Estimating the Production and Market Value-Based Impacts of Nutritional Goals in NE Iowa*

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There is growing concern over the "food miles", the "input BTUs ", and the nutritional value of conventionally delivered and distributed fresh fruits, vegetables, and melons. At the same time, there are scores of ongoing efforts to re-invigorate rural economies by re-introducing fruit and vegetable production into areas of the U.S. that had ceded those production specializations to other regions of the U.S., along with a reinvestigation of producer to distributor relationships in fruits and vegetable origination, marketing, and ultimately distribution to consumers. This research describes the potential economic impacts of a nutritionist-suggested level of fresh fruits and vegetable consumption coupled with increased levels of local production of these commodities and builds off of earlier work done by the author. It combines the net economic impacts of shifting from traditional commodity crops (corn and soybeans in Iowa) to horticulture crops with an imagined producer-owned wholesale and retail distribution network to gauge overall job and income gains for Iowa or for regions in Iowa. We also assess animal, poultry, and whole grain components of the hypothetical diet. The potential economic outcomes are identified and quantified in this study. The methodology and applicability to other regions and other local production and distribution contexts are discussed as well.

Introduction

There is a movement across much of the U.S. in support of local foods production and consumption. There are a host of reasons for this: there is an incremental increase in attention concerning the nutritional values of our diets; the idea that foods travel great distances has become an important issue in a period of growing awareness of energy use; the systematic erosion of local food producing capacities has alarmed some agricultural policy experts; and

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there is an ongoing concern over the economic vitality of rural areas. Following is an abbreviated summary of some of the concerns.

The nutritional value of foods has recently become of concern, and with justification. Davis (2004) found that among 43 garden vegetables and fruits there had been statistically reliable declines in the nutrient values of 6 of 13 nutrients when compared to baseline values from 1950. That research concluded that varieties have evolved over the years to travel and store better at the expense of nutritional content. We get, according the Kirschenmann (2006) a decided trade-off between cheap food and nutritious food.

Of course there is also the increasing demand for and consumption of organically grown fruits, vegetables, and meats. Health and nutrition consciousness has sparked much greater sales and a much wider array of foodstuffs that legitimately carry an "organically" produced designation. There is confusion, as a result, or a fusion of the terms locally produced with organic. They are not at all synonymous, and this research does not address organic production, although the localized economic impact of organic conversion is also an important study area for rural development (see for example, Chase, et al 2005, Swenson, et al 2006).

The distances that foods travel are of concern too, more so of late because of re-emergent energy issues. According to Lovins (2005), despite the fact that American producers have become much more energy efficient in all manner of production over the past 25 years, the fact remains that "… U.S. agriculture uses at least ten times as much fossil fuel energy to produce food as the caloric value embodied in the food (p. 8)." He goes on to note that the average item of food travels 1,500 miles. We have it, then, that food is energy intensive in its production, efficiencies notwithstanding, in its processing, and in its distribution. Locally produced, however, does not necessarily mean more energy efficiency, and local promoters need to use caution when inferring energy savings (see Pirog and Benjamin 2005).

Over the decades, concentrations in different types of foods production have evolved and erosions in overall food production diversity in many areas of the U.S. Older baby boomers that grew up in the Midwest might recall that farming operations of the 50's and 60's were quite diversified producing, typically, an array of crops, grasses, animals, poultry products, and fruits and vegetables. Seasonal produce stands were common on the edges of cities, and roadside stands were common in the countryside. Small towns had locker plants to process local animals, as well as creameries and hatcheries. These small town and regional production, processing, and distribution systems eroded strongly in the 60s and the 1970s.

The 1990s saw the emergence of centralized farmers' markets in many communities, especially larger communities, where the markets become more of a weekly festival rather than an ongoing, daily, albeit seasonal operation. This emergence of local food sales (not all of which is locally produced) came at a time when, for example in Iowa, the state's overall commodity production diversity declined strongly to where corn, soybeans, hogs, and layers were the dominant sources of agricultural income in the state – items that for the most part are not part of community marketing structures. And this decade has seen an explosion of community markets, farmers' markets, and the emergence of community supported agricultural operations (CSAs). CSAs are subscription-based local foods systems where subscribers receive a periodic basket of fruits, vegetables, or other produce. Where there were only about 50 such operations in the late 1980s, the number is perhaps as many as 1,000 across the U.S. now.

