Corn and soybean meal are the main feed ingredients, with the addition of nutritional supplements such as amino acids, macro and micro minerals. *Every poultry meat and egg company in Indiana owns a feed mill. In 2004 about 17 million bushels of corn and 184,000 tons of soybean meal were used in Indiana as feed ingredients for the poultry meat sector. This is equivalent to 1.8% of corn and 3% of soybeans produced in the state in 2004. The turkeys consumed most of the corn and soybean meal, followed by the broilers and ducks (Figure 5). For the table egg sector approximately 24 million bushels of corn and 252,365 tons of soybean meal were used (Figure 6). This is equivalent to 2.5% of corn and 4% of soybeans produced in Indiana in 2004, although both ingredients may be obtained from adjacent states depending on price and quality.*

Slaughter and Further Processing Plants

In the poultry meat sector, processing includes de-feathering, eviscerating, trimming and chilling of the whole or cut-up birds. The meat may then

be submitted to further processing where it becomes the primary ingredient for ready-to-cook or ready-to-eat products such as chicken nuggets, marinated duck meat and turkey sausages. For the table egg sector, processing includes cleaning, sanitizing, grading, packaging into cartons and refrigeration of eggs for transport. Eggs may also undergo further processing. For this, eggs are broken, separated from the shells, then pasteurized and separated into their subcomponents: egg whites, egg yolks and shells. The subcomponents may also be combined with other ingredients to create a final product. These products can fall into four categories: refrigerated liquid egg products, frozen egg products, dried egg products and non food by-products. *Table 1 tabulates some of the processed and further processed products produced in the state. All processing and further processing plants in the state are highly mechanized and automated to handle high volumes of product. Every plant still requires a lot of human labor. Most of the employment of the whole sector is accounted for by the processing stages.*

Spent Hen Processing Facility

A spent hen processing facility slaughters and processes hens which have ceased their egg production cycle. The meat is used as an ingredient for soups, chicken salad, hot dogs and canned chicken (Scanes et.al.). *Indiana has one such facility*

Figure 5. Consumption of Corn and Soybean Meal by Different Poultry Industries

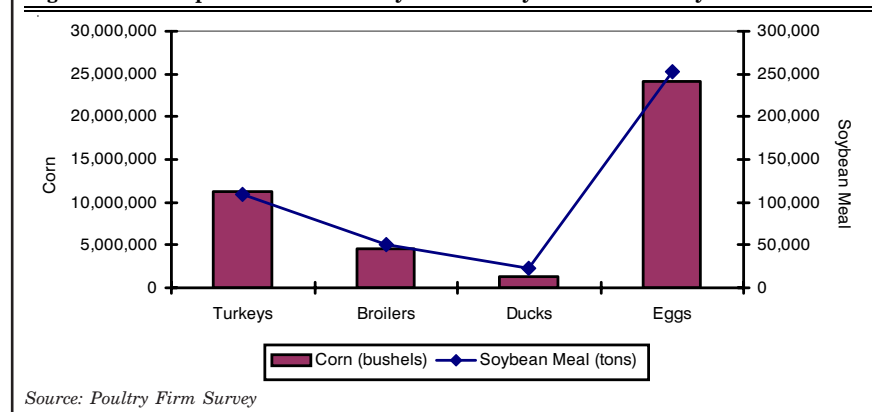
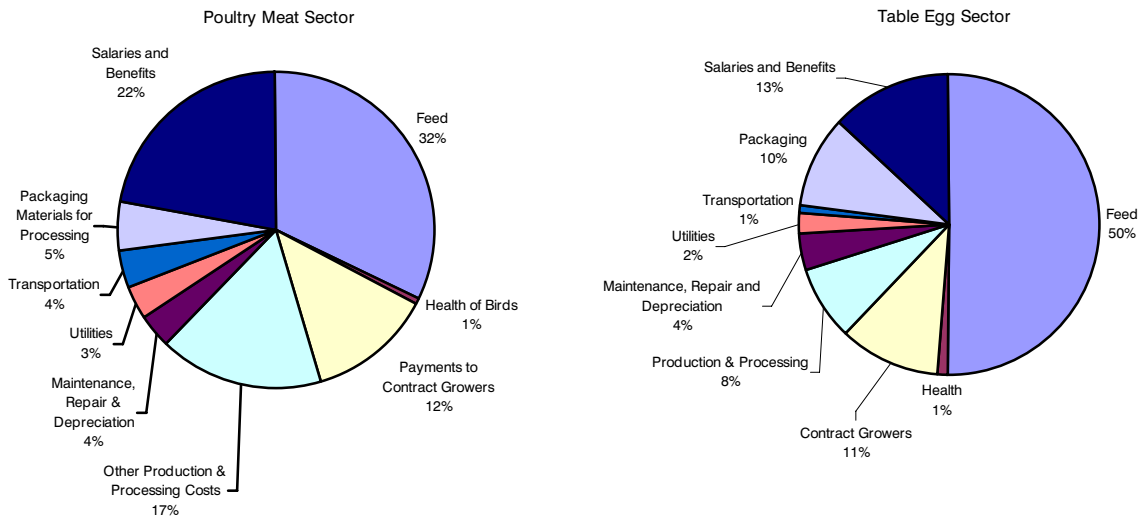


Figure 6. Cost Structure for the Poultry Meat and Table Egg Sector



Source: Poultry Firm Survey

and it obtains hens from in-state and out-of-state egg producing companies.

Cost Structure for the Poultry Meat and Table Egg Sectors

This section describes the cost structure of the meat and egg sectors in Indiana. Data was obtained from a survey administered to the 14 poultry firms in the state. The data represents the cost structure of the poultry industry at the processor level.

