

Economic Impact of the Maine Food System and Farm Vitality Policy Implications

A Report to the Joint Standing Committee on Agriculture, Conservation and Forestry
Second Regular Session of the 120th Maine Legislature

By
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ABOUT THE AUTHOR

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EXECUTIVE SUMMARY

As directed by the Joint Standing Committee on Agriculture, Conservation and Forestry of the 120th Maine Legislature, this paper constructs and quantifies a model of the Maine Food System and estimates the impacts from increasing Maine household expenditures for Maine food products. It also discusses the challenges inherent in three alternative strategies to increase Maine farm vitality.

Based on most recent Census data (1997 and 1998), the total Maine Food System generates \$3.35 billion in Maine economic activity. The largest part of this activity (57%) is in food retailing, 30% is in food processing and 13% is from farm production. The economic multipliers of Maine farm production and food processing industries are about 1.7, and about 1.6 for the Maine food retail industry.

Increasing the proportion of unprocessed Maine farm products purchased by Maine households through the conventional retail system contributes little to farm income because those purchases represent only 14% of the sales from Maine farms. For example, a 5% increase in the purchase of unprocessed Maine farm products by Maine households represents an increase in Maine farm sales of only 0.7% and generates about \$5 million of activity in the Maine economy.

Increasing Maine farm sales substantially, say by 5% (\$22 million annually), through the existing retail system requires a decrease in purchases of out-of-state products by Maine households of 38%. Given existing consumer preferences and food costs, this seems to be an unrealistic change in consumer behavior.

The same gain in farm sales can be accomplished by shifting an additional 15% of the total current purchasing by in-state food processing firms to Maine products. While this may be achievable with certain products in certain markets, given the eroding competitiveness of Maine commodity farms, it seems to be an unlikely long-term vitality strategy.

An equivalent increase in farm sales can be accomplished by shifting an additional 1% of total Maine household food expenditures to direct purchases from farms. While this is a modest shift in terms of total system behavior change, it does represent a sizable expansion in the capacity of Maine farms to process and market directly to Maine consumers. Although challenging from both a policy and farm investment perspective, it may represent the most favorable strategy for the long-term vitality of the Maine farming industry.

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t, to the extent possible, the benefits to the State as a whole from increased purchasing of locally grown food....” (Public Laws of 1999, chapter 769). The Maine DAFRR developed the baseline information on locally consumed food (Maine Department of Agricultural, Food and Rural Resources, 2000). This report addresses the second directive, to estimate the benefits from an increase in Maine household purchases of locally grown foods.

The legislative directive is addressed with three research objectives:

- Estimate the direct economic impact of the farm production industry in Maine (Part II).
- Estimate the impact of two related farm industries: food processing and food retail (Part III).
- Demonstrate and estimate the impact of the Maine Food System (Part IV).

This report also discusses some limitations of three alternative strategies to increase Maine farm sales (Part V).

¹ Time trend graphs of the total acreage of farms in Maine, the average farm size in Maine, the number of farms in Maine, and the real value of farm output in Maine are found in Appendix A; Trends in Maine Farming.

II. ECONOMIC IMPACT OF THE MAINE FARM PRODUCTION INDUSTRY

A. Conceptual Background

To estimate the economic impact of Maine farm production industry, a theoretical description of farm production activities in Maine is provided. Maine farm establishments participate in the state economy in two ways: purchasing of farm inputs and selling of farm goods and services. These two activities constitute backward and forward linkages of the farm production industry. Backward linkages are the purchases that farm establishments make to produce raw food products. For example, businesses that sell products such as fertilizer and farm equipment depend upon the farm purchases for revenue. Forward linkages are the purchases made by households or private firms for Maine farm products. For example, food processors, households, and retail food stores depend on farm production for inputs and consumptive purposes.

Figure 1 depicts a simple model of the Maine farm production industry in relation to the state economy. The arrows represent the backward and forward linkages of the farm production industry. The in-state industries and sectors that Maine farm establishments interact with are symbolized by the blocked rectangles. As presented, the Maine farm production industry purchases inputs, such as farm-equipment and supplies, from private establishments and in turn sells farm products to the retail food industry, households and food processing industry. While the Maine farm production industry interacts with others, like out-of-state farm production industries and governmental entities, to simplify the presentation these entities are not shown in Figure 1.