Lastly, and to the point of this research, we arrive at a revival of concern over the prospects of growing, raising, processing, and marketing foods locally as an economic development strategy. All local foods production promotions make note that buying locally keeps money in the region and supports rural vitality. There of course is the basic import-substitution argument where a dollar spent locally on fruits and vegetables or any other locally grown or raised commodity sustains demand for production inputs and otherwise supports additional layers of household spending. In short, local production and consumption that serve as a substitute for imported goods have a decided, localized economic impact provided of course that quality is good as or better and that the difference in consumption costs does not make your average regional household worse off.

This kind of assumption is tailor made for traditional community impact analysis techniques, and over the past two years, several studies addressing the local and statewide economic impact potential of increased fruits and vegetable production in Iowa have been conducted. The Leopold Center for Sustainable Agriculture at Iowa State University is a national leader in research and activities in support of marking and food systems development and sponsored the first of these research efforts (Swenson 2005). In the fall of 2005 they developed a prototype, on-line Iowa Produce Market Potential Calculator.[1] This calculator was designed to give counties in Iowa a sense of the demand, production, and potential sales that might be possible from local foods production. In building that calculator, the scientists developed a keen sense of the overall absence of food production in the state as it related to a typical recommended diet of fruits and vegetables. A very basic question was asked: if Iowa were able to produce all

[1] For information about the construction, assumptions, and limitations of the calculator, please go to http://www.leopold.iastate.edu/research/calculator/home.htm

Iowa-appropriate fruits, melons, and vegetable that the population would be expected to consume for a three month period, what would be the statewide economic impact? The lessons learned from that research exercise were applied to this regional study.

Part 1. Basic Input Tables

The basic information and steps that have been accomplished in support of estimating the potential regional economic impacts that might accrue to the northeast Iowa region of Allamakee, Clayton, Fayette, Howard, and Winneshiek County (hereafter NE Iowa) due to the development of food production systems capable of providing for the nutritional needs of residents are described in this section. All nutritional information used in this analysis is based on tables prepared by Angie Tagtow. Those data were translated into candidate commodity values from which estimates were made of the amount of production that would be necessary to produce that diet. There are several steps along the way from production to consumption, and commodity weights are reduced along that journey. Hence, when there is a nutritional goal, we need to move upstream to anticipate how much of a commodity needs to be purchased to meet that goal, and moving further, how much needs to be produced by growers.

The daily diet consisted of a mix of fruits and vegetables, dairy products, meats, and whole grains. The diet amounts to 1,591 grams of consumption daily. Table 1 contains the initial estimates based on the candidate food items. The ratios of production to retail to consumption were determined using updated values from the Iowa Produce Market Calculator. The 2,000 calorie per day diet consists of apple, tomato, carrot, squash, spinach, and potato as Iowa grown vegetables, along with the protein sources of milk, pork, beef, and egg. Last, whole grains were simulated using wheat (whole grain wheat bread in the diet) and oats as the foundations for the servings. In consuming 1,591 grams of the recommended diet, 2,205 grams of the food items would need to be purchased from retailers. To supply that amount to retailers, the producers would generate 2,679 grams of the respective items per capita.

The next step in estimating the potential economic value of this diet in this region involved identifying the prices that would be paid to producers and the prices that would be charged to consumers for the elements in the diets. All prices were obtained using USDA information for 2006. While there has been a strong upward movement in some food prices in 2007, the 2006 data are preferred for this analysis as that is the same year as the data in the model that will be applied to these data later in this assessment process. Those price data are contained in Table 2 and are on a per pound basis using national price data. State level price data are not available. The price data help us to understand the expected revenues to producers and the expected costs to consumers.

Table 1. Per Capita Diet and Production Requirements

	Daily Diet Per Capita in Grams		
Commodities / Activities	Daily Requirements	Amount Sold at Retail	Production Necessary to Meet Daily Requirement
Apple	125	174	206
Tomato	180	254	339
Broccoli	46	111	137
Spinach	15	29	39
Carrot	64	93	109
Squash	57	109	145
Potato	58	82	97
Milk	735	919	1,044
Pork	32	52	76
Beef	32	47	75
Poultry	29	48	85
Eggs	50	59	65
Whole Grains (whole wheat bread)	85	124	141
Other Grains (oats)	85	106	121
Total	1,591	2,205	2,679

