Economic Impacts on the Illinois Economy of Alternative Dairy Production Systems

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Abstract

The dairy industry in Illinois has declined in farm numbers, cows, and value of dairy product. The value of direct and indirect output from dairy fell from $823 million in 1978 to $434 million in 1997. Alternative dairy systems (120 cow intensive grazing, 120 cow traditional with and without purchased feed, and a 600 cow concentrated feeding system with purchased feed) were evaluated for their potential to sustain or expand dairy in Illinois. The economic impact of each system on the Illinois economy was evaluated using IMPLAN. Internalizing the production of feeds resulted in lower output and employment multipliers. This paper is in part a summary of a Masters thesis by Ruwali (2002).

Introduction

Illinois produces an abundance of feed crops, has a milder winter climate than its northern neighbors, and has a strong farming culture, yet only produces one-fifth of the dairy products consumed in the state. The state produced around 2,081 million pounds of milk in 2001, (FAPRI 2001, 96), which is only 20 percent of the states' consumption of milk products. This is corroborated by the IMPLAN regional purchase coefficient for the dairy products sector for Illinois in 1997, which is approximately 0.20. The state's production is further projected to decline to 1,888 million pounds (FAPRI 2001, 96) by 2010 even though national milk consumption growth is expected to grow at an annual rate of 1 percent till the year 2010 (FAPRI 2001, 92). In addition, states to the south of Illinois are deficit milk producing states. It would appear that Illinois has attributes and a potential market to provide opportunities to sustain or expand the state's dairy industry.

Despite this potential for growth, Illinois' dairy production has been declining in terms of number of dairy farms, number of dairy cows, milk production volume, and value of production

(table 1). Nearby states of Iowa, Indiana and Wisconsin have experienced similar trends, although to a lesser extent (table 1). To reverse the decline in milk production in Illinois will likely require changes in current production practices by Illinois dairy producers to be more competitive.

Table 1. Change from 1978 to 1997 in Number of Dairy Farms, Number of Milk Cows, Pounds of Milk, and Milk Market Value in 1997 Dollars

	Illinois	Iowa	Indiana	Wisconsin	U.S.
Dairy farms	-68%	-67%	-58%	-50%	-63%
Milk cows	-39%	-35%	-29%	-21%	-11%
Milk production	-8%	-7%	1%	5%	29%
Milk market value	-47%	-41%	-39%	-33%	-23%

Source: Percentages calculated from NASS Data

These trends in Illinois and its neighboring states result from the regional shift in milk production to the west and southwest U.S. From 1978 to 1997, milk cow numbers increased by 64% in California, 94% in Idaho, and 461% in New Mexico (NASS 2002). To further illustrate the structural change, table 2 provides a comparison between Illinois, Wisconsin, California and the U.S. California has larger dairy herds, greater milk production per cow, and lower cost of production per cwt of milk than Illinois and Wisconsin. It is apparent Illinois' dairy industry will need to be more cost competitive to sustain or expand its dairy industry.

Table 2. Dairy Structure Comparison for Illinois, Wisconsin, California and U.S. for 2000

	Illinois	Wisconsin	California	U.S.
Dairy Farms (no.)	2,100	21,000	2,500	105,170
Share of U.S. Milk Production (%)	1	14	19	100
Average Herd Size (cows)	57	64	624	87
Dairy Farms with 500+ Cows (%)	0.2	0.7	44	3
Milk Production by 500+ Cows (%)	3	9	78	36
Milk Production per Cow (lbs)	17,450	17,306	21,169	18,201
Cost of Production ($/cwt)*	18.38	16.90	12.48	16.53

Source: USDA-NASS

* USDA-ERS 1999 Regional estimates North Central, Upper Midwest, Pacific and U.S.

Alternative dairy systems (120 cow intensive grazing, 120 cow traditional with and without purchased feed, and a 600 cow concentrated feeding system with purchased feed) were selected to be evaluated in terms of cost and returns to proprietor and their impact on the Illinois economy if they were adopted. The systems were selected from a review of literature and consultation with dairy specialists.

A report by Stacey Hamilton et al (2002) has described the advantages of the intensive grazing system as reduced feed purchases for the purchaser as the cows harvest most of the forage. Capital investment is concentrated in land and cows rather than machinery and buildings. They also describe pasture dairy as being more environmental friendly, as the cows are not housed in the parlor for more than 2 hours. This significantly reduces the cost for waste management as the animals spend 70 percent of their time out on the pasture. In addition studies by Hanson et al (1995), Kriegl (2001), and the CIAS (2002) found that pasture dairy systems were more profitable than conventional systems of similar size.

