

**THE COMPETITIVE AND COMPARATIVE ADVANTAGES OF HAWAII'S
AGRICULTURAL EXPORTS TO THE JAPAN MARKET
FY 2009**

Japan is the most important foreign export market for Hawaii's agricultural products. From 1995 to 2006, more than 2/3 of Hawaii's agricultural exports to foreign countries were destined for Japan. This study systematically evaluated the competitive and comparative advantages of Hawaii's various agricultural exports to the Japan market. While Hawaii had comparative advantage in fresh papayas, pineapples (processed), cut flowers/buds, macadamia nuts (processed), ornamental fish, and tuna in 1995, it has considerably lost its comparative advantage in these products over the years. The emergence of abalone and desalinated deep-sea water as top export products to Japan shows that Hawaii has capitalized on its under-tapped but abundant natural resource – sea water. Moreover, Hawaii has taken advantage of the brand recognition by Japanese consumers of Hawaii products, in particular desalinated deep-sea water and roasted coffee, for having high quality.

In a complementary study, the prices of agricultural production inputs faced by Hawaii farmers were compared with those faced by farmers from competing countries. Hawaii farmers face higher costs for most of the factors used in agricultural production including labor, electricity, fertilizer, land, and transportation relative to their U.S. mainland and Japanese market competitors. Nevertheless, Hawaii farmers face lower costs for diesel fuel and loan financing which can help mitigate the higher costs of other production inputs, provided that access to diesel fuel and financing remains affordable in the future. The findings of this study suggest that Hawaii may be losing competitiveness in some of its products in the Japan market due to lower labor costs and more efficient production techniques in some of its competitors. Whether these are the exact reasons for Hawaii's loss of competitiveness is a rich subject requiring future research.

FINAL REPORT

EI-19: COMPETITIVENESS OF HAWAII'S' AGRICULTURAL PRODUCTS IN JAPAN

**EI-20: A COMPARISON OF AGRICULTURAL INPUT PRICES: HAWAII vs. ITS
MAJOR EXPORT COMPETITORS**

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**THE COMPETITIVE AND COMPARATIVE ADVANTAGES OF HAWAII'S
AGRICULTURAL EXPORTS TO THE JAPAN MARKET
(Grant Agreement 12-25-G-0885)**

Final Report to

The Federal-State Marketing Improvement Program (FSMIP)
United States Department of Agriculture
Agricultural Marketing Service
Transportation and Marketing Division

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Department of Agriculture
Agricultural Development Division

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Executive Summary

Japan is the most important foreign export market for Hawai'i's agricultural products. From 1995 to 2006, more than two-thirds of Hawai'i's agricultural exports to foreign countries were destined for Japan. This research study systematically evaluates the competitive and comparative advantages of Hawai'i's various agricultural exports to the Japan market. While Hawai'i had comparative advantage in fresh papayas, pineapples (processed), cut flowers/buds, macadamia nuts (processed), ornamental fish, and tuna in 1995, it has lost its comparative advantage considerably in these products over the years.

The emergence of abalone and desalinated deep-sea water as top export products to Japan shows that Hawai'i has capitalized on its under-tapped but abundant natural resource – sea water. However, it must be emphasized that better production techniques have greatly contributed to the increase in competitiveness of Hawai'i in these two sea water products. Moreover, Hawai'i has taken advantage of the brand recognition by Japanese consumers of Hawai'i products, in particular desalinated deep-sea water and roasted coffee, for having high quality (see Appendix II for complete study).

In the complementary study, we looked at the prices of different agricultural production inputs faced by Hawai'i farmers with those faced by farmers from other competing countries. The inputs under review include labor, energy, fertilizer, land, agricultural machinery, water, transportation, and financing. We first compare the input costs in Hawai'i relative to all countries with available data, then compare the input costs in Hawai'i relative to the state's major competitors in the top export markets for its agricultural goods, namely, the U.S. mainland and Japan.

Among the various input costs considered, Hawai'i farmers face higher costs of labor, electricity, fertilizer, land, and transportation relative to their U.S. mainland and Japanese market competitors. Thus, it is apparent that Hawai'i farmers face a disadvantage relative to their competitors in most of the factors used in agricultural production. Nevertheless, Hawai'i farmers face lower costs for diesel fuel and loan financing. These can help mitigate the higher costs of other production inputs, provided that access to diesel fuel and financing remains affordable in the future (see Appendix III for complete study).

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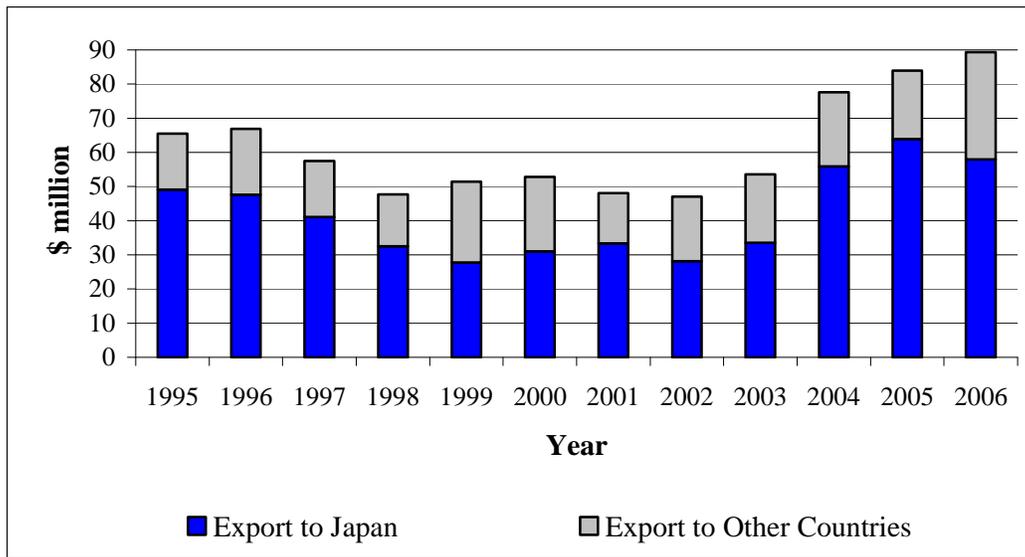
Background

In the era of diversified agriculture, it is imperative to understand the competitive and comparative advantage¹ of Hawai`i's various agricultural products, i.e., in which agricultural products Hawai`i is relatively more competitive and stands a better chance to thrive in the long run. Hawai`i's agricultural products in general are in a competitively disadvantageous position due to its high labor and resource costs, small scale of operations, and isolated geographic location. Given increasing national and worldwide competition, it is also important to understand the performance of Hawai`i's major competitors in the various markets (e.g., the local, U.S. mainland, and foreign markets) in terms of their relative strength of competitive and comparative advantage, i.e., whether or not Hawai`i's major competitors are becoming relatively less (or more) competitive as compared to Hawai`i's situation, to help Hawai`i's agribusiness evaluate possible market opportunities and barriers.

Broadly speaking, Hawai`i's agricultural products are destined for three markets: the local (Hawai`i), U.S. mainland and foreign countries. A previous FSMIP project had successfully evaluated the competitive and comparative advantage of Hawai`i's agricultural products in U.S. mainland markets (see Cai, Leung and Loke, 2007a and 2007b). An on-going effort funded by the USDA-ARS has allowed us to refine the comparative advantage assessment methodology to evaluate Hawai`i's comparative advantage in the U.S. Mainland market. This study complements the ongoing project by expanding the assessment scope to the Japan market, which is the most important export market for Hawai`i's agricultural products destined for foreign countries. Figure 1 shows that during the last 12 years from 1995 to 2006, more than 2/3 of Hawai`i's agricultural exports to foreign countries are destined to the Japan market. It is envisioned that this study would help Hawai`i's agriculture enterprisers and policy-makers to evaluate the competitive environment of Hawai`i's agricultural products in the Japan market and thus identify possible market opportunities and initiatives to enhance the competitiveness of Hawai`i's agricultural products in the Japan market.

¹ For detailed discussion of the concepts of competitive advantage and comparative advantage, see Cai and Leung (2007a).

Figure 1
Hawai'i's Agricultural Exports to Foreign Countries, 1995-2006



Data Source: World Trade Atlas 2007

(* Estimation includes agricultural exports under the trade codes HS01 to HS22)

In the complementary study, entitled “A Comparison of Agricultural Input Prices: Hawai'i vs. Its Major Export Competitors,” the primary goal to compare the prices of different agricultural production inputs faced by Hawai'i farmers with those faced by farmers from other competing countries. This issue is important since changes in input prices are significant not only to output supply (production level), but also to the productivity and thus profitability of farmers, the welfare of consumers, and the export earnings of countries and states. Additionally, input prices provide valuable information for the formulation of government policies and programs aimed at promoting efficiency, stability, growth, and equity in the agricultural sector.

Methodology

While competitive advantage can be measured directly through market share, comparative advantage have to be measured by “revealed comparative advantage”² indices that are constructed based on trade statistics. In this study, we utilize the normalized revealed

² The approach of “revealed comparative advantage” is first developed by Balassa (1965).

comparative advantage (NRCA) index³ to measure comparative advantage, as it is comparable over space and time. Thus, we could examine the dynamics of Hawai'i's comparative advantage as well as compare the performance of Hawai'i's agricultural exports to its major competitors in the Japan market.

Time series analysis is then applied to the NRCA index to examine the historical trajectory of competitive and comparative advantage for Hawai'i and its major competitors in the Japan market, i.e., whether the exporter (Hawai'i or its competitors) exhibited a trend to gain or lose comparative advantage in a particular product. It is envisioned that such a historical assessment could reveal the competitive and comparative advantage situation more systematically and reliably than a simple evaluation of the current or average situation (for example, the situation in 2006 or the average situation between 1995 and 2006).

Specifically, we examined the comparative advantage (CA) patterns of Hawai'i's agricultural exports to the Japan market from 1995 to 2008. For the analysis, the agricultural products investigated were classified as either unprocessed/semi-processed or processed products. Unprocessed/semi-processed includes raw or fresh products and semi-processed products with minimal chemical transformation. Eleven were included in this classification: abalone (live or fresh), coffee (unroasted), cut flowers/buds, fruits and nuts (except for papayas, pineapples, and macadamia nuts), fixed vegetable fats and oils, macadamia nuts (fresh or dried), ornamental fish (live), papayas (fresh), pineapples (fresh or dried), seaweeds (fresh or dried, whether or not ground), and tuna (fresh or chilled, no fillets or other meat). Processed agricultural products included preserved products and products that were mixed with other substances. Nine were included in this classification: cocoa (processed), coffee (roasted), food preparations, fruit or vegetable juice, grape wine, macadamia nuts (processed), pineapples (processed), sugar confectionery, and water (bottled).

In the complementary study, the inputs under review include labor, energy, fertilizer, land, agricultural machinery, water, transportation, and financing. We first compare the input

³ The NRCA index is the only revealed comparative advantage index that is comparable across commodity, producer, and time. See Yu, Cai and Leung (2008) for further discussion on the index.

costs in Hawai'i relative to all countries with available data, then compare the input costs in Hawai'i relative to the state's major competitors in the top export markets for its agricultural goods, namely, the U.S. mainland and Japan. We consider the competitors of Hawai'i to be exporters to the U.S. mainland, for the agricultural exports analyzed in Yu et al. (2009), and exporters to Japan, for the goods analyzed in Parcon et al. (2010).

Discussion and Recommendations

The findings of this study are relevant for policy makers, as they suggest that Hawai'i may be losing competitiveness in some of its products in the Japan market due to lower labor costs and more efficient production techniques in some of its competitors. Whether these are the exact reasons for Hawai'i's loss of competitiveness is a rich subject requiring future research. If Hawai'i is not able to compete in these aspects, then other ways must be found to improve competitiveness in the products experiencing competitive disadvantage. Otherwise, it may be necessary to abandon promotion of these products and focus attention and limited resources on promotion of products with the brightest prospects, such as desalinated deep-sea water, roasted coffee, and abalone, as this study suggests. In addition, findings of this study suggest that the role of research and technology is important in harnessing the productive capacities of natural resources. Finally, the study findings are disseminated to elected government officials and staff members, government decision-makers, policy analysts, researchers and agribusiness stakeholders.

