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Economic Impacts of Increasing Hawai'i's Food Self-Sufficiency

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Recent surges in the price of oil and food safety scares have heightened concern about energy and food self-sufficiency in Hawai'i among the general public, business community, and government leaders. This is understandable, given that Hawai'i, located approximately 2,500 miles from the continental United States, is one of the most geographically isolated areas of the world. We are at the mercy of global events over which we have very little influence or control.

For example, we are vulnerable to food supply disruptions due to dock strikes and farm production fluctuations in the U.S. mainland. Recent increases in freight transportation cost due to the spike in fuel price may potentially enhance the competitiveness of local production to replace imports.

A reduction in dependency on imported food is certainly a public policy goal that we should not ignore. However, even though Hawai'i can conceivably grow anything that we consume, the quest to achieve 100% food self-sufficiency is impractical, unattainable and perhaps impossible, as it imposes too high a cost for society. The reduction in transportation cost resulting from technological change in the shipping industry during the past decades and the liberalization of the global trade have led to massive concentration of production of commodities, including food, in regions where economy of scale can be captured, resulting in more efficient and profitable production. For example, much of the vegetables consumed in the US are produced in California. Trade has thus provided consumers in Hawai'i with access to cheaper foods and a greater variety of foods.

While Hawai'i will probably continue to import most of its food supply, we should not overlook the value of purchasing and producing more locally grown foods. Besides improving our level of food security, producing and consuming locally grown foods also have several added benefits. A recent opinion editorial by Sandra Lee Kunimoto, chairperson of the Hawai'i Board of Agriculture, summarized the benefits of "buying local":

> "Purchasing locally grown produce keeps the money flowing through our community. When you purchase foods grown elsewhere, you are supporting agribusinesses in other areas. Also, the nutritional content of locally grown foods is often higher, since many vegetables begin to lose their nutritional value after they are picked." (The Honolulu Advertiser, August 14, 2008)

In addition, consuming and producing more locally grown foods may decrease the "food miles" involved in transporting foods and thus may conserve energy and reduce our carbon footprint.

Finally, the widespread importation of fresh produce into Hawai'i greatly increases the risk of introducing harmful invasive pests that could unleash devastating effects on the islands' agricultural economy and their fragile ecosystems. The unwelcome introduction of fruit flies, miconia trees, coqui frogs, red fire ants and varroa mites have severe consequences beyond agriculture and require hundreds of millions in public dollars to fund eradication or containment programs.

While some consumers are willing to pay for these added benefits, to replace food imports beyond the

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present level will require raising the demand for and production of locally grown foods. Public programs can be instrumental in accomplishing this. On the demand side, the Hawai'i Department of Agriculture has been actively promoting farmers' markets and the "Buy Fresh, Buy Local" call-to-action program designed to raise awareness of the benefits of locally grown foods. Similarly, the Island Fresh and Hawaii Seal of Quality branding programs also seek to achieve brand awareness and loyalty toward local products. On the supply side, government supported programs such as input subsidies, tax credits, low-interest agricultural loans, crop insurance, and preferential purchasing by public institutions can be implemented.

This publication does not seek to provide a comprehensive evaluation of the costs and benefits of increasing food self-sufficiency. Instead, it focuses on the economic multiplier effect of increasing food self-sufficiency. We hope this background information can raise awareness and be useful for further public policy debate on increasing food self-sufficiency in Hawai'i. In order to put things into perspective, we will first explore the extent of food self-sufficiency in Hawai'i.