Only three production inputs account for 64% of total costs for the meat sector and 74% for the egg sector. Feed, salaries and contract

payments are the three most important cost inputs. The purchasing of feed ingredients represents the highest cost to both sectors of Indiana’s poultry industry (Figure 6). Feed represents 32% of total costs for the meat sector and 50% for the egg sector. The two main feed ingredients, corn and soybean meal, are abundant in Indiana at lower costs than states in the west, east and southern United States. Any price increases in feed ingredients would have a major effect on the cost of producing poultry products. A 10% increase in corn and soybean

meal cost would represent and extra expense of \$8 million to the poultry meat sector and \$10.5 million to the egg sector in Indiana.

The second highest cost category is employee salaries and benefits which represent 22% and 13% of the total costs for the meat and egg sectors respectively. Most of the salaries were paid to employees who work at the processing facility. The meat sector had 3,344 employees and paid salaries of approximately \$96.3 million (Table 2). The average income for each employee was \$28,809. The egg sector employed 1,687 employees and paid salaries of approximately \$45.6 million. The average salary for an egg sector employee was \$27,000.

The third highest expense for both sectors is the payment to contract farmers. The meat sector paid \$53.7 million to 596 contract farmers (Table 3), which is equivalent to 12% of total cost. The egg sector paid \$14.2 million to 55 contracted farmers which represented 11% of the total cost to the sector.

Due to the processing and further processing of meats and eggs, packaging is important for the integrity of the final products. Packaging (paper and plastic) represents 5% of total cost to the meat sector and 10% to the egg sector. The poultry firms

Table 1. Processed and Further Processed Poultry Products from Indiana

Ducks	Broilers	Turkeys	Eggs
<ul style="list-style-type: none"> ➤ Whole duckling (w/o marinade) ➤ Bone-in parts: whole leg, breast quarter ➤ Boneless breast (w/o skin) ➤ Giblets - Livers ➤ Tongues & Feet 	<ul style="list-style-type: none"> ➤ whole broilers ➤ Cut-up parts: breasts, thighs, drumsticks, leg quarters, wings 	<ul style="list-style-type: none"> ➤ Fresh/Frozen whole turkeys ➤ Cut-up parts: breast, tenderloins, thighs, wings, drums, breast skin, wing tips, tails 	<ul style="list-style-type: none"> ➤ Table eggs in cartons
<p>Further Processed Products</p> <ul style="list-style-type: none"> ➤ Duck sticks ➤ Pre-cooked and Marinated Breast Filets, whole legs and fully cooked, ready to eat half ducks 	<p>Further Processed Products</p> <ul style="list-style-type: none"> ➤ Lemon Pepper Rotisserie Chicken ➤ Chicken Cordon Bleu ➤ Chicken with Broccoli and Cheese ➤ Breaded chicken parts ➤ Flavored/seasoned chicken parts 	<p>Further Processed Products</p> <ul style="list-style-type: none"> ➤ Ground turkey ➤ Turkey Sausages ➤ MST - mechanically separated turkey 	<p>Further Processed Products</p> <ul style="list-style-type: none"> ➤ refrigerated liquid yolks, ➤ liquid whites, ➤ liquid whole eggs, ➤ diced eggs, ➤ pre-cooked scrambled egg patties, ➤ dried egg products ➤ hard cooked eggs

also incur transportation costs to deliver final products to their customers. For the meat sector transportation represents 4% of total costs, while for the egg sector transportation represents 1% of the total cost. Maintenance, repair and depreciation of facilities represent 4% of total costs for both sectors. The utility cost (use of water, electricity, gas, telephone) represents 3% of the total cost to the meat sector and 2% to the egg sector. Veterinary supplies, including pharmaceuticals represents a minor cost to both industries at 1% of total costs. Other production and processing costs represent 17% for the meat sector and 8% for the egg sector. This category includes condiments and other meats used in further processing, insurance, purchase of breeding stock, office supplies, processing personnel supplies, sanitary and cleaning supplies, marketing expenses, property taxes and insurance.

Total Economic Activities of the Indiana Poultry Industry

The total economic activities of an industry can be separated into three categories – direct, indirect and induced. The direct economic activities have to do with the sales, income and employment that are generated solely by the Indiana poultry industry. Sales represent the total value of all the poultry products that are sold by the industry. Income represents the salaries received by the people that are employed by the poultry industry.

The indirect economic activities are related to the poultry industry's purchases of materials and services from ancillary industries within the state. Examples of ancillary industries to the state's poultry industry include trucking firms that transport finished product, vendors of farm equipment and plant equipment, vendors of processing equipment, vendors of packaging supplies, veterinary services, real estate agencies and financial institutions. The purchases by the Indiana poultry industry represent sales to the vendors who provide their services and materials. The vendor's sales are

	Employees	Salaries	Average Income
Poultry Meat Sector	3,344	\$96,337,938	\$28,809
Table Egg Sector	1,687	\$45,549,028	\$27,000
Total	5,031	\$141,886,966	\$28,203

Source: Poultry Firm Survey

	Farmers	Total Annual Payment	Average Annual Payment
Poultry Meat Sector	596	\$53,731,973	\$90,154
Table Egg Sector	55	\$14,214,000	\$258,436
Total	651	\$67,945,973	\$104,372

Source: Poultry Firm Survey

then allocated as income payments to their employees and to purchases from other vendors. The transactions between the poultry industry and their vendors and between vendors of the vendors result in multiple rounds of linked economic activities.

