Appendix

An Economic Analysis of the Dairy Industry in Franklin, Hampshire and Hampden County, Massachusetts [IMPLAN]

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Contents

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Introduction

Input-output analysis using the Minnesota Implan Group (MIG) modeling software IMPLAN (IMpact analysis for PLANning) was used to analyze the impact of dairy farming and related food manufacturing industries on a three-county region and to derive their economic multipliers. The database provided by MIG contained 322 different sectors in Franklin, Hampshire and Hampden counties in western Massachusetts. This information was then used to analyze the additional economic impacts of a new dairy processing facility with $1.8 million in output for the study area. The economic impact of an additional $1 million of dairy farm production was also evaluated.

The dairy farming industry (on farm production) and related food processing sectors (fluid milk, cheese, and ice cream) were selected to model the impact of these activities on the local economy. The total cash receipt value from sales was used as an input level to calculate multipliers to estimate the economic contribution of the industry on total output, employment, and labor income. The direct, indirect, and induced impacts for sectors are measured in millions of dollars. Results for output and labor income effects are in 2008 dollars. The impact of employment is measured in total jobs, both full time and part time.

Key Findings

- The combined output of the dairy farming, fluid milk processing, dry milk, and ice cream manufacturing sectors was $611.8 million or 1.3 percent of the regional economy.
- These industries also contributed $120.3 million of value added to the local economy.
- The output from these industries has a multiplier effect on the local economy. In total, the dairy cattle and milk production sector generates an additional $1.31 for each dollar produced. The fluid milk and butter manufacturing sector generates an additional $1.57 for each dollar produced.
- A new fluid milk processing facility with sales between one and three million dollars would have a total economic effect on the three-county region ranging from $1.3 to $4.7 million. For every million dollars of sales this total effect would provide 4.8 new jobs, labor income of $234,945, and value added of $407,471.
- An additional output of $1 million in regional dairy farm production would have a total effect on the three-county region of $1,315,085. This total effect includes 12.6 new jobs, labor income of $127, 246 and value added of $550,161.

Industry Baseline

Summary of Regional Economic Impact

Data sets representing the total economic activity of Franklin, Hampshire and Hampden counties were purchased from the Minnesota IMPLAN group along with software to run the modeling program. A single model was then created that captured the all industrial sectors that exist in the three-county region. The generated data was then exported into Excel worksheets. Table 1 provides an overview of the IMPLAN model information including the details of the gross regional product.

Table 1. IMPLAN Regional Model Information

Model Information			
Model Year: 2008 Gross Regional Product: $25.017 billion Total Personal Income: $25.7 billion Total Employment: 343,375 Number of Industries: 322		Areas in the Model: Franklin, Hampshire, Hampden County. Land Area (square miles): 1,850 Population: 687,558 Total Households: 269,323 Average Household Income: $95,565	
Gross Regional Product			
Value Added		**Final Demand**	
Employee Compensation	$15,289,920,000	Households	$21,869,040,000
Proprietor Income	$1,408,226,000	State/Local Government	$3,078,776,000
Other Property Type Income	$6,631,599,000	Federal Government	$817,152,600
Indirect Business Tax	$1,688,039,000	Capital	$3,302,695,000
		Exports	$19,017,860,000
		Imports	($22,037,490,000)
		Institutional Sales	($1,030,250,000)
Total Value Added	$25,017,780,000	Total Final Demand	$25,017,780,000

The Dairy Industry

Data for the dairy cattle and production, fluid milk and butter manufacturing, cheese manufacturing, dry condensed, and evaporated dairy product manufacturing, and ice cream and frozen dessert manufacturing sectors were extracted from the worksheets for further analysis. Industries are defined and assigned individual codes and separate lines within a matrix of the entire economy laid out in IMPLAN. The assignment of codes is based on standard industrial classification categories used by the federal government. All agricultural sector codes in IMPLAN reports are 1-19, with dairy cattle and milk being assigned a code of 12. Food processing and manufacturing industries contained in codes 40 through 60 with fluid milk and butter assigned to 55, while ice cream and frozen dessert is number 58. Therefore, dairy cattle and production is on-farm production while fluid milk and butter are food processing industries. Table 2 summarizes the annual economic impact of dairy farming and related food processing on the local economy. It shows the number of employees in each sector and the dollar contribution of dairy farms and dairy product manufacturing facilities in the three counties. The total impact of the dairy industry from direct, indirect and induced effects is $611.9 million which represents the cash receipts received by dairy farmers and food processors for their products.