Table 2. Per Capita Producer and Consumer Prices in 2006

	Prices Per Pound	
Commodities / Activities	Producers	Consumers
Apple	0.30	1.02
Tomato	0.43	1.56
Broccoli	0.34	1.37
Spinach	0.29	0.66
Carrot	0.21	1.36
Squash	0.24	1.44
Potato	0.10	0.51
Milk	0.13	0.36
Pork	0.83	2.80
Beef	1.87	3.97
Poultry	0.47	1.57
Eggs (per egg)	0.04	0.11
Whole Grains (whole wheat bread)	0.08	1.42
Other Grains (oats)	0.07	1.63

Table 3 combines information determined in the first and the second table to arrive at the potential economic values for producers and the costs for consumers in the NE Region. The prices paid to the producers for all of the diet items would be $51.3 million, and the prices that the consumers would pay for this diet would be $150.2 million. These amounts are based on a 2006 population estimate for the region of 84,983 persons. The cost of the diet per capita for one year would be $1,767.

Table 3. Annual Values: Producer Returns and Consumer Prices

	Total Prices Received or Paid	
Commodities / Activities	Producers	Consumers
Apple	4,207,193	12,084,406
Tomato	10,020,776	26,971,672
Broccoli	3,152,369	10,405,474
Spinach	770,659	1,291,255
Carrot	1,525,635	8,608,300
Squash	2,398,049	10,672,757
Potato	696,048	2,873,399
Milk	9,262,018	22,382,736
Pork	4,336,623	9,882,690
Beef	9,628,297	12,697,296
Poultry	2,736,789	5,112,312
Eggs	1,240,752	3,340,724
Whole Grains (whole wheat bread)	789,475	11,997,099
Other Grains (oats)	560,199	11,856,593
Total	51,324,882	150,176,715

At this point in the analysis, we have arrived at the foundation values for beginning to compile the basic economic impact amounts that would be associated with scenarios that argued for the purchase of locally produced foods. Before moving forward, some adjustments to the overall values need to be considered. Many of these foods are produced in this region to varying degrees. Using Iowa yield data, again from the Iowa Market Produce Calculator, the total number acres of land needed to produce the total fruits and vegetables of the diet were calculated. Those values are in Table 4.

Table 4. Seasonal Commodites Land Requirements

	Acres Need at Percent of Local Production	
Commodities / Activities	10 Percent	25 Percent
Apple	140	351
Tomato	84	210
Broccoli	94	234
Spinach	38	94
Carrot	25	63
Squash	146	364
Potato	30	75
Total Crop	557	1,391

As the growing season in Iowa is much shorter than many of the fruits and vegetable areas of the U.S. this table assumes two potential acreage values for the seasonal crops; a 10 percent locally supplied amount would require 557 acres of production, and if a quarter of the daily diet were locally grown (or 100 percent for three months of the year), then 1,391 acres would be needed. All subsequent modeling uses the 25 percent of consumption assumption.

Table 5 details all of the non-seasonal elements of the diet. There is no reason to suppose that an entire year's diet from these foods could not be supplied locally as the growing season is less an issue so the values are annual amounts. The units of measurement are detailed by food item.

Table 5. Nonseasonal Annual Production Requirements

Commodities / Activities	Amount	Unit
Milk	712,463	cwt
Pork	52,060	cwt
Beef	51,406	cwt
Poultry	58,230	cwt
Eggs	2,584,900	dozen
Whole Grains (whole wheat bread)	2,808	Acres
Other Grains (oats)	3,942	Acres

Table 6 gives us the potential value to producers of the seasonal crops. At a 10 percent level of local supply, producers would realize $2.28 million in revenues, and at 25 percent, $5.69 million. Tomatoes would provide the greatest revenue per commodity item in the seasonal group, followed by apples. Potatoes and spinach would provide the least.

Table 6. Seasonal Crop Production Revenues

Commodities / Activities	10 Percent	25 Percent
Apple	420,719	1,051,798
Tomato	1,002,078	2,505,194
Broccoli	315,237	788,092
Spinach	77,066	192,665
Carrot	152,564	381,409
Squash	239,805	599,512
Potato	69,605	174,012
Total Crop	2,277,073	5,692,682

For comparisons purposes, the values of a half of a year's supply and a full year's supply of the non-seasonal food items are displayed in Table 7. Were just half of the diet supplied by local producers of meat, dairy, and grain products, they would receive $14.3 million in payments at 2006 prices. At 100 percent they would receive $28.55 million.