In the complementary study, we take a cue from the USDA-ERS (2011), which forecasted crop-related expenses to increase in 2011 by an average of 9.5% from their 2010 values, and attributed the principal drivers of these expenses to input prices. As Hawai'i's agriculture is in the midst of significant change and revitalization, input prices are indeed important considering the growing view among many people in the Islands that agriculture, especially food crops, should be a more prominent concern.

Among the various input costs considered, Hawai'i farmers face higher costs of labor, electricity, fertilizer, land, and transportation relative to their U.S. mainland and Japanese market competitors. The study finds that Hawai'i farmers face a disadvantage relative to their competitors in most of the factors used in agricultural production. Nevertheless,

Hawai'i farmers face lower costs for diesel fuel and loan financing. These can help mitigate the higher costs of other production inputs, provided that access to diesel fuel and financing remains affordable in the future.

Publications and Web Access

The two studies funded by this FSMIP grant entitled "*Competitiveness of Hawai'i's Agricultural Products in Japan*" and "*A Comparison of Agricultural Input Prices: Hawai'i vs. Its Major Export Competitors*" were published the University of Hawai'i at Manoa's Cooperative Extension Service, College of Tropical Agriculture and Human Resources (UH-CTAHR) as Economic Issues #19 and Economic Issues #20 respectively. They are currently available at CTAHR's website as follows:

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-19.pdf>

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-20.pdf>

Additionally, Economic Issues #20 is posted at the website of the Kohala Center in Kona on the Big Island. The Kohala Center is an independent, not-for-profit, community-based center for research, conservation, and education.

<http://www.kohalacenter.org/pdf/EI-20.pdf>

Both publications would eventually be linked to the Hawaii Department of Agriculture's website.

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Appendix I

Financial Report

Listing of Federal Itemized Expenditures (09/01/2009 - 09/30/2011)

Payment Date	Activity	Expenditure
Mar. 2011	Univ. of Hawai'i-ORS, FY 11	\$15,351.04
Apr. 2011	Univ. of Hawai'i-ORS, FY 11	\$15,373.07
Sept. 2011	Univ. of Hawai'i-ORS, FY 12	\$7,659.00
Sept. 2011	Supplies and Other Miscellaneous Items	\$2,499.74
Sub-Total		<u>\$40,882.85</u>

Listing of State Itemized Expenditures (09/01/2009 - 09/30/2011)

Activity Date	Staff	Hour	Rate	Expenditure
2009-2011	M. Loke, HDOA	480	\$ 39.00	\$18,720.00
2009-2011	S. Sakamoto/Fiscal Office, HDOA	60	\$ 25.00	\$1,500.00
2009-2011	M. Hudson, USDA-NASS	60	\$ 55.00	\$3,300.00
2009-2011	Editorial Staff, UH-CTAHR	120	\$ 30.00	\$3,600.00
2009-2011	PS Leung, UH-CTAHR	240	\$ 60.00	\$14,400.00
2009-2011	Reviewers (Lee/Edmunds/Hollyer/Nakamoto)	20	\$ 50.00	\$1,000.00
2009-2011	Miscellaneous Expenses - phone/office supplies/paper/photocopy/printer ink/etc.			\$3,000.00
Sub-Total				<u>\$45,520.00</u>
Grand Total				<u>\$86,402.85</u>

Appendix II

Competitiveness of Hawai'i's Agricultural Products in Japan

- See Document Attached

Appendix III

A Comparison of Agricultural Input Prices: Hawai'i vs. Its Major Export Competitors

- See Document Attached



Competitiveness of Hawai'i's Agricultural Products in Japan

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This publication extends and updates a recent CTAHR publication that assessed Hawai'i's comparative advantage (CA) in selected agricultural products in the U.S. mainland market.¹ While the previous publication assessed the CA patterns of Hawai'i's agricultural exports to the U.S. mainland market over the period 1995 to 2005, this publication examines the CA patterns of Hawai'i's agricultural exports to the Japan market over the period 1995 to 2008.

For the analysis, the agricultural products investigated were classified as either unprocessed/semi-processed or processed products. Unprocessed/semi-processed includes raw or fresh products and semi-processed products with minimal chemical transformation. Eleven were included in this classification: abalone (live or fresh), coffee (unroasted), cut flowers/buds, fruits and nuts (except for papayas, pineapples, and macadamia nuts), fixed vegetable fats and oils, macadamia nuts (fresh or

dried), ornamental fish (live), papayas (fresh), pineapples (fresh or dried), seaweeds (fresh or dried, whether or not ground), and tuna (fresh or chilled, no fillets or other meat). Processed agricultural products included preserved products and products that were mixed with other substances. Nine were included in this classification: cocoa (processed), coffee (roasted), food preparations, fruit or vegetable juice, grape wine, macadamia nuts (processed), pineapples (processed), sugar confectionery, and water (bottled).

Table 1 lists each product's average value and average share in Hawai'i's total agricultural exports to Japan during the periods 1995–1999, 2000–2004, and 2005–2008. These 20 products comprised about 84 percent of Hawai'i's total agricultural exports to Japan in the period 1995–1999, about 77 percent in 2000–2004, and about 90 percent in the period 2005–2008.

Among the products investigated, cut flowers/buds, fresh/dried macadamia nuts, fresh papayas, and processed pineapples experienced declining shares in Hawai'i's total agricultural exports. Unroasted coffee and fixed vegetable fats and oils had relatively constant market shares. Roasted coffee, food preparations, grape wine, and water had increasing market shares. The

¹ Yu, R., J. Cai, P.S. Leung, and M. Loke. 2008. Comparative advantage trends of selected agricultural products in Hawai'i in the U.S. mainland market. College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, Economic Issues no. 14, <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-14.pdf>.

Table 1. Top agricultural exports from Hawai'i to Japan, by value and share, 1995–2008

Product	Average Value (US\$M)			Share to Total Agricultural Exports to Japan (%)		
	1995-1999	2000-2004	2005-2008	1995-1999	2000-2004	2005-2008
<i>Unprocessed/Semi-Processed</i>						
Abalone	0	1.23	1.39	0.00	3.56	2.36
Coffee, Unroasted	2.22	2.04	3.13	5.92	5.88	5.33
Cut Flowers/Buds	2.63	1.60	0.67	7.00	4.62	1.14
Fruits and Nuts	0.18	0.22	0.15	0.47	0.62	0.26
Fixed Vegetable Fats/Oils	0.04	0.06	0.09	0.11	0.18	0.15
Macadamia Nuts, Fresh or Dried	0.27	0.03	0.02	0.73	0.08	0.03
Ornamental Fish	0.31	0.02	0.09	0.83	0.04	0.15
Papayas	12.14	6.47	3.50	32.33	18.68	5.95
Pineapples, Fresh or Dried	0.00	0.68	0.45	0.01	1.95	0.76
Seaweeds	0.31	1.20	0.76	0.84	3.45	1.29
Tuna	1.69	0.34	0.65	4.50	0.98	1.11
<i>Processed</i>						
Cocoa, Processed	6.57	6.64	8.07	17.50	19.18	13.72
Coffee, Roasted	0.51	1.08	2.04	1.36	3.11	3.46
Food Preparations	0.07	0.10	1.53	0.19	0.29	2.61
Fruit or Vegetable Juice	0.37	0.64	0.80	0.99	1.85	1.36
Grape Wine	0.04	0.12	0.29	0.10	0.36	0.49
Macadamia Nuts, Processed	1.80	1.80	1.01	4.80	5.21	1.72
Pineapples, Processed	1.98	0.92	0.53	5.28	2.65	0.90
Sugar Confectionery	0.19	0.21	0.11	0.52	0.59	0.18
Water	0.11	1.15	27.51	0.29	3.33	46.78
Total of Twenty Agricultural Products	31.46	26.53	52.80	83.76	76.64	89.76
Other Agricultural Products	6.10	8.09	6.02	16.24	23.36	10.24
Total Agricultural Products	37.56	34.62	58.82	100.00	100.00	100.00

Sources: World Trade Atlas, UN Commodity Trade Statistics, Trade Statistics of Japan

Notes: The detailed HS codes and description of each product are shown in the Appendix.

remainder exhibited irregular changes in market share during 1995–2008.

Japan is the most important market of Hawai'i's agricultural exports next to the U.S. mainland.² For the period 1995–2008, Hawai'i exported about 72 percent (in terms of value), on average, of its agricultural products destined for the foreign market to Japan. Among all the products being produced and exported by Hawai'i to Japan, only the share of *agricultural* products experienced a steady increase over the period 1995–2008.³

The export value of agricultural products was about 24 percent of Hawai'i's total export to Japan in the period 1995–1999. It increased by 13 percentage points to 37 percent in the period 2000–2005, and it increased by another 18 percentage points to 55 percent in the period 2005–2008. Export shares of other product groups, on the other hand, either declined or remained constant.⁴ Given the importance of the Japan market to Hawai'i, an analysis of the comparative and competitive advantage of Hawai'i's agricultural products exported to Japan can provide valuable information about the direct or indirect competition faced by Hawai'i's agricultural exports in

² Agricultural Products were defined as those falling under HS (Harmonized Tariff Schedule of the United States) Chapters 01–24.

³ Excluding mineral products (HS Codes 25-27) and vehicles, aircraft, vessels, and associated transportation equipment (HS Codes 86–89).

⁴ World Trade Atlas, 2009.

Table 2. Comparative advantage of Hawai'i's agricultural exports to Japan, 1995 and 2008

PRODUCT	1995	2008	1995-2008
<i>Unprocessed/Semi-Processed</i>			
Abalone	0.00	0.17	0.17
Coffee (Unroasted)	0.09	0.18	0.09
Cut Flowers/Buds	0.59	0.03	-0.56
Fixed Vegetabel Fats and Oils	0.00	0.00	0.00
Fruits and Nuts	0.02	0.00	-0.02
Macadamia Nuts (Fresh or Dried)	0.00	0.00	0.00
Ornamental Fish	0.06	0.01	-0.05
Papayas	2.51	0.29	-2.22
Pineapples (Fresh or Dried)	-0.01	-0.01	0.00
Seaweeds	0.01	0.04	0.03
Tuna	0.67	0.02	-0.65
<i>Processed</i>			
Cocoa (Processed)	1.27	1.20	-0.07
Coffee (Roasted)	0.03	0.40	0.37
Food Preparations	-0.03	-0.09	-0.06
Fruit and Vegetable Juice	0.01	0.12	0.11
Grape Wine	-0.05	-0.03	0.02
Macadamia Nuts (Processed)	0.38	0.10	-0.28
Pineapples (Processed)	0.26	-0.01	-0.27
Sugar Confectionery	0.00	0.00	0.00
Water	0.03	5.08	5.05
Others	-5.84	-7.50	-1.66

Japan, which will be useful for recognizing and building on the competitiveness of Hawai'i's agricultural products.

Measurement of comparative advantage

Following the study on the comparative advantage of Hawai'i's agricultural exports to the U.S. mainland market, the normalized revealed comparative advantage (NRCA) index (Yu et al. 2009)⁵ is used to measure the comparative advantage (CA) of Hawai'i's agricultural products to Japan. The NRCA of Hawai'i's agricultural product i in the Japanese market is given by:

$$(1) \quad NRCA_i^h = \frac{E_i^h}{E} - \frac{E_i}{E} \frac{E^h}{E}$$

where E_i^h denotes the supply of agricultural product i to Japan from Hawai'i, E_i denotes the supply of agricultural product i to Japan from Hawai'i and the rest of

the world, E^h denotes the total supply of all agricultural products to Japan from Hawai'i, and E denotes the total supply of all agricultural products to Japan from Hawai'i and the rest of the world. The NRCA score signifies the extent of comparative advantage (or disadvantage) that

Hawai'i possesses in a certain product. $NRCA_i > 0$ implies that Hawai'i has comparative advantage in product i , $NRCA_i < 0$ implies that Hawai'i has comparative

disadvantage in product i , and $NRCA_i = 0$ implies that Hawai'i has neither comparative advantage nor disadvantage in product i .