The induced economic activities occur because the employees and business owners that spend at least some of their incomes on consumer goods and services within the state of Indiana. The purchase of food, television sets, air conditioners, vehicles and the like by people that earn their incomes through the poultry industry and its vendors would then be credited as induced economic activities.

The sum of the direct, indirect and induced economic activities make up the total economic activities related to Indiana poultry industry. For this study, an Input-Output model for the state of Indiana was used to assess the interaction among sectors of economy of Indiana. Specifically IMPLAN (IMPact Analysis for PLANning) software

was used to identify and estimate the value of the linkages of purchases and sales of commodities between industries, businesses and final consumers. A model using 2002 data (most recent available) was constructed for the state of Indiana and was utilized to measure the indirect and induced economic activities related to Indiana's poultry industry. The IMPLAN model contains the linkages between 509 sectors of the Indiana economy.

The direct economic activities were obtained through a survey administered to the fourteen poultry companies in the state during the first months of 2005. The value of poultry output or sales in 2004 was \$806,594,200. The industry employed 5,031 people and paid \$141,886,966 in salaries (Table 4). After including the indirect and induced effects, the total economic effects attributable to the Indiana poultry industry included an estimated \$1,739,553,923 in industrial sales, 12,277 jobs and personal income of approximately

	Output	Labor Income	Employment
Direct	\$806,594,240	\$141,886,960	5,031
Indirect	\$707,309,699	\$153,757,291	4,672
Induced	\$225,650,003	\$73,285,607	2,574
Total	\$1,739,553,923	\$368,929,866	12,277

Source: IMPLAN

Table 5. Total Economic Effects Attributed to Indiana's Poultry Industry by Sector

	Output	Labor Income	Employment
Poultry Industry & Other Agriculture	\$1,251,769,619	\$201,572,488	7,587
Utilities	\$23,622,555	\$4,934,957	50
Manufacturing	\$67,150,037	\$11,953,955	230
Trade	\$74,771,658	\$31,563,311	997
Transportation & Warehousing	\$39,794,155	\$16,487,131	421
Finance, Insurance & Real Estate	\$60,591,232	\$14,513,262	414
Services	\$75,526,107	\$34,784,535	1,511
Healthcare & Social Assistance	\$34,206,067	\$18,473,535	495
Others	\$112,122,493	\$34,646,693	572
Total	\$1,739,553,923	\$368,929,866	12,277

Source IMPLAN

\$368,929,866 to the people of Indiana.

Table 5 presents the total economic activities obtained from IMPLAN separated into nine different industry sectors (i.e., effects on the 509 sectors of the IMPLAN model were aggregated into 9 different sectors). The "poultry industry & other agriculture" sector had the highest effects on output, labor income and employment. The output for this sector represents the total amount of sales of the poultry industry and of other agricultural industries supported by it, such as corn and soybean farming. The sales of agricultural products were valued at \$1,251,769,619, which represents 72% of the sales in Indiana associated with the poultry industry. This sector paid \$201,572,488 in salaries for its 7,587 workers, which is equivalent to 55% of total labor

income and 62% of total employment. The average labor income for an employee in this sector was \$26,568 per year. Further economic activity, sales and employment, were generated by the poultry industry in other industry sectors of Indiana. The service sector which encompasses educational services, professional services, food services and entertainment accounted for 1,511 jobs and \$75,526,107 in sales. The trade sector accounted for 997 jobs and \$74,771,658 in sales. Economic activity was also created in the utilities sector, manufacturing sector, transportation & warehousing sector, finance, insurance & real estate sector, healthcare & social assistance sector, and others sector. These sectors aggregately represent 23% of total sales, 27% of total labor income, and 18% of total employment. The average salary for all jobs

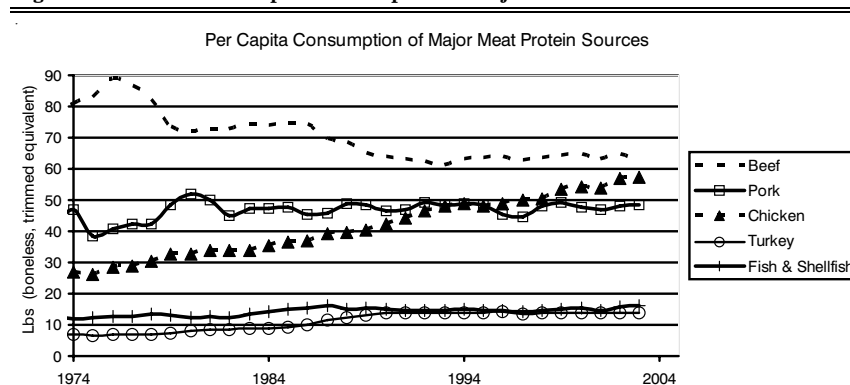
associated with the Indiana poultry industry was \$30,050.

Indiana Poultry Industry Outlook

U.S. per capita poultry consumption (broilers, turkey and eggs) has increased by 47% over the past 30 years (Figure 7). In 2004 U.S. per capita consumption of poultry products was 104 lbs, more than beef and pork. Poultry product consumption is expected to increase domestically due to several factors including population growth, increasing disposable incomes, health benefits and relatively low prices compared to other protein sources. The poultry industry's ability to develop and market a variety of ready to cook products will continue to support future consumption growth.