Table 2. Employment, output and labor income for the dairy industry			
Description	Employment	Output * 2008 dollars	Employee Compensation 2008 Dollars
Total (3 county economy)	343,375	47,204,011,763	15,289,920,912
Dairy cattle and milk production	229	21,377,714	910,469
Fluid milk and butter manufacturing	366	260,166,256	23,065,480
Cheese manufacturing	0	0	0
Dry, condensed, and evaporated dairy product manufacturing	19	20,891,266	1,230,155
Ice cream and frozen dessert manufacturing	557	309,415,904	43,323,740
Total (dairy cattle + manufacturing)	1,170	611,851,140	68,529,844
percent of local economy	0.34%	1.30%	0.45%
*Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales. For Retail and wholesale trade, output = gross margin and not gross sales.			

Value Added

Value added is the difference between an industry or an establishments total output and the cost of its intermediate inputs. With IMPLAN modeling, value added equals employee compensation plus proprietor income plus other property type income plus indirect business taxes. Table 3 shows value added for each industry in this analysis.

Table 3. Value Added					
Description	Employee Compensation	Proprietor Income (1)	Other Property Type Income (2)	Indirect Business Tax (3)	Total Value Added
Total (3 county economy)	15,289,920,912	1,408,225,850	6,631,599,034	1,688,038,484	25,017,784,281
Dairy cattle and milk production	910,469	1,473	6,917,988	277,330	8,107,259
Fluid milk and butter manufacturing	23,065,480	0	13,203,855	551,316	36,820,651
Dry, condensed, and evaporated dairy product manufacturing	1,230,155	21,756	1,006,118	30,009	2,288,037
Ice cream and frozen dessert manufacturing	43,323,740	0	29,105,476	664,393	73,093,609
Total (dairy cattle + processing)	68,529,844	23,229	50,233,436	1,523,048	120,309,557
% of local economy	0.45%	0.00%	0.76%	0.09%	0.48%
(1) Proprietor income consists of payments received by self-employed individuals and unincorporated business owners. This income also includes the capital consumption allowance and is recorded on Federal Tax form 1040C.					
(2) Other property type income is profits for the most part.					
(3) Includes taxes on sales, property, and production, but it excludes employer contributions for social insurance and taxes on income.					

Multipliers

IMPLAN modeling allows an analyst to choose from multipliers that capture only direct and indirect effects (Type I), multipliers that capture all three effects noted above (Type II), and multipliers that capture the three effects noted above and further account for commuting, social security and income taxes, and savings by households (Type SAM). Total effects multipliers usually range in size from 1.5 to 2.5 and are interpreted as indicated below:

- *Output multipliers* relate the changes in sales to final demand by one industry to total changes in output (gross sales) by all industries within the local area. An industry output multiplier of 1.65 would indicate that a change in sales to final demand of $1.00 by the industry in question would result in a total change in local output of $1.65.
- *Income and employment multipliers* relate the change in direct income to changes in total income within the local economy. For example, an income multiplier for a direct industry change of 1.75 indicates that a $1.00 change in income in the direct industry will produce a total income change of $1.75 in the local economy. Similarly, an employment multiplier of 1.75 indicates that the creation of one new direct job will result in a total of 1.75 jobs in the local economy.
- *Value added multipliers* are interpreted the same as income and employment multipliers. They relate changes in value added in the industry experiencing the direct effect to total changes in value added for the local economy.

The resulting multipliers are measures of a change in the industry. The output and labor income multipliers measure direct, indirect, and induced change per dollar of change in the industry's output. The employment multipliers measure direct, indirect, and induced employment effects from the production of an additional one million dollars of output. Table 4 shows the output multipliers for the dairy industry.

Table 4. Output Multipliers

Industry	Multipliers			
	Direct	Indirect	Induced	Total Impact
Dairy cattle and milk production	1.000000	0.237146	0.079456	1.316602
Fluid milk and butter manufacturing	1.000000	0.427084	0.146952	1.574036
Cheese manufacturing	0.000000	0.000000	0.000000	0.000000
Dry, condensed, and evaporated dairy product manufacturing	1.000000	0.452746	0.131675	1.584421
Ice cream and frozen dessert manufacturing	1.000000	0.526162	0.215190	1.741352