Table 7. Nonseasonal Production Revenues

Commodities / Activities	50 Percent	100 Percent
Milk	4,631,009	9,262,018
Pork	2,168,311	4,336,623
Beef	4,814,148	9,628,297
Poultry	1,368,394	2,736,789
Eggs	620,376	1,240,752
Whole Grains (whole wheat bread)	394,737	789,475
Other Grains (oats)	280,100	560,199
	14,277,076	28,554,153

All of these values represent the total amounts of production. We need to consider current production, however. While we cannot do a food item by food item audit, we can assume that a mix of fruits and vegetables are already grown in the region that can theoretically be considered in alignment with the dietary recommendations. We also know that the region is a supplier of beef, pork, poultry, and dairy products, so the current production of those commodities also needs to be calculated. Those values are displayed in Table 8. They are used to calculate offsets later in this report when the total net production gains to the region are considered in light of the dietary recommendations. As is readily evident, the region is completely self-sufficient in milk, pork, and beef production. All other categories of diet items range from zero, effectively, to 62 percent locally supplied.

Table 8. Estimated Current Production

	Amount	Unit	Percent of Demand Met by Existing Production
Vegetable	166	Acres	17%
Orchard	216	Acres	62%
Potatoes	0	Acres	0%
Milk	11,975,012	cwt	1681%
Pork	5,171,527	cwt	9934%
Beef	2,169,182	cwt	4220%
Poultry	20,643	cwt	35%
Eggs	0	Dozen	0%
Whole Grains (whole wheat bread)	584	Acres	21%
Other Grains (oats)	1,179	Acres	30%

Part 2. Input-Output Analysis at the Producer Level.

The overall economic value of the recommended diet to local agricultural producers is next estimated using an input-output model of the study region. An input-output model is a detailed accounting of regional industries. It estimates the amounts and types of inputs that local industries purchase from local suppliers and from imported sources. These relationships, or linkages, form the foundations for calculating the multiplier effect that increases or decreases in production may have with the regional economy. If production in a sector increases, so too, by logic, will the production in the sectors that supply goods and services to it, and, iteratively, the sectors that supply goods and services to those suppliers, and so on.

The first estimate is the total value of the seasonal food production as measured at the farm gate. Here only the returns to the farmers are estimated considering all supply linkages and other associated spending that gets supported. This estimate assumes that 25 percent of the food items in this nutritional group are produced locally. This producer component would generate $5.592 million in output, $1.8 million in labor income, and require 44 jobs. In so doing, the producers would need $876,327 in locally supplied inputs, which in turn would require 14.4 jobs making $326,980 in labor income. When the workers in the direct and indirect sectors convert their labor incomes into household spending, they would induce $1.04 million in output, requiring 12.1 jobs paying $291,009 in labor income. Combined, the value of producing 25 percent of these food items to the area populace would support $7.61 million in output, and 70.4 jobs making $2.38 million in labor income.

A multiplier column is also listed. The values represent the ratio of the total value to the direct amount. The output multiplier of 1.34 means that for every dollar's worth of production on the farm there is $.34 in output supported off of the farm. The labor income multiplier of 1.35 means that for every dollar's worth of labor income earned on the farm, there is $.35 in labor income earned off of the farm in all other sectors. The jobs multiplier of 1.61 means that for every job on the farm, there is 61/100th of a job off of the farm that is supported.

Table 9. Seasonal at 25 Percent of Annual Demand

	Direct	Indirect	Induced	Total	Multiplier
Output	5,692,682	876,327	1,040,884	7,609,893	1.34
Value Added	2,983,734	448,219	618,215	4,050,168	1.36
Labor Income	1,766,825	326,980	291,009	2,384,814	1.35
Jobs	43.8	14.4	12.1	70.4	1.61

The next table lists the overall economic values associated with all of the nonseasonal items. As these commodities can be supplied all year long, the overall amounts are much greater. Total output for these remaining food items were they all sourced locally would be $28.55 million, and in so producing would take 167 jobs paying $2.1 million in labor income. Considering all inter-relationships, this production would link directly or indirectly to $45.2 million in output, 306 jobs, and $5.9 million in labor income.