Of total U.S. production, about 16.4% of broiler meat, 8% of turkey meat and 10.4% of duck meat were exported in 2004. Historical export quantities of broiler and turkey meat are presented in Figure 8. From 1990 to 2003, total exports of broiler and turkey meat has almost quintupled from 1.2 billion pounds 5.3 billion pounds. This increase in exports has occurred due to competitively priced, high quality U.S. products and income increases in the importing countries (Salin et.al.). Most of the poultry exports are destined to Russia, Mexico, Japan, Canada, China, Hong Kong, Taiwan, Latvia and Estonia. Exports of poultry meats and eggs are expected to continue to increase due trading countries that have higher disposable incomes and to trade agreements, such as DR-CAFTA with Central America and the Dominican Republic, that facilitate trade.

Growth in domestic consumption and exports is likely to translate into overall industry growth. The Indiana poultry industry is in a good position to grow. Indiana has a competitive position compared to other poultry and egg producing states. The primary advantage of Indiana producers is the availability of low cost feed. Feed represents 32% and 50% of the total cost of producing and processing meats and eggs. Any savings on feed has a relatively large

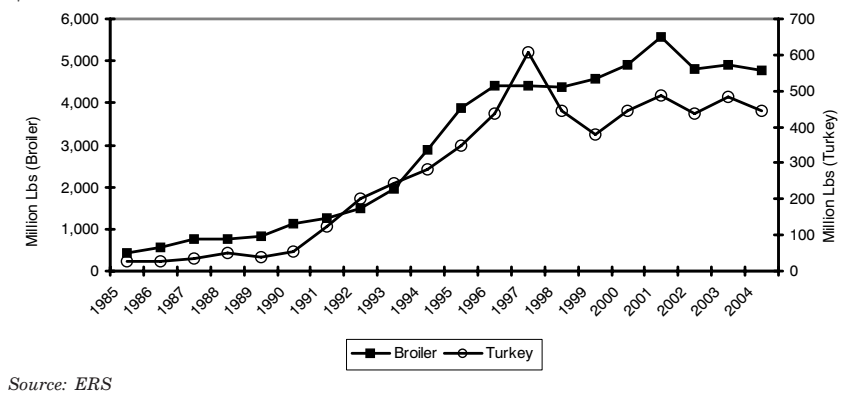
Figure 7. Historical Per Capita Consumption of Major Protein Sources in the U.S.

Source: ERS

impact on production costs. The second advantage for the state is market access. Indiana processors are close to major urban areas such as Chicago, St. Louis, Indianapolis, and have an efficient transportation systems to distribute their products to the densely populated eastern U.S. markets. With increasing fuel prices, Indiana processors will face lower distribution costs than producers located farther from major markets. Results from the producers' survey indicate that during the next five years, the Indiana poultry industry will be expanding through capital investments of \$189 million in new production and processing facilities in the state. Industry expansion in the state means improved farm income through backward linkages to the farm. It will also add income and employment in the processing, marketing and distribution sectors of the industry.

Thanks for valuable suggestion for this article to Lee Schrader, Retired Professor, Department of Agricultural Economics, Purdue University and Mickey A. Latour, Poultry Specialist, Associate

Figure 8. U.S. Broiler and Turkey Exports



Professor of Animal Sciences,
Purdue University.

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Economic Importance of the Indiana Dairy Industry

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The Indiana dairy industry is an important part of the state's agricultural sector. Indiana's milk production in 2004 was estimated at 3 billion pounds (344 million gallons) of milk, equivalent to 1.7% of the total milk produced in the United States. This production represented \$491 million in cash receipts to the state at the farm gate level (Indiana Agricultural Statistics). The industry also provided fulltime employment to about 3,750 Indiana residents and paid a total of \$107 million in salaries (estimates from IMPLAN model for Indiana).

The economic importance of the Indiana dairy industry goes beyond farm cash receipts. Milk production in the state also generates additional income and employment in the Indiana economy through backward linkages. Backward linkages include

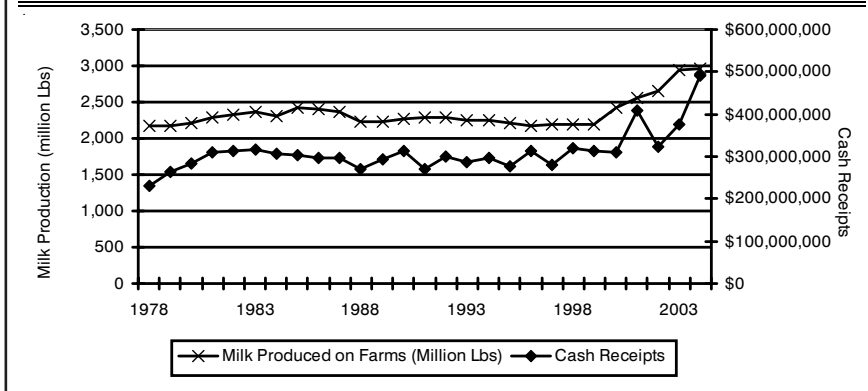
all inputs and services utilized and paid for by the dairy producers. The dairy industry input and service suppliers, such as grain farmers and veterinary services, in turn generate more economic activity through their spending and employment. Economic activity is also associated with households spending money earned from the dairy operations or input suppliers on household consumption. This paper estimates that the Indiana dairy industry is responsible for \$986.4 million in gross sales in the state, and supports the employment of 7,357 Indiana residents who earn incomes of \$229.4 million.

This report documents the size and structure of the Indiana dairy industry, and presents the total economic activities associated with the dairy industry in the state.

Indiana's Dairy Industry Production, Value and Location

Milk production has historically been an important farm enterprise in Indiana. In 1978 about 2.2 billion pounds of milk were produced in the state. This represented \$230 million in cash receipts. During the next decade production was rather stable at 2.3 billion pounds of milk. By 2004 production had increased by 30% to 3 billion pounds. This production ranked Indiana 14th in U.S. milk production (Indiana Agricultural Statistics), and the farm gate value was estimated at an all time high of \$491 million (Figure 1). In 2004 dairy farmers received the highest annual average milk prices ever. Farmers received on average \$16.70 per hundredweight of milk. The price was \$3.80 higher than the previous annual average and \$3.06

Figure 1. Historical Indiana Milk Production and Cash Receipts at Farm Level



higher than the average for the previous decade.