Analysis of comparative advantage

Table 2 presents the NRCA scores of the products under investigation for 1995 and 2008.⁶ Column 1 shows that in 1995, among the products investigated, Hawai'i had comparative disadvantage in only one unprocessed/semi-processed product (fresh or dried pineapples) and two processed agricultural products (food preparations and grape wine). Column 2 shows that in 2008 Hawai'i had comparative disadvantage in only one unprocessed/semi-processed product (fresh or dried pineapples) and three processed products (food preparations, grape wine, and processed pineapples).

The difference in NRCA scores between 1995 and 2008, shown in column 3, reveals that of the unprocessed/semi-processed agricultural products investigated, three gained CA from 1995 to 2008 (abalone, unroasted coffee, and seaweeds), and five lost CA (cut flowers/buds, fruits and nuts, ornamental fish, papayas, and tuna). Of the processed agricultural products, four gained CA from 1995 to 2008 (roasted coffee, fruit or vegetable juice, grape wine, and water), and four lost CA (processed cocoa, food preparations, processed macadamia nuts, and processed pineapples). Thus, of the 20 products investigated, nine lost CA, seven gained CA, and four (fixed vegetable fats and oils, fresh or dried macadamia nuts, fresh or dried pineapples, and sugar confectionery) maintained CA. The changes in CA in the Japan market echoes the CA pattern for some exports of Hawai'i to the U.S. mainland market. For example, coffee gained CA both in the U.S. mainland market and in Japan, while processed pineapples and papayas lost CA in both markets.

⁵ Yu, R., J. Cai, and PS. Leung. 2009. The revealed normalized comparative advantage index. *Annals of Regional Science* 43:267–282.

⁶ To facilitate the presentation, the NRCA score has been rescaled by a constant of 10,000.

Following the Yu et al. 2009 study on the comparative advantage of Hawai'i's agricultural exports to the U.S. mainland market, a simple time-trend model is likewise employed to detect the trends of change in CA,⁷ that is, if CA has exhibited a tendency to decline or increase, hence revealing a more robust picture of the competitiveness of Hawai'i's products. Table 3 presents the comparative advantage trends for the products under investigation. The comparative advantage trend examines the annual changes in NRCA scores from 1995 to 2008.

Among the unprocessed agricultural products, Hawai'i had a positive and statistically significant⁸ CA trend for only one product, abalone. For processed agricultural products, there is evidence of positive and significant CA trends in two products: roasted coffee and water. Meanwhile, during the same period of 1995 to 2008, Hawai'i kept losing CA in four unprocessed agricultural products (cut flowers/buds, ornamental fish, papayas, and tuna) and in two processed agricultural products (processed macadamia nuts and processed pineapples). The CA trends are consistent with the change in CA for these products identified in Table 2. Eleven agricultural products investigated revealed no significant trend in gaining or losing CA from 1995 to 2008. Other agricultural products (*Others*), meanwhile, are significantly losing CA. In addition, trends of CA in the Japan market echoes the CA trends for some exports of Hawai'i to the U.S. mainland market. For instance, coffee (both roasted and unroasted) had positive CA trends both in the U.S. mainland market and in Japan, while processed pineapples had declining CA trends in both markets.

⁷ To examine the trend of a particular product's CA over time, the following model is used:

$$NRCA_{i,t}^h = \alpha_i^h + \beta_i^h t + \varepsilon_{i,t}^h, \text{ where } \alpha_i^h \text{ is the intercept, } \beta_i^h \text{ is the slope coefficient, } t \text{ is the time index, and } \varepsilon_{i,t}^h \text{ is a}$$

random error term. If β_i^h is not statistically different from zero, this implies that Hawai'i's CA in agricultural product i is stable; otherwise, it is unstable. In particular, $\beta_i^h > 0$ suggests that Hawai'i is gaining CA in agricultural product i and $\beta_i^h < 0$ suggests otherwise.

⁸ p-value <0.05.

Table 3. Comparative advantage trends of Hawai'i's agricultural exports to Japan, 1995–2008

PRODUCT	β (trend)	p-value
<i>Unprocessed/Semi-Processed</i>		
Abalone	0.029	0.010
Coffee (Unroasted)	0.011	0.358
Cut Flowers/Buds	-0.042	0.000
Fixed Vegetabel Fats and Oils	0.000	0.715
Fruits and Nuts	-0.001	0.612
Macadamia Nuts (Fresh or Dried)	-0.005	0.101
Ornamental Fish	-0.005	0.002
Papayas	-0.184	0.000
Pineapples (Fresh or Dried)	0.008	0.228
Seaweeds	0.009	0.146
Tuna	-0.027	0.013
<i>Processed</i>		
Cocoa (Processed)	0.002	0.878
Coffee (Roasted)	0.026	0.000
Food Preparations	0.011	0.348
Fruit or Vegetable Juice	0.005	0.117
Grape Wine	-0.002	0.522
Macadamia Nuts (Processed)	-0.019	0.010
Pineapples (Processed)	-0.028	0.004
Sugar Confectionery	-0.003	0.084
Water	0.428	0.000
Others	-0.212	0.034

Note: p-value <0.05 indicates statistical significance.

Table 4 displays the major competitors with Hawai'i in the Japan market for products for which Hawai'i had a significant CA trend, i.e., cut flowers/buds, ornamental fish, papayas, processed macadamia nuts, processed pineapples, tuna, abalone, roasted coffee, and water. Shown are the values of Japan's imports from the world and top-country suppliers, the percentage share of each country's supply in Japan's market, and Hawai'i's share in the U.S. supply to Japan for the years 1995, 2000, 2005, and 2008.

Cut flowers/buds

The USA is not a major supplier of cut flowers/buds to Japan, but Hawai'i produces about one- to two-thirds of this total supply (depending on the year cited). The major exporters of cut flowers/buds to Japan in 1995 were the Netherlands, Thailand, and New Zealand. However, by 2005, the shares of these three countries, together with the USA, in the Japan market dramatically went down.

This is despite of the increasing total imports by Japan of cut flowers/buds, in terms of quantity (See Appendix Figure 1). Malaysia, Republic of Korea, China, other Asian countries, and Colombia started to gain market shares. Colombia's main advantage over Hawai'i is its lower labor cost. Malaysia, South Korea, and China, meanwhile, have an advantage because of their proximity to Japan, which minimizes shipping and postharvest storage costs. In addition, Malaysia and China, aside from having competitive wages, have governments that are promoting their cut flower industry by providing several support programs to investors.⁹ Along with the declined share of the U.S. supplies in the Japan market, the share of Hawai'i in the U.S. supply declined as well. Hawai'i's share in the U.S. supply went down from 76 percent in 2000 to 31 percent in 2008. This is in light of the declining island lands dedicated to flower-growing and shifting to more lucrative use of land.¹⁰ In a report published by the U.S. Department of Agriculture in 2008, the number of farms dedicated to cut flowers fell from 50 in 2003 to 37 in 2007. Likewise, production area fell from 3,005,000 ft² in 2003 to 2,350,000 ft² in 2007.¹¹ Along with these, Hawai'i had a continuous decline in CA in cut flowers/buds from 1995 to 2008, with the NRCA score falling from 0.63 in 1995 to 0.03 in 2008. Based on this decreasing trend, the CA of Hawai'i's cut flowers/buds is expected to continue declining in the Japan market in the near future. This observation is consistent with the findings on Hawai'i's exports of cut flowers to the U.S. mainland market. The CA of Hawai'i's exports of fresh cut anthuriums, potted orchids, and fresh foliage to the

⁹ For instance, the Chinese government offers interest-free loans for greenhouse construction, provides study tours to the Netherlands and Israel (two major players in the international cut-flower industry), and funds research to develop better growing, distribution, and marketing techniques (Clements-Hunt, A. 2004. *Cut flowers: A multi-million dollar industry blooms in rural China*. International Trade Center, International Trade Forum; Stewart, A. 2006. *Flower confidential: The good, the bad, and the beautiful in the business of flowers*. North Carolina: Algonquin Books of Chapel Hill). Similarly, the Malaysian government initiated a variety of policies for the industry: tax incentives, financing of growers' participation in international trade shows and exhibitions, and sponsorship of foreign consultants with production and marketing expertise (http://www.green-seeds.com/land_flor4.html).

¹⁰ Stewart, A., 2006; http://www.humanflowerproject.com/index.php/weblog/comments/todays_Hawaiian_lei_kiss_not_included.

¹¹ National Agricultural Statistics Service. 2008. *Hawaii flowers and nursery products annual survey*.

U.S. mainland also declined steadily over the period 1995–2005.

Ornamental fish (live)

In 1995, the United States was the second top supplier of ornamental fish to Japan, next to Singapore, which is the largest exporter of ornamental fish in the world.¹² The USA supplied about 14 percent of the total imports of Japan. Hawai'i's share of this supply is only 4 percent, and the majority came from Florida. The major exporters of ornamental fish to Japan are Singapore, Indonesia, Malaysia, Hong Kong, and Thailand, which are considered main production centers of ornamental fish.¹³ From 1995 to 2008, Hawai'i's share in the U.S. supply and of the total imports by Japan did not exhibit any dramatic changes, but the share of the USA in the Japan market significantly declined, to 5 percent. Both Brazil and Colombia have captured larger shares of the Japan ornamental fish market, 15 and 9 percent, respectively, in 2008.

In spite of Hawai'i's initial efforts to stimulate its ornamental fish industry,¹⁴ it has not been very successful in penetrating the international market. One primary reason is that wholesale buyers of ornamental fish prefer to buy from suppliers with large volumes and varieties. Florida still controls over 95 percent of the U.S. supply, mainly because it can provide these requirements to buyers.¹⁵ Hawai'i's capacity in these aspects is still limited, as its ornamental fish industry is still in a development stage.¹⁶ Although Hawai'i did not exhibit comparative disadvantage in ornamental fish, a significant decreasing trend was detected over the period 1995–2008. As a result, its NRCA score declined from 0.06 in 1995 to 0.01 in 2008. It is expected that this CA will continue to decline in the near future.

Papayas (fresh)

In 1995, the USA captured almost the entire papaya import market in Japan, with all of the U.S. supply coming from Hawai'i. By 2005, the U.S. share (i.e., Hawai'i) in

¹² <http://www.agribdc.gov.my/html/themes/bdc/pdf/ornamental.pdf>.

¹³ Watson and Shireman, 2002. *Production of ornamental aquarium fish*; <http://edis.ifas.ufl.edu/pdf/FA/FA03900.pdf>.

¹⁴ CTSA, 2004. *Accomplishment report*, Center for Tropical and Subtropical Aquaculture, The Oceanic Institute and University of Hawai'i.

¹⁵ Watson and Shireman, 2002.

¹⁶ CTSA, 2004.