Imported food share and self-sufficiency trends

How much of the food we consume in Hawai'i is imported? Unfortunately, this information is not readily available due to the difficulties in reconciling the various data sources on imports, food expenditures, and local production[1]. For example, while customs data provides fairly disaggregated imports of various food items from foreign sources, interstate trade data is rather crude and not comparable with the customs data. Furthermore, it is an enormous, if not impossible, task to convert data consistently from the various sources to a common point in the supply chain. For example, the food expenditures data is at the retail level, the import data is normally valued either at FOB (free on board) or CIF (cost, insurance, freight), and the production data is commonly valued at farm-gate. Despite the above difficulties, a recent study conducted by the Rocky Mountain Institute[2] estimated that 85% of the food we consumed is imported. In a presentation at the 2003 Hawaii Agriculture Conference, Ken Meter estimated that more than 90% of our food is imported.[3] While a definitive figure is yet to be derived, it is generally believed that most of the food we consumed in Hawai'i is imported. In comparison, the food self-sufficiency level of the New England region is estimated as 28% in 1997.[4] In contrast, the import share of our national food consumption is estimated at 7% based on value and 15% based on volume in 2005.[5]

Although data on the overall food import share is not readily available, investigating the trends of consumption and supply of several major locally grown foods may shed some light in tracking the extent of our food self-sufficiency level. Table 1 shows that during the ten-year period from 1994–1995 to 2004–2005, total food consumption expenditures by Hawai'i consumers increased from $2.6 to $3.7 billion,[6] thus growing at an average annual rate of 3.4%. Per capita annual food expenditures likewise increased from $2,192 to $2,899, for an annual rate of 2.8%[7] during the same period. While more money was spent on food, its share of disposable income decreased from 13.3% to 11.8% during this same ten-year period.[8] Furthermore, the proportion spent on food away from home (eating out) has increased from 44.4% to 47.7%. The amounts spent on the selected food items all show an average annual increase of more than 2%, except for pork (at 0.3%) and fresh milk and cream (at 1.4%). Consumer spending on fresh vegetables increased from $109 to $166 million in the ten-year period while its share increased from 7.4% to 8.6% of the total at-home food expenditures. Likewise, the amount spent on beef increased from $96 to $148 million in the ten-year period, with its share increasing from 6.6% to 7.7% of the total at-home food expenditures. This set of selected food items together

1. It should be noted, though, that the self-sufficiency level of fresh vegetables and fruits can be estimated, as the Hawai'i Department of Agriculture actively tracks the inshipment quantity of fresh vegetables and fruits.
2. Rocky Mountain Institute. 2007. *Island of Hawai'i Whole System Project Phase I Report*.
3. Cited on page 41 in Brian Halweil's 2004 book, *Eat Here*, Norton/Worldwatch Books.
4. Holm, D., R. Rogers, and D. Lass. 2000. *Food Self-Sufficiency in the New England States, 1975–1997.* Department of Resource Economics, University of Massachusetts, Amherst.
5. Jerado, A. 2008. What share of U.S. consumed food is imported? *Amber Waves*, ERS, USDA.
6. In nominal terms.
7. With food inflation running at about 1.6% per annum during the same period, it would mean that real per capita food expenditures have increased about 1.2% annually.
8. For the United States, this share decreased from 13.3% to 10.5% for the same period.

Table 1. Annual total food expenditures, Hawai'i.

	1994–1995		2004–2005		Average annual change 94/95 to 04/05
	($ million)	(%)*	($ million)	(%)*	(%)
All food	2,623	13.3	3,678	11.8	3.4
Food at home	1,459	55.6	1,924	52.3	2.8
Beef	96	6.6	148	7.7	4.4
Pork	73	5.0	75	3.9	0.3
Eggs	20	1.3	28	1.5	3.8
Fresh milk and cream	54	3.7	61	3.2	1.4
Fresh fruits	92	6.3	118	6.1	2.5
Fresh vegetables	109	7.4	166	8.6	4.3
Food away from home	1,164	44.4	1,754	47.7	4.2

Source: Average annual expenditures from BLS Consumer Expenditures Survey, 1994–1995 and 2004–2005, Honolulu.
Note: *All food is expressed as % of disposable income; food at home and food away from home are expressed as % of all food; other food items are expressed as % of food at home.

comprised 31% of the total food consumed at home in 2004–2005.