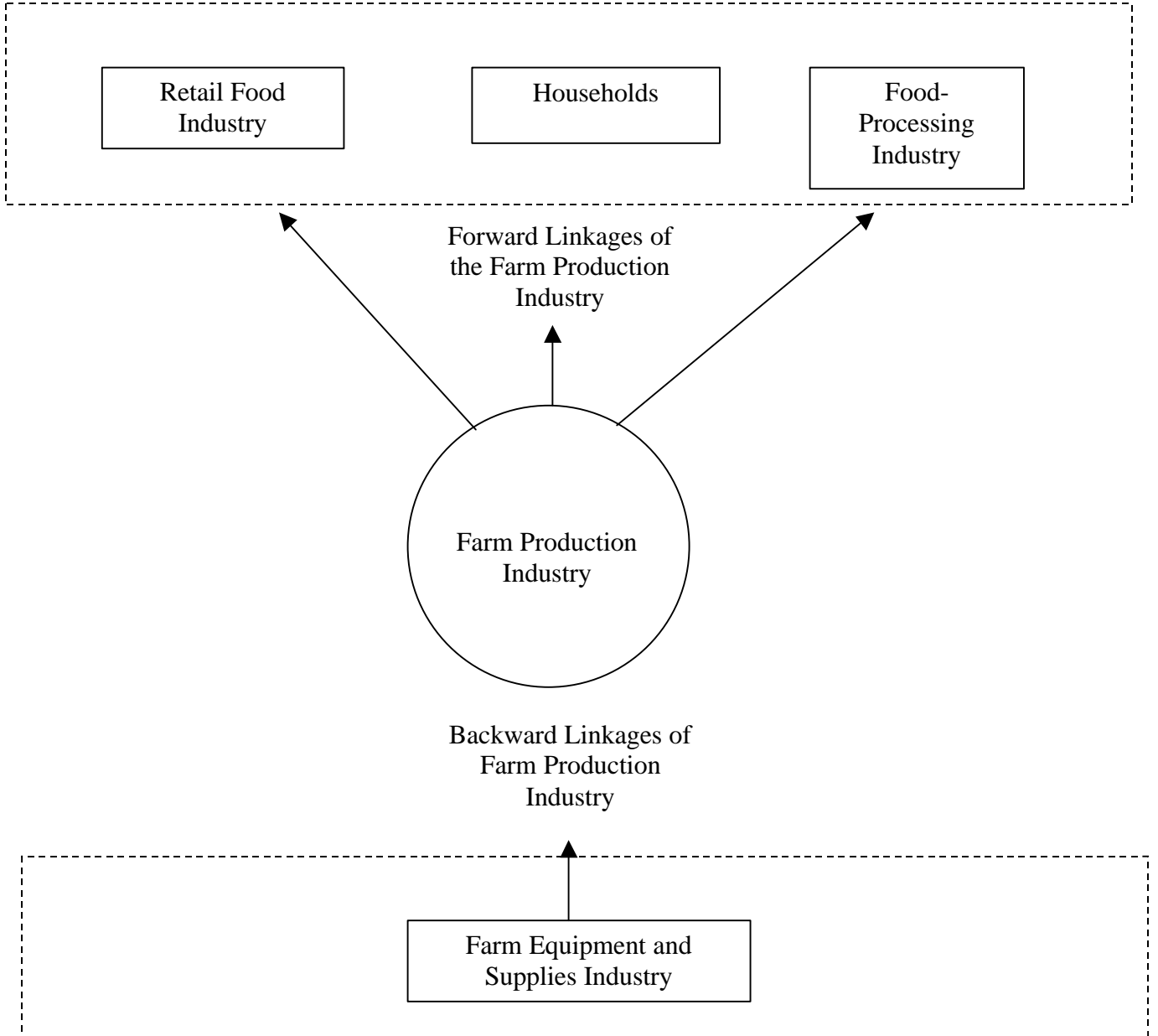
B. Methodology

An IMPLAN input-output model is used to estimate the backward and forward linkages of the Maine farm production industry. IMPLAN is a PC based economic analysis system, originally developed by the U.S. Forest Service for its planning needs in the 1980s. It is now updated and maintained by the Minnesota IMPLAN Group, Inc. in Stillwater, MN.

The IMPLAN program consists of regional economic information using the following data sources from 1998: Regional Economic Information System, Bureau of Labor Statistics, and the Bureau of Economy Analysis Benchmark, Input-Output study. Information from these data sources is gathered through a survey of firms within an economic sector or from public reports. The IMPLAN computer software is used to implement a Maine input-output model. The Maine model also uses data from the 1997 U.S.D.A Agricultural Census and 1998 Economic Census.

An input-output model traces the flow of goods and services among private businesses, households, and government agencies. Thus, estimates from an input-output model represent the dollar value of goods and services sold within a specified region and

Figure 1. Theoretical Impact of the Farm Production Industry



during a specified time period (Schaffer, 1999). For this analysis, the information provided from the input-output model is used to describe the relationship that the farm production industry has with the rest of the Maine economy. This includes the dollar value of purchases made by farm establishments in Maine and the dollar value of Maine farm products sold.

C. Previous Research and the Definition of the Farm Production Industry

Estimating the economic impact of farm production requires a careful definition of the farm production industry. Goldman, Leones, and Schuter (1994) find that the agricultural industry is not consistently defined among 27 research reports that have estimated the impact of agriculture. Several state impact studies have used a definition of farm production that is limited to businesses that produce only raw food products (Hastings, Tanjuakio and Tytus, 1996). Others have included the food processing sectors, food retail sectors and clothing retail sectors (Goldman, Leones, and Schuter, 1994). The more expansive definitions estimate a greater contribution of an agricultural industry to a regional or state economy.

For this analysis the Maine farm production industry is defined as an aggregation of farm production sectors that supply food to Maine consumers, animals, private, and public institutions, out-of-state consumers, animals, and private and public institutions. This is consistent with the more narrow definition noted above. A list of all economic sectors included in the definition of the farm production industry is found in Appendix B. The more expansive definition above is similar to the construct of the Maine Food System discussed later in this paper.

D. Backward Linkages of the Farm Production Industry

Backward linkages determine the amount of economic activity generated from the production of a particular sector and can be used to estimate the economic multiplier of that sector. The backward linkages of the farm production industry are the expenditures resulting from an increase in farm production. The backward linkage estimates shown here represent the direct, indirect, and induced impacts of a hypothetical \$1,000 of farm goods produced in the state of Maine.

The direct impact is the production of \$1,000 of farm goods. The indirect impacts represent the increased purchases of non-labor inputs by the farm production industry to produce \$1,000 worth of farm products and subsequent purchases by farm input suppliers (Hastings, 1996). The induced impacts “measure the effects of changes in household spending resulting from employment changes generated by the direct and indirect effects” (Hastings 1996).

Using total farm sales data from the 1997 U.S Agricultural Census and the estimate from the IMPLAN input-output model, impacts of a hypothetical \$1,000 of farm goods produced in Maine are shown in Table 1.

Table 1². Backward Linkages of Farm Production Industry
(in dollar units, representing 1998 linkages)

	Direct	Indirect	Induced	Total
Farm Production	1000	78	1	1079
Farm and Ag Misc.	0	21	0	21
Construction	0	21	3	24
Food Processing	0	25	4	29
Manufacturing	0	36	14	50
TCPU (Transportation, Communications, & Utilities)	0	52	21	73
Trade	0	68	29	97
Retail Food	0	1	16	17
FIRE (Finance, Insurance, & Real Estate)	0	59	44	103
Services	0	40	66	106
Government	0	0	12	12
Other	0	0	2	2
Total	1000	401	212	1,613

Production of \$1,000 of farm goods requires \$401 of purchases by farms and farm input suppliers. To produce \$1000 worth of farm goods, four industries -- Farm Production, Trade, FIRE (Finance, Insurance, and Real Estate) and TCPU (Transportation, Communications, and Utilities) -- supply 64% of the non-labor inputs. Thus, farm establishments and farm input suppliers purchase mostly goods and services from other farms, wholesale and retail trade establishments, and financial and transportation firms for the production of Maine farm goods.

The total induced impact from \$1,000 of farm production, representing the additional output generated by expenditures made by consumers employed by farm establishments and related industries, is \$212. The induced impact influences the Services and FIRE industries the most, reflecting the general purchasing patterns of Maine households.

