The Economic Impacts of Increased Fruit and Vegetable Production and Consumption in Iowa: Phase II

Prepared for the
Regional Food Systems Working Group
Leopold Center for Sustainable Agriculture

by
Dave Swenson
Economics Department- Iowa State University

May 2006

This report was reviewed and edited by:
Rich Pirog, Marketing and Food Systems Program Leader – Leopold Center for Sustainable Agriculture – Iowa State University
Angie Tagtow, MS, RD, LD - Iowa Department of Public Health, Bureau of Nutrition & Health Promotion
Mary Adams, Editor, Leopold Center for Sustainable Agriculture

For more information, contact:

Rich Pirog
rspirog@iastate.edu
515 294-1854

Dave Swenson
dswenson@iastate.edu
515 294-7458

Abstract

This report measures the potential net economic impacts that could accrue to the state of Iowa were it to achieve various levels of fruits and vegetable production *and* direct and grocery sales to consumers. Two of the scenarios anticipate expanded Iowa production of 37 fruits and vegetables so that they substitute directly for existing imported commodities for a quarter of the year. Both scenarios add a new industry where farmers directly market their production to consumers. Scenario one assumes that the entire increment to production is directly marketed, while the second assumes that half of the production is directly marketed. The third and fourth scenarios examine the economic impact that would occur under a consumption-based consideration where all Iowans followed a diet including five or seven servings of Iowa-grown fruits and vegetables per day for three months of the year. These scenarios proceeded with the assumption that half of the increase in production would be directly marketed and the other half would be sold at the wholesale level using conventional means.

All scenarios carefully offset economic losses that primarily would accumulate to corn and soybean farming and from the existing Iowa fruit and vegetable retailing sectors (primarily grocery stores). The scenarios also accounted for existing fruit and vegetable production in order to determine net potential regional or statewide economic gains. The study determines conclusively that, given the scenarios, there is the potential for substantial economic development to occur through import substitution. These gains are realized at the producer level as the amount of industrial output and value added per acre increase markedly in fruit and vegetable production as compared to conventional agricultural practices. These gains also are realized at the direct marketing level because payments made to the new direct marketing sector would, in the main, stay in Iowa rather than migrating to other fruit- and vegetable-producing states and distributors.

Note: The author and reviewers of this paper want to acknowledge Karen Jetter, James A. Chalfant, and Daniel Sumner for their groundbreaking work in 2004 linking potential economic gains for California fruit and vegetable growers with increased levels of fruit and vegetable consumption. Their research served as an inspiration for part of this study. For more information on this California study, go to http://aic.ucdavis.edu/pub/briefs/brief27.pdf

Introduction

This report examines the magnitude of economic change that might accrue to the state of Iowa were it to increase its production of selected fruits and vegetables. The scenario presupposes two things: first, that fruit and vegetable production levels in Iowa increase to satisfy certain levels of existing demand, and second, that all or half of those increments to fruit and vegetable production are directly marketed to Iowa household and business consumers by the actual producers. On net, an increase in the production of fruits and vegetables will have a positive effect on the Iowa economy because much of the state's fresh fruit and vegetable consumption are based on out-of-state sources. By substituting in-state production for out-of-state purchases, money that otherwise would have left the state remains in the state. Keeping money in the state is desirable because money that leaves the state rarely returns. Money that remains in the state has a stimulative or multiplier effect on the whole economy. We call that kind of economic impact *import substitution*.

Data and methods

Two primary sources of data and technology were employed for this assessment. The first is the underlying data in the *Iowa Produce Market Potential Calculator*[1], a model developed and deployed by the Leopold Center for Sustainable Agriculture and Iowa State University's Center for Transportation Research and Education for estimating different configurations of fruit and vegetable production opportunities in Iowa and in its 99 counties. This model is derived from a baseline data set that estimates levels of fruit and vegetable production in Iowa, overall demand, prices received by farmers and retailers, and other data or factors pertinent to the analysis.

The second source of data and technology is the IMPLAN modeling system for the State of Iowa. This data set consists of inter-industrial transactions for more than 400 Iowa industries. In specific, and in the case of this study, it already contains both a vegetable and melons production sector and a fruit and fruit tree sector. In short, it contains estimates of the interactions that those sectors have with the rest of the Iowa economy, and the model can be used to simulate what happens to the Iowa economy when we change production levels in those agricultural sectors, along with changes that may be made to other components of the economy.

Four scenarios are assessed in this study:

[1] For information on the assumptions made and limitations in use of the Iowa Produce Market Potential Calculator, go to http://www.leopold.iastate.edu/research/calculator/home.htm

1. The first supposes that 25 percent of 37 fruits and vegetables consumed by Iowans over a calendar year are grown and directly marketed by Iowa farmers.
2. The second supposes that of the 25 percent of 37 fruits and vegetables consumed by Iowans and grown and distributed by Iowa farmers, half (12.5 percent) is actually directly marketed and the other half (12.5 percent) is sold to wholesalers and will flow into conventional direct distributors (grocery stores).
3. The third scenario imagines that all Iowans followed a diet including five servings of fresh fruits and vegetables a day, and that for three months of the year all of these servings of fruits and vegetables were grown by Iowa farmers, and half of the produce items were directly marketed by Iowa producers.
4. The fourth scenario imagines that all Iowans follow a diet including seven servings of fresh fruits and vegetables a day, and that for three months of the year all of these servings of fruits and vegetables were grown by Iowa farmers, and half of the produce items were directly marketed by Iowa producers.

Most of the technical and procedural steps that are employed in scenario 1, below, apply to the other three scenarios. Consequently, the description of scenario 1 contains nearly all of the pertinent documentation of research assumptions, steps, and limitations of the research, and these will not be repeated in describing the last three scenarios.

Scenario 1

This scenario imagines an increase in Iowa's production of sets of fruits and vegetables to a point where 25 percent of 37 selected fruits and vegetables consumed in the state over a calendar year are grown and marketed by Iowa farmers.