An intensive grazing system for our study is a 120 cow dairy with 144 acres of pasture and another 130 acres for hay and silage. Pasture accounts for approximate 40 percent of the dry matter. Milk production is 17,000 lbs per cow.

A traditional system for our study is a 120 cow dairy with cows housed in a barn with 450 acres to produce silage, hay and grain for feed. The family working on the farm fulfilled most of the labor requirement. Milk production is 20,000 lbs per cow. Milk production per cow is above state averages, but is comparable to the production level achieved by the upper one-third of dairy farms participating in Illinois Farm Business Farm Management record keeping service (University of Illinois Extension 2002, 34). A modified traditional system was also evaluated which purchased all feed.

A concentrated feeding system is described to be one, which has the number of milking cows over 500, extensively utilizing hired farm labor. In these farms there are free stall barns and larger parlors with milking done at least three times a day. The advantages of this system are in the efficiencies obtained due to a large-scale operation. Bailey et al (1997) concluded that large scale dairy operation can be economically feasible in the midwest despite greater investments in housing and waste management systems compared with similar operations in the West and Southwest. For this study our concentrated system consisted of 600 cows housed in a free stall barn producing 21,000 lbs of milk per cow.

Objectives

The objectives of this research were to (1) compare and contrast the cost structure and returns between an intensive grazing, traditional and concentrated dairy system and (2) estimate the local /regional economic impacts of establishing a dairy in the state by tracing the forward and backward linkages. The motivation for this research was in response to the problem of the declining milk production in Illinois. The expected outcome of this research was to provide the community, dairy industry and policy makers with information for sustaining and developing the Illinois dairy industry. To fulfill the objectives four research questions were proposed:

1. What primary industries are impacted by dairy production?
2. What is the potential gain in economic activity if Illinois matched production with consumption?
3. How do the three systems compare in cost and return to the proprietor?
4. What is the impact on the local economy upon adoption of a new dairy system?

Economic Impact of Dairy on the Primary Sectors of the State Economy

In 1997 the value of dairy products in Illinois was $286 million and the total value resulting from direct and indirect output from the dairy sector was approximately $491 million

(IMPLAN database 1997) (table 3). A change in Illinois dairy production clearly has consequences beyond the dairy sector, especially in the trade, services, and finance sectors of the Illinois economy.

Table 3. Dairy Industry's Direct, Indirect and Induced effect on Illinois Economy

Sector	Employment*	Output**
Dairy Farm Products	1,236	286,702
Agriculture (AGG)	264	17,357
Mining (AGG)	4	296
Construction (AGG)	80	6,175
Manufacturing (AGG)	80	27,073
Utilities (AGG)	175	27,488
Trade (AGG)	682	46,234
Finance (AGG)	182	34,840
Services (AGG)	694	41,487
Government (AGG)	25	2,868
Total	3,422	490,519

*Number of Jobs
**Direct, Indirect, and Induced Impact 1997 Dollars (1,000)
AGG = single digit SIC
1997 IMPLAN data

Potential Gain in Economic Activity from Matching Production with Consumption

The potential impact on the Illinois economy of achieving self sufficiency in milk production is illustrated in this section. Self-sufficiency in milk production would increase dairy-products-sector employment from 1,236 to 6,716 (table 4.). This would result in an overall increase in related Illinois employment from 3,422 to 18,590, (table 4). Although it is unlikely the dairy industry would expand to this extent, the potential market is there, if Illinois dairies can become competitive in order to recover market share. For employment the dairy sector in Illinois has a multiplier of 2.77. That is, for every direct employee in the dairy products sector there are additional 1.77 employees in other sectors in the state economy.

Table 4. Dairy Industry's Direct, Indirect and Induced Effect on Illinois Employment due to an Increase in the Dairy Sector Output that Matches Production with Consumption

Sector	Current Employment*	Increased Employment	Total Employment**
Dairy Farm Products	1,236	5,479	6,716
Agriculture (AGG)	264	1,168	1,432
Mining (AGG)	4	17	20
Construction (AGG)	80	354	433
Manufacturing (AGG)	80	357	437
Utilities (AGG)	175	777	952
Trade (AGG)	682	3,023	3,705
Finance (AGG)	182	806	988
Services (AGG)	694	3,077	3,772
Government (AGG)	25	110	135
Total	3,422	15,168	18,590

*Number of Jobs
**Direct, Indirect, and Induced Impact 1997 on 1997 Dairy Sector Employment
AGG = single digit SIC
1997 IMPLAN Data

Table 5 summarizes the potential impact on the state economy of an expansion of the Dairy Products sector to meet consumption needs of Illinois. Note that the output multiplier is 1.71. The increase in production would increase output by 5 times, employment by nearly 4.5 times and value added by approximately 4 times the1997 levels.