Table 4. Major suppliers of selected agricultural products to Japan, selected years

Products	1995			2000			2005			2008		
	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply
Cut Flowers/Buds												
World	214.64			162.02			229.71			277.11		
Netherlands	73.99	34%		33.73	21%		11.73	5%		8.51	3%	
Thailand	40.13	19%		27.57	17%		28.07	12%		33.01	12%	
New Zealand	29.92	14%		18.88	12%		14.76	6%		12.64	5%	
Malaysia	2.90	1%		6.23	4%		41.15	18%		59.69	22%	
Colombia	7.34	3%		11.98	7%		34.01	15%		52.31	19%	
Republic of Korea	2.78	1%		18.49	11%		20.68	9%		13.77	5%	
China	1.01	0.47%		1.07	1%		15.45	7%		30.27	11%	
Other Asia	7.49	3%		9.94	6%		18.43	8%		20.78	7%	
USA	5.66	3%		3.32	2%		1.78	1%		0.80	0.30%	
Hawaii	3.47	2%	61%	2.51	2%	76%	0.85	0.37%	48%	0.25	0.10%	31%
Ornamental Fish												
World	77.97			32.14			28.80			26.19		
Singapore	15.98	20%		5.52	17%		4.34	15%		4.68	18%	
Hong Kong	9.92	13%		2.34	7%		1.16	4%		0.81	3%	
Indonesia	9.04	12%		4.42	14%		4.03	14%		3.97	15%	
Malaysia	6.13	8%		4.15	13%		2.72	9%		1.33	5%	
Brazil	4.96	6%		4.46	14%		4.23	15%		3.89	15%	
Thailand	3.32	4%		1.00	3%		2.57	9%		0.80	3%	
Colombia	1.03	1%		1.07	3%		1.34	5%		2.37	9%	
USA	10.72	14%		2.90	9%		1.23	4%		1.38	5%	
Hawaii	0.41	0.53%	4%	0.07	0.22%	2%	0.06	0.21%	5%	0.08	0.31%	6%
Papaya												
World	14.27			12.53			9.25			7.77		
Philippines	0.25	2%		4.54	36%		4.45	48%		5.63	72%	
USA	14.02	98%		7.82	62%		4.67	51%		2.08	27%	
Hawaii	14.02	98%	100%	7.21	58%	92%	4.67	51%	100%	1.97	25%	94%
Macadamia Nuts, Processed												
World	10.79			6.79			6.53			5.80		
Australia	1.51	14%		1.37	20%		3.80	58%		3.14	54%	
USA	9.03	84%		5.34	79%		2.69	41%		2.64	45%	
Hawaii	2.14	20%	24%	1.89	28%	35%	0.93	14%	34%	0.70	12%	26%
Pineapples, Processed												
World	66.55			45.70			60.50			59.52		
Thailand	31.12	47%		22.12	48%		33.11	55%		31.65	53%	
Philippines	16.16	24%		11.82	26%		12.11	20%		11.77	20%	
Indonesia	7.79	12%		6.73	15%		8.39	14%		7.59	13%	
Costa Rica	0.00			0.00			1.21	2%		5.27	9%	
USA	3.82	6%		1.60	3%		1.45	2%		0.04	0.10%	
Hawaii	1.54	2%	40%	0.80	2%	50%	1.09	2%	75%	0.00	-	-
Tuna												
World	319.79			258.86			288.80			257.85		
Taiwan	94.05	29%		28.78	11%		15.86	5%		11.40	4%	
Indonesia	86.62	27%		82.21	32%		101.67	35%		117.35	46%	
FS Micronesia	33.70	11%		7.34	3%		1.17	0.41%		3.05	1%	
Australia	6.88	2%		11.03	4%		11.07	4%		15.54	6%	
Palau	6.33	2%		5.67	2%		29.23	10%		25.11	10%	
Thailand	2.66	1%		6.98	3%		16.39	6%		19.36	8%	
Sri Lanka	2.89	1%		10.15	4%		25.21	9%		12.09	5%	
USA	38.64	12%		18.00	7%		7.56	3%		34.91	14%	
Hawaii	4.00	1%	10%	0.30	0.12%	2%	1.28	0.44%	17%	0.36	0.14%	1%

Source: Computed from UN COMTRADE, World Trade Atlas, and Trade Statistics of Japan

Note: Japan's top suppliers of other agricultural products investigated in the current study are contained in the Appendix.

Table 4. Major suppliers of selected agricultural products to Japan, selected years (continued)

Products	1995			2000			2005			2008		
	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply
Abalone												
World	21.37			16.33			32.17			33.92		
Australia	12.03	56%		10.11	62%		10.62	33%		6.70	20%	
China	5.97	28%		0.29	2%		3.01	9%		0.53	2%	
South Korea	0.02	0.12%		0.00	0.01%		9.45	29%		21.19	62%	
USA	1.61	8%		2.40	15%		4.18	13%		2.65	8%	
Hawaii	-	-	-	0.003	0.02%	0.16%	1.48	5%	35%	1.16	3%	44%
Coffee, Roasted												
World	22.69			25.86			40.82			85.96		
United Kingdom	2.94	13%		4.95	19%		4.03	10%		12.52	10%	
Switzerland	-	-		0.64	2%		1.60	4%		16.63	19%	
Brazil	0.98	4%		0.74	3%		2.55	6%		6.94	8%	
Colombia	0.06	0.27%		0.68	3%		1.32	3%		7.57	9%	
USA	12.42	55%		12.38	48%		18.37	45%		25.39	30%	
Hawaii	0.21	1%	2%	0.89	3%	7%	1.18	3%	6%	2.74	3%	11%
Water												
World	120.04			115.47			279.17			369.95		
France	84.21	70%		98.61	85%		178.14	64%		235.02	64%	
USA	14.52	12%		10.56	9%		80.90	29%		109.20	30%	
Hawaii	0.25	0.21%	2%	0.42	0.37%	4%	16.70	6%	21%	34.40	9%	32%

Source: Computed from UN COMTRADE, World Trade Atlas, and Trade Statistics of Japan

Note: Japan's top suppliers of other agricultural products investigated in the current study are contained in the Appendix.

Japan was cut by half with growth in the Philippines' market share. By 2008, the Philippines overtook Hawai'i as the largest supplier of papayas to Japan, capturing 72 percent of the market. With the world price of papaya declining in the period 1995–2008 (see Appendix Figure 2), an explanation of Hawai'i's loss to the Philippines is production cost, particularly labor cost, in which Hawai'i is unable to compete. Another reason believed to have significantly contributed to Hawai'i's loss is the rejection by Japan of genetically engineered Hawai'i papayas.¹⁷ Among the products identified as having significant comparative disadvantage trends, Hawai'i has the greatest comparative disadvantage trend in papaya (–0.198). Papaya likewise exhibited the largest decline in CA from 1995 (2.71) to 2008 (0.32), with the NRCA score falling by 88 percent (–2.39). This finding of a decline in Hawai'i's CA in papaya is consistent with the findings of many other studies.¹⁸

Macadamia nuts (processed)

A comparable picture can be seen in the case of Hawai'i's processed macadamia nuts. In 1995, the United States held 84 percent of the processed macadamia nuts market in Japan, with Hawai'i holding 24 percent of this total and California providing the remainder. Australia, the only other major exporter of processed macadamia nuts to Japan, held about 14 percent of the market share. Along with the decline in Japan's total quantity imported of processed macadamia nuts (See Appendix Figure 1), the U.S. market share declined to 45 percent in 2008, but the Australia market share went up to 54 percent. Although the Hawai'i share of the U.S. supply increased from 24 percent in 1995 to 35 percent in 2000, its share declined to 26 percent in 2008. Parallel to this observation, Hawai'i's CA in processed macadamia nuts in the Japan market has fallen, with the NRCA score dropping by about 73 percent, from 0.41 in 1995 to 0.11 in 2008.

¹⁷ Greenpeace International (2006). *The failure of GE papaya in Hawaii*. Netherlands: Greenpeace International.

¹⁸ See for instance, Yu, R., J. Cai, M.K. Loke, and PS. Leung, 2009, *Assessing the comparative advantage of Hawaii's agricultural exports to the U.S. mainland market*. *Annals of Regional Science*, DOI 10.1007/s00168-009-0312-9; and Cai, J., PS. Leung, and M. Loke, 2007, *Comparative advantage of selected agricultural products in Hawai'i: A revealed comparative advantage assessment*. College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa, Economic Issues no. 11, <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/EI-11.pdf>.

Australia's macadamia nut industry has experienced progressive growth through the years largely because of the efforts of the Australian Macadamia Society (AMS). Although the greater focus of AMS is to help the growers of macadamia nuts, it has proven to be helpful as well to processors of macadamia nuts. AMS supports efforts in improving processing efficiencies and marketing of processed macadamia nuts. For instance, AMS provides publicity and information by distributing brochures about processed Australian macadamia nuts at events, offering samples of processed nuts and helping improve perception of the health effects of macadamia nuts.¹⁹ Hawai'i has a similar industry body, the Hawaii Macadamia Nut Association (HMNA). While AMS is a well-funded organization, which allows for various research efforts and projects that help improve the efficiency of both macadamia nut growers and processors, HMNA is plagued by financial difficulties and has been unable to meet its responsibilities to the Hawai'i macadamia nut growers.²⁰ Assistance from HMNA to macadamia nut processors is not expected. Based on the historical trend, Hawai'i's CA in processed macadamia nuts in the Japan market is expected to continue to decline in the near future. Furthermore, two of the leading processors are owned by off-shore multinational corporations and conduct independent marketing. Lower market prices for macadamia nuts and new buying contracts between the processors and local growers have also caused much dissension in the ranks. HMNA was unable to mitigate many of the challenges between growers and processors.

Pineapples (processed)

Hawai'i is the largest supplier of U.S. exports of processed pineapples, but the major exporters of processed pineapples to Japan are its neighbors: Thailand, the Philippines, and Indonesia. Similar to the situation of cut flowers/buds, the USA is not a significant supplier of processed pineapples to Japan. An increasing trend in Hawai'i's share in the U.S. export of processed pineapples to Japan can be observed from 1995 to 2005 (Table 4). In 2005, Hawai'i supplied 75 percent of the U.S. exports to Japan. However, with the closures of the Del Monte

¹⁹ <http://www.macnuts.com.au/industry.htm>.

²⁰ HMNA does not even have a full-time staff member to oversee any projects. Its failure to raise money from its members has kept it from meeting its service goals and holding educational meetings (<http://www.ctahr.hawaii.edu/fb/macadami/macadami.htm#top>).

Plantation cannery in Central O'ahu in 2006 and the Maui Land and Pineapple Company's cannery in 2007, Hawai'i's share of the U.S. export dropped to zero, and the U.S. share in the Japan market fell from 2 to merely 0.1 percent. The Del Monte operations were transferred to a low-labor-cost country, Costa Rica, where in 2008 it held 9 percent of the Japan market, up from only 2 percent in 2005. From 1995 to 2008, Hawai'i experienced a position of comparative advantage to comparative disadvantage, with its NRCA score falling to -0.01 in 2008 from 0.29 in 1995. According to the CA trend, Hawai'i's processed pineapples will likely continue to lose comparative advantage in the Japan market in the near future.

Tuna (fresh or chilled)

In 1995, the USA was the third top supplier of tuna to Japan, next to Taiwan and Indonesia. The USA supplied about 12 percent of the total imports of Japan, with Hawai'i providing about 10 percent of this supply. In the late 1990s, there was a heightened concern that longline fishing gear posed a threat to protected sea turtles. As a result, in November 1999 the Federal Court in Honolulu ordered a temporary seasonal closure of certain waters to Hawai'i-based longline vessels.²¹ This directly and indirectly reduced Hawai'i's share in the Japan tuna market to 0.12 percent in 2000. By 2008, although the final regulations only affected the swordfish fishery, and total tuna catch in Hawai'i has actually been increasing, Hawai'i's shares in the U.S. supply and of the total imports of Japan were only 0.14 percent and 1 percent, respectively. Indonesia, Palau, and Thailand captured larger shares of the Japan tuna market. From 1995 to 2008, Hawai'i showed a decline in its comparative advantage in tuna, with its NRCA score falling by almost 97 percent, from 0.67 in 1995 to 0.02 in 2008.

Despite Hawai'i's losing CA in the aforementioned products in the Japan market, it is gaining CA in three products (roasted coffee, abalone, and water), revealing a shift of CA among these products.

Roasted coffee

From 1995 to 2008, Hawai'i had a positive CA trend in roasted coffee. In 1995, its NRCA score for roasted coffee was only 0.04, but in 2008 it increased to 0.44, representing an increase of 1,100 percent. Hawai'i is the

only coffee-growing state in the USA. Other cities that process or roast coffee, such as Seattle, Los Angeles, and San Francisco, have to first import coffee beans from coffee-growing regions such as South and Central America and Africa and countries such as Indonesia. While Seattle remains the top exporter of roasted coffee in the USA, Hawai'i has been taking over some of the market share from Seattle and California. In 2008, Hawai'i supplied 11 percent of the U.S. export to Japan, up from only 2 percent in 1995. Based on the historical trend, Hawai'i's CA in roasted coffee is expected to continue to increase in the near future. With the total quantity of roasted coffee imported by Japan showing an upward trend (see Appendix Figure 1), the roasted coffee industry in Hawai'i has a promising future.