High milk prices in 2004 were the result of limited supply and increasing demand forces. During the first half of 2004 there was a significant reduction in U.S. farm milk supply. USDA estimates showed an average 1% decrease in production levels of the top 20 dairy producing states compared to the same period in 2003. The reduction in milk supply was due to several factors. Due to low prices for the previous 2 years, farmers cut production by reducing the sizes of their herds. In May 2003 the U.S. banned the importation of replacement dairy cows from Canada following the disclosure of a bovine spongiform encephalopathy (BSE) case. As milk prices started to increase, dairy farmers had difficulties increasing production because of the limited supply of replacement heifers. Another factor that affected milk

supply was the lower amount of bST (bovine somatotropin) available to U.S. dairy farmers. The hormone is used to increase average milk yield by 10 pounds per cow per day. About 2% of the U.S. milk supply is attributed to the use of bST. The Cooperatives Working Together (CWT) program was also created in July 2003. This program was created and funded by dairy cooperatives, whose interest is to address the supply and demand imbalances that can depress milk prices by retiring dairy herds, reducing milk marketings, and increasing exports (GAO, 2004).

Milk production in the state has increased despite the decline in the number of dairy cows. The increase in milk production for the last 26 years has occurred due to the increasing milk productivity of cows. Yearly milk production per cow (lbs) in 1978 was 10,729 lbs per month (Figure 2). By 2004, the yearly milk production per cow had increased by

84% to 19,747 lbs. This increasing productivity is due primarily to improved genetics, improved feeding rations, changing technology and higher intensity management of the dairy herds. In 2004 Indiana ranked 10th in the U.S. in milk production per cow. The increase in productivity has been able to outpace the decreasing number of cows in the state. The lowest number of cows in the state for the past quarter century occurred in 1999 with approximately 136,000 milk cows, a 33% decrease of cow numbers in 1978. By 2004, the number of cows in the state increased marginally to 150,000 cows (Indiana Agricultural Statistics).

Milk production occurs in 99% of all Indiana counties. Yet most of the milk production occurs in the northern and northwestern counties of the state. Table 1 presents the counties with the highest dairy cow inventory in January 1, 2005 (Indiana Agricultural Report). The top five counties which represent 43% of the total dairy cows in the state are Elkhart, Newton, Jasper, Lagrange and Marshall.

Changing Structure of Indiana Dairy Farms

The dairy industry is undergoing dramatic structural changes. Fewer dairy farms are producing larger amounts of milk. In general the industry is becoming more concentrated. According to the Agricultural Census (1978), there were 7,590 farms with at least one milking cow in Indiana in 1978. About 56% of these farms had 1 to 19 cows and

Figure 2. Milk Cows on Indiana Farms and Monthly Milk Productivity

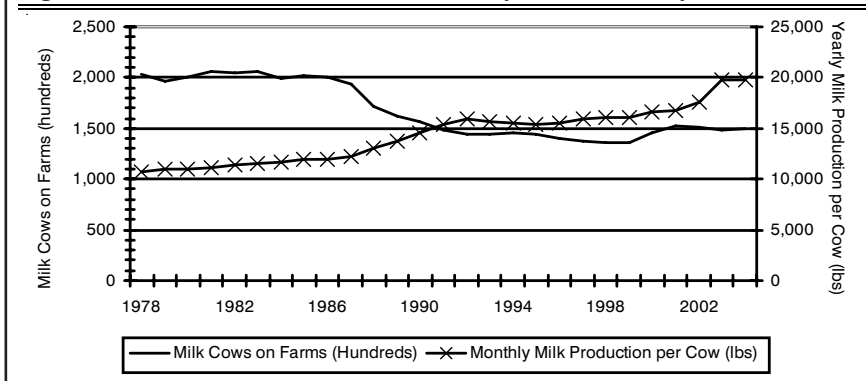


Table 1. Milk Cow Inventory in January 1, 2005

County	Milk Cows
1. Elkhart	17,100
2. Newton	16,600
3. Jasper	16,400
4. Lagrange	9,100
5. Marshall	6,000
6. Adams	5,100
7. La Porte	4,500
8. Noble	4,100
9. Kosciusko	3,600
10. Cass	3,500

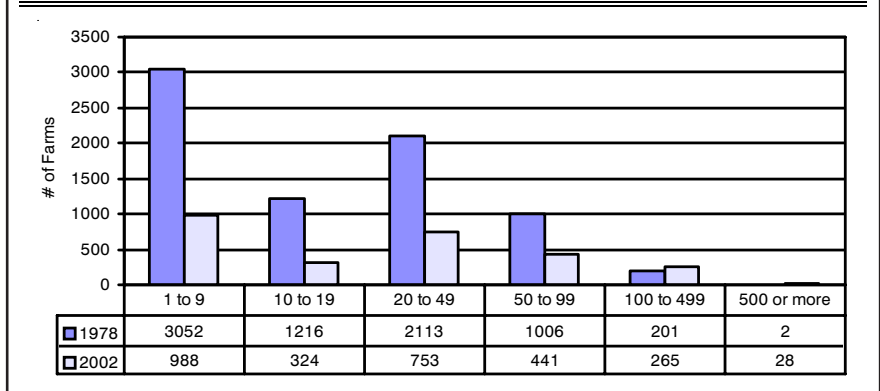
2.7% had herds of 100 cows or more. There were only 2 farms with herds of 500 or more cows (Figure 3). On average there were 24 milking cows per farm in 1978. By 2002, the number of farms with at least one milking cow had decreased by 63% to 2,799. Of these, about 47% had herds of 1 to 19 cows and 10.5% had herds of 100 cows or more. The number of farms with more than 500 cows grew to 28 farms (Agricultural Census 2002). The average milking cows per farm increased to 52.