Primary Assumptions:

- Increased production in fruits and vegetables will reduce corn and soybean production,
- Prices reflect sales of conventional rather than organic produce,
- All new fruit and vegetable sales would be farmer to consumer (direct-market) sales,
- Existing food store retail sales (actually retail margins for the stores; loss in sales by farmers from other states/countries is not accounted for in the model) will be reduced by an amount proportionate to coincide with the new direct market sales,
- All of the production to meet this goal of 25 percent is for in-state consumption, and
- The following commodities are used for the analysis:

Apples, Apricots, Asparagus, Beans (Snap),Blackberries, Blueberries, Broccoli, Cabbage, Cantaloupes, Carrots, Cauliflower, Cherries, Cucumbers, Eggplant, Garlic, Grapes, Greens/Collards, Lettuce (Head), Lettuce (Leaf), Nectarines, Okra, Onions, Peaches, Pears, Peppers (Bell), Plums, Potatoes (Fresh), Potatoes (Sweet), Pumpkins, Radishes, Raspberries, Spinach, Squash, Strawberries, Sweet Corn, Tomatoes, Watermelons

Data Transformations and Secondary Assumptions

Estimates of per capita consumption of 37 selected fruits and vegetables are contained in the *Iowa Produce Market Potential Calculator*. Adjustments in that data set are made for produce shrinkage (farm weight is higher than retail weight) from farm to consumer, and the prices received by producers and by retailers are specified. In addition, expected yields per acre in Iowa are estimated per fruit and vegetable commodity to ascertain the amount of land needed to grow the produce. Finally, the model estimates the amount of current Iowa fruit and vegetable production.

Accordingly, in the *Iowa Produce Market Potential Calculator*, there are several data sets estimated per commodity assessed that are pertinent to our analysis:

- Farm Pounds. This is the total number of pounds that need to be produced by commodity type (each produce item is considered a commodity). This value is the current consumption in Iowa times the population, adjusted for shrinkage from farm to retail and from retail to customer.
- Farm Acres. As this is a production increment and the amount of land available for production in Iowa is considered fixed, an estimate of the acreage for the produce increments is needed.
- Farm Receipts. This is the farm level sales value of the produce increments so that sector gets credit for its economic contribution to the change.
- Retail Pounds. Reductions in weight and volume as products move from farm to retail.
- Retail Receipts. The sales value at the store level is the total potential value of this commodity in Iowa given existing demand.
- Corn and Soybean Offsets. In the modeling structure, the existence of land in Iowa is treated as a fixed and efficiently used factor. Land that goes into the production of fruits and vegetables has to be obtained from land that is already cropped.[2] An average of corn and soybean usage is needed to calculate offsets to production.

[2] It is assumed, given existing market conditions and the distribution of other incentives, that these scenarios replace existing commodity production (not subsidy) uses of agricultural land in Iowa.

All of the baseline data for the items above (except the corn and soybean offset calculations) were driven by the *Iowa Produce Market Potential Calculator*. The calculation of the corn and soybean offsets was made using data from the 2002 Census of Agriculture[3], within which the distribution of acres in Iowa was determined for producing each crop. Those acres then were divided into that year's output values in the IMPLAN model to identify the average output per acre for those farm commodities.

Isolating Economic Effects and Net Economic Impacts

Preparing the Model

Many people assume that all economic activity, regardless of sector, has an economic impact on the Iowa economy. Most seasoned analysts, however, reserve the use of the term "economic impact" to cases where a clear addition to regional or statewide economic product is discernible. Prior to that determination, it is more appropriate to use labels such as the "economic values" or the "economic effects." The distinction is not trivial. Many people naïvely use the findings of input-output studies, usually reduced to a multiplier value, to infer broad-based causality without engaging in the very painstaking task of sorting out what truly is and truly is not caused by some level of production change in a specific sector.[4] Input-output multipliers indicate neither. Instead they produce ratios that describe the extent to which one industry or set of industries links with other industries in the region of scrutiny.

Input-output systems are neither black boxes nor are they static systems. The proper use of these highly powerful and useful analytic tools involves scrutinizing the baseline data that are contained in the model, modifying those data where appropriate, amending assumptions about the relationships of different kinds of firms in the model, and, if needed, manually introducing sectors into the economy that otherwise might not exist in a region.

The IMPLAN modeling system for Iowa that is maintained at ISU already contains both a fruits and fruit tree sub-sector and a vegetable and melon farming sub-sector in its baseline accounts for the state of Iowa. The data that are in the model, then,

[3] http://www.nass.usda.gov/Census_of_Agriculture/index.asp

[4] Modeling systems are relatively inexpensive to purchase, as are the annual data updates that users purchase. They, too, are increasingly user-friendly, and one need not know very much about regional industrial structures to operate them. There are scores of "economic impact" studies that are produced by consultants and by university-based service organizations that are often, at best, simply the printing of the default statistics of the modeling systems. As a consequence, many, if not most, economic impact studies produced for communities and for companies in Iowa and in other states generally are not well prescribed and described. Any consumer of "economic impact" information is, at the outset, advised to be highly skeptical of the results.

represent the weighted average values of production characteristics for these two areas of analysis. Iowa produces relatively low amounts of many of the fruits and vegetables that are contained in Scenario 1. As a consequence, by relying on the statewide values that are in the modeling system, the production functions are biased towards existing Iowa fruit and vegetable commodities instead of the much more diverse schedule supposed in this exercise. There are, however, very few cost-of-production itemizations available for application to the state of Iowa. Lacking that specificity, the values utilized in this model are highly reflective of national averages, but remain weighted towards existing production in the state (e.g., apples, sweet corn, melons, cantaloupes, tomatoes, etc.).

The model also requires another very important modification by supposing that the producer-farmers also become seller-farmers. This means that a direct marketing network is set up so that farmers, via this producer-owned network, market their goods directly to households and other final consumers. This requires fashioning in the model a new industry that in the main does not exist in the state, or if it does exist is subsumed wholly within other sectors of the economy. To accomplish this, a separate direct marketing function was created within the model to complement the fruit and vegetable farming sectors. In so doing, it is not assumed that a buyer-seller relationship exists between market and producer. Instead, it is assumed that the direct marketing activity is a value-added enhancement to production and that ownership of the produce does not change from the farmer until it reaches the consumer. By so doing, the two sectors are allowed to interact separately and without duplication with their respective supplying sectors and, importantly, without interfering with each other in the modeling structure or the modeling mathematics.[5], [6]

[5] The modeling system for Iowa contains well over 400 industrial classifications. A new sector is introduced by using the unused Iowa tobacco farming sector, introducing basic assumptions about the industry, and adding expected technical coefficients for purchases in the local economy and for payments to production factors. In this example, national fruits and vegetable retail store statistics for the United States were used to identify expected payments to value added by the new sector were used. Technical coefficients, the local purchasing of inputs, were determined by averaging purchases by existing food stores and by other miscellaneous retailers. These baseline values were discerned from the existing Iowa model and were further modified to reflect the dependence this new sector would have on Iowa-based warehousing, cold storage, and transportation systems instead of, like grocery stores and existing producer warehouses, largely out-of-state sources for these necessary inputs. Once modified, the model is re-balanced to account for the existence of the new industry. The new industry does not skew the baseline model as only one job and one job's worth of production are introduced into the modeling system initially.