The total impact of \$1,000 of farm production creates \$613 of additional output within the Maine economy. This represents a multiplier of 1.6. For every \$1,000 of farm production in Maine, \$1,613 of economic activity is generated.

² The definitions of industries listed here, other than farm production, retail food, and government, are located in Appendix C: Definition of Industries.

E. Forward Linkages of the Farm Production Industry

Forward linkages of the Maine farm production industry represent sales of farm output by farm establishments in Maine. The estimation method employed here uses total sales from the 1997 U.S. Agricultural Census and estimates from the IMPLAN input-output model to represent 1998 agricultural activity.

Table 2. Forward Linkages of the Farm Production Industry
(representing 1998 linkages)

	Total Sales (in Millions of Dollars)	Percentage of Total Sales
Households	62.0	14%
Exports	191.3	43%
Food Processing	146.5	33%
Food Retail	11.7	3%
Manufacturing	3.6	<1%
Agricultural Other	17.6	4%
Other	12.1	3%
Total	444.8	100%

As seen in Table 2, exports represent the largest purchasing group of Maine farm items. A total of \$191 million, or 43% of all farm sales, is exported to out-of-state entities, either domestic or foreign. Within Maine, the food processing industry is the largest purchaser of Maine farm products accounting for \$146.5 million, or 33% of total Maine farm sales. Households in Maine consume \$62 million of unprocessed Maine farm production, or 14% of total farm sales.

In summary, the farm production industry has an economic multiplier of 1.6 and sales of about \$445 million annually, with 43% of sales sold outside the state, 33% sold to in-state food processors and 14% purchased by Maine households in unprocessed form.

III. ECONOMIC IMPACTS OF FARM RELATED INDUSTRIES

A. Maine Food Processing Industry

The economic impact of the food processing industry³ is estimated in the same manner as the farm production industry. First, the backward linkages of the food processing industry are described. The backward linkage estimates of the Maine food processing industry represent the direct, indirect, and induced effects due to \$1,000 of

³ This analysis utilizes the definition of the food processing industry given by the U.S. Economic Census: "This major group includes establishments manufacturing or processing foods and beverages for human consumption, and certain related products, such as manufactured ice, chewing gum, vegetable and animal fats and oils and prepared feeds for animals and fowls ..." (U.S. Census Bureau, 2002).

food processing sales. Secondly, the forward linkages of the food processing industry are estimated.

B. Backward Linkages of the Food Processing Industry

Using total food processing sales data from the 1998 U.S. Economic Census and the IMPLAN input-output model estimates, the impacts of a hypothetical \$1000 of processed food produced in Maine are shown in Table 3.

Table 3. Backward Linkages of The Food Processing Industry
(in dollar units, representing 1998 linkages)

	Direct	Indirect	Induced	Total
Farm Prod	0	118	1	119
Farm and Ag Misc	0	3	0	3
Construction	0	12	3	15
Food Processing	1000	41	4	1045
Manufacturing	0	45	13	58
TCPU	0	56	20	76
Trade	0	80	29	109
Retail Food	0	5	16	21
FIRE	0	27	43	70
Services	0	101	64	165
Government	0	1	14	15
Other	0	0	2	2
Total	1000	489	210	1698

Food processing firms and input suppliers purchase \$489 of non-labor inputs to produce an additional \$1,000 of processed food products, representing the indirect impacts. Inputs from Farm Production, Services and Trade comprise 61% of those purchases. To produce \$1000 of processed food goods, firms purchase \$118 of raw food products from farms, \$101 of services from a variety of establishments (legal, advertising, engineering, and repair) and \$80 of inputs from wholesale and retail trade establishments.

The additional wages generated from the direct and indirect effect creates \$210 of household spending for each \$1,000 of processed food output. Over half of the induced impact contributes to the FIRE (primarily financial) and Services industries.

The total effect of an additional \$1,000 of processed food products creates \$698 of additional output within the Maine economy, which translates to an industry multiplier of 1.7. Thus, \$1,000 of processed food output by Maine firms generates \$1,698 of economic activity in Maine.

C. Forward Linkages of the Food-Processing Industry

The forward linkages of the Maine Food Processing Industry are shown in Table 4. These estimates reflect the total food processing sales in Maine for 1998.

Table 4. Forward Linkages of the Food Processing Industry
(1998)

	Total Sales (in Millions of Dollars)	Percentages
Farm Production	11.8	<1%
Households	332.1	28%
Exports	727.3	61%
Food Processing	47.4	4%
Food Retail	50.3	4%
Manufacturing	2.8	<1%
Agricultural Other	0.7	<1%
Other	17.4	1%
Total	1189.8	100%

Nearly 90% of processed food goods are channeled into two categories: exports and Maine households. The largest proportion of food products processed in Maine, \$727 million or 61%, is exported, primarily to domestic markets. Maine households purchase \$332.1 million, or 28%, of food items processed in Maine.

D. The Maine Retail Food Industry

The impact of the retail food industry is generated in the same manner as the impact estimates of farm production and food processing in previous sections. First, the backward linkages of the Maine retail food industry are described. Secondly, the forward linkages, or the flow of sales, of the retail food industry are estimated.

For this analysis, the retail food industry is defined as food stores and restaurants. The measure of economic activity used for food stores is only the value added by food retail establishments. It does not include the value of the products that are purchased and resold. Thus, food store output in this analysis represents marketing services that include, for example, advertising and shelf-space rental costs for food items. However, the restaurant industry output used in IMPLAN represents the total sales of restaurant establishments in Maine for 1998. Therefore, the backward and forward linkages associated with the retail food industry represent the impact of food store marketing services and restaurant industry sales in the Maine economy.

E. Backward Linkages of the Retail Food Industry

The backward linkages of the Maine retail food industry are shown in Table 5. These estimates reflect the impact of a hypothetical \$1000 worth of food-marketing services and restaurant output.

Table 5. Backward Linkages of The Retail Food Industry
(in dollar units, representing 1998 linkages)

	Direct	Indirect	Induced	Total
Farm Production	0	10	2	12
Farm and Ag Misc	0	0	0	0
Construction	0	8	6	14
Food Processing	0	30	8	38
Manufacturing	0	11	24	35
TCPU	0	29	37	66
Trade	0	29	52	81
Retail Food	1000	8	29	1037
FIRE	0	29	78	107
Services	0	68	117	185
Government	0	0	15	15
Other	0	0	3	3
Total	1000	222	371	1593

Retail food establishments and retail food input suppliers purchase \$222 worth of inputs to create an additional \$1,000 worth of marketing services and restaurant sales. Services (legal, repair, engineering, and advertising) account for 30% of the indirect impact and is the largest single input used by the retail food industry. Inputs from Food Processing, TCPU, Trade, and FIRE comprise another 55% of those purchases made by the retail food industry and retail food input suppliers.