The changing structure of Indiana dairy farms and dairy farms in general has occurred due to the industrialization of the farm by technological changes and improved management skills of farmers. Technological advances that have been adopted by dairy farmers include: on-farm refrigerated bulk milk tanks for storage, improved milking equipment, modern and efficient milking parlors, better animal housing, improved feed handling and waste handling systems, and improvements in animal nutrition and health. These technological advances coupled with the management of larger herds of milking cows has allowed dairy farms to take advantage of economies of size, i.e. lower per unit production costs as total milk production increases. Larger farms tend to be more cost-effective because fixed costs like land and machinery are spread over more units of production. In addition, larger farms may receive volume premiums and hauling discounts because greater volumes of milk can be marketed (Blayney, 2002; GAO, 2001).

Marketing of Indiana Milk

Milk produced in Indiana is both marketed direct as fluid milk products and processed into other dairy products, especially ice cream and milk sherbet. In 2004 Indiana ranked 2nd in ice cream production in the United States. Approximately 91.2 million gallons of ice cream, 34.5 million gallons of low fat ice cream, and 4.6 million gallons of milk sherbet were produced in the state. Production of these products

Figure 3. Number of Farms with Milking Cows in Indiana in 1978 and 2002

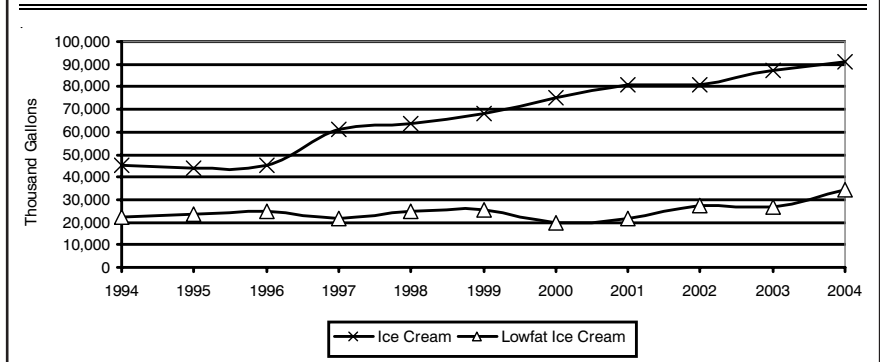


has increased for the last decade. The production of ice cream and low fat ice cream have increased by 103% and 54% respectively since 1994 (Figure 4). Approximately twelve pounds of milk are necessary for the production of one gallon of ice cream. Thus the equivalent of 53% of Indiana’s milk production in 2004 was processed into ice cream. Milk from other states was also utilized in the production of ice cream, thus it is not clear the proportion of Indiana milk destined for fluid milk products and processing products.

Data regarding Federal Milk Marketing Orders (FMMO) in 2004 showed that approximately 94% of all milk produced in Indiana was marketed under Federal Milk Marketing Orders (FMMO). FMMO is a federal program that establishes minimum pricing rules for the sale of raw fluid-grade milk from the producer to the processor or manufacturer (Blayney and Normile, 2004).

The minimum prices set by the FMMO are based on the type of dairy products the milk is used to produce: Class I (fluid milk used for beverage products), Class II (milk for perishable manufactured products such as ice cream and cottage cheese), Class III (milk for cream cheese and hard cheese manufacturing), and Class IV (milk for butter and dry product manufacturing). There are 10 Federal milk orders in the United States: Appalachian, Arizona-Las Vegas, Central, Florida, Mideast, Northeast, Pacific Northwest, Southeast, Southwest and Upper Midwest (Figure 5). In 2004, Indiana produced about 13% of the milk marketed in the Appalachian order, 11% of the milk marketed in the Mideast order and 0.7% of the Central order. Indiana also sourced the Florida, Southeast, and Upper Midwest orders, but Indiana specific data is not available due to confidentiality.

Figure 4. Historical Ice Cream Production in Indiana



Total Economic Activities Associated with the Indiana Dairy Industry

Total economic activities associated with the dairy industry can be separated into three categories: direct, indirect and induced. The direct economic activities are related to the sales, income and employment that are generated solely by the Indiana dairy industry. Sales represent the total value of all the dairy products and byproducts that are sold by the industry. Income represents the salaries received by the people that are employed by the dairy industry.

The indirect economic activities are related to the dairy industry's purchases of materials and services from ancillary industries within the state. Examples of ancillary industries to the state's dairy industry include trucking firms that transport raw and finished product, vendors of farm equipment and plant equipment, vendors of processing equipment, veterinary services, real estate agencies and financial institutions. The purchases by the Indiana dairy industry represent sales to the vendors who provide their services and materials. The vendor's sales are then allocated

as income payments to their employees and to purchases from other vendors. The transactions between the dairy industry and their vendors and between vendors of the vendors result in multiple rounds of linked economic activities.

The induced economic activities occur because the employees and business owners that spend at least some of their incomes on consumer goods and services within the state of Indiana. The purchase of food, television sets, air conditioners, vehicles and the like by people that earn their incomes through the dairy industry and its vendors would then be credited as induced economic activities.