[6] The farmers markets would be year-round, self-contained facilities dispersed strategically across the state. The paradigm was the distribution of state-run liquor stores that existed in Iowa up until the mid-1980s. It was imagined that the direct sales facilities would be distributed similarly across the state.

The modeling system contains both a grain crop and an oilseeds sector. For Iowa, the vast majority of economic activity in these categories is in corn or soybean production. In the assessment, when fruit and vegetable production are increased, more land is needed for production, so corn and soybean production acres are concomitantly reduced (offset) in the state. Cropland acres are treated as fixed amounts in this and subsequent scenarios. That means that any increase in vegetable or fruit production has to come at the expense of acreage in corn and soybean production. The *Iowa Produce Market Potential Calculator* determines the expected acreage needs of the different scenarios. Grain and oilseeds production are offset in the model by the weighted acres of both crops in the state. The output values per acre of production that are in the model are used as opposed to gross receipts statistics for grain marketing because of the very pervasive and significant amount of federal financial support enjoyed by farmers. The IMPLAN modeling system attempts to allocate those public payments to the appropriate production sector in the Iowa economy.

The last sectoral consideration is relatively basic and is accomplished by the IMPLAN model itself. When production is shifted away from retail food stores towards farmer-owned direct marketing structures, store sales are reduced and brand-new sales are added to the direct marketing sector. Households don't change what they purchase or the amount that they spend, but they change *where* they purchase. This scenario changes where the produce is both grown and distributed. Consequently, the stores do not lose the gross amount of sales, they lose the standard margins that they would assign to those sales. Those margins pay indirect costs and the value-added payments to labor, store owners, and investors. The modeling system is adjusted to acknowledge a shift in sales at the household level away from the retail sector. The modeling system, subsequently, figures out the change in margins and enters that into the calculations as an offset.[7]

Scenario 1: Direct Economic Values

This scenario supposes that a quarter of the state's present consumption of 37 fruits and vegetables is produced in Iowa and sold directly to Iowans. Table 1 below itemizes by subtotal for fruits and vegetables the various direct changes in economic activity

[7] Input-output modeling systems treat retail sales much differently than other sectors of the economy. For stores such as grocery stores, the system does not add to the sector's output the cost of goods sold. Instead, all of those transactions are statistically allocated to warehouses, distributors, manufacturers, and other food producers – enterprises that add value to the product along the distribution production and distribution chain. Grocery stores' industrial output, then, is simply the value of their margins. This prevents the accounting of production-to-wholesale-to retail system of goods distribution from resulting in significant, confusing, and needless double counting.

that would occur in the Iowa economy were this scenario realized. At the outset there would be an increase in production and receipts for Iowa farmers growing fruits and vegetables. Iowa farmers would use almost 15,400 acres of cropland to produce 186.9 million pounds of commodities worth $37.1 million. In utilizing this land, the farmers would forego just over $4 million in receipts from corn and soybean farming. By direct marketing their crops, Iowa farmers need to realize the difference between their farm-level market price and the total retail value of the commodities. Hence, Iowa farmers would be expected to realize $99.5 million in direct marketing receipts, which are directly offset by a reduction of sales of this commodity from the retail sector. Accordingly, the expected margin mark-up from the retail sector that would have accumulated to them is reduced because the farmers sold $136.5 million worth of fresh fruits and vegetables ($37.1 million at the farmers' level + $99.5 million at the direct market level = Total Retail Value of $136.54 million).

Table 1

Production and Retail Assumptions for Scenario 1

Scenario 1			
	Fruits	Vegetables	Total
Farm Pounds	31,903,024	154,976,807	186,879,831
Farm Acres	4,881	10,508	15,389
Farm Receipts	8,921,120	28,149,128	37,070,249
Retail Pounds	26,450,359	126,047,947	152,498,306
Gross Retail Receipts	31,217,012	105,322,688	136,539,699
Retail Margin Offset	(8,584,678)	(28,963,738)	(37,548,416)
Corn Offset	(785,053)	(1,690,176)	(2,475,228)
Soybean Offset	(486,896)	(1,048,260)	(1,535,155)
Direct Marketing Output	22,295,891	77,173,559	99,469,451

When these value categories are entered one-by-one into the input-output modeling system, the following sets of initial or direct expected net values are realized. Total industrial output, a measure of the sales value of the economic activity, would increase by $94.98 million in Iowa. To produce and distribute this output, workers and sole proprietors of farms and other establishments would see a net increase in their labor

incomes of $40.6 million. Finally, this whole process would directly support 1,556 jobs in the economy.

Table 2
Net Direct Economic Activity from Scenario 1

Total Industrial Output (Sales)	94,980,897
Labor Income	40,582,799
Jobs	1,556.1

These values, however, are only part of the picture. All of the aforementioned additions and offsets to the economy necessarily involve linkages with other industries. At any point in the scenario, when production levels are changed, there are multiplied-through impacts on other sectors of the economy. To measure these effects, the input-output modeling structure is used.

Producing the Estimates

Each addition and offset to the Iowa economy indicated in Table 1 was run separately through the modeling system so that each change in economic activity could be accounted independently.

The summary tables that are produced from the modeling system contain the industrial output values, jobs, and labor incomes pertinent to the analysis as follows:

- *Industrial output* is the sales value of production in the economy.
- *Labor income* represents all of the payments to labor in the forms of wages, salaries, and cash-like benefits (medical insurance, retirement contributions, etc.) as well as normal returns to sole proprietors for their labor and management.
- *Jobs* refer to the number of positions in a sector, not the number of employed persons. Because many people have more than one job, there are always more jobs than employed persons in any economy. In addition, there are significant qualitative differences among the different sectors. Jobs in manufacturing are much more likely to be full-season, full-time jobs. Many jobs in retail and in the personal services sector may be part-time or seasonal.