Table 5. Dairy Industry's Direct, Indirect and Induced Effect on Illinois Economy due to an Increase in the Dairy Sector Output that Matches Production with Consumption

Sector	Current Output*	Increased Output	Total Output**
Dairy Farm Products	286,702	1,270,749	1,557,451
Agriculture (AGG)	17,357	76,930	94,287
Mining (AGG)	296	1,313	1,609
Construction (AGG)	6,175	27,368	33,543
Manufacturing (AGG)	27,073	119,997	147,071
Utilities (AGG)	27,488	121,833	149,321
Trade (AGG)	46,234	204,922	251,156
Finance (AGG)	34,840	154,419	189,259
Services (AGG)	41,487	183,883	225,370
Government (AGG)	2,868	12,711	15,579
Total	490,519	2,174,127	2,664,646

*Dairy Sector Output for 1997
**Direct, Indirect, and Induced Impact 1997 Dollars (1,000)
AGG = single digit SIC
1997 IMPLAN data

Comparison of Cost and Return of the Three Dairy Systems

Budgets for an intensive grazing system producing 17,000 lbs./cow of milk, a traditional system producing 20,000 lbs./cow of milk, and a concentrated feeding system producing 21,000 lbs./cow were developed in detail, accounting for the different costs: labor, purchase feed, integrated enterprise budgets to grow hay, pasture or corn, economies of scale, land costs, building costs and maintenance, machinery costs and maintenance, insurance, capital recovery, and receipts (milk, cull cows, calves, etc) for the three systems. Enterprise budget data was based on budgets and production records from Illinois, Ohio, Missouri and Kansas. Illinois commodity prices were average prices 1992-2000. All dollar values were converted to 1997 dollars.

For a comparison of the cost and returns obtainable for each system an enterprise budget for just the dairy enterprise was prepared. For this comparison feeds fed are valued at their market value. The results suggested that the intensive grazing system had the minimum input cost per cow ($1898) and the highest net return per cow ($379), table 6. The concentrated feeding system had the second highest net return followed by the traditional system. The intensive grazing system and the concentrated feeding systems had comparable returns over operating costs, but the ownership costs for buildings and equipment resulted in lower returns over all economic costs. These results imply that the traditional system could improve profitability by adopting an intensive grazing system, or by increasing in size to obtain size efficiencies, or by improving production efficiency by obtaining more milk per cow. The intensive grazing system had lower feed cost because of lower production and due to valuation of pasture. Pasture was valued on hay equivalent value which understated the assumed nutritive value of well managed intensive grazing.

Table 6. Summary Cost and Return Comparisons per Cow of Alternative Dairy Systems

	Intensive Grazing	Traditional System Purchase Feed	Concentrated System
Milk sales (pounds)	17,000	20,000	21,000
Total receipts	2,537	2,938	3,072
Milk sales	2,272	2,674	2,808
Feed costs	722	1,261	1,267
Total operating costs	1,531	2,075	2,073
Return over operating costs	1,006	863	1,000
Building costs	48	360	293
Equipment costs	35	101	56
Return above economic costs	379	-442	-202

All costs and receipts are in 1997 dollars

The Impact of the Three Systems on the Economy

Whole farm budgets were estimate for each system to develop production coefficients for the IMPLAN model. The whole farm budgets were a compilation of the dairy, pasture, hay, corn and corn silage enterprises for intensive grazing system and traditional system that grew its feed. Budget items were assigned to the appropriate standard industrial classification (SIC) sector that accurately defines the activity or commodity then assigned to the corresponding IMPLAN sector. For these systems that grow their own feed, University of Illinois (UIUC) Farm Lab (1999) crop and forage budgets were modified and expanded in detail in order to direct costs to the appropriate sector.

Comparisons were made in terms of economic activity generated for each of the systems. Impact analysis was also done for the intensive grazing system, at the county and national level

to get the maximum and minimum limits for the multipliers for the value added, output, employment, and proprietary income components. This was done to estimate the effect if all the backward linkages for this system were contained in the region.