The total increase in household spending due to the direct and indirect effects of \$1,000 of retail food industry activity is \$371, exceeding the amount of indirect impact. The induced impact, the effect of additional wages due to the purchases and production of restaurant output and food store marketing services, influences the Services industry the most, \$117.

The total impact to the Maine economy from \$1,000 worth of retail food products and services generates a total of \$593 of additional output within the Maine economy. Thus, the food retail industry multiplier is roughly 1.6. Each \$1,000 of increased retail food activity generates \$1,593 of increased economic activity in Maine.

F. Forward Linkages of the Retail Food Industry

The forward linkages associated with the retail food industry in Maine are the total amount of marketing services and restaurant output sold to households, government entities, and other industries. The total output of the retail food industry in Maine for 1998 is shown in Table 6.

Table 6. Forward Linkages of the Retail Food Industry
(1998)

	Total Output (in Millions of Dollars)	Percentages
Households	1459.3	73%
Exports	350.0	18%
Food Processing	5.4	<1%
Food Retail	14.3	<1%
Manufacturing	47.0	2%
Other	127.0	6%
Total	2003.0	100%

The retail food industry produces about \$2 billion in marketing services and restaurant output. The industry output is greater than the farm production and the food processing industries combined. Households purchase the majority of the retail food industry services and output, about \$1.5 billion or 73% of the total activity. Non-Maine residents purchase \$350 million, or 18%, of the Maine retail marketing services and restaurant output.

IV. ECONOMIC IMPACT OF THE MAINE FOOD SYSTEM

A. Quantifying the Maine Food System

The above sections estimate the backward and forward linkages as well as the economic multipliers of the farm production, food processing and retail food industries. This section constructs and demonstrates the total Maine food system. The Maine food system is an aggregation of all final food products and services that are produced within the state. It represents the final products and services sold by the farm production industry, the food processing industry, and the food retail industry. Since some of the sales reported by the three industries are inputs to those industries, for example farms sales that are inputs to processed food sales, these intermediate products must be subtracted from the sum of all sales to avoid double counting. Thus, final food products are calculated by subtracting intermediate goods from total sales of each industry. Intermediate goods, those used as inputs for the production of food products, are not considered final food products.

Table 7. The Maine Food System
(1998, in millions of dollars)

	Farm Production	Food Processing	Food Retail	Total
Farm Production	0 ⁴	11.8	.1	11.9
Households	62.0	332.1	1459.3	1853.4
Exports	191.3	727.3	350.0	1268.6
Food Processing	146.5	47.4	5.4	199.3
Food Retail	11.7	50.3	14.2	76.2
Manufacturing	3.6	2.8	47.0	53.4
Agricultural Other	17.6	0.7	1.0	19.3
Other	12.1	17.4	126.0	155.5
Total	444.8	1189.8	2003.0	3637.6
Intermediate Inputs	-11.9	-199.3	-76.2	-287.4
Total Final Goods	432.9	990.5	1926.8	3350.2
Percentage of Final Goods	13%	30%	57%	100%

The total production of food products and services in Maine was worth \$3.35 billion in 1998. All sectors reported sales of \$3.64 billion, but \$287 million were inputs to other products, leaving total final sales of \$3.35 billion. More than half, 57%, of the total value of the Maine food system is represented by retail marketing and restaurant services. The food processing industry contributed 30% and the farm production industry supplied 13% of the total value of the final sale of food goods and services in Maine.

B. Maine Household Food Purchases in 1998

Food purchases by Maine households are estimated in order to measure the impact of Maine household behavior on Maine agriculture and the Maine economy. The total amount of retail food services, processed food products, and farm goods purchased by Maine households is calculated using data from the 1997 Agricultural Census, 1998 Economic Census and IMPLAN Input-Output model.

As seen in Table 8, Maine households purchased nearly \$2.98 billion of food in 1998. Of that, \$1.85 billion was from in-state firms and \$1.12 billion from out-of-state firms. Across industries, the majority of food expenditures by Maine households, 54% or \$1.598 billion, contribute to the retail food industry, most to in-state firms. Households contribute \$1.26 billion of their expenditures to the food processing industry, with three times as much going to out-of-state compared to in-state firms. Only 4% of Maine household expenditures, or \$120 million, contributes to the farm production industry, with slightly more than 50% of that going to Maine farms. Consequently, only about 2% of Maine household purchases go to Maine farm establishments for unprocessed foods.

⁴ The IMPLAN model states farm production in terms of output, including crops produced and used on the same farm, rather than sales. While some farm production is sold to other farmers, those sales are undetermined, and total sales are allocated proportionately across all other industries. Consequently, each sales category may be slightly overstated, but the relative sales values across industries are correct as presented.

Table 8. Maine Households' Food Purchases in 1998 (in millions of dollars)

	In-State	Out-of state	Total
Farm Production (raw food products)	62.0	58.4	120.4
Food Processing	332.0	926.8	1258.8
Food Retail	1459.3	139.0	1598.3
Total	1853.3	1124.2	2977.5

C. Economic Impact of Substituting Maine Farm Products for Out-of-State Farm Products

One strategy advocated to promote agricultural vitality is to increase the consumption of Maine farm products by Maine households. To increase Maine farm sales, households could purchase more farm goods from Maine farmers rather than from out-of-state. Such a behavioral change would require no other system change; it assumes food products would flow through the retail food system as they do now.

This section evaluates the impact of a 5% increase in purchases of Maine farm goods by Maine households with a corresponding decrease in farm goods purchased from out-of-state. This purchasing scenario assumes that the 5% increase in Maine farm sales is due to changes in household purchasing behavior, where Maine households increase purchases of Maine farm products through the existing food system. That behavior change might result from promotion of local farm production to consumers, or incentives to the retail sector to substitute Maine products for imported products.