The tables also isolate the different economic values that accrue in the measurement process. First, the model isolates the direct values. *Direct values* refer only to the firm

or the industry that we are studying. It refers to that industry's output, jobs, and the total labor income earned by the jobs in that industry alone. *Indirect values* are the sales that are made as intermediate inputs to the direct industry that under study. For example, fruit and vegetable production requires the purchase of intermediate inputs like machinery, seed, fertilizers, fuel, utilities, repair services, legal and other financial services, transportation, and other essential inputs. These intermediate sales are summarized as indirect effects. Finally, when workers in the direct industry and in the industries that supply inputs to the direct industry take their labor income and convert it to household-level purchases, they *induce* another round of economic activity in an area. The *total economic value* is the sum of the direct, indirect, and induced rounds of economic activity.

Finally, the model also produces multipliers for industrial output, labor income, and for jobs. Multipliers are simply the quotient of the total economic values divided by the direct values. They indicate by what magnitude the rest of the economy is linked to sales, labor income production, or the jobs that are found in the direct sector.

Total Economic Values

Tables 3 through 8 itemize by transaction how Scenario 1 would affect the Iowa economy. The direct industrial output value of this level of production of fruits and vegetables would be worth $37.1 million, would sustain 190 production jobs in this sector, and would pay those workers/farmers $9.63 million in total labor income. To grow those crops would require $9.0 million in inputs produced by 124 workers earning a total of $3.3 million in labor income. When workers in the direct and indirect sectors spent their earnings, they would induce $9.5 million in sales, requiring another 120 workers making $3.1 million. The total economic activity associated with this amount of production in the agricultural sector links to $55.6 million in total sales and $16 million in statewide labor income supporting 434 jobs.

This table also lists multipliers. The output multiplier of 1.5 means that for every dollar of output in the direct industry (fruit and vegetable farming), $.50 of output is supported in the rest of the economy. The labor income multiplier of 1.66 means that for every dollar paid in labor income in the direct industry, $.66 of labor income is supported in the indirect and the induced sectors of the economy. The jobs multiplier of 2.28 means that for every job in the direct sector measured, 1 and 28/100th of a job is supported in the remaining economy.

Table 3

Fruit and Vegetable Farming Economic Impact – Scenario 1

Fruit and Vegetable Farming	Direct	Indirect	Induced	Total	Total Multiplier
Total Industrial Output	37,070,248	9,007,737	9,515,237	55,593,224	1.50
Labor Income	9,629,401	3,319,123	3,056,805	16,005,329	1.66
Jobs	190.1	123.7	119.9	433.7	2.28

In order to offset the fruits and vegetables expansion, a reduction in corn and soybean production is warranted. Those values are found in Table 4. The land required to produce the increased fruits and vegetables comes at the expense of soybean and corn farming. That production shift would result in a reduction in agricultural output in the soybean and corn sectors of $4.01 million, the production of which required 42 jobs earning $1.11 million in labor income. That level of production called for $1.26 million in inputs, which necessitated 14 more jobs making $406,060 in income. The direct and indirect job-holders' lost income would have translated into $1.134 million in reduced household purchases, which would have further reduced 14 jobs and $364,400 in income. Total off-setting effects would have been $6.4 million in output, $1.88 million in labor income, and nearly 71 jobs.

Table 4

Grain and Soybean Offset – Scenario 1

Grain and Soybean Offset	Direct	Indirect	Induced	Total	Total Multiplier
Total Industrial Output	(4,010,383)	(1,261,203)	(1,134,362)	(6,405,948)	1.60
Labor Income	(1,107,308)	(406,059)	(364,417)	(1,877,784)	1.70
Jobs	(41.8)	(14.3)	(14.3)	(70.5)	1.69

Next is the addition of economic activity to the Iowa economy that would accumulate by producer-owned direct market outlets. Those values are in Table 5. First, it is not assumed that this sector purchases the produce for sale from the farmers. This sector is treated as if it is linked to, yet still accounted for separately from the production sector. Artificial transactions between producer and direct-marketers are not created, instead the supposition is that the direct marketing costs (including returns to the marketers) accrue after the producers receive full payment for their crops as producers.

The total net direct industrial output in this sector is expected to be $99.5 million, which would support 2,342 jobs making $49.49 million in labor income. This industry would require an estimated $25.76 million in inputs, requiring an additional 255 jobs

making $8.6 million in income. The direct and the indirect workers would induce $42.65 million in output, paying $13.7 million to 538 job-holders. Total economic activity for the Iowa economy would be $167.88 million in output, $71.8 million in labor income, and 3,135 jobs.

Table 5

Direct Marketing Economic Impact – Scenario 1

Direct Marketing	Direct	Indirect	Induced	Total	Total Multiplier
Total Industrial Output	99,469,448	25,760,500	42,646,762	167,876,710	1.69
Labor Income	49,492,352	8,566,843	13,700,431	71,759,627	1.45
Jobs	2,341.7	255.4	537.5	3,134.7	1.34

The last step is to account for the value of the reduced sales that this scenario would entail for the existing food stores component of the Iowa economy. The retail value of this scenario, as described in Table 1, was $136,539,699, but as has already been described, the marginal output change associated with that reduction in sales must be calculated. Those values are in Table 6. The margined reduction in output to the retail sector is $37.55 million. That amount of margined sales supported 934 jobs making $17.43 million in income. Those margined losses resulted in an indirect reduction in output of $5.85 million, which reduced jobs in supplying industries by 65 and incomes by $2.05 million. Induced losses were $13.7 million, yielding 173 more lost jobs and $4.41 million in additional labor income declines. The total effects would be $57.1 million in reduced output, $23.9 million in labor income, and 1,172 jobs.

Table 6

Food Retail Offset – Scenario 1

Retail Offset	Direct	Indirect	Induced	Total	Total Multiplier
Total Industrial Output	(37,548,416)	(5,848,227)	(13,716,190)	(57,112,831)	1.52
Labor Income	(17,431,646)	(2,049,468)	(4,406,414)	(23,887,528)	1.37
Jobs	(933.9)	(65.3)	(172.9)	(1,172.1)	1.26

All of these separate treatments can be added together to estimate a net economic effect. Those values are in Table 7. The direct economic amounts from all four treatments would be the equivalent of $95 million in direct output, 1,556 jobs, and $40.6 million in labor income. These net direct values are accumulating to the fruit and vegetable farmers' labor or to the activity of direct marketing to consumers. This net direct output increase is linked indirectly to $27.7 million in sales, requiring 300

jobs making $9.4 million. Direct and indirect worker spending induces $37.3 million in output, supporting 470 jobs and nearly $12 million in income. In total, all of the net values to the economy attributable to this scenario would be worth $159.95 million in output, $62 million in labor income, and 2,326 jobs.[8]

Table 7

Total Economic Effects – Scenario 1

Total Economic Effects	Direct	Indirect	Induced	Total
Total Industrial Output (Sales)	94,980,897	27,658,807	37,311,447	159,951,155
Labor Income	40,582,799	9,430,439	11,986,405	61,999,644
Jobs	1,556.1	299.5	470.2	2,325.8

Table 7 isolates the total economic value of all of the production additions or deletions to the Iowa economy in the abstract. Fruit and vegetable production in Iowa and those values need to be taken into account in the assessment process. This is a very important step because it is the last procedure in isolating the net increment to Iowa's economic production that could be attributed the fulfillment of this scenario. By so doing and declaring that net economic increment in production to be pure import substitution, it can be concluded that the net changes, accounting for existing production, represent estimates of the potential positive economic impacts for the state of Iowa.