The relative advantage of growing one's own feed is expressed in the value added components of the dairy systems, given in table 7. The highest return, based on percentage of receipts is for the intensive grazing dairy and the traditional dairy system where most of the feed is grown at the dairy farm.

Table 7. Dollar Value of Value Added Components for the Alternative Dairy Systems

Value Added	Intensive grazing dairy	Traditional system growing the feed	Traditional system buying the feed	Concentrated System
Employee compensation	40,815	80,036	65,395	326,976
Proprietary income	48,721	117,150	67,884	278,240
Other property income	129,949	70,015	-50,211	-118,986
Indirect business taxes	4,692	9,247	2,133	8,068

Output multiplier impact for the state of Illinois economy was the greatest for the traditional farm systems with the purchasing all feed having the highest multiplier of 1.95 and the grow feed system having the next highest multiplier of 1.85, table 8. Internalizing the production of feed stuffs results in lower output multiplier. Employment impact was the highest for the large concentrated feeding systems with a multiplier of 5.15. The employment multiplier of 5.15 and the joint income multiplier of 5.04 calculated from the IMPLAN data are likely higher then one might expect at the state level. This impact is higher than all the others as the purchases made from the others sectors were the most for this establishment and this had a greater impact due to higher indirect and induced impact on the other sectors. In this sector most

of the feed requirement (80 percent) was imported from outside Illinois. This shows that even as the size of operation increases it is not necessary that the benefits of this increase will help the local economy. These increases in jobs and value added leak through the local economy to neighboring counties and states.

Table 8. Comparing the Multipliers for Alternative Dairy Systems Using an Illinois Model

	Intensive Grazing System	Traditional System Grow Feed	Traditional System Purchase Feed	Concentrated System
Total output multiplier	1.72	1.85	1.95	1.79
Employment multiplier	2.54	3.32	2.92	5.15
Employee compensation multiplier	3.36	2.77	2.71	3.04
Joint income multiplier	1.31	1.45	5.04	3.66
Total value added multiplier	1.77	1.92	3.42	3.49

The actual impact on the local economy can vary from the obtained impact multiplier because of the changes in the structure of the economy and the dairy industry from the existing economic structure from which the IMPLAN model is based. The comparisons of the multipliers estimated at the county, state, and national level for grazing system illustrated a potential range in multipliers because as the region increases in size the regional purchase coefficient increases, table 9. The percentage change in the multiplier from the state multiplier was less for the county multiplier and greater for the national multiplier which implies greater changes in interstate purchases than intrastate purchases.

Table 9. Comparison for the Intensive Grazing System at the County, State and National Level

Multipliers	Intensive Grazing County Level	Intensive Grazing State Level	Intensive Grazing National Level
Total output multiplier	1.40	1.72	2.5
Employment multiplier	2.25	2.54	4.1
Employee compensation multiplier	2.23	3.36	5.27
Total value added multiplier	1.42	1.77	2.46

The economic impact of a 120 herd intensive dairy farm on the national economy is given in table 10. The impact is the result of minimizing imports from outside the economy by the dairy farm. This dairy farm has largest impact on the economy in the services, manufacturing, and wholesale trade sectors of the economy. The expected impacts of a dairy farm on the local economy, county level, would be expected to be less, due to domestic imports from outside of the county. This is especially true in the manufacturing, prepared feeds, nitrogenous and phosphoric fertilizers, agricultural chemicals, chemical preparations, and petroleum refining sectors of the economy, table 10. Very few counties are self-sufficient is providing commodities and products in these specialized sectors of the economy.