We now turn to the local production trends of these same foods to see whether they have kept pace with the consumption trends. It is interesting to note that other than beef and fresh vegetables, the rest of the foods all show a declining production trend during the ten-year period from 1995 to 2005 (Table 2). The production and consumption of beef in Hawai'i has remained stable at an average annual growth rate of 4.4%. Only production of fresh vegetables has outpaced its consumption by a large margin (5.8% vs. 4.3%). In other words, during this ten-year period we have become more self-sufficient only in fresh vegetables, while the level of self-sufficiency for beef remains relatively stable.[9] For all the other food items we have become less self-sufficient. It is safe to say that our overall level of food self-sufficiency has declined during the past decade. Conversely, the import share of the food we consumed has most likely increased somewhat in this same period. In summary, we do not produce much of the food we consume, and we continue to be more reliant on imports.

9. It should be noted that a small amount of vegetables are actually destined for the export market (for example, Maui onions) and also that the value of beef production includes the value of calf export, which is quite substantial. Thus the actual self-sufficiency levels for these two food items are in fact less than as portrayed here.

Table 2. Hawai'i production of selected food products, 1995 and 2005.

	1995 ($ million)	2005 ($ million)	Annual change (%)
Beef	14.64	22.55	4.4
Pork	6.67	4.55	-3.7
Eggs	13.52	8.98	-4.0
Fresh milk	32.15	18.39	-5.4
Fresh fruits*	28.22	25.75	-0.9
Fresh vegetables	38.60	67.72	5.8
Total	133.80	147.93	1.0

Source: Statistics of Hawai'i Agriculture, State of Hawai'i Data Book, various issues. Notes: Data are farm-gate values; *excluding pineapples.

Economic impacts of increasing food self-sufficiency

Now that we know most of the food we consume is imported, we would like to examine the potential economic impact if all or part of these imports can be replaced by local production. As alluded to earlier, for every dollar spent on imported food, we are supporting agribusinesses elsewhere, and that same dollar could have been invested in our local economy. The benefits of retaining that dollar in our own economy can be traced using an economic input-output model. For example, if we purchase $40 of local produce instead of imported produce from a grocery store and if the farm share of this produce is 25%,

Table 3. Economic multipliers for selected food and agricultural industries, Hawai'i.

	Multipliers			
	Output (sales)	Earnings	State tax	Employment
Beef	1.90	0.51	0.063	24.20
Pork	1.90	0.51	0.063	24.20
Eggs	1.90	0.51	0.063	24.20
Fresh milk	1.90	0.51	0.063	24.20
Fresh fruits	1.95	0.58	0.075	31.20
Fresh vegetables	2.06	0.54	0.078	26.30

Source: The 2005 State of Hawaii Input-Output Study, August 2008, DBEDT.
Note: Beef, pork, eggs and milk are represented by a single sector in the 2005 Input-Output Model.

the local farmer could increase production or sales by $10 to satisfy this shift in purchasing pattern.[10] In order to increase production by $10, this farmer will have to purchase additional inputs, such as water, fertilizers, seeds, and energy; some of these inputs will be purchased from local enterprises, while some will be imported. In order to provide the inputs for this farmer, these local enterprises will have to increase their outputs, which will in turn require them to purchase more inputs from other local enterprises and imports. This "rippling" effect throughout the economy represents the *indirect* impact resulting from the initial *direct* change of $10 increase in sales of this farmer's production.

The local farmer will also need to hire additional workers. The pay these additional workers received will eventually be spent on goods and services in the economy. These additional purchases by the workers will mean yet more production of these goods and services, which will set off another round of "rippling" effect throughout the economy. This effect is referred to as the *induced* impact. If the indirect impact amounts to $6 and the induced impact is $4, the resulting direct, indirect, and induced impact from the initial increase in this local farmer's sales of $10 will total $20, representing a multiplier effect of 2.0. In other words, to support a one-dollar increase in this farmer's sales, supporting local industries will have to increase their outputs by another dollar. Similarly, we can also trace the economy-wide impacts on earnings, employment, and state tax collections due to the increase of this farmer's sales. It should be mentioned that we are assuming that whether the product is locally grown or imported, it will go through the same marketing channel. Thus the only change will stem from the increased farm sales or production as portrayed in the above example.