Abalone (live or fresh)

Abalone is a popular luxury seafood delicacy in Japan. Australia and China were the top suppliers of abalone to Japan in 1995. The USA was supplying 8 percent of Japan's imports at that time, with the supply coming mainly from California. In 1997, due to depletion of wild abalone populations in California, commercial abalone fishing was closed there, raising the demand for farm-raised abalone. With the establishment of the Big Island Abalone Corporation (BIAC) in 2000, Hawai'i started supplying abalone to Japan in 2001. BIAC operates the sole abalone farm in Hawai'i, which is currently the largest in the nation.²² By 2005, South Korea and the USA had already captured larger shares of the abalone market in Japan. In 2008, Hawai'i was supplying almost half of the U.S. exports to Japan. However, it is notable that the U.S. supply declined and South Korea captured a larger share of the market, which is a growing threat to Hawai'i's abalone producer. With Hawai'i being able to respond to the increasing demand by Japan for farm-raised abalone (see Appendix Figure 1), Hawai'i has gained CA in this product. In 1995, the NRCA score for abalone was zero, but by 2008 it had increased to 0.19.

Water (bottled)

Another popular Hawai'i product being exported to Japan is mineral water. In fact, among the three products identified as having significant CA trends, Hawai'i has the greatest CA in mineral water (0.472). Mineral water

²¹ Allen and Gough, 2007; http://www.pifsc.noaa.gov/tech/NOAA_Tech_Memo_PIFSC_8.pdf

²² <http://www.highbeam.com/doc/1G1-95121706.html>

likewise had the greatest increase in NRCA score from 1995 to 2008, from 0.03 in 1995 to 5.59 in 2008, representing a 556 percent increase in the NRCA score. In 1995, France dominated the Japan mineral water import market, supplying 70 percent of Japan's imports. The USA held 12 percent of the market, with Hawai'i supplying only 2 percent, and Los Angeles, San Francisco, and Seattle providing the majority of the U.S. supply. In 2002, Hawai'i started exporting desalinated deep-sea water to Japan with the establishment of Koyo USA Corporation.²³ Since then, several other companies have invested in the desalinated deep-sea water industry in Hawai'i. With this, Hawai'i's share in Japan's market dramatically increased, from less than 1 percent in 1995–2000 to 6 percent in 2005. Likewise, the share of Hawai'i in the U.S. supply to Japan increased by 17 percentage points from 4 percent in 2000 to 21 percent in 2005. By 2008, Hawai'i's share of Japan's market further increased to 9 percent, with its share in the U.S. supply increasing further to 32 percent. Similar to roasted coffee, with the total quantity imported of mineral water by Japan showing an upward trend (See Appendix Figure 1), the desalinated deep-sea water industry in Hawai'i holds great potential.

The exportation of both abalone and desalinated deep-sea water are products of research projects supported by the Natural Energy Laboratory of Hawai'i Authority (NELHA). NELHA is a state agency set up to research ocean thermal energy conversion processes and related technologies.²⁴ Currently, NELHA supports over 30 thriving enterprises utilizing the natural riches of the ocean depths. The success of abalone and desalinated deep-sea water exportation emphasizes the importance of continuous government support for research that eventually could enhance the competitiveness of U.S. and Hawai'i products. Similarly, government support for organizations such as the Hawaii Coffee Association, which promotes Hawai'i as a coffee origin, would be beneficial to ensure that the roasted coffee industry continues to blossom.

²³ Though bottled sea water has been around in Japan since mid-1990s, deep-sea water coming from Hawai'i is touted as having the highest quality, because nothing can match the depth, quality, and purity of water drawn from the middle of the Pacific Ocean (<http://www.uswaternews.com/archives/arcglobal/4japathir10.html>).

²⁴ <http://www.dswihawaii.com/nelha.html>.

Figure 1 shows a competitiveness matrix relating the NRCA score of each product with Japan's total imports of the product over time. The classification of products—rising stars, missed opportunities, declining stars, and retreat—is based on the competitiveness matrix developed by the World Bank and the United Nations Organization.²⁵ Rising stars are products where Hawai'i has a positive and statistically significant NRCA trend and where Japan is increasing its total imports. Missed opportunities take place in products in which Hawai'i has a negative and statistically significant NRCA trend or a statistically insignificant NRCA trend and in which Japan is increasing its total imports. Declining stars are products in which Hawai'i has a positive and statistically significant NRCA trend but in which Japan is decreasing its total imports. Finally, the situation of a product is considered a retreat when Hawai'i has negative and statistically significant NRCA trend or statistically insignificant NRCA and the total imports by Japan of the product is decreasing.

Abalone, roasted coffee, and bottled water are Hawai'i's rising stars. Both roasted coffee and bottled water have had a positive and statistically significant CA, along with expanding imports in the Japan market (See Appendix Figure 1). While abalone has shown a positive CA trend, its market share declined from 2005 to 2008. With the Japan abalone import market showing an upward trend (See Appendix Figure 1), Hawai'i's agriculture policy-makers and abalone growers should take action to prevent the further slide of Hawai'i's market share in the Japan abalone market; otherwise, abalone may become a missed opportunity. Cut flowers/buds are classified under missed opportunity, as Hawai'i has failed to keep up with the growing demand for cut flowers/buds in Japan (See Appendix Figure 1). Papayas, processed macadamia nuts, processed pineapples, ornamental fish, and tuna, meanwhile, are classified under retreats. As Japan has decreased its imports of these products (See Appendix Figure 1), Hawai'i has had a declining CA in them.

Notable is that all unprocessed/semi-processed agricultural products (except for abalone) are classified as missed opportunity or retreat. Products that are classified as rising stars, meanwhile, are processed agricultural products (roasted coffee and bottled water). While abalone is an exception, its production requires a different

²⁵ See Mandeng, O. 1991. World competitiveness and international specialization. *Eclac Review* 45.

Figure 1. Competitiveness matrix of Hawai'i's Agricultural exports to Japan, 1995–2008

N R C A t r e n d	Declining Stars	Rising Stars Abalone* Coffee (Roasted) Water (Bottled)
	Retreats Papaya Macadamia Nuts (Processed) Pineapples (Processed) Ornamental Fish Tuna Macadamia Nuts (Fresh/Dried) Seaweeds	Missed Opportunities Cut Flowers/Buds Cocoa (Processed) Coffee (Unroasted) Fixed Vegetable Fats and Oils Food Preparations Fruit or Vegetable Juice Fruits and Nuts Grape Wine Pineapples (Fresh/Dried) Sugar Confectionery
Japan's Total Imports		

*Exhibited declining market share from 2005 to 2008

kind of technology. This suggests that better production techniques have an important role in increasing the international competitiveness of Hawai'i's products.

Conclusion

While Hawai'i had comparative advantage in fresh papayas, pineapples (processed), cut flowers/buds, macadamia nuts (processed), ornamental fish, and tuna in 1995, it has lost its comparative advantage considerably in these products over the years. The emergence of abalone and desalinated deep-sea water as top export products to Japan shows that Hawai'i has capitalized on its under-tapped but abundant natural resource—sea water.²⁶ However, it must be emphasized that better production techniques have greatly contributed to the increase in competitiveness of Hawai'i in these two sea water products. Moreover, Hawai'i has taken advantage of the brand recognition by Japanese consumers of Hawai'i

products, in particular desalinated deep-sea water and roasted coffee, for having high quality.²⁷

The findings of this study are relevant for policy makers, as they suggest that Hawai'i may be losing competitiveness in some of its products in the Japan market due to lower labor costs and more efficient production techniques in some of its competitors. Whether these are the exact reasons for Hawai'i's loss of competitiveness is a rich subject requiring future research. If Hawai'i is not able to compete in these aspects, then other ways must be found to improve competitiveness in the products experiencing competitive disadvantage. Otherwise, it may be necessary to abandon promotion of these products and focus attention and limited resources on promotion of products with the brightest prospects, such as desalinated deep-sea water, roasted coffee, and abalone, as this study suggests. In addition, findings of this study suggest that the role of research and technology is important in harnessing the productive capacities of natural resources.

²⁶ Mark Anderson, formerly of the state's Foreign-Trade Zone Division, noted that Hawai'i always had difficulty creating new export industries because Asia and the West Coast have more resources and cheaper labor, but Hawai'i may have discovered an inexhaustible gold mine in water. (<http://archives.starbulletin.com/2004/10/11/business/story2.html>).

²⁷ Japanese visitors have been flocking the farmers' markets seeking both a local experience and local products, often for omiyage (gifts).

Acknowledgments

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Appendix

Appendix Table 1. Product description and HS codes

Product	HS Code	Description
<i>Unprocessed/Semi-Processed</i>		
Abalone	1605906020	Abalone, Live or Fresh
Coffee (Unroasted)	0901110000	Coffee, Not Roasted/Not Decaffeinated
	0901120000	Coffee, Not Roasted/Decaffeinated
Cut Flowers/Buds	0603100000	Cut Flowers/Buds, Fresh
	0603190000	Cut Flowers/Buds, Fresh
	0603900000	Cut Flowers/Buds, Dried, Dyed, Bleached
Fixed Vegetable Fats and Oils	1515900000	Other Fixed Vegetable Fats and Oil
	1515908000	Fixed Vegetable Fats/Oil, Not Chemically Modified
	1515908002	Fixed Vegetable Fats/Oil, Not Chemically Modified, NESOI
Fruits and Nuts	0802909500	Nuts, Shelled, Fresh or Dried, NESOI
	0811909000	Fruits and Nuts, Uncooked/Cooked by Water, Frozen, NESOI
	0812908800	Fruits and Nuts, Provisionally Preserved, Inedible, NESOI
	0813408500	Other Fruits and Nuts
Macadamia Nuts (Fresh or Dried)	0802608000	Macadamia Nuts Shelled, Fresh or Dried
Ornamental Fish	0301100000	Ornamental Fish, Live
Papayas	0807200000	Papayas, Fresh
Pineapples (Fresh or Dried)	0804300000	Pineapples, Fresh or Dried
Seaweeds	1212200000	Seaweeds
Tuna	0302320000	Yellowfin Tunas
	0302330000	Skipjack Tunas
	0302340000	Bigeye Tunas
<i>Processed</i>		
Cocoa (Processed)	1806100000	Cocoa Powder, Containing Added Sugar or Other Sweetening
	1806206000	Confectioners Coatings/Products Containing Not Less 6.8% Cocoa Solid Block
	1806209000	Cocoa Preparations in Bulk Form, NESOI
	1806310040	Chocolate and Other Food Preparations Containing Cocoa, Confectionery, in Block, Slabs or Bars Weighing 2 Kgs or Less, Filled
	1806310080	Chocolate or Cocoa Preparations, Non-Confectionery, in Blocks/Bars Not Over 2 Kg, Filled
	1806321000	Chocolate or Cocoa Preparations, Confectionery, in Blocks/Bars Not Over 2 Kg
	1806323550	Chocolate and Other Food Preparations Containing Cocoa, in Block, Slabs or Bars Weighing 2 Kgs or Less, Not Filled, Except Confectionery
	1806900063	Chocolate Retail - Confectionery
	1806900073	Cocoa Preparations Except Confectionery, NESOI, For Retail
	1806900083	Confectionery, Cocoa Food Preparations, NESOI, Not Retail
	1806900093	Cocoa Preparations, NESOI, Not Put Up for Retail Sale, Except Confectionery