Table 10. Intensive Grazing (National Level Impacts) Using a National Model

Intensive Grazing (National Level Impacts)
120 cow herd

Sector		Output Impact (Receipts) $	Employment Impact	Employee Compensation Impact $	Joint Income Impact $	Total Value Added Impact $
1	Agriculture (AGG)	8,527	0.11	913	2,457	3,562
12	Feed Grains	1,976	0.02	39	748	875
13	Hay and Pasture	1,442	0.06	47	585	704
26	Agricultural, Forestry, Fishery Services	6,212	0.25	2,309	925	3,394
28	Mining (AGG)	8,904	0.03	1,346	3,478	5,303
48	Construction (AGG)	3,390	0.04	937	449	1,417
56	Maintenance and Repair Other Facilities	6,369	0.10	2,838	968	3,835
58	Manufacturing (AGG)	84,749	0.42	17,738	10,532	29,455
78	Prepared Feeds, N.E.C	12,983	0.03	1,118	373	1,597
202	Nitrogenous and Phosphatic Fertilizers	3,793	0.01	399	391	822
204	Agricultural Chemicals, N.E.C	11,836	0.03	1,739	3,342	5,170
209	Chemical Preparations, N.E.C	316	0.00	62	53	118
210	Petroleum Refining	8,927	0.01	461	792	1,498
213	Lubricating Oils and Greases	384	0.00	50	15	73
274	Metal Barrels, Drums and Pails	1,685	0.01	417	223	657
433	Utilities (AGG)	24,860	0.15	6,460	6,246	14,056
435	Motor Freight Transport and Warehousing	21,254	0.20	5,468	2,728	8,518
443	Electric Services	7,948	0.02	1,370	4,737	7,184
446	Sanitary Services and Steam Supply	2,815	0.02	986	642	2,193
447	Wholesale Trade	78,308	0.70	30,527	12,412	54,829
448	Building Materials & Gardening	5,748	0.13	2,796	1,075	4,803
449	Trade (AGG)	34,265	0.93	13,928	5,400	23,844
456	Banking	22,150	0.13	5,510	10,230	16,241
457	Credit Agencies	19,723	0.51	13,361	2,360	16,377
458	Finance (AGG)	33,153	0.10	5,741	16,803	26,140
459	Insurance Carriers	10,472	0.07	3,748	2,277	6,757
462	Real Estate	23,037	0.12	1,519	11,934	16,255
463	Services (AGG)	98,864	1.71	43,352	14,530	59,450
482	Miscellaneous Repair Shops	5,672	0.08	1,428	1,053	2,647
507	Accounting, Auditing and Bookkeeping	4,243	0.09	2,362	1,283	3,670
509	Research, Development & Testing Services	3,078	0.05	1,710	286	2,020
510	Government (AGG)	4,866	0.05	2,641	3	2,644
512	Other State and Local Govt Enterprises	4,390	0.03	1,148	839	1,987
526	120 Cow Grazing Dairy	377,876	2.00	40,815	178,670	224,177
	Total Impact (Direct, Indirect and Induced)	944,215	8.19	215,283	298,838	552,274
	Multipliers	2.50	4.10	5.27	1.67	2.46

Joint Income=Proprietors Income +Other property type income

Summary and Conclusions

In response to our four research questions, we can conclude:

1. What primary industries are impacted by dairy production?

Change in the dairy product sector whether a decline or an increase in production have significant impact beyond the dairy sector. The trade, service and finance sectors would account for 60% of the added output.

2. What is the potential gain in economic activity if Illinois matched production with consumption? Matching production with consumption would increase output by 5 times, employment by nearly 4.5 times, and value added by approximately 4 times the1997 levels. It is not out intention to imply that Illinois should achieve self sufficiency in milk production, but to illustrate the potential for the dairy industry to support additional economic activity in the state.

3. How do the three systems compare in cost and return to the proprietor?

Cost and returns comparison of the intensive grazing, traditional and concentrated dairy systems indicate that Illinois dairies could become more cost competitive. Intensive grazing resulted in lower feed cost and building and equipment costs than the traditional dairy. Concentrated feeding systems had lower building and equipment costs and higher productivity than the traditional farm.

4. What is the impact on the local economy upon adoption of a new dairy system?

Impacts on the economy can vary by type of dairy system adopted. Output multipliers varied from 1.72 for intensive grazing to 1.95 for the traditional system that purchased all feed. Internalizing feed production resulted in lower output multipliers. Employee compensation multipliers were higher for the intensive grazing and concentrated feeding system than the two traditional systems, which is likely due to the greater labor required by the traditional system in

comparison to the other systems. The comparison of multipliers estimated at the county, state and national level for the intensive grazing illustrated the potential range in multipliers by changing the regional purchasing coefficients. The total employment multiplier for intensive grazing ranged between 2.25 and 4.1. The total value added multiplier ranged between 1.42 and 2.46. The percentage change in the multiplier from the state multiplier was less for the county multiplier and greater for the national multiplier which implied greater interstate changes in purchases than intrastate changes in purchases.

The Illinois dairy sector has been a major contributor in supporting economic activity in certain regions of Illinois. Policy makers must decide whether the industry can remain competitive and if there is a future role for the dairy sector to be an engine of economic activity in Illinois. To this end agricultural economist can provide information on the changing structure of the dairy industry and implications of regulations affecting the industry.

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