As seen in Table 9, a 5% increase in consumption of Maine farm products by Maine households represents an increase in Maine farm sales of \$3.1 million (5% of \$62 million). The impact of such a shift in household preferences creates direct, indirect and induced impacts. The direct effect is \$3.1 million in additional farm output in Maine. The total indirect effect, increased purchases of inputs required by the farm industry and input suppliers to produce \$3.1 million of farm products, is \$1.24 million.

The induced impact of the increase in locally consumed farm products by Maine households is \$657 thousand. The total impact of a 5% increase in locally consumed goods by Maine households generates roughly \$5 million dollars of additional output within the Maine economy.

Table 9. Economic Impact of a 5% Increase in Household Purchases of Maine Farm Products

(in dollars, representing 1998 linkages)

	Direct	Indirect	Induced	Total
Farm Prod	3,100,000	241,800	3,100	3,344,900
Farm and Ag Misc.	0	65,100	0	65,100
Construction	0	65,100	9,300	74,400
Food Processing	0	77,500	12,400	89,900
Manufacturing	0	111,600	43,400	155,000
TCPU	0	161,200	65,100	226,300
Trade	0	210,800	89,900	300,700
Retail Food	0	3,100	49,600	52,700
FIRE	0	182,900	136,400	319,300
Services	0	124,000	204,600	328,600
Government	0	0	37,200	37,200
Other	0	0	6,200	6,200
Total	3,100,000	1,243,100	657,200	5,000,300

V. ALTERNATIVE STRATEGIES TO INCREASE FARM VITALITY

Because household purchases are a small component of total farm sales, an increase in locally consumed goods of 5% directly increases farm sales by only 0.7% (\$3.1 of \$445), representing a very modest boost in farm income. This suggests that a strategy of increasing household purchases of Maine farm products through the current food system results in only a modest economic impact because household purchases represent a small proportion of Maine farm sales.

This section of the analysis discusses possible purchasing scenarios that would increase total farm sales substantially, for example by 5%, which is equivalent to a \$22 million increase. It compares some of the limitations of three alternative strategies to increase overall farm sales by 5%. The three alternative scenarios imply different behavior changes by Maine industries or households. The three purchasing scenarios are:

1. An increase in the purchase of Maine farm products by Maine households within the current food industry.
2. An increase in the purchase of Maine farm products by the Maine food processing industry.
3. An increase in the direct purchasing of Maine farm goods and services by Maine households.

A. Increasing the Purchase of Maine Farm Products by Maine Households within the Existing Food System.

The first purchasing scenario is similar to the strategy discussed above, but at a level that can increase farm sales by 5%, representing a yearly increase of \$22 million. In this scenario, households in Maine are encouraged to increase consumption of Maine farm goods by policies that promote the purchase of local food production or provide direct or indirect assistance to producers of locally grown products or to firms in the retail food industry.

As noted above, in 1998, Maine households purchased \$62 million dollars of food products from the Maine farm production industry and \$58 million from imported farm production industries. Of the amount purchased from Maine farms, about \$9 million⁵ were purchased directly from Maine farmers. Thus, Maine households purchased a total of \$53 million dollars of Maine farm goods through the retail food industry.

A \$22 million increase in farm sales by substituting in-state farm goods for out-of-state farm goods represents a 41% (\$22 million of \$53 million) increase in the purchases of Maine farm products and a reduction of purchases of imported farm goods by 38% (\$22 million of \$58 million). Shifts of this magnitude would likely be difficult to achieve. The current allocation of product between out-of-state and in-state producers is the result of consumer preferences and marketing system infrastructure and costs and is established through private market transactions.

Such a large shift may be unrealistic to achieve within the current system where Maine households consume roughly an equivalent amount of farm products from Maine and from out-of-state. This analysis does not estimate the amount of support needed to create such a change but it would likely require an aggressive public policy initiative supported by substantial resources. It seems to be an impractical way to achieve such an income shift.

B. Increasing the Purchase of Maine Farm Products by Maine Food Processors

The second purchasing scenario has the Maine food processing industry, which is the second largest purchaser of Maine farm goods with \$147 million of expenditures in 1998, increase its purchase of Maine farm products. In this scenario, the food processing industry is given incentives to substitute Maine farm goods for imported farm goods to increase Maine farm sales by \$22 million. The incentives may take the form of assistance to help Maine farm establishments become more competitive or incentives provided directly to Maine food processors in purchasing of Maine farm products.

⁵ The estimate for Maine 1998 direct farm sales was generated by applying a time trend to the United States Department of Agriculture 1997 Census of Agriculture data on direct farm sales from Maine households (New England Agricultural Census Service, 1997).

An increase in Maine farm purchases of \$22 million requires a 15% shift in the spending patterns of the food processing industry (\$22 million of \$147 million). Once again, while this project does not analyze the amount and type of state programs required to create such a shift, it does seem to be substantial. This is especially the case given the competitive nature of the food processing industry, where contracts to retail institutional users are bid in units of pennies a pound or less. Given that Maine commodity farms appear to be losing, rather than gaining, their national competitive positions, it is probably unreasonable to expect a shift of that amount without substantial monetary incentives to food processing firms. While this scenario may be useful to expand certain market niches, it probably is impractical as the basis of a long-term agricultural development policy.

C. Increasing Direct Purchases of Maine Farm Production by Maine Households

The third purchasing scenario considers an increase in household food expenditures for products produced, processed and marketed by Maine farm establishments. This scenario assumes that a 5% increase in Maine farm sales results from consumers shifting \$22 million of food expenditures from the food retail and food processing industries directly to the Maine farm production industry. The total amount spent on food products and services by Maine households is roughly \$3 billion, of which only 2%, or \$62 million, represents purchases of Maine farm products. Under this scenario, farm establishments would be capturing about 1% (\$22 million of \$2,857 million) of household expenditures that now contribute to the food processing and food retail industries⁶.

While this shift is substantial in terms of the current capacity of Maine farms to produce and sell directly to consumers, it is modest in terms of changes in consumer behavior. As noted above, it represents a shift of only 1% in total consumer food purchasing behavior. It is modest compared to the so-called “\$10 per week” proposal that calls for Maine households to shift \$10 per week of their food purchases directly to Maine farms during the roughly twenty week Maine harvest season. With about 500,000 Maine households, this represents a shift of \$100 million, four times the shift suggested here. The scenario analyzed here would require about 25% of Maine families to shift about \$10 per week of their food expenditures directly to Maine farms during the Maine harvest season.