Appendix Table 1 (continued). Product description and HS codes

Product	HS Code	Description
Coffee (Roasted)	0901210000	Coffee, Roasted/Not Decaffeinated
	0901220000	Coffee, Roasted/Decaffeinated
Food Preparations	2106901800	Preparations for Alcoholic Beverages, GT 0.5% by Volume GT 50% by Weight
	2106905800	Food Preparations of Geletin, NESOI
	2106906573	Preparations for Manufacture of Beverages, NESOI
	2106906587	Herbal Teas, Etc.
	2106906592	Food Preparations, NESOI, Canned
	2106906595	Food Preparations, NESOI, Frozen
	2106907090	Edible Preparations, Not Canned/Frozen, Not Containing Sugar, NESOI
Fruit or Vegetable Juice	2009308000	Fruit Juices, Unmixed, Unfermented, Concentrated
	2009315050	Citrus Juice (Single Fruit), NESOI, Brix Value < 20
	2009600040	Fruit Juices, Unfermented, Concentrated, Frozen
	2009800000	Juice of Any Other Single Fruit or Vegetable
	2009809000	Juice of Any Single Fruit or Vegetable, NESOI
	2009904000	Fruiti Juice, Unfermented
	2202903600	Juice of Any Single Fruit or Vegetable, (Except Orange Juice), Fortified with Vitamins/Minerals, Non-Concentrated Form
Grape Wine	2204212000	Effervescent Wine of Fresh Grape in Containers 2 Liters or Less
	2204214000	Grape Wine, NESOI, Not Over 14% Alcohol, Containers 2 Liters or Less
	2204217000	Grape Wine, NESOI, Over 14% Alcohol, Containers 2 Liters or Less
Macadamia Nuts (Processed)	2008199010	Macadamia Nuts, Prepared or Preserved
Pineapples (Processed)	2008200000	Pineapples, Prepared or Preserved, NESOI
	2009402000	Pineapple Juice, No Spirit, Unfermented, Concentration Not More Than 3.5 Degrees
	2009404000	Pineapples Juice, Unfermented, Frozen
	2009412000	Pineapple Juice, Brix Value < 20, Concentration Not More Than 3.5 Degrees
	2009414000	Pineapple Juice, Brix Value < 20, NESOI, Unfermented
	2009492000	Pineapple Juice, NESOI, Not Concentrated or Concentration Not More Than 3.5 Degrees
	2009494000	Pineapple Juice, NESOI, No Vitamins, Unfermented
Sugar Confectionery	1704903000	Confections or Sweetmeats Ready for Consumption, No Cocoa
	1704907000	Sugar Confectionery, Without Cocoa, NESOI
Water	2201100000	Mineral Waters and Aerated Waters, Natural or Artificial, Not Sweetened
	2201900000	Waters Not Sweetened or Flavored, NESOI

Source: World Trade Atlas

Appendix Table 2. Major suppliers of selected agricultural products to Japan in selected years

Products	1995			2000			2005			2008		
	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply
Cocoa (Processed)												
World	317.13			310.54			380.48			501.40		
Singapore	49.12	15%		52.98	17%		85.62	23%		188.86	38%	
Australia	37.24	12%		36.18	12%		41.90	11%		38.36	8%	
Belgium	24.74	8%		23.84	8%		48.95	13%		54.26	11%	
France	18.04	6%		15.07	5%		35.57	9%		42.33	8%	
New Zealand	27.51	9%		22.64	7%		20.71	5%		21.80	4%	
Rep. of Korea	18.37	6%		18.34	6%		22.15	6%		20.58	4%	
USA	50.60	16%		45.05	15%		34.56	9%		35.59	7%	
Hawaii	7.35	2%	15%	7.69	2%	17%	6.17	2%	18%	8.46	2%	24%
Fixed Vegetable Fats and Oils												
World	20.86			30.43			45.02			74.56		
Thailand	1.01	5%		3.28	11%		16.02	36%		18.01	24%	
India	1.75	8%		8.10	27%		4.16	9%		9.34	13%	
Sweden	3.93	19%		2.38	8%		1.58	4%		2.31	3%	
China	1.02	5%		1.46	5%		3.06	7%		9.83	13%	
Italy	0.01	0.04%		1.26	4%		2.62	6%		4.90	7%	
Viet Nam	0.00			0.00			2.05	5%		14.44	19%	
USA	5.74	27%		3.88	13%		5.21	12%		4.16	6%	
Hawaii	0.03	0.14%	1%	0.05	0.16%	1%	0.08	0.18%	2%	0.04	0.05%	1%
Food Preparations												
World	403.36			505.42			926.92			878.46		
China	15.36	4%		31.71	6%		144.43	16%		110.00	13%	
Rep. of Korea	55.87	14%		49.42	10%		72.26	8%		97.18	11%	
Singapore	37.19	9%		33.57	7%		44.71	5%		95.68	11%	
New Zealand	35.84	9%		47.35	9%		52.24	6%		58.02	7%	
Thailand	29.53	7%		30.73	6%		43.53	5%		100.82	11%	
Belgium	33.11	8%		27.99	6%		50.87	5%		27.98	3%	
Netherlands	12.75	3%		7.25	1%		15.92	2%		65.16	7%	
USA	130.57	32%		192.54	38%		364.27	39%		190.74	22%	
Hawaii	0.18	0.04%	0.14%	0.12	0.02%	0.06%	3.83	0.41%	1%	0.12	0.01%	0.06%
Fruits and Nuts												
World	32.77			32.57			70.63			50.04		
France	16.29	50%		15.85	49%		19.79	28%		18.71	37%	
China	6.49	20%		7.34	23%		22.00	31%		13.80	28%	
Thailand	2.64	8%		3.19	10%		5.33	8%		7.00	14%	
United Kingdom	3.24	10%		4.33	13%		3.91	6%		3.52	7%	
Egypt	2.39	7%		2.31	7%		3.37	5%		3.12	6%	
Rep. of Korea	0.07	0.22%		0.42	1%		6.28	9%		5.61	11%	
USA	4.75	14%		3.39	10%		1.87	3%		1.15	2%	
Hawaii	0.42	1%	9%	0.38	1%	11%	0.31	0.44%	17%	0.00	-	-
Fruit or Vegetable Juice												
World	193.16			183.28			175.30			234.06		
Australia	40.45	21%		20.48	11%		33.60	19%		40.88	17%	
China	2.48	1%		3.94	2%		24.03	14%		11.66	5%	
Netherlands	3.66	2%		5.78	3%		11.16	6%		10.26	4%	
Italy	7.13	4%		8.73	5%		6.37	4%		8.10	3%	
Chile	2.80	1%		5.76	3%		13.18	8%		13.25	6%	
Other Asia	3.33	2%		3.28	2%		7.73	4%		6.02	3%	
USA	91.70	47%		76.44	42%		53.31	30%		75.63	32%	
Hawaii	0.25	0.13%	0.27%	0.78	0.43%	1%	0.80	0.46%	2%	0.99	0.42%	1%

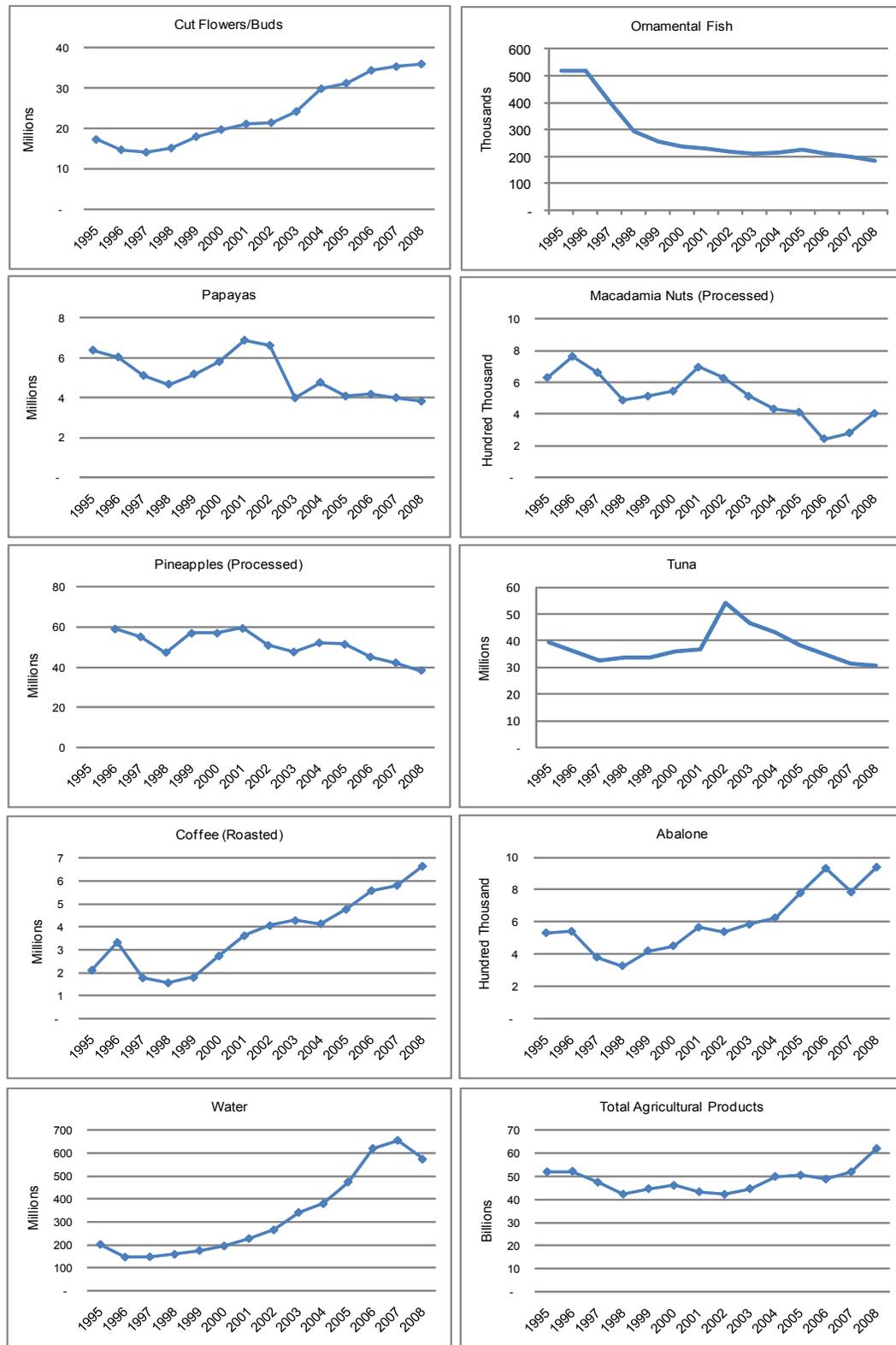
Sources: Computed from UN COMTRADE, World Trade Atlas, and Trade Statistics of Japan

Appendix Table 2 (continued). Major suppliers of selected agricultural products to Japan in selected years