Table 10. Nonseasonal at 100 percent of annual demand

	Direct	Indirect	Induced	Total	Multiplier
Output	28,554,154	14,080,513	2,544,020	45,178,688	1.58
Value Added	4,529,338	5,315,925	1,510,224	11,355,486	2.51
Labor Income	2,082,398	3,086,040	711,245	5,879,684	2.82
Jobs	166.9	109.4	29.6	305.9	1.83

These values are huge and impressive, but when doing economic impact analysis we want to isolate the net new amounts of productivity. There already is production of seasonal and nonseasonal food items in the area (see Table 8). Once we control for the value of existing production, we arrive at our first estimate of the net economic impact for this diet in this region considering just increases in production.

Table 11 gives us the seasonal production estimates. Direct new output is reduced to $4.3 million requiring 31 jobs making $1.3 million in labor income. Considering all linkages, 51 jobs making $1.77 million in labor income produce $5.71 million in total output in the region.

Table 11. Seasonal at 25 Percent of Annual Demand Adjusted for Existing Production

	Direct	Indirect	Induced	Total	Multiplier
Output	4,277,027	659,696	771,658	5,708,382	1.33
Value Added	2,258,530	337,378	458,318	3,054,226	1.35
Labor Income	1,305,446	244,688	215,736	1,765,870	1.35
Jobs	30.7	10.7	9.0	50.5	1.64

As the region is significantly self-sufficient in the production of hogs, beef, and milk, the nonseasonal food item estimates are drastically lowered. Those amounts are in Table 12. The net new productivity required reduces to $4.035 million, using just 6.4 jobs making $510,305 in labor incomes. In total considering all relationships, this new productivity would link to 16.7 jobs making $787,558 in labor income.

Table 12. Nonseasonal at 100 Percent of Annual Demand Adjusted for Existing Production

	Direct	Indirect	Induced	Total	Multiplier
Output	4,035,492	642,774	352,890	5,031,156	1.25
Value Added	1,428,476	307,993	168,894	1,905,363	1.33
Labor Income	510,305	190,665	86,588	787,558	1.54
Jobs	6.4	6.0	4.3	16.7	2.61

The land that must go into the production of fruits and vegetables and the production of the grains for this assessment has to come from existing production. The next adjustment calculates the value of reducing total corn and soybean farmland acres and the associated economic impacts of that shift. To produce the 25 percent goal of fruits and vegetables and to produce the grains in the regional diet, 5,996 acres will have to be obtained from the conventional farming acres of the region. This estimate compares the values in Tables 4 and 5 above with those in Tables 8 to determine the needed acreage. The current-practice value of that acreage reduction to corn and soybean farming in the region is displayed in Table 13.

The region's grain producing sector would see a reduction in the demand for 14.6 jobs making combined $441,696 in labor income. In all, after considering multipliers, the economic impact results in a reduction in 20.5 jobs and $580,073 in labor income.

Table 13. Losses to Corn and Soybean Producers from Reduced Acreage

	Direct	Indirect	Induced	Total	Multiplier
Output	-1,760,920	-186,780	-260,785	-2,208,485	1.25
Value Added	-885,820	-99,422	-154,927	-1,140,168	1.29
Labor Income	-441,696	-65,493	-72,883	-580,073	1.31
Jobs	-14.6	-2.8	-3.0	-20.5	1.40

From Tables 11, 12, and 13 we can arrive at, on the farm production side, the economic impact of net new farm level productivity in the region as a result of this nutritional goal. In Table 14 we see that after adjusting for existing production in all of the commodities and for the losses to soybean and corn producers because of acreage reductions, the region would see a net gain of 22.5 jobs at the farm level making $1.374 million in labor incomes. In all, after considering all inputs and household spending effects, regional job gains would be 46.7, and income gains would be $1.973 million. Readers will notice that the resulting multipliers from the entire process in Table 14 are greater than those posted in Table 13 for just corn and soybean farming. Accordingly, per million dollars of output expansion in support of the nutritional goal for the region, greater income and job impacts are expected to accrue to the region than would be the case were grain farming to increase output by the same amount.