Table 8 accounts for local production or local supply of fruits and vegetables. Once done, we find that the direct economic impacts yield $83.1 million in net new direct output, $35.5 million in direct labor income, and 1,358 direct jobs. To produce these sales would require a net increase in indirect sales of $24.2 million, utilizing 262 jobs earning $8.25 million. Induced household sales in Iowa would increase by $32.62 million, necessitating 411 more jobs and $10.5 million in income. Total potential statewide economic impacts would be $139.9 million in output, 54.2 million in labor income, and 2,032 jobs.

[8] This table is the sum of the previous four estimates; hence, a column of multipliers would be misleading.

Table 8

Total Economic Effects – Accounting for Existing Production – Scenario 1

	Direct	Indirect	Induced	Total
Total Industrial Output	83,090,335	24,192,384	32,615,679	139,898,402
Labor Income	35,467,985	8,250,353	10,477,877	54,196,216
Jobs	1,358.4	262.1	411.0	2,031.5

Scenario 2: Reduce Direct Marketing Amount by 50 Percent

This scenario contains all of the production information in Scenario 1, but it makes one modification in the distribution of that production. While we still suppose that 25 percent of 37 fruits and vegetables consumed by Iowans are grown by Iowa producers, it differs from the previous example in that half of that production is directly marketed to consumers and the other half is sold to wholesale distributors to distribute via conventional sales (i.e., grocery stores).

There are two basic adjustments that are made to the model as a consequence: the value of all direct sales is halved, and the margined losses to retail grocery stores are halved. These changes are displayed in Table 9. Once the model is initially constructed, all inter-industrial relationships and transactions are fixed and linear unless there is a reason to alter inter-industrial production coefficients. This scenario does not require a modification of the model, just assumptions about the flow of this produce to the consumers: half flows via direct-market sales and half flows via conventional distribution systems. Accordingly, all of the aforementioned procedures and terminology do not change.

Table 9
Production and Retail Assumptions for Scenario 2

Scenario 2			
	Fruits	Vegetables	Total
Farm Pounds	31,903,024	154,976,807	186,879,831
Farm Acres	4,881	10,508	15,389
Farm Receipts	8,921,120	28,149,128	37,070,249
Retail Pounds	26,450,359	126,047,947	152,498,306
Gross Retail Receipts	31,217,012	105,322,688	136,539,699
Retail Margin Offset	(4,292,339)	(14,481,869)	(18,774,208)
Corn Offset	(785,053)	(1,690,176)	(2,475,228)
Soybean Offset	(486,896)	(1,048,260)	(1,535,155)
Direct Marketing Output	11,147,946	38,586,780	49,734,725

Table 10 itemizes the different changes that accumulate through the model given this scenario change. The economic values for the new fruit and vegetable farming activity and for the grain and soybean offsets do not change from the previous scenario. What does change is the amount of expected economic activity that would accumulate to producers and to the Iowa economy were half of this increased production direct marketed and the remaining half sold wholesale and distributed conventionally. Hence, the direct marketing sector's direct values are reduced to $49.73 million in sales that would generate $24.75 million in labor income for 1,171 jobs. Working those values through the indirect and the induced sectors yields a total modeled output increase of $83.94 million, $35.9 million in labor income, and 1,567 jobs.

These gains were offset by the still reduced margined sales in grocery stores. These margined losses are $18.8 million in direct output, yielding a reduction in the demand for 467 retail workers making, collectively, $8.72 million. Working these offsets through the indirect and induced sectors produces $28.6 million in output reductions, $11.94 million in labor income reductions, and 586 fewer jobs.

Table 10

Economic Effects Details for Scenario 2

	Direct	Indirect	Induced	Total	Total Multiplier
Fruit and Vegetable Farming					
Total Industrial Output $	37,070,248	9,007,737	9,515,237	55,593,224	1.50
Labor Income $	9,629,401	3,319,123	3,056,805	16,005,329	1.66
Jobs	190	124	120	434	2.28
Grain and Soybean Offset					
Total Industrial Output $	(4,010,383)	(1,261,203)	(1,134,362)	(6,405,948)	1.60
Labor Income $	(1,107,308)	(406,059)	(364,417)	(1,877,784)	1.70
Jobs	(42)	(14)	(14)	(71)	1.69
Direct Marketing					
Total Industrial Output $	49,734,724	12,880,250	21,323,381	83,938,355	1.69
Labor Income $	24,746,176	4,283,422	6,850,216	35,879,814	1.45
Jobs	1,171	128	269	1,567	1.34
Retail Offset					
Total Industrial Output $	(18,774,208)	(2,924,114)	(6,858,095)	(28,556,416)	1.52
Labor Income $	(8,715,823)	(1,024,734)	(2,203,207)	(11,943,764)	1.37
Jobs	(467)	(33)	(86)	(586)	1.26

Table 11 identifies the total economic values of this scenario along with the potential economic impact after taking into consideration the amount of fruits and vegetables that already are produced in Iowa. The total direct economic values of 25 percent of 37 fruits and vegetables under this distribution change gives us $64 million in industrial output while providing $24.6 million in income to 852 workers. Considering additional indirect and induced effects, this produces $104.6 million in total industrial output, and $38.1 million in labor income for 1,345 workers.

The economic impacts indicate a declaration of the net import-substitution value of this increased production over existing levels coupled with the direct market sales consideration. Given that adjustment, 750 workers making $21.6 million in labor income directly produce $56.34 million in new output for the Iowa economy. In consideration of all other multiplier effects through the economy, those direct values result in $92.02 million in total output, $33.5 million in labor income, and 1,183 jobs.