Products	1995			2000			2005			2008		
	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply	Value (US\$ millions)	Share in Japan Market	Share in US Supply
Grape Wine												
World	339.23			604.70			752.21			870.38		
France	199.57	59%		350.29	58%		462.46	61%		507.24	58%	
Italy	34.35	10%		81.56	13%		103.40	14%		131.30	15%	
Germany	57.05	17%		35.27	6%		26.22	3%		21.19	2%	
Chile	1.22	0.36%		27.93	5%		25.83	3%		45.28	5%	
USA	20.54	6%		53.00	9%		48.04	6%		59.98	7%	
Hawaii	0.03	0.01%	0.15%	0.08	0.01%	0.15%	0.16	0.02%	0.33%	0.56	0.06%	1%
Macadamia Nuts (Fresh or Dried)												
World	11.50			11.53			36.55			16.99		
Australia	6.84	59%		6.17	54%		23.38	64%		10.80	64%	
Kenya	3.91	34%		3.50	30%		3.34	9%		0.00	-	
Malawi	-	-		0.82	7%		4.88	13%		2.57	15%	
South Africa	0.24	2%		0.00	-		4.62	13%		2.82	17%	
USA	0.27	2%		0.72	6%		0.00	-		0.00	-	
Hawaii	0	-	-	0.00	-	-	0.00	-	-	0.00	-	-
Pineapples (Fresh or Dried)												
World	52.50			48.60			89.65			84.85		
Philippines	51.77	99%		46.97	97%		86.95	97%		84.14	99%	
Taiwan	0.72	1%		0.83	2%		0.85	1%		0.64	1%	
USA	0.01	0.01%		0.01	0.02%		1.57	2%		0.01	0%	
Hawaii	-	-	-	0.00	-	-	1.41	2%	90%	0.00	-	-
Seaweeds												
World	174.88			150.22			179.31			172.49		
Rep. of Korea	113.95	65%		68.18	45%		69.05	39%		64.10	37%	
China	33.70	19%		60.49	40%		87.06	49%		82.18	48%	
Chile	9.01	5%		8.99	6%		7.84	4%		12.21	7%	
Canada	0.70	0.40%		1.52	1%		5.14	3%		7.04	4%	
USA	1.99	1%		0.82	1%		0.99	0.08%		0.45	0.09%	
Hawaii	0.23	0.13%	12%	0.67	0.45%	82%	0.99	0.55%	100%	0.45	0.26%	100%
Sugar Confectionery												
World	60.70			60.92			83.40			78.49		
Netherlands	14.94	25%		13.58	22%		12.58	15%		9.35	12%	
Spain	7.78	13%		11.09	18%		12.89	15%		13.66	17%	
Germany	3.47	6%		2.58	4%		13.59	16%		12.81	16%	
China	0.76	1%		14.90	24%		10.60	13%		6.22	8%	
Thailand	0.07	0.11%		0.94	2%		5.54	7%		6.39	8%	
USA	2.77	5%		4.00	7%		4.23	5%		4.58	6%	
Hawaii	0.06	0.10%	2%	0.46	0.76%	12%	0.17	0.20%	4%	0.11	0.14%	2%
Coffee (Unroasted)												
World	1096.11			768.05			877.65			1104.97		
Brazil	256.56	23%		178.16	23%		246.17	27%		279.50	24%	
Colombia	222.76	20%		178.68	23%		237.72	26%		282.89	24%	
Indonesia	152.58	14%		84.89	11%		74.47	8%		130.82	11%	
Guatemala	70.41	6%		69.41	9%		90.82	10%		125.48	11%	
Ethiopia	54.25	5%		56.66	7%		70.86	8%		26.63	2%	
Viet Nam	48.87	4%		22.52	3%		25.99	3%		125.05	11%	
Honduras	46.26	4%		38.56	5%		14.31	2%		23.61	2%	
Jamaica	26.05	2%		28.41	4%		18.29	2%		25.44	2%	
United Rep. of Tanzania	36.63	3%		21.03	3%		24.90	3%		26.56	2%	
Mexico	25.77	2%		26.52	3%		16.71	2%		12.39	1%	
USA	3.77	0.35%		4.14	0.53%		3.42	0.37%		3.87	0.33%	
Hawaii	1.44	0.13%	38%	1.54	0.20%	37%	2.76	0.30%	81%	2.15	0.18%	56%

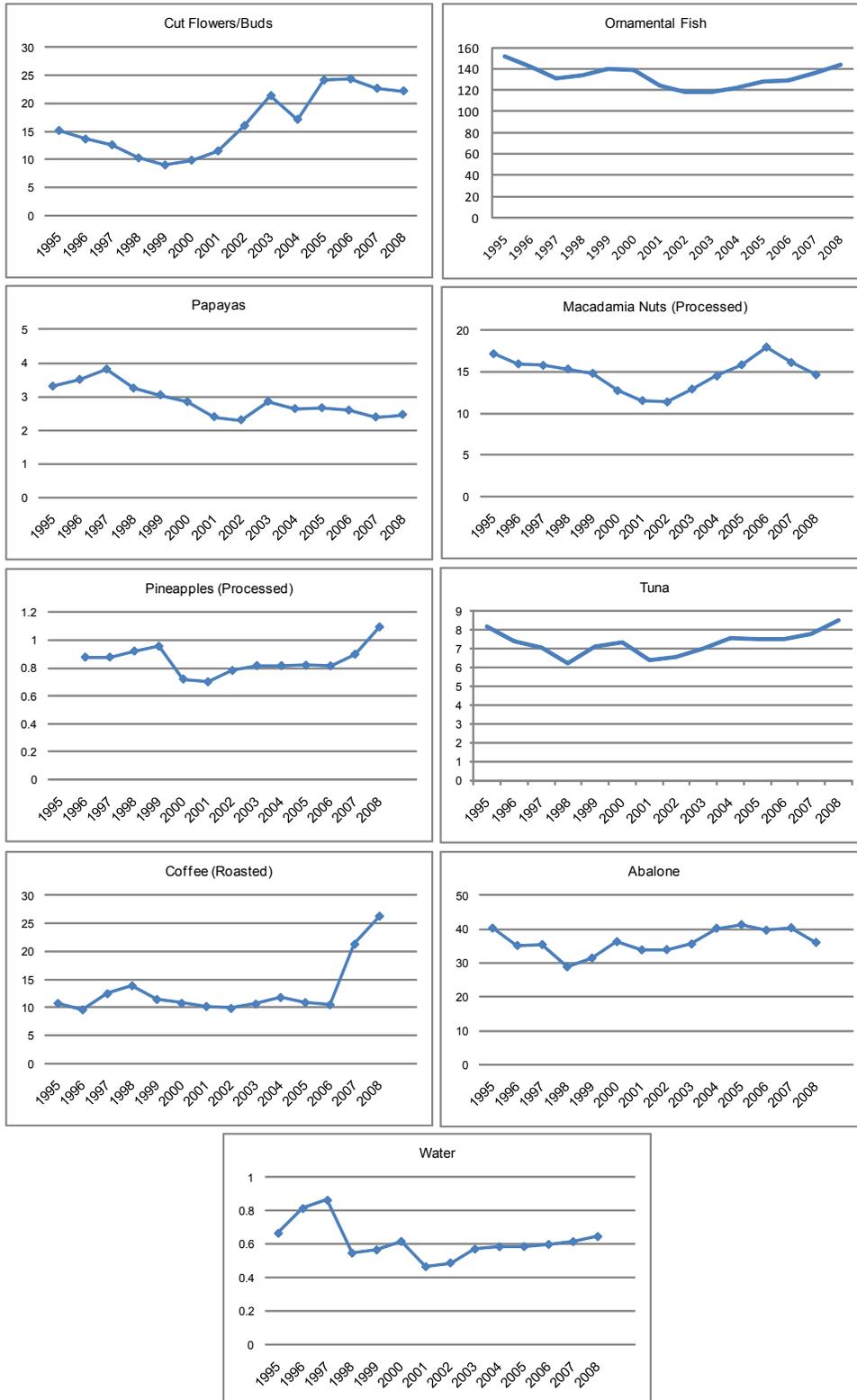
Sources: Computed from UN COMTRADE, World Trade Atlas, and Trade Statistics of Japan

Appendix Figure 1. Total quantity of selected agricultural products imported by Japan, 1995–2008; units in kg except water, in liters



Source: UN Comtrade

Appendix Figure 2. Average price of selected agricultural products, 1995–2008; units in \$/kg except water, in \$/liter



Source: UN Comtrade



A Comparison of Agricultural Input Prices: Hawai'i vs. Its Major Export Competitors

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The importance of agricultural input prices to farmers' choices can hardly be overemphasized. Many studies have estimated that the responsiveness of farmers to changes in input prices is significant not only to output supply (production level), but also to the productivity and thus profitability of farmers, the welfare of consumers, and the export earnings of countries and states. In addition, input prices provide valuable information for the formulation of government policies and programs aimed at promoting efficiency, stability, growth, and equity in the agricultural sector.¹

According to ERS-USDA (2011), crop-related expenses are forecasted to rise in 2011 by an average of 9.5% from their 2010 values, and the principal drivers of these expenses are input prices. As Hawai'i's agriculture is in the midst of significant change and revitalization, input prices are very important given the growing view among many people in the Islands that agriculture, especially food crops, should be a more prominent concern.

The goal of this fact sheet is to compare the prices of different agricultural production inputs faced by Hawai'i farmers with those faced by farmers from other competing countries. The inputs under review include labor, energy, fertilizer, land, agricultural machinery, water, transportation, and financing. We first compare the input costs in Hawai'i relative to all countries with available data, then compare the input costs in Hawai'i relative to the state's major competitors in the top export markets for its agricultural goods, namely, the U.S. mainland and Japan. We consider the competitors of Hawai'i to be exporters to the U.S. mainland, for the agricultural exports

analyzed in Yu et al. (2009), and exporters to Japan, for the goods analyzed in Parcon et al. (2010). Table 1 lists the top competitors of Hawai'i in agricultural products according to the aforementioned studies.

We attempt to make the comparison as consistent as possible by deriving data for a particular input from a single source. In cases where data for Hawai'i are not available, the average data for the U.S. are used as a basis of comparison. We cover the years 1998–2008, or as many of these years as are available in the data. Some crops reviewed include papayas, pineapples, coffee, macadamia nuts, flowers, and foliage.

As expected, Mexico and Canada, being partners of the U.S. in the North American Free Trade Agreement (NAFTA), are among the top competitors of Hawai'i in the U.S. mainland market. Mexico is the top exporter of papayas, but it also exports fresh pineapples, coffee, and foliage to the U.S. mainland. Canada, meanwhile, exports orchids and foliage. Competitors from Central and South America include Belize, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, and Guatemala. Agricultural products coming from these countries include papayas, raw sugar, coffee, foliage, and orchids. Competitors from Africa include Kenya, Malawi, and South Africa, with macadamia nuts as the main export product. Australia, meanwhile, competes in the market for raw sugar and macadamia nuts. Among European nations, Italy and the Netherlands compete in the market for orchids and foliage. Taiwan and Thailand likewise compete in these markets. The Philippines, meanwhile, competes for raw sugar.

Table 1. Top Competitors for Hawai'i's Agricultural Exports – U.S. Mainland and Japan

U.S. Mainland		Japan	
<i>North America</i>	<i>Africa</i>	<i>South America</i>	<i>Oceania</i>
Mexico	Kenya	Brazil	Australia
Canada	Malawi	Colombia	<i>Europe</i>
<i>Central and South America</i>	South Africa	<i>Asia</i>	France
Belize	<i>Europe</i>	Indonesia	Switzerland
Brazil	Italy	Malaysia	United Kingdom
Colombia	Netherlands	Philippines	
Costa Rica	<i>Asia</i>	Singapore	
Dominican Republic	Philippines	Thailand	
Ecuador	Taiwan	China	
Guatemala	Thailand	South Korea	

Notes: Agricultural exports for the U.S. mainland were based on Yu et al. (2009). Top competitors were based on import shares of different countries obtained from the USDA Foreign Agricultural Service (FAS) database.

Sources: www.fas.usda.gov and Parcon et al. (2010).

Japan's neighboring countries are the top competitors of Hawai'i in the Japanese market. For example, the Philippines is the top exporter of papayas to Japan. Indonesia is a major exporter of coffee and tuna. Malaysia and Thailand are major exporters of cut flowers/buds. Singapore is a major exporter of processed cocoa. South Korea is the top exporter of abalone and seaweeds, while China is a major exporter of fruits and nuts, and cut flowers/buds. Hawai'i competitors in the Japan market from South America include Brazil and Colombia, which are both competitors in the market for coffee. The latter is likewise a major competitor in cut flowers/buds. Among European nations, France is a major competitor in fruits and nuts, Switzerland in cut flowers/buds, and the United Kingdom in coffee. Australia, meanwhile, is Hawai'i's top competitor in the macadamia nut market.