Table 14. Net Regional Gains Considering Corn and Soybean Offsets and Existing Production

	Direct	Indirect	Induced	Total	Multiplier
Output	6,551,599	1,115,690	863,763	8,531,053	1.30
Value Added	2,801,186	545,949	472,285	3,819,421	1.36
Labor Income	1,374,055	369,860	229,441	1,973,355	1.44
Jobs	22.5	13.9	10.3	46.7	2.08

Step 3. Estimating the Gains from Producer-to-Retail Selling Configurations

While the production gains from meeting the nutritional requirements are substantial, there is more to be acquired as producers develop mechanisms for direct selling of their producer. This research begins with some very basic assumptions:

- Producer-seller operations will be basic businesses that concentrate only on the seasonal sale of the fruits and vegetables.
- The operations' costs are configured considering just 4 months of operation to distribute the seasonally grown commodities.
- The producer-seller operations will be arrayed regionally in sufficient numbers to meet the needs of the existing population.
- Gains to the producer-sellers have to take into account losses to existing grocery stores in the region.
- The producer-sellers will directly market 50 percent of their seasonal production in support of the nutritional goals and the remaining 50 percent will go to existing wholesale operations.
- The average returns to producer-sellers are higher than would be the case from grocery stores as there is an assumption that significant transport cost savings are realized by the owners.
- No calculations are made for lost trucking and warehousing activity that would originally have delivered these goods and services to region grocery stores. It is assumed that all of that economic activity originates externally to the region and irrelevant for our analysis.

We first calculate the value of economic activity at the producer-seller level. The consumers' costs for the seasonal portion of their recommended diet would be $18.23 million annually. The producer-sellers would market half of that value and sell to wholesale the other half. This leaves about $9.12 million in remaining consumption left to market. The producer-seller is required to first pay him or herself for the value of the produce that is going to be directly marketed. That amount is $2.85 million. The difference between the price sold and the amount paid for the produce represents the producer-seller gross margin – the cost of doing business. Accordingly, Table 15 represents the best estimate of the value of that activity to the region.

It would take an estimated 184 seasonal jobs to directly sell this produce across the multi-county area. Those workers owners would generate $2.82 million in value added, of which $2.54 million would come in the form of labor income. The operations would purchase $1.14 million in indirect inputs into their operations from regional suppliers, which would in turn require nearly 13 jobs to produce making $367,546 in labor incomes. When the workers in the markets and in the supplying industries spent their paychecks on household goods and services in the region, they would induce another $1.43 million in output, sustaining 16.5 more jobs and $400,097 in labor incomes.

In all, the operations would generate $8.841 million in regional output, $4.3 million in value added, $3.3 million in labor income, and 214 jobs. These are the gross values from the operation. But to account fairly, we need to offset sales at the retail level.

Table 15. Total Economic Effects of Producer / Seller Markets

	Direct	Indirect	Induced	Total	Multiplier
Output	6,270,000	1,138,694	1,432,237	8,840,932	1.41
Value Added	2,822,657	592,112	848,257	4,263,028	1.51
Labor Income	2,536,488	367,546	400,097	3,304,130	1.30
Jobs	184.3	12.8	16.5	213.6	1.16

The retail offsets are contained in Table 16. The reader will immediately notice that the values lost to the grocers is much less than the gains made to the direct sellers. The differences take some explaining. When we do input output analysis at the retail level we only look at the regional margins, not the gross sales. The margins of the grocers for $9.113 million in sales were $2.5 million. The difference is the cost of the goods sold. Stated differently, the value of the delivered commodity reflects the payments to the producer, the payments to the processor, and the payments to the transporter and wholesaler. Those payments are external to this economy, in the main, so the only economic activity taking place within the region is the marginal activity at the grocer: all of the operational costs the retailer must bear – rents, utilities, labor, etc. – to be in business.

The regional margins to the producer-sellers are greater. We must assume that they are paying for regional transportation services and regional warehousing activity as part of their cost of operation. Net savings on transportation and storage is next reflected in higher returns to ownership. Accordingly, the lost margins to the retailers are less than the marginal gains to the new producer-sellers. In short, the producer-seller configuration assumes that much more of the economic activity that would have been margined outside of the region is captured within the region and absorbed as costs by the farmer / retailers.

The losses, in total, to the regional grocery store operations would, once multiplied through cost 67 jobs making $1.27 million in labor income. In all, the regional reduction in industrial output would be $3.39 million.