Table 11
Total Economic Effects and Economic Impacts for Scenario 2

	Direct	Indirect	Induced	Total
Total Economic Effects				
Total Industrial Output $	64,020,381	17,702,671	22,846,161	104,569,216
Labor Income $	24,552,446	6,171,752	7,339,397	38,063,595
Jobs	852	204	288	1,345
Total Economic Impacts				
Total Industrial Output $	56,336,321	15,577,904	20,104,046	92,018,273
Labor Income $	21,605,534	5,430,986	6,458,484	33,495,004
Jobs	750	180	253	1,183

Scenario 3: A Consumption-Based Goal
Five servings of fruits and vegetables

This scenario is fundamentally different than the previous two in that it combines a consumption goal with a production goal. In this scenario, all Iowans followed a diet including five servings of fresh fruits and vegetables a day[9] and for three months of the year all of those servings of fruits and vegetables were grown by Iowa farmers. It is estimated that 19.5 percent of Iowans consume five or more servings of fruits and vegetables per day.[10] Thus, a diet including five servings a day of fruits and vegetables would create a significant demand for produce among Iowa food retailers and direct marketers.

One set of consumption recommendations for adults are for five to nine servings of fruits and vegetables per day.[11] Apples, carrots, spinach, squash and tomatoes were selected as the target fruits and vegetables for these reasons:

- Produce items can be grown easily in all Iowa counties,
- Produce items can be supplied for three months of the year (apples, carrots, and squash can be stored for extended periods after harvest, farmers can produce spring and late summer crops of spinach, tomatoes are easily grown in greenhouses),
- Nutrient density of produce items[12]

[9] Apples, carrots, spinach, squash, tomatoes
[10] 2005 Behavioral Risk Factor Surveillance System – fruit and vegetable consumption data for Iowa. Iowa Department of Public Health. Accessed at www.idph.state.ia.us
[11] Produce for Better Health Foundation. Eat 5 to 9 A Day for Better Health. Accessed at www.5aday.gov/what/index.html. U.S HHS, National Cancer Institute, and National Institute of Health

The serving size for fruits and vegetables is one-half cup.[13] Although the U.S. Department of Agriculture recommends that two servings of fruits and three servings of vegetables per day make up the five servings,[14] apples are the only fruit in this selection because most of the other fruits grown in Iowa currently are produced on very few acres or have relatively short periods of product availability. For example, Iowa pears and cherries are grown on very few acres, and strawberries are widely available in Iowa only for four to five weeks.

The calculations account for the shrinkage factors from farm weight to consumption weight for the five fresh produce items selected. As in Scenario 2, half would be marketed directly by Iowa producers. Iowans, like most Americans, are likely to get some of their servings of fruits from citrus juices such as oranges and tropical fruits such as bananas. These fruits are not included in the scenario because they cannot be grown in Iowa. However, since recommendations are for eating seven to nine servings of fruits and vegetables per day, it seems reasonable to assume that five of these servings could be supplied by Iowa-grown produce.

The amount of production associated with this scenario is much greater than in the previous two even though the variety of affected fruits and vegetables is much smaller. This scenario (Table 12) would require on-farm production of 382 million pounds of produce and would require nearly 31,800 acres of crop land. Expected farm level receipts, owing to the intrinsic market value of this mix of produce, would jump to $101.2 million. In addition, again given the mix and volume of these products, gross retail receipts associated with this scenario would be $429.7 million.

---

[12]USDA National Nutrient Database for Standard Reference, Release 18 (2005). Accessed at www.nal.usda.gov/fnic/foodcomp/search/index.html

[13] Produce for Better Health Foundation. Eat 5 to 9 a Day for Better Health. Accessed at: www.5aday.gov/what/index.html . U.S HHS, National Cancer Institute, and National Institute of Health

[14] Dietary Guidelines for Americans. Accessed at: www.health.gov/dietaryguidelines/dga2005/ report/

Table 12
Production and Retail Assumptions for Scenario 3

Scenario 3			
	Fruits	Vegetables	Total
Farm Pounds	134,845,547	247,187,159	382,032,706
Farm Acres	13,485	18,337	31,821
Farm Receipts	23,867,662	77,286,992	101,154,654
Retail Pounds	113,917,518	207,667,568	321,585,086
Gross Retail Receipts	111,061,507	318,590,823	429,652,330
Retail Margin Offset	(7,496,652)	(43,009,761)	(50,506,413)
Corn Offset	(2,168,966)	(3,816,350)	(5,985,317)
Soybean Offset	(1,345,209)	(2,366,929)	(3,712,139)
Direct Marketing Output	43,596,922	117,566,967	161,163,889

Table 13 itemizes the major components of direct, indirect, induced, and total economic change that could accumulate under this scenario. The direct value of sales to producers would be $101.15 million, which would provide labor income of $26.4 million to 492 job holders (to include the producers). Once this economic activity worked its way through the entire economy, the total economic activity would amount to $151.5 million in total output, $43.7 million in labor income, and 1,152 jobs in the economy. The loss of corn and soybean production must be accounted for in order for this horticultural production to take place on the same land. Those losses would include $9.7 million in direct corn and soybean output, reducing job numbers in those sectors by 101 and $2.7 million in labor income. Total multiplied-through losses would be $15.5 million in output, $4.54 million in labor income, and 170 jobs.

Next, the direct marketing of half of this produce through the producer/marketer retail distributorships is added. The remaining product would serve as an item-by-item substitute for produce currently imported and would be distributed to the state's existing wholesalers and, thence, to the state's retailers in the conventional manners in which goods are distributed. Under the direct marketing assumption, the farmer/distributors would realize gross sales of $161.2 million (in addition to the prices already realized as producers). These sales would require, at the volumes suggested by this scenario, 3,794 jobs and $80.2 million in labor income. When this

works through the economy, it supports total economic output of $272 million, $116.3 million in labor income, and 5,079 jobs. These gains to the economy are offset with losses in the margined economic activity at the retail level, which would multiply to amount to total output losses of $76.8 million, and $32.1 million in reduced incomes to 1,577 job holders.