This scenario assumes that Maine farm owners could have processed and marketed a total of \$31 million of farm products directly to Maine households in 1998. As noted earlier within this section, in 1998 Maine farm establishments sold roughly \$9 million of product directly to Maine consumers. Increasing direct marketing of farm

⁶ A reduction in food processing and food retail sales will subsequently decrease Maine farm sales. However, the effect upon Maine farm sales is insignificant (\$434 thousand). The results of this scenario are not influenced by the decrease in household purchases of food processing and retail food products and services.

products to Maine consumers by \$22 million would require a 247% increase in direct marketing sales (\$22 million compared to \$9 million). Such an increase would likely be difficult to accomplish in the short term, but would represent substantial opportunity for the farm production industry in the long run.

To generate a \$22 million increase in Maine farm sales directly to consumers, a policy would probably focus on promoting direct sales to Maine consumers and on providing assistance to farmers who want to market directly to Maine households. This scenario, in comparison to the previous two, seems to require less drastic behavioral change within the Maine food system, except for expansion of direct marketing capacity of farmers, and may be the most expedient purchasing strategy to increase farm vitality.

Table 10 summarizes the behavioral changes necessary to increase total Maine farm sales by 5% with the three scenarios discussed in this section of the analysis. Substituting Maine farm goods for imported goods within the current food system requires consumers to reduce their purchase of imported food products by 38%, a substantial shift considering the current allocation represents existing consumer preferences and food costs. Substituting Maine farm goods for imported goods purchased by Maine food processors requires processors to shift an additional 15% of their total purchases to Maine farm goods. Increasing farm goods purchased by households directly from farms requires a shift in total consumer spending of only 1%, but a substantial investment in direct marketing capacity.

Table 10. Change Required to Increase Farm Sales by 5%

Strategy	Required Change in Food System
Import Substitution by Households	38% of Imported Farm Goods Displacement
Food Processing Increase	15% Increase in Food Processing Purchases
Farm Direct Marketing Income	1% Shift in Food System Expenditures by Households

VI. CONCLUSIONS

This analysis finds that the Maine farm production industry had an economic multiplier of 1.6 and total sales of roughly \$445 million in 1998. The multiplier of each food related industry is similar to the farm production industry. The food processing industry multiplier is roughly 1.7 and the food retail multiplier is about 1.6. The total value of farm sales is less than the total food processing sales, \$1.2 billion, and the retail food industry value, \$2 billion. The Maine food system, as a whole, generates 11% of the Gross State Product.

This analysis also finds a strong link between the retail food industry and households. The majority of food purchases made by Maine households are obtained through the retail food industry. In addition, the retail food industry purchases a large

proportion of inputs from households as labor services. The analysis also finds that there is a strong link between the food processing industry and the farm production industry. A large proportion, 33%, of inputs purchased for the production of food-processed goods are from the Maine farm production industry.

Because household purchases of unprocessed Maine farm products are only 14% of total sales of Maine farms, increasing those purchases results in only modest gains in farm income and Maine economic activity. For example, increasing household purchases of Maine farm products in the current system by 5% contributes \$5 million to the Maine economy and increases farm sales by only 0.7%.

To increase total farm sales by 5%, a direct substitution of in-state farm goods for out-of-state farm goods through the existing food system requires a 38% reduction in purchases of imported farm products by Maine households, an unlikely change in existing preferences.

A more plausible scenario might be to shift the preferences of Maine food processors for Maine food products. The equivalent 5% increase in farm income would require a 15% shift in processor purchasing behavior. While this may be a reasonably achievable strategy in certain market niches, it seems unlikely to be a sound long-term state strategy.

The most achievable long-term scenario may be for farms to invest in the processing and marketing of farm goods sold directly to Maine households. A 5% increase in total farm sales by increasing sales made directly to Maine households requires a 1% shift of total household food expenditures. Thus, farm sales can increase substantially without drastic changes to the present food system, resulting in a modest decline in food retail and processing spending by Maine consumers.

However, an increase of that magnitude in direct marketing of Maine farm products likely requires a substantial investment in the marketing capacity of Maine farm establishments. While seemingly a more plausible policy option, shifting consumer preferences to directly purchasing more from farmers and assuring that farm establishments can gear up to meet that demand does represent a challenge to both policy makers and the Maine farm community.