The total output multiplier indicates how many dollars worth of indirect plus induced effects are generated for each additional dollar produced by the dairy sector. For example, for each additional dollar produced by the dairy cattle and milk production, $0.24 worth of indirect output is generated by other industries. These industries are local businesses supplying farms with feed, milking equipment, machinery, auto parts, construction, and other crop-producing farms, but also engineering services, veterinary services, power-generating businesses, insurance carriers, wholesalers, warehouses, etc. An additional $0.08 worth of induced output is generated by increased household spending due to dairy industry activities. The induced impact includes restaurants, health clinics and hospitals, food and beverage stores, real estate and legal services, telecommunications, etc. In total, the dairy cattle and milk production sector generates an additional $1.31 for each dollar produced. The output multipliers can be used to

gauge the interdependence of sectors. The larger the output multiplier, the greater the interdependence of the sector or industry on the rest of the local economy.
Table 5 depicts changes in employment due to changes in output in the industry. These changes are measured in number of jobs, both full time and part time, per million dollars change in output. For example, with each $1 million dollar output increase in dairy cattle and milk production, 13 jobs would be created in the local economy. A $1 million increase in fluid milk and butter manufacturing would create 5 new jobs.

Table 5. Employment Multipliers

Industry	Multipliers			
	Direct	Indirect	Induced	Total Impact
Dairy cattle and milk production	10.709412	1.903458	0.672505	13.285374
Fluid milk and butter manufacturing	1.405323	2.380885	1.243448	5.029656
Cheese manufacturing	0.000000	0.000000	0.000000	0.000000
Dry, condensed, and evaporated dairy product manufacturing	0.911651	2.317650	1.114314	4.343614
Ice cream and frozen dessert manufacturing	1.799204	2.362147	1.820780	5.982131
The Direct, Indirect, Induced and Total Effects are Per Million Dollars of Output				

The labor income multipliers in Table 6 show the direct, indirect, and induced labor income for both employee compensation and proprietor income, generated per dollar of output. They receive $0.13 in labor income per dollar of income in the dairy cattle and milk production industry.

Table 6. Labor Income Multipliers

Industry	Multipliers			
	Direct	Indirect	Induced	Total Impact
Dairy cattle and milk production	0.042659	0.058860	0.027130	0.128649
Fluid milk and butter manufacturing	0.088657	0.099269	0.050189	0.238115
Cheese manufacturing	0.000000	0.000000	0.000000	0.000000
Dry, condensed, and evaporated dairy product manufacturing	0.059925	0.108392	0.044966	0.213284
Ice cream and frozen dessert manufacturing	0.140018	0.135206	0.073498	0.348721
The Direct, Indirect, Induced and Total Effects are Per Million Dollars of Output				

As stated earlier, value added is the difference between an industry or an establishments total output and the cost of its intermediate inputs. Table 7 shows the value added multipliers for the dairy industry sectors in the region.

Table 7. Value Added Multipliers

Industry	Multipliers			
	Direct	Indirect	Induced	Total Impact
Dairy cattle and milk production	0.379239	0.128768	0.048218	0.556225
Fluid milk and butter manufacturing	0.141527	0.182268	0.089175	0.412971
Cheese manufacturing	0.000000	0.000000	0.000000	0.000000
Dry, condensed, and evaporated dairy product manufacturing	0.109521	0.191421	0.079905	0.380847
Ice cream and frozen dessert manufacturing	0.236231	0.215592	0.130583	0.582406

Regional Purchase Coefficient

A Regional Purchase Coefficient (RPC) is the proportion of the total demand for a commodity by all users in the Study Area that is supplied by producers located within the Study Area. For example, if the RPC for the commodity ''fish'' is 0.8, then 80 percent of the demand by local fish processors, fish wholesalers, and other fish consumers are met by local fish producers. Conversely, 20 percent of the demand for fish is satisfied by imports. (IMPLAN)

The average regional purchase coefficients for the industries studied are as follows:

- Dairy cattle and milk products: .15374 (85 percent of total demand is met by imports)
- Processed fluid milk and butter: .70038 (30 percent is met by imports)
- Processed dry milk, condensed and evaporated milk: .59920 (40 percent is met by imports)
- Ice cream and frozen desserts: .84659 (15 percent is met by imports)

Regional Sales Coefficient (or local use demand)

The average regional sales coefficient is the amount of the locally produced commodity going to local demand. The regional sales coefficients for the industries studied are as follows:

- Dairy Cattle and milk products: .90155 (9 percent is available for export)
- Processed fluid milk and butter: .35963 (64 percent is available for export)
- Processed dry milk, condensed and evaporated milk: .80368 (20 percent is available for export)
- Ice cream and frozen desserts: .10761 (89 percent is available for export)

Impact of a New Milk Processing Facility

The regional model developed for this IMPLAN analysis was also used to identify the impact of potential changes in the local dairy industry. IMPLAN Industry Activity Type is the most fundamental and commonly used impact type. Changes in sales, employment, wages (employee compensation), and proprietor income can all be used to measure the effects a specific industry or sector has on a study area. The following industry activities were run through the model:

1) A new fluid milk processing facility with a final output ranging from $1 to $3 million of output; and
2) An increase of $1 million in sales in the local dairy farm sector.