Table 16. Total Economic Offsets of Existing Grocers' Lost Sales

	Direct	Indirect	Induced	Total	Multiplier
Output	-2,506,187	-351,831	-536,907	-3,394,925	1.35
Value Added	-1,443,576	-183,057	-318,801	-1,945,435	1.35
Labor Income	-1,009,782	-113,636	-150,173	-1,273,591	1.26
Jobs	-56.3	-3.9	-6.3	-66.5	1.18

Table 17 nets the two tables. Considering the losses to the grocery stores, the region gains 128 new direct jobs, which in turn generate net new regional demand for inputs that will sustain nearly 9 jobs. When all of those workers spend their paychecks in the region on household goods and services they will help support 10 more jobs. In total, the producer-seller scenarios will be expected to generate $5.44 million in new regional output, $2.7 million in value added, $2.03 million in labor incomes, and 147 jobs.

Table 17. Net Regional Economic Effects of Producer / Seller Markets After Considering Lost Sales To Grocery Stores

	Direct	Indirect	Induced	Total	Multiplier
Output	3,763,813	786,863	895,330	5,446,006	1.45
Value Added	1,755,712	409,055	529,456	2,694,223	1.53
Labor Income	1,526,706	253,910	249,924	2,030,539	1.33
Jobs	128.0	8.9	10.2	147.1	1.15

Step 4. The Regional Economic Value of Processing Industries

This step differs from the activity in Step 3. There we anticipated the development of a reasonably viable direct selling configuration that allowed, with a minimum of processing, the direct sale of locally grown produce. There are components of this diet, however, that require processing. In short, while a notion of some kind of local market activity might seem appealing, the fact remains that except for egg production and distribution, the remaining elements of the diet require modern factory systems to process and distribute to regional retailers.

There were discussions on configuring this portion of the project that looked at the reasonableness of local dairies, butcher – locker plants, and bakeries and other grain processing operations with the idea of identifying the potential for new business activity in the region. While this may sound good from a local foods development perspective, the fact remains that regional consumers already receive a substantial amount of their meat products either directly or indirectly from local suppliers. In addition, one could argue that, in terms of consumer welfare, the distribution of the remaining elements of the diet to Iowans is done more efficiently than nearly anywhere else in the nation; therefore consumers' welfares are quite high. In short, it is hard to imagine intermediate commodity processing that yielded as much commodity as cheaply to consumers as is the current configuration of meat, poultry, dairy, and egg distributions in Iowa, irrespective of the region's position.

Arriving at no particularly satisfactory solution to this issue, the overall value of the processing of the remainder of the diet was calculated. This is a very straightforward exercise that identifies what would be the value to the region were the entirety of the nonseasonal components of the diet processed in the region. It is assumed that the entirety of the agricultural value added processing of the beef, pork, dairy, egg, poultry, and whole grain portions of the diet were produced in the region.

Two industries, fluid milk processing and cereal manufacturing, were not in evidence and had to be manually added to the model. The remaining animal slaughter, processing, rendering, and baking sectors were in evidence. The size of the industries was determined using national industrial output per capita in the industries multiplied times the regional population. An additional adjustment offset the value of U.S. production for exports of these commodities and the difference in this regional diet from overall national total consumption per capita.

Table 18 contains the results of the analysis. On a current value of production basis, were the commodities in the diet processed in total in the region, they would yield the following economic effects: 188 jobs in all making $7.42 million in labor incomes would generate nearly $90 million in output (sales). In producing those sales, the firms would buy $78.34 million in inputs, thereby supporting an additional 527 jobs making $11.8 million in incomes. Here we see that the value of inputs is actually higher than the value of the direct industries. That is because these industries are generally quite capital intensive. After the workers spend their paychecks, they induce $9.24 million in sales requiring almost 107 workers making $2.6 million in labor income.

Table 18. Total Processor Economic Effects

	Direct	Indirect	Induced	Total	Multiplier
Output	89,922,616	78,335,768	9,239,205	177,497,584	1.97
Value Added	11,289,992	20,613,118	5,469,879	37,372,988	3.31
Labor Income	7,417,627	11,779,540	2,581,225	21,778,392	2.94
Jobs	188.0	527.1	106.6	821.7	4.37

The indirect values in Table 18 need to be adjusted, however, for the value of the locally supplied inputs that are found in Table 10 above. As we do not want to, in the final table, double count values that have already been accounted, we subtract existing input values and then recalculate the table. Those findings are in Table 19. After than adjustment, the direct values remain unchanged, but the indirect values reduce to $35.7 million in non-agricultural inputs that require 251 jobs making $6.6 million in labor incomes. Induced sales amount to $6.7 million, requiring 77 jobs. In total, the processing activities, after accounting for all production, is worth $89.7 million in output, $26.02 million in value added, of which $15.9 million is labor income to 516 jobs.