Appendices
And
References

APPENDIX A. Trends in Maine Farming

Figure A.1: Acreage Dedicated to Farming in Maine

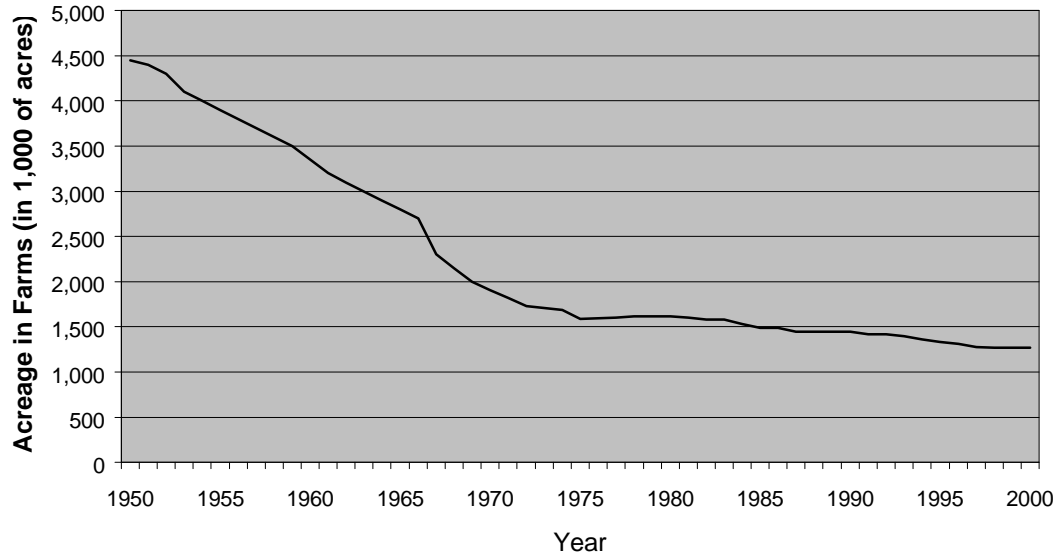


Figure A.2: Average Farm Size

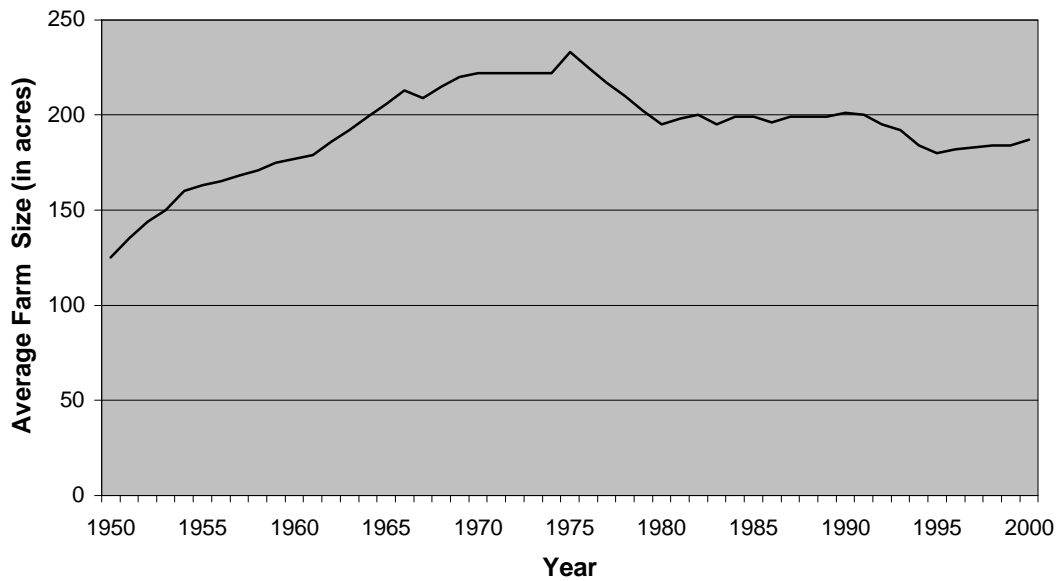


Figure A.3: Number of Farms in Maine

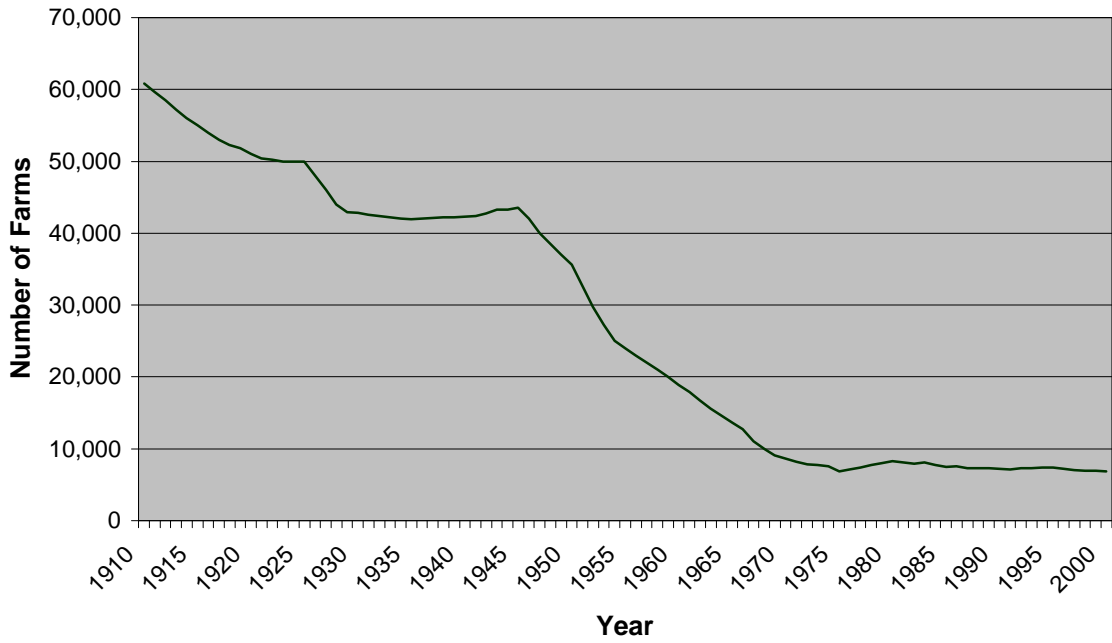
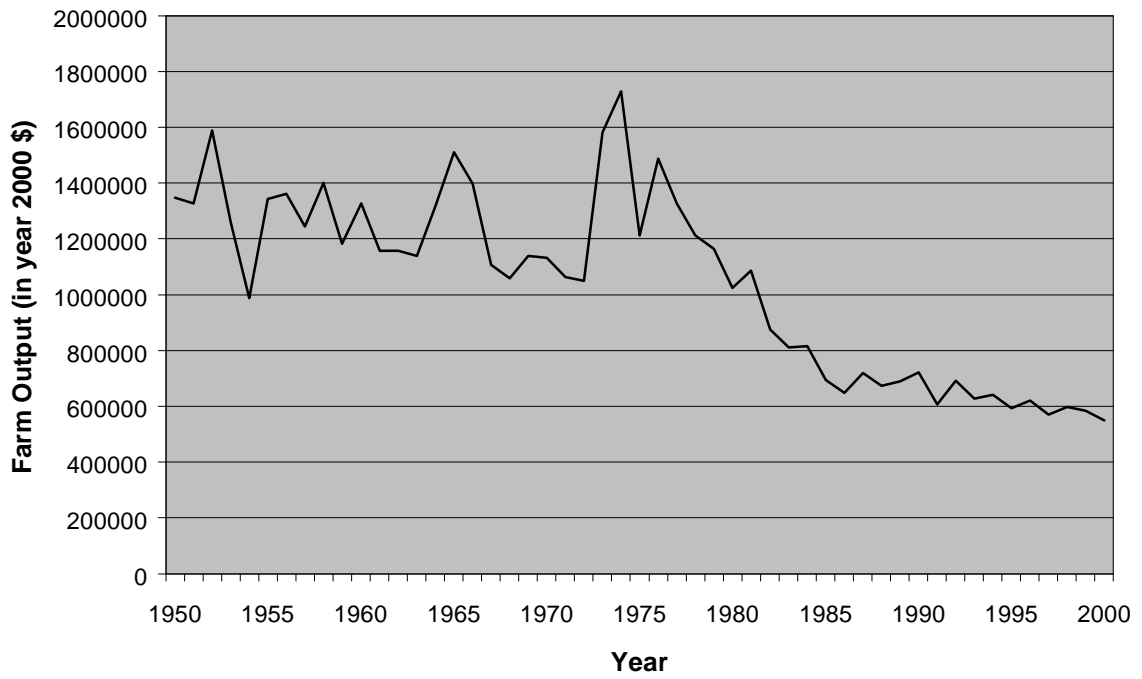