New Fluid Milk Processing Facility Producing Between $1 and $3 Million Dollars in Sales

To assess the regional impacts of a new fluid milk processing facility an expected low and high sales range was selected. At the high end, with sales of $3 million, the facility would have a total effect on the three-county region of $4,715,641. This total effect includes 14.3 new jobs, labor income of $704,834 and value added of $1,222,412. Table 8 shows the direct, indirect and induced effect of this new processing facility. On the lower end, with sales of $1 million, the new facility would have a total effect on the three-county region of $1,571,880. This total effect includes 4.8 new jobs, labor income of 234,945, and value added of $407,471. Table 9 shows the direct, indirect and induced effect of this new processing facility.

Table 8. Impact of $3Million in Sales from New Processing Facility

Impact Type	Output	Employment	Labor Income	Total Value Added
Direct Effect	$ 3,000,000	4.0	$ 262,428	$ 418,928
Indirect Effect	$ 1,278,322	6.8	$ 293,842	$ 539,524
Induced Effect	$ 437,318	3.5	$ 148,562	$ 263,961
Total Effect	$ 4,715,641	14.3	$ 704,834	$ 1,222,412

Table 9. Impact of $1 Million in Sales from New Processing Facility

Impact Type	Output	Employment	Labor Income	Total Value Added
Direct Effect	$ 1,000,000	1.3	$ 87,476	$ 139,643
Indirect Effect	$ 426,107	2.3	$ 97,948	$ 179,842
Induced Effect	$ 145,773	1.2	$ 49,521	$ 87,987
Total Effect	$ 1,571,880	4.8	$ 234,945	$ 407,471

An Increase of $1 Million in Sales in the Local Dairy Farm Sector.

While using IMPLAN modeling software and regional data, we wanted to see what the economic impact of an additional $1 million in sales by local dairy farms would be if markets improved and dairy operations expanded. An additional output of $1 million of on farm dairy products would have a total effect on the three-county region of $1,315,085. This total effect includes 12.6 new jobs, labor income of 127, 246 and value added of $550,161. Table 10 shows the direct, indirect and induced effect from this increase in local sales by dairy farms.

Table 10. Impact of $1 Million in Additional Milk Sales by Local Dairy Farms

Impact Type	Output	Employment	Labor Income	Total Value Added
Direct Effect	$ 1,000,000	10.2	$ 42,193	$ 375,104
Indirect Effect	$ 236,075	1.8	$ 58,219	$ 127,364
Induced Effect	$ 79,010	0.6	$ 26,834	$ 47,692
Total Effect	$ 1,315,085	12.6	$ 127,246	$ 550,161

Definitions

For a particular producing industry, multipliers estimate three components of total change within the local area:

- *Direct effects* represent the initial change in the industry in question.
- *Indirect effects* are changes in inter-industry transactions as supplying industries respond to increased demands from the directly affected industries.
- *Induced effects* reflect changes in local spending that result from income changes in the directly and indirectly affected industry sectors.

Proprietor Income

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

Indirect business taxes (IBT)

Prior to the 2003 comprehensive NIPA revision, IBT was the name of one of the three components of value added. It consists of tax and nontax liabilities that are chargeable to business expenses when calculating profit-type incomes and of certain other business liabilities to government agencies that are treated like taxes. Thus, IBT includes taxes on sales, property, and production, but it excludes employer contributions for social insurance and taxes on income. As part of the NIPA revision, this component was modified and termed "taxes on production and imports less subsidies." The major differences between the two are attributable to the treatments of subsidies and non-taxes. (BEA)

Employment multipliers

I-O multipliers used to estimate the total number of jobs (both full-time and part-time) throughout the economy that are needed, directly and indirectly, to deliver $1 million of final demand for a specific commodity. (BEA)

Indirect effects

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

Indirect requirements coefficients

Ratios that show the production required of an industry and of all other industries to meet that industry's initial demand for production. The coefficient can be calculated as the total requirements matrix less the identity matrix less the direct requirements matrix. (BEA)

Induced effects

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

Industry

A group of establishments engaged in the same or similar types of economic activity. (BEA)