Table 13

Total Economic Effects – Scenario 3

	Direct	Indirect	Induced	Total	Total Multiplier
Fruit and Vegetable Farming					
Total Industrial Output	101,154,654	24,361,712	25,994,733	151,511,099	1.50
Labor Income	26,389,490	8,941,004	8,350,902	43,681,396	1.66
Jobs	492	333	328	1,152	2.34
Grain and Soybean Offset					
Total Industrial Output	(9,697,456)	(3,049,699)	(2,742,986)	(15,490,141)	1.60
Labor Income	(2,677,568)	(981,886)	(881,191)	(4,540,645)	1.70
Jobs	(101)	(35)	(35)	(170)	1.68
Direct Marketing					
Total Industrial Output	161,163,889	41,738,065	69,097,781	271,999,734	1.69
Labor Income	80,189,247	13,880,300	22,197,919	116,267,467	1.45
Jobs	3,794	414	871	5,079	1.34
Retail Offset					
Total Industrial Output	(50,506,413)	(7,866,455)	(18,449,660)	(76,822,529)	1.52
Labor Income	(23,447,324)	(2,756,743)	(5,927,073)	(32,131,140)	1.37
Jobs	(1,256)	(88)	(233)	(1,577)	1.26

Table 14 summarizes all of the activity. Total economic effects are first. This is the total value to the economy of the components of this scenario. The total economic impacts are second. They represent the expected increment to economic activity in the state once existing production of the commodities specified in this scenario is accounted for.

Table 14

Total Economic Effects and Economic Impacts – Scenario 3

	Direct	Indirect	Induced	Total
Total Economic Effects				
Total Industrial Output	202,114,674	55,183,623	73,899,866	331,198,164
Labor Income	80,453,845	19,082,675	23,740,557	123,277,077
Jobs	2,928	624	931	4,484
Total Economic Impacts (considering existing production)				
Total Industrial Output	184,529,714	50,382,379	67,470,218	302,382,311
Labor Income	73,453,969	17,422,390	21,675,013	112,551,371
Jobs	2,674	570	850	4,094

Were this scenario completely realized it would sustain (either directly or indirectly) $331.2 million in total economic output, $123.3 million in total labor income, and 4,484 total jobs in Iowa. By way of a net increase in the state's economic activity (our economic impact) considering existing production, the values are still very large: $302.4 million in total new industrial output, $112.6 million in labor income, and 4,094 jobs.

According to the United States Department of Agriculture, the recommended number of servings of fruits and vegetables per day varies by age, gender, and activity level.[15] For example, recommendations include four servings per day (two cups) for an active two-year old male, 13 servings (6 and ½ cups) for an active 25 year-old male, 10 servings (five cups) for an active 55 year-old female, and 11 servings (five and ½ cups) for an active 70-year old male.[16] Given this range and Iowa's population distribution the target recommendation of five servings per day for Scenario 3 appears realistic, if not conservative, as an estimation for the entire population for the economic analysis.

Scenario 4 – A Consumption-Based Goal
Seven servings of fruits and vegetables per day

This scenario, similar to Scenario 3, combines a nutritional goal with a production goal. In this scenario it is suggested that all Iowans followed a diet including seven servings of fresh fruits and vegetables a day[17] and that for three months of the year all of those servings of fruits and vegetables were grown by Iowa farmers. The same reasoning was used to select these seven fruits and vegetables as was used in Scenario 3. Also as in Scenario 3, half would be marketed directly by Iowa producers.

The amount of production associated with this scenario is greater than Scenario 3. This scenario, as indicated in Table 15, would yield on-farm production of 613.7 million pounds of produce and would require nearly 50,000 acres of crop land, the latter being a 225 percent increase. Expected farm-level receipts, owing to the intrinsic market value of this mix of produce, would jump to $152.3 million, a 311 percent increase over the previous scenario. In addition, again given the mix of these products, direct marketing receipts also would increase by more than the proportion of production or

[15] USDA Center for Nutrition Policy and Promotion. My Pyramid Plan: Steps to a Healthier You. April 2005. Accessed at: http://www.mypyramid.gov/pyramid/fruits.html and http://www.mypyramid.gov/pyramid/vegetables.html
[16] Ibid.
[17] Apples, broccoli, carrots, spinach, squash, potatoes, and tomatoes

the acres appropriated from other crop production. The gross retail receipts associated with this scenario would be more than $601 million.

Table 15
Production and Retail Assumptions for Scenario 4

Scenario 4			
	Fruits	Vegetables	Total
Farm Pounds	134,845,547	478,831,269	613,676,816
Farm Acres	13,485	36,511	49,996
Farm Receipts	23,867,662	128,426,336	152,293,997
Retail Pounds	113,917,518	399,283,576	513,201,094
Gross Retail Receipts	111,061,507	490,258,527	601,320,034
Retail Margin Offset	(14,993,303)	(66,184,901)	(81,178,205)
Corn Offset	(2,168,966)	(5,872,731)	(8,041,698)
Soybean Offset	(1,345,209)	(3,642,312)	(4,987,522)
Direct Marketing Output	43,596,922	180,916,096	224,513,018

Table 16 itemizes the major components of direct, indirect, induced, and total economic change that could accumulate under this scenario. The direct value of sales to producers would be $152.3 million, which would provide labor income of $39.73 million to 740 jobs (to include the producers). Once this economic activity worked its way through the entire economy, the total economic activity would amount to $228.11 million in total output, $65.8 million in labor income, and 1,734 jobs in the economy. The loss of corn and soybean production that would have occurred on that same land must be offset. Those losses would be $13.03 million in direct corn and soybean output, reducing jobs in those sectors by 136 and $3.6 million in labor income. Total multiplied-through losses would be $20.8 million in output, $6.1 million in labor income, and 229 jobs.

Next, the direct marketing of half of this produce through our producer/marketer retail distributorships is added. The remaining product would serve as an item-by-item substitute for produce currently imported and would be distributed to the state's existing wholesalers and, thence, to the state's retailers in the conventional manners in which goods are distributed. Under the direct marketing assumption, the

farmer/distributors would realize gross sales of $224.5 million (in addition to the prices already realized as producers). These sales would require, at the volumes suggested by this scenario, 5,286 jobs and $111.7 million in labor income. When this works through the economy, it supports total economic output of $378.92 million, $161.97 million in labor income, and 7,075 jobs. Gains to the economy are offset with losses in the margined economic activity at the retail level, which would multiply to amount to total output losses of $123.5 million, and $51.64 million in reduced income and 2,534 fewer jobs.