The 68-sector 2005 Hawai'i State Input-Output Model provides the necessary tool to estimate the potential economy-wide impacts of replacing the imports of some of the major food items. Table 3 shows the respective multipliers for selected food and agricultural industries. For example, an increase in the final farm-gate sales of $1 of locally grown fresh vegetables will generate a total of $2.06 in sales, $0.54 in earnings, and $0.078 in state tax revenues throughout the economy. The employment multipliers are in total jobs per million dollars of final farm-gate sales increase. For example, a million-dollar increase in final farm-gate sales of locally grown fresh vegetables will generate about 26.3 jobs.

Table 4 shows the estimated economy-wide impacts of doubling the current (2005)[11] share of total consumption from local production of the major foods consumed in Hawai'i. For example, doubling the sales of eggs would generate $17.06 million in sales, $4.58 million in earn-

10. For the moment, we are assuming that this farmer has the capacity to increase the production level and still stay profitable at the prevailing farm-gate price. We also assume that the retail price of the local produce is the same as the imported produce. However, departing from the current equilibrium levels of import share by increasing local production would generally be unprofitable unless there is a shift in demand whereby consumers are willing to pay a higher price for this additional locally grown produce, or government intervenes by supporting programs to enhance the competiveness of more local production, or both.

11. The estimated economic impacts are expressed on an annual basis using 2005 as the reference year.

Table 4. Estimated economic impacts of doubling the current share of total consumption from local production of selected food products.

	Local production minus export*	Estimated total consumption from local production+	Potential import replacement*	Economy-wide impact on			
				Sales	Earnings	State tax collections	Jobs
	($ million)	(%)	($ million)	($ million)	($ million)	($ million)	(number)
Beef	5.08	4.50	5.08	9.64	2.59	0.32	123
Pork	4.55	3.90	4.55	8.65	2.32	0.29	110
Eggs	8.98	20.00	8.98	17.06	4.58	0.57	217
Fresh milk	18.39	10.00	18.39	34.94	9.38	1.16	445
Fresh fruits	21.40	34.78	21.40	41.73	12.41	1.60	668
Fresh vegetables	60.92	33.50	60.92	125.49	32.90	4.75	1,602
Total	119.31	n.a.	119.31	237.51	64.17	8.69	3,165

Notes: *At farm-gate values, 2005. +Hawai'i Department of Agriculture's estimates.

Table 5. Estimated economic impacts of replacing 100% of imports of selected food products.

	Local production minus export*	Estimated total consumption from local production+	Potential import replacement*	Economy-wide impact on			
				Sales	Earnings	State tax collections	Jobs
	($ million)	(%)	($ million)	($ million)	($ million)	($ million)	(number)
Beef	5.08	4.50	107.72	204.67	54.94	6.79	2,607
Pork	4.55	3.90	112.19	213.16	57.22	7.07	2,715
Eggs	8.98	20.00	35.92	68.24	18.32	2.26	869
Fresh milk	18.39	10.00	165.48	314.42	84.40	10.43	4,005
Fresh fruits	21.40	34.78	40.14	78.26	23.28	3.01	1,252
Fresh vegetables	60.92	33.50	120.95	249.16	65.31	9.43	3,181
Total	119.31	n.a.	582.40	1,127.91	303.46	38.99	14,629

Notes: *At farm-gate values, 2005. +Hawai'i Department of Agriculture's estimates.

ings, $0.57 million in tax revenues, and 217 jobs. From a fiscal point of view, we could use the $0.57 million increase in tax revenues as the amount the state government could afford to spend on programs to support the expansion of the egg industry by another fold. Of course, other non-monetary benefits need to be considered, such as the creation of new jobs, availability of more fresh and nutritious products, an increased sense of self-reliance, and better environmental stewardship.