The sum of the direct, indirect and induced economic activities make up the total economic activities related to Indiana dairy industry. For this study, an Input-Output model for the state of Indiana was used to assess the interaction among sectors of the economy of Indiana. Specifically IMPLAN (IMPact Analysis for PLANning) software was used to identify and estimate the value of the linkages of purchases and sales of commodities between industries, businesses and final consumers. A model using 2002 data

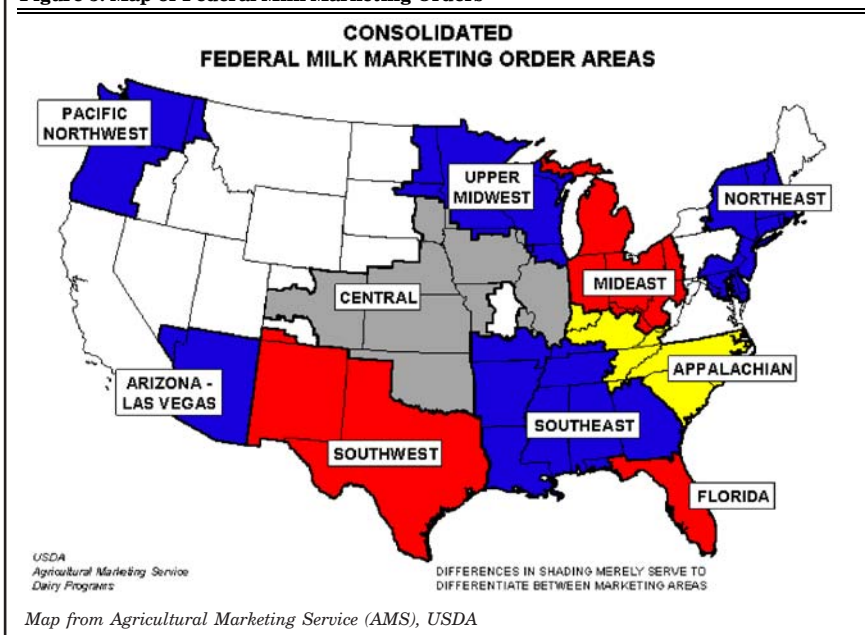
(most recent available) was constructed for the state of Indiana and was utilized to measure the indirect and induced economic activities related to Indiana's dairy industry. The IMPLAN model contains the linkages between 509 sectors of the Indiana economy.

The direct economic activities were estimated using enterprise budgets for the dairy industry from Ohio State University and Iowa State University. The budget includes the cost of one cow lactation plus dry period as well as a replacement heifer. Cows are assumed to be in the herd for three years, thus the budgets include one third of the feed costs required to raise a heifer. Since there were three times as many cows as heifers raised in Indiana in 2004 (Indiana Agricultural Statistics) the budget gives a good approximation of the costs of maintaining the herd of cows and raising the replacement heifers in 2004. Data from Indiana Agricultural Statistics for 2004, such as input prices, milk production levels and cow inventories, were used to complete the budget. Table 2 presents the income and cost of producing milk in the state of Indiana.

Income from milk production in 2004 was estimated at \$533 million dollars. Dairy farmers produced 2.962 billion pounds of milk and obtained an average return of \$16.70 per hundredweight of milk. Indiana farmers received \$490,646,000 for their production. Dairy farmers complemented their incomes by selling calves and cows that were taken off production. Indiana farmers received \$42 million from the sale of cull milk cows and calves.

The cost of producing milk was estimated at approximately \$483 million. Feed expenses accounted for 38% of the total cost. The Indiana dairy industry made the following purchases to feed their cows: 9.3 million bushels of corn at a cost of \$18 million, 219 thousand tons of soybean meal at a cost of \$64 million, 1.8 million tons of corn silage at a cost of \$32 million, 486 thousand tons of hay equivalents at a cost of \$40 million and other feed additives,

Figure 5. Map of Federal Milk Marketing Orders



Map from Agricultural Marketing Service (AMS), USDA

such as vitamins, minerals and fats, at a cost of \$27 million.

The second highest cost category for milk production after feed is labor. Our budget assumes that 60 hours of labor a year per cow are employed by the industry. We utilized a labor charge of \$11.90 per hour which includes workers compensation, social security, and fringe benefits for operations and management employees. To approximate employment in the industry, the required labor to manage the 150,000 cows in Indiana was calculated. This figure was then divided by 2400 hours, considered to be the hours of labor per year required for a full time job. It is estimated that the industry employed 3,750 Indiana residents working full time in 2004. These employees earned total salaries and benefits of \$107 million. It is important to point out that the dairy industry may indeed employ more people. Dairy farmers with smaller herds of cows may have a second job and thus devote only a fraction of their time to milk production. Estimating the total number of part time jobs in milking is difficult, and a full time equivalent estimate seems more appropriate.

Other costs to the industry included: 1) the hauling of animals and milk products - \$9 million, 2) medicine and services to maintain animal well being - \$14.7 million, 3) fuels, utilities and repairs - \$22.5 million, 4) cost of accounting and Dairy Herd Improvement (DHIA) - \$4.2 million, 5) breeding fees - \$6 million, 6) bedding, supplies and miscellaneous - \$24 million, 7) machinery, equipment and facilities - \$78 million, and 8) interest and insurance on herds - \$35.85 million. These costs add up to \$194.25 million (Table 2). The residual value between income and total costs can be described as returns to unpaid labor and management.