Table 16

Total Economic Effects – Scenario 4

	Direct	Indirect	Induced	Total	Total Multiplier
Fruit and Vegetable Farming					
Total Industrial Output	152,294,000	36,677,923	39,136,527	228,108,450	1.50
Labor Income	39,730,856	13,461,182	12,572,751	65,764,790	1.66
Jobs	740	501	493	1,734	2.34
Grain and Soybean Offset					
Total Industrial Output	(13,029,220)	(4,097,487)	(3,685,397)	(20,812,105)	1.60
Labor Income	(3,597,503)	(1,319,233)	(1,183,943)	(6,100,678)	1.70
Jobs	(136)	(47)	(46)	(229)	1.68
Direct Marketing					
Total Industrial Output	224,513,024	58,144,162	96,258,236	378,915,418	1.69
Labor Income	111,709,456	19,336,268	30,923,317	161,969,038	1.45
Jobs	5,286	577	1,213	7,075	1.34
Retail Offset					
Total Industrial Output	(81,178,205)	(12,643,636)	(29,653,864)	(123,475,700)	1.52
Labor Income	(37,686,535)	(4,430,872)	(9,526,497)	(51,643,903)	1.37
Jobs	(2,019)	(141)	(374)	(2,534)	1.26

Table 17 summarizes all of the activity. Total economic effects are first. This is the total value to the economy of the components of this scenario. The total economic impacts are second, and represent the expected increment to economic activity in the state once existing production of the commodities specified in this scenario are accounted for.

Table 17

Total Economic Effects and Economic Impacts – Scenario 4

	Direct	Indirect	Induced	Total
Total Economic Effects				
Total Industrial Output	282,599,600	78,080,961	102,055,502	462,736,063
Labor Income	110,156,274	27,047,345	32,785,628	169,989,247
Jobs	3,871	890	1,286	6,046
Total Economic Impacts (considering existing production)				
Total Industrial Output	262,500,483	72,527,668	94,797,086	429,825,237
Labor Income	102,321,713	25,123,678	30,453,841	157,899,231
Jobs	3,595	826	1,195	5,616

Were this scenario completely realized it would sustain, either directly or indirectly, $462.7 million in total economic output, $170 million in total labor income, and 6,046 total jobs in Iowa. By way of a net increase in economic activity (our economic impact) in the state considering existing production, the values are still very large: $429.8 million in total new industrial output, $157.9 million in labor income, and 5,616 jobs.

According to the United States Department of Agriculture, the recommended number of servings of fruits and vegetables per day varies by age, gender, and activity level.[18] For example, recommendations include four servings per day (two cups) for an active two-year old male, 13 servings (6 and ½ cups) for an active 25 year-old male, 10 servings (five cups) for an active 55 year-old female, and 11 servings (five and ½ cups) for an active 70-year old male.[19] Given this range and Iowa's population distribution the target recommendation of seven servings per day for Scenario 4 appears a realistic estimate for the entire population in the economic analysis.

Comparing Scenarios 3 and 4

Moving from a consumption goal of five servings a day (Scenario 3) to seven servings a day (Scenario 4) provides an additional $127.4 million in industrial output, an additional $45.3 million in labor income, and 1,522 total jobs. Again, it is important to

[18] USDA Center for Nutrition Policy and Promotion. My Pyramid Plan: Steps to a Healthier You. April 2005. Accessed at: http://www.mypyramid.gov/pyramid/fruits.html and http://www.mypyramid.gov/pyramid/vegetables.html

[19] Ibid.

note that Scenario 4 is adding two vegetables (broccoli and potatoes) to the five produce items (apples, carrots, spinach, squash, tomatoes) found in Scenario 3.

Conclusions

Iowa is a national leader in corn, soybeans, and livestock production. However, Iowa does not produce enough of many of the fruits and vegetables to supply the population with its average consumption needs. If Iowa farmers were to provide 100 percent of the average consumption needs for the 37 fruits and vegetables it grows for a three-month period out of the year, there would be significant positive economic impact in the state. If Iowans were to consume five to seven servings a day of fruits and vegetables and Iowa farmers were to provide 100 percent of a selected set of fruits and vegetables for a three-month period out of the year for those servings, the net economic impact would be far greater. Given that increased fruit and vegetable consumption has been linked with positive health benefits and that the majority of Iowans eat fewer than five servings of fruits and vegetables per day, an increase in fruit and vegetable consumption of Iowa grown-produce could provide increased health and economic benefits for Iowa citizens.

Cautions

Outputs (findings) are only as good as the inputs (data) and the feasibility of the assumptions. The two modeling systems, the *Iowa Produce Market Potential Calculator* and the input-output model, both may in the future need additional refinements to adequately describe the financial and regional economic dynamics of a changing or evolving fruit and vegetable production sector in Iowa.

Many Iowans have summer gardens to supply part of their fruit and vegetable needs. Produce from these gardens is not accounted for in the models used in this study. It is likely that the economic impacts estimated in this study would be reduced by a small percentage if production in home gardens could be estimated and taken into account.

Scenarios 3 and 4 are consumption-based and require the majority of Iowans to increase their consumption of fruits and vegetables. It is logical to assume that by increasing consumption of fruits and vegetables, consumption by Iowans of other foods would decrease. If most of the decreased consumption involved items not produced and/or processed in Iowa, there would be a negligible offset to the economic

gains realized in these two scenarios. If most of the consumption decrease was for items that were produced and/or processed in Iowa, there would be offsets to consider. Since it is very difficult if not impossible to identify which foods would experience consumption decreases due to Scenarios 3 and 4, these potential offsets are not included in this study.

These are "what-if" scenarios – the gaps from current production levels to the scenarios are huge. Each scenario requires the virtual fabrication of industrial and household characteristics that may not be realistic. In particular, the modeling and the assumptions require the reconfiguration of the scale, scope, and supporting infrastructure associated with production and distribution in Iowa, the potential of which is not, at the indicated levels estimated here, evident in the current system.

The scenarios assume that grocery stores and existing wholesalers would cede this territory, *fait accompli*, to Iowa farmer-producers and direct marketers. It assumes that historical national horticultural producing states (California, Texas, Michigan, Florida, and Washington) would not respond to stop this change by or are otherwise indifferent. It also assumes that the local produce would be competitively priced with produce from these national leaders. In short, we do not take into account market equilibrium responses to this change.

Finally, the scenarios beg awareness and sober consideration of the reasons that there are areas of regional production specialization of commodities. These regional specializations presuppose production efficiencies, labor and technical infrastructure suited for production and distribution, transportation and marketing networks, and, of course, climatic differences that determine expected returns on land and other investments.