If we were to achieve 100% self-sufficiency on this same set of selected products, it would translate to a $582 million increase in direct sales, which is slightly more than the current agricultural production in Hawai'i (Table 5). We should note that much of the current agricultural production is destined for exports (pineapple, macadamia nuts, coffee, sugarcane) or non-food products (flowers, nursery plants, seed crops) and not for local food consumption. The estimated economy-wide impacts are quite substantial in this case, with over $1.1 billion in sales, $303 million in earnings, $39 million in tax revenues, and over 14,000 jobs.

Finally, Table 6 provides the estimated impacts of a $100 increase of locally grown products (to replace imports) purchased at the retail level taking into account

Table 6. Estimated economic impacts of replacing $100 of imports by locally produced products at retail level.

	Increased consumption of local products at retail	Farm share*	Potential import replacement at farm-gate	Economy-wide impact on			
				Sales	Earnings	State tax collections	Jobs
	($)	(%)	($)	($)	($)	($)	(number)
Beef	100.00	46.90	46.90	89.11	23.92	2.95	0.00113
Pork	100.00	31.10	31.10	59.09	15.86	1.96	0.00075
Eggs	100.00	42.00	42.00	79.80	21.42	2.65	0.00102
Fresh milk	100.00	31.00	31.00	58.90	15.81	1.95	0.00075
Fresh fruits	100.00	28.00	28.00	54.60	16.24	2.10	0.00087
Fresh vegetables	100.00	25.00	25.00	51.50	13.50	1.95	0.00066

Note: *Farm share % from USDA Farm-to-Retail Price Spread Worksheets.

the differing farm share or marketing margin for each food product under consideration. For example, with a farm share of only 25%, a $100 increase in the purchase of locally grown fresh vegetables (instead of imported fresh vegetables) purchased at a retail outlet will generate approximately $51.50 in sales, $13.50 in earnings, and $1.95 in tax revenues.

Summary

It is clear that we do not produce much of the food that we consume in Hawai'i. The previous analysis describes the estimated economic impacts on increasing self-sufficiency scenarios of selected crops by doubling the present percentage of total consumption from local production (Table 4), and a 100% self-sufficiency (Table 5). To take a broader perspective, if we just consider the food expenditures of our local consumers,[12] it already amounted to $3.7 billion[13] in 2004–2005. Assuming that 85% of the food we consumed is imported, this translates to $3.1 billion leaving our state to support agribusinesses elsewhere. If we could replace just 10% of these imported foods, assuming we have the available and appropriate resources and infrastructures for such an expansion[14], it would amount to some $313 million, or $94 million at the farm-gate, assuming a 30% farm share. Taking into account the multiplier effects, this $94 million would generate an estimated economy-wide impact of $188 million in sales, $47 million in earnings, $6 million in state tax revenues, and more than 2,300 jobs.[15] This is not a trivial amount.

One obvious question is whether the $6 million tax revenues generated from a 10% food import replacement strategy would be sufficient to design and run a government program to support the expansion of local production. Value should also be assigned to other non-monetary benefits such as job creation, better environmental stewardship (e.g., keeping open space and the island landscape green and recharging the aquifer system), increased levels of food self-reliance, and land preservation, as well as any associated costs when compared to other public programs and projects. This publication does not provide answers to these important questions but instead provides the background information and a point of departure for subsequent debate and assessment of the benefits and costs of increasing food self-sufficiency in Hawai'i.

12. We also need to feed our visitors. In 2007, Hawai'i visitors spent an estimated $2.42 billion for food and beverages (2007 Annual Visitor Research Report, DBEDT, 2008).

13. This is a rounded figure. We used $3.678 billion (as shown in Table 1) in subsequent calculations.

14. A recent study by David S. Timmons shows that the potential maximum food self-sufficiency level based on the current productive capacity in Hawai'i is about 34.5% (Timmons, D.S. *Measuring and Understanding Local Foods: The Case of Vermont*, Master's Thesis, University of Vermont, May 2006).

15. Based on an average sales multiplier of 2.0, earnings multiplier of 0.5, state-tax multiplier of 0.06, and job multiplier of 25.

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