The economic activity indicators from IMPLAN model which include output, labor income and employment are presented in table 3. The results are separated into direct, indirect and induced activities. The direct output by the dairy industry was valued at

Table 2. Budget for the Production of Milk in Indiana in 2004

Income		
Milk Sales		\$490,646,000
Sale of Culled Cows & Calves		\$42,417,263
<i>Total</i>		\$533,063,263
Feed Costs		
Corn	(9.3 million bushels)	\$18,135,000
Soybean Meal	(219 thousand tons)	\$64,496,250
Corn Silage	(1.8 million tons)	\$32,400,000
Hay equivalents	(486 thousand tons)	\$40,216,500
Feed Additives		\$26,820,000
<i>Total</i>		\$182,067,750
Other Costs		
Hauling		\$9,000,000
Veterinary and Health		\$14,700,000
Fuel, utilities and repairs		\$22,500,000
DHIA & Accounting		\$4,200,000
Breeding Fees		\$6,000,000
Bedding, supplies and miscellaneous		\$24,000,000
Labor		\$107,100,000
Machinery, Equipment, Facilities		\$78,000,000
Interest, Insurance on herd at 10% annually		\$35,850,000
<i>Total</i>		\$301,350,000
<i>Total Costs</i>		\$483,417,750

\$533 million. The industry paid \$107 million in salaries to its 3,570 full-time employees. Indirectly, the dairy industry supported sales of \$313 million in the Indiana economy. These sales further generated 2,189 full time jobs in Indiana with labor income of \$76 million. The induced activities associated with the dairy industry resulted in sales of \$140 million, with further full time employment of 1,598 Indiana residents who received \$46 million in labor income. Thus, the total economic activity associated with the Indiana dairy industry was \$986 million in sales and \$229 million in income paid to the 7,357 persons employed in Indiana due to the dairy industry.

Table 4 presents the total economic activity indicators obtained

from the IMPLAN model separated into 9 different industry sectors (i.e., effects on the 509 sectors of the IMPLAN model were aggregated into 9 sectors). The “dairy industry and other agriculture” sector includes both the dairy industry, and other agricultural industries such as corn and soybean farming. The output for this sector represents the total amount of sales of the dairy industry and other agricultural industries supported by it. The value of sales in Indiana for this sector was \$689.5 million. This sector accounted for 70% of the total sales in Indiana associated with the dairy industry. This sector also accounted for 60% of total labor income, and 63% of the total jobs. The average labor income for an employee in this sector was \$29,725 per year. The

Table 3. Direct, Indirect and Induced Effects Attributed to Indiana's Dairy Industry

	Output	Labor Income	Employment
Direct	\$533,063,264	\$107,099,704	3,570
Indirect	\$313,255,560	\$76,713,872	2,189
Induced	\$140,080,831	\$45,607,640	1,598
<i>Total</i>	\$986,399,636	\$229,421,219	7,357

economic activity generated by the dairy industry is evident in the additional jobs and output generated in the other industry sectors of Indiana. The services sector, which includes educational services, professional services, food services and entertainment accounts for 886 jobs and \$20 million worth of output. The trade sector accounts for 636 jobs and \$20 million worth of output. The other 6 sectors account for 1,206 additional jobs and \$52 million worth of output. The average salary for all jobs associated with the dairy industry is \$31,184.

Indiana Dairy Industry in the Future

The Indiana dairy industry will continue to be a valuable employment and income generator in the state of Indiana. Milk production in the state will continue to increase due to the high milk prices of 2004 and 2005 that have motivated certain farmers to expand the size of their dairy herds. A constraint to dairy herd expansion is the availability and the prices of replacement heifers, which are less restrictive with the easing of restrictions on Canadian imports of replacement heifers. Continued improvement of milk production per cow will further increase total milk production in the state. The industry will continue to consolidate into fewer and larger

dairy operations with advanced technology that will allow reductions in per unit cost of producing milk.

The Indiana dairy industry is in a good position to grow. The state has a competitive position compared to other dairy states. The primary advantage of Indiana producers is the availability of low cost feed. Feed represents 38 % of the total cost of producing milk. Any savings on feed has a relatively large impact on production costs. The booming ethanol industry in Indiana will have mixed effects on the dairy industry. On one hand, corn prices may increase locally which will result in an increase in the cost of dairying. On the other hand a co-product of ethanol production, distiller's dried grains with solubles (DDGS), may be a substitute for corn and in addition provide protein supplements to the feed (Baker and Zahniser, 2006). The second advantage for the state is market access. Indiana's state motto indeed is the "Crossroads of America". Indiana processors are close to major urban areas such as Chicago, St. Louis, Indianapolis, and have an efficient transportation systems to distribute their products to the densely populated southern and eastern U.S. markets. With increasing fuel prices, Indiana processors will face lower distribution costs than producers

located farther away from major markets. Indiana also has a moderate climate that is suitable for dairying. Industry growth in the state means improved farm income through backward linkages to the farm. It will also add income and employment in the processing, marketing and distribution sectors of the industry.

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Table 4. Total Output, Labor Income & Employment by Industry Sector

	Output	Labor Income	Employment
Dairy Industry and Other Agriculture	\$689,540,437	\$137,600,165	4,629
Utilities	\$11,908,650	\$2,503,533	25
Manufacturing	\$59,873,268	\$9,849,150	194
Trade	\$47,023,572	\$19,889,994	636
Transportation and Warehousing	\$17,584,088	\$7,361,128	183
Finance, Insurance & Real Estate	\$49,217,355	\$10,383,616	301
Services	\$43,923,967	\$19,942,603	886
Healthcare and Social Assistance	\$21,290,887	\$11,501,718	308
Other	\$46,037,412	\$10,389,312	194
Total	\$986,399,636	\$229,421,219	7,357