Table 19. Total Processor Economic Effects After Removing Producer Effects

	Direct	Indirect	Induced	Total	Multiplier
Output	89,922,616	35,701,101	6,695,185	132,318,902	1.47
Value Added	11,289,992	10,767,855	3,959,655	26,017,502	2.30
Labor Income	7,417,627	6,611,102	1,869,980	15,898,709	2.14
Jobs	188	251	77	516	2.74

The region already produces a very large amount of meat products with production deficits in evidence only in fluid milk production, bakery products, and in cereal manufacturing. On an import substitution basis, there is an argument for the development of these industries to enhance regional production and incomes. The remaining processing sectors, however, produce significantly in excess of local demand, so there is no local need that is unmet.

When we look at the job requirements in each contributing industry constituting the processors in Table 19, we find that 78 jobs are required specifically in the fluid milk, baking, and cereal industries to process the remaining nutritional needs. Re-running the model with just those jobs in those industries yields the potential processor net gains to the region. In Table 20 we find that the net new 78 processing jobs pay $3.08 million in labor income, require the labor of 104 indirect non farm jobs making $2.74 million, which combined supported another 32 induced jobs making $775,843. In total, the value of new processing to meet the nutritional goal would multiply through and sustain $76.91 million in additional regional output, $10.8 million in value added, of which $6.6 million would be paid to 214 jobs.

Table 20. Total Processor Economic Effects After Removing Producer Effects and Accounting for Existing Processing Employment

	Direct	Indirect	Induced	Total	Multiplier
Output	53,061,203	21,066,373	2,777,790	76,905,365	1.45
Value Added	4,684,146	4,467,514	1,642,836	10,794,496	2.30
Labor Income	3,077,526	2,742,904	775,843	6,596,273	2.14
Jobs	78	104	32	214	2.74

By the methods deployed in this analysis, we can accumulate the net increments to regional productivity by summing the values in Tables 14, 17, and 20. Added together they produce the amounts found in Table 21. A total of 229 direct jobs in production, retail, and processing making $5.98 million in labor income would require 127 jobs making $3.37 million producing inputs. When labor incomes were converted to household consumption they would need another 52 jobs making $1.255 million. In all, this nutritional goal could potentially amount to $90.88 million in total industrial output, $17.3 million in value added, of which $10.6 million would be labor income accruing to 408 job holders in the region.

Table 21. Total Economic Impacts: Production, Retail, and Processing After Considering Existing Production, Processing, and Retail Offsets

	Direct	Indirect	Induced	Total
Output	63,376,615	22,968,926	4,536,882	90,882,425
Value Added	9,241,043	5,422,519	2,644,577	17,308,139
Labor Income	5,978,287	3,366,674	1,255,207	10,600,167
Jobs	229	127	52	408

Conclusion

A pretty good question right now might be: what does this all mean? The simple answer is that this is all supposed information designed to simulate the value of a healthy diet that was met in significant part by local production. The values contained in Table 21 help us to understand the kind of regional income and job gains that would be realized were the region to accomplish all of its local food production and local diet objectives.

The next question might be: what do we do with this information? These statistics, again, are simulations. They are designed to help growers, promoters, and state officials understand that there is intrinsic economic gain to be achieved from local foods production. The question of whether households in the region are, on average, economically better off from one form of goods production and distribution or another, is not addressed. We only look at the value of production shifts within an economy.

Is it realistic to assume that, were NE Iowans to move towards the recommended diet, there would be concomitant increases in local foods production? Is it reasonable to assume that the development of and the shift away from local grocers to farmer / retailers is possible? Can we envision a systematic reorganization of thinking and patterns of exchange that are less externally focused and more internal? And ultimately, are there costs to this type of shift that are not identified?

There are strong economic forces at work that have, over time, decided where production centers for different commodities locate in this country. There are also policy decisions at the state and national levels that accentuate those regional production specializations and protect and perpetuate them. There are also emerging issues that may portend change and a slow evolution in the nature of food production and distribution. Emerging high energy costs coupled with high primary commodity and food costs may lead to patterns of different decisions and conclusions about food production, processing, and distribution.

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