Figure A.4: Maine Farm Output



APPENDIX B. Sectors Included Into the Definition of the Farm Production Industry

- Oilseed and grain farming:
 - Soybean farming
 - Wheat farming
 - Corn Farming
 - Rice Farming
 - Other Grain Farming

- Vegetable and melon farming:
 - Potato farming
 - Other vegetable and melon farming

- Fruit and tree nut farming:
 - Apple orchards
 - Grape vineyards
 - Strawberry farming
 - Berry farming
 - Tree nut farming

- Greenhouse, nursery, and floriculture production
 - Food crops grown under cover
 - Floriculture production
 - Tree nursery production

- Cattle ranching and farming
 - Beef cattle ranching and farming
 - Cattle feedlots

- Dairy cattle and milk production

- Hog and pig farming

- Poultry and egg production
 - Chicken egg production
 - Broilers and other meat-type chicken production
 - Turkey production
 - Poultry hatcheries

- Sheep and goat farming

- Animal aquaculture

APPENDIX C. Definitions of Industries

Farm and Agriculture Miscellaneous: This industry is a conglomeration of five economic sectors: forest products, greenhouse and nursery products, forestry products, agricultural, forestry and fishing services, and landscape and horticultural services.

Construction: This division covers all employer establishments (establishments with payroll) primarily engaged in contract construction or construction on their own account for sale. Construction is defined by three broad types of activity: building construction by general contractors or by operative builders, heavy construction general contractors, construction by other special trade contractors. (U.S Census Bureau, 2002)

Food Processing: This major group includes establishment manufacturing or processing foods and beverages for human consumption, and certain related products, such as manufactured ice, chewing gum, vegetable and animal fats and oils and prepared feeds for animals and fowls. (U.S Census Bureau, 2002)

Manufacturing: The manufacturing division includes establishments engaged in the mechanical or chemical transformation of materials or substances into new products. These establishments are usually described as plants, factories, or mills and characteristically use power driven machines and materials handling equipment. Establishments engaged in assembling component parts of manufactured products are also considered manufacturing if the new product is neither a structure nor other fixed improvement. Also included is the blending of materials, such as lubricating oils, and/or plastics resins. (U.S Census Bureau, 2002)

TCPU: Transportation, Communications, and Utilities industries except Railroad Transportation and U.S. Postal Service. (U.S Census Bureau, 2002)

Trade: This industry is a conglomeration of wholesale and retail trade establishments. Wholesale trade includes establishments primarily engaged in selling merchandise to retailers. Retail Trade includes establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise, such as installation and repair services. (U.S Census Bureau, 2002)

FIRE: This division includes establishments operating primarily in the fields of finance, insurance, and real estate. Finance includes depository institutions, nondepository credit institutions, holding (but not predominantly operating) companies, other investment companies, brokers and dealers in securities and commodity contracts, and security and commodity exchanges. Insurance covers carriers of all types of insurance, and insurance agents and brokers. Real estate includes owners, lessors, lessees, buyers, sellers, agents, and developers of real estate. Establishments primarily engaged in the construction of buildings for sale (operative builders) are classified in Construction. (U.S Census Bureau, 2002)

Services: This division includes establishments primarily engaged in providing a

wide variety of services for individuals, business and government establishments, and other organizations. Hotels and other lodging places; establishments providing personal, business, repair, and amusement services; health, legal, engineering, and other professional services; educational institutions; membership organizations, and other miscellaneous services, are included. (U.S Census Bureau,2002)

Other: This division includes all governmental establishments, state and federal. However, the industry does not include educational services provided by state or federal government. The Other sector comprises establishments engaged in providing services not specifically provided for elsewhere in the classification system. Establishments in this sector are primarily engaged in activities, such as equipment and machinery repairing, promoting or administering religious activities, grantmaking, advocacy, and providing dry-cleaning and laundry services, personal care services, death care services, pet care services, photo finishing services, temporary parking services, and dating services. Lastly, private households that engage in employing workers on or about the premises in activities primarily concerned with the operation of the household are included in this sector. (U.S Census Bureau, 2002)

REFERENCES

- Conklin N.C., Leones J.P, "Agriculture in the Arizona Economy." A Joint Project of Arizona Department of Agriculture Arizona State University and The University of Arizona. April 1993
- Economic Research Service, "USDA. Data, Maine Fact S
Retrieved October 22, 2001, available
<http://www.ers.usda.gov/StateFacts/ME.htm>)
- Goldman, G., Leones J., and Schulter G, "Redefining Agriculture in Interindustry
American Journal of Agricultural Economics. 76 (December
1994): 1123-1129
- Hastings, S.E., Tanjuakio R., Tytus P.J. "The Economic Contribution of
Agriculture and Resource Economics Review
(April, 1996):46-53.
- Henry, M., and Shulter, G., "Measuring Backward and Forward Linkages in the
U.S. Food and Fiber System." *Agricultural Economics Research, U.S.DA,
Bureau of Agricultural Economics*. (1986 fall)37:33-39
- Maine Department of Agriculture, Food, and Rural Resources. "Locally
Consumed Food Products". Presented before the Maine Legislative Joint
Standing Committee on Agriculture, Conservation and Forestry. Autumn,
2001.
- Maine State Code: chapter 769, S.P. 982 2532
- New England Agricultural Statistics Service. "1997 Census of Agriculture
Profile" (Online, Retrieved, November 2001, available,
<http://www.nass.usda.gov/census/census97/profiles/me/mepst.pdf>)
- Schaffer, W.A. "Regional Impact Models". (Online Retrieved October 4, 2001
available: www.rri.wvu.edu/webbook/Schaffer/index.html)
- U.S Census Bureau. "1997 Economic Census: Summary Statistics for the United
States 1997 NAICS Basis". (Online Retrieved February 2002 available:
<http://www.census.gov/epcd/ec97/us/US000.HTM>)