A. Labor

About 40–70% of costs in agricultural production worldwide are related to labor costs (Encina 2010).² In the case of Hawai'i, approximately 35–40% of agricultural production cost is labor (Arita et al. 2011). Hence, it is expected that labor costs play a central role in the competitiveness of Hawai'i agricultural producers, more

than any other singular input such as fertilizer or pesticide. Table 2A shows the 10 countries with the highest average monthly wage in agriculture, hunting, and forestry (NAICS 111, 112, 113). Among the 54 countries with available data on wages, the U.S. ranks 5th, with an average monthly wage of \$1,530. Notable, however, is that Hawai'i's average monthly wage, \$2,063, is 35% higher than the national average. Likewise, Hawai'i's wage rate has grown rapidly from 2002 to 2008, at an annual average rate of about 3.4%, compared to the national average of 3.1%.

Compared to its competitors³ in the U.S. mainland market, Hawai'i has the highest average monthly wages, as seen in Table 2B. Relative to its competitors in the Japanese market, Hawai'i has the 3rd highest average monthly wage next to Switzerland

and the United Kingdom, as seen in Table 2C. While Hawai'i's labor cost can be competitive relative to its high-income country competitors such as Switzerland and the United Kingdom, it is quite apparent that it cannot compete with the low labor costs of its middle- and low-income country competitors in South and Central America and Asia.

B. Energy—Fuel and Electricity

Energy costs are embedded in most agricultural inputs and processes—fertilizer and pesticide production, irrigation, crop drying, operation of agricultural machinery, refrigeration, and packaging. Thus, energy costs are of utmost concern not just to farmers, but to consumers who face these costs embedded in the price of their food. Table 3 shows the pump price for diesel for the top 10 of 176 countries, compared with the U.S.'s ranking of 117th. Rugaber (2011) reports that energy prices in the U.S. are still relatively tame compared with the inflation in many developing countries; nevertheless, Hawai'i remains very vulnerable to fluctuations in the global oil markets.

Table 4A displays the 10 countries with the highest electricity prices, a list on which the U.S. does not appear. Among 52 countries with available data, the U.S. ranks

Table 2A. Monthly Wages in Agriculture, Hunting, and Forestry¹ (U.S. Dollars)

Rank ²	Country ³	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Switzerland	3,190.07		2,903.76		2,883.34		3,457.99		3,392.77		4,074.45	3,317.06
2	Bermuda							3,500.00	3,023.00	3,181.00	3,288.00		3,248.00
3	United Kingdom	1,830.34	1,869.08	1,750.26		2,014.92	2,223.77	2,654.80	2,652.37	2,794.55	3,177.45		2,329.73
4	San Marino				1,338.74	1,477.86	1,660.26	2,011.51	1,459.11	1,661.69			1,601.53
5	Hawai'i				1,856.00	1,904.00	1,944.00	1,932.00	2,060.00	2,180.00	2,276.00	2,348.00	2,062.50
	% annual growth					2.59%	2.10%	-0.62%	6.63%	5.83%	4.40%	3.16%	3.44%
	U.S.	1,260.00	1,360.00	1,388.00	1,484.00	1,496.00	1,588.00		1,608.00	1,688.00	1,648.00	1,776.00	1,529.60
	% annual growth		7.94%	2.06%	6.92%	0.81%	6.15%		1.26%	4.98%	-2.37%	7.77%	3.10%
6	Israel								1,069.81	1,105.75	1,215.17	1,468.50	1,214.81
7	Australia	1,100.62	1,210.36	1,089.96									1,133.65
8	New Caledonia		1,088.76										1,088.76
9	Slovenia	900.35	887.76	771.01	764.37	817.07	1,002.18	1,130.85	1,163.56	1,238.98			964.01
10	Italy												798.59

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank.

² Ranking is based on the average for the period 1998–2008. There were a total of 49 countries with available data, but others were not shown for brevity purposes. ³ Turkey, Zimbabwe, and Serbia experienced hyperinflation during the period covered and thus were excluded from the list of countries.

Sources: Country data are from LABORSTA-ILO (<http://laborsta.ilo.org>)

Data for Italy are from agri-info.eu (<http://www.agri-info.eu>). Hawai'i data are from the 2008 Employment and Payrolls in Hawai'i.

Table 2B. Monthly Wages in Agriculture, Hunting, and Forestry,¹ U.S. Mainland Market Competitors of Hawai'i (U.S. Dollars)

Rank	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Hawai'i				1,856.00	1,904.00	1,944.00	1,932.00	2,060.00	2,180.00	2,276.00	2,348.00	2,062.50
	U.S.	1,260.00	1,360.00	1,388.00	1,484.00	1,496.00	1,588.00		1,608.00	1,688.00	1,648.00	1,776.00	1,529.60
2	Australia	1,100.62	1,210.36	1,089.96									1,133.65
3	Italy												798.59
4	Costa Rica	198.34	222.67	216.26	206.39			236.86	217.53			196.98	213.58
5	Brazil	274.32	183.42	182.69	161.60	140.14							188.43
6	Mexico	114.17	127.50	149.27	180.49	184.16	181.06	183.13	204.62	214.95	228.23	239.09	182.42
7	Colombia					61.84	79.52	165.68	113.53	136.90	155.54		118.84
8	Philippines	89.92	111.51		106.92		115.69		132.74				111.36
9	Thailand				47.08	131.04	56.54			81.29	95.15		82.22

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank.

Sources: Country data are from LABORSTA-ILO (<http://laborsta.ilo.org>)

Data for Italy are from agri-info.eu (<http://www.agri-ifo.eu>). Hawai'i data are from the 2008 Employment and Payrolls in Hawai'i.

Table 2C. Monthly Wages in Agriculture, Hunting, and Forestry,¹ Japanese Market Competitors of Hawai'i (U.S. Dollars)

Rank	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Switzerland	3,190.07		2,903.76		2,883.34		3,457.99		3,392.77		4,074.45	3,317.06
2	United Kingdom	1,830.34	1,869.08	1,750.26		2,014.92	2,223.77	2,654.80	2,652.37	2,794.55	3,177.45		2,329.73
3	Hawai'i				1,856.00	1,904.00	1,944.00	1,932.00	2,060.00	2,180.00	2,276.00	2,348.00	2,062.50
	U.S.	1,260.00	1,360.00	1,388.00	1,484.00	1,496.00	1,588.00		1,608.00	1,688.00	1,648.00	1,776.00	1,529.60
4	Australia	1,100.62	1,210.36	1,089.96									1,133.65
5	Brazil	274.32	183.42	182.69	161.60	140.14							188.43
6	Colombia					61.84	79.52	165.68	113.53	136.90	155.54		118.84
7	Philippines	89.92	111.51		106.92		115.69		132.74				111.36
8	Thailand				47.08	131.04	56.54			81.29	95.15		82.22
9	Indonesia										46.36	54.87	50.61

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank.

Sources: Country data are from LABORSTA-ILO (<http://laborsta.ilo.org>). Hawai'i data are from the 2008 Employment and Payrolls in Hawai'i

Table 3. Energy Prices: Pump Price for Diesel¹ (U.S. Dollars per Gallon)

Rank ²	Country	1998	2000	2002	2004	2006	2008	Average
1	Monaco						5.87	5.87
2	United Kingdom	4.20	4.62	4.54	6.06	6.55	6.25	5.37
3	Norway	4.16	4.35	4.47	5.45	6.28	6.17	5.15
4	French Polynesia					4.50	5.26	4.88
5	Italy	3.52	3.14	3.26	4.96	5.64	6.17	4.45
6	Denmark	3.22	3.41	3.56	5.11	5.49	5.83	4.43
7	Switzerland	3.44	3.18	3.52	5.19	5.15	5.75	4.37
8	Sweden	3.18	3.03	3.63	5.19	5.45	5.75	4.37
9	Liechtenstein	3.37	3.18	3.52	5.19	5.15	5.75	4.36
10	Ireland	3.86	2.73	3.03	4.88	5.11	6.21	4.30
--/--								
117	U.S.	1.02	1.82	1.48	2.16	2.61	2.95	2.01

Notes: ¹ Fuel prices=pump prices of most widely sold grade of diesel fuel. ² Ranking is based on the average for the period 1998–2008. A total of 176 countries had available data, but others were omitted for brevity purposes.

Source: World Development Indicators of the World Bank (<http://data.worldbank.org/indicator/EP.PMP.DE>)

Table 4A. Electricity Price for Industry¹ (U.S. Dollars per Kilowatt Hour)

Rank ²	Country	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Dominican Republic							0.217	0.207	0.212
2	Nicaragua								0.186	0.186
3	Italy	0.107	0.113	0.147	0.161	0.174	0.210	0.237	0.290	0.180
4	Haiti							0.174		0.174
(5)	Hawai'i	0.117	0.110	0.122	0.134	0.158	0.180	0.184	0.261	0.158
	% annual growth		-5.65%	10.71%	9.43%	18.28%	13.74%	2.34%	41.73%	12.94%
5	Panama							0.144		0.144
6	Japan	0.127	0.115	0.122	0.127	0.123	0.117	0.116		0.121
7	Chile							0.096	0.145	0.121
8	Austria				0.096	0.102	0.109	0.134	0.154	0.119
9	Colombia							0.103	0.125	0.114
10	Ireland	0.060	0.075	0.094	0.096	0.099	0.122	0.149	0.186	0.110
-/-										
39	U.S.	0.051	0.049	0.051	0.053	0.057	0.062	0.064	0.070	0.057
	% annual growth		-3.92%	4.08%	3.92%	7.55%	8.77%	3.23%	9.38%	4.71%

Notes: ¹ Energy end-use prices including taxes, converted using exchange rates. ² Ranking is based on average for the period 2001–2008. A total of 53 countries had available data, but others were omitted for brevity purposes. **Sources:** Country data from the International Energy Agency, Energy Prices & Taxes—Quarterly Statistics, Fourth Quarter 2009, Part II, Section D, Table 21; and Part III, Section B, Table 18, 2008. Hawai'i data from the United States Energy Information Administration, *Monthly Energy Review*, May 2010, Table 9.9.

Table 4B. Electricity Prices for Industry,¹ U.S. Mainland Market Competitors of Hawai'i (U.S. Dollars per Kilowatt Hour)

Rank	Country	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Dominican Republic							0.217	0.207	0.212
2	Italy	0.107	0.113	0.147	0.161	0.174	0.210	0.237	0.290	0.180
3	Hawai'i	0.117	0.110	0.122	0.134	0.158	0.180	0.184	0.261	0.158
4	Colombia							0.103	0.125	0.114
5	Brazil							0.095	0.120	0.108
6	Costa Rica							0.079	0.093	0.086
7	Mexico	0.053	0.056	0.062	0.077	0.088	0.099	0.102	0.126	0.083
8	Ecuador							0.065	0.070	0.068
9	Thailand	0.056	0.057	0.060	0.063	0.066	0.078	0.073	0.075	0.066
10	Netherlands	0.059	c	c	c	c	c	c	c	0.059
11	Australia	0.044	0.049	0.054	0.061					0.052
12	Canada	0.042	0.039	0.047	0.049	0.055	0.059			0.049
13	South Africa	0.013	0.012	0.019	0.022	0.022	0.022			0.018

Notes: ¹ Energy end-use prices including taxes, converted using exchange rates.

c = confidential

Sources: Country data are from the International Energy Agency, Energy Prices & Taxes—Quarterly Statistics, Fourth Quarter 2009, Part II, Section D, Table 21; and Part III, Section B, Table 18, 2008.

Hawai'i data are from the United States Energy Information Administration, *Monthly Energy Review*, May 2010, Table 9.9.

Table 4C. Electricity Prices for Industry,¹ Japanese Market Competitors of Hawai'i (U.S. Dollars per Kilowatt Hour)

Rank	Country	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Hawai'i	0.117	0.110	0.122	0.134	0.158	0.180	0.184	0.261	0.158
2	Colombia							0.103	0.125	0.114
3	Brazil							0.095	0.120	0.108
4	Singapore		0.067	0.070	0.074	0.080	0.096	0.112	0.141	0.091
5	United Kingdom	0.051	0.052	0.055	0.067	0.087	0.117	0.130	0.146	0.088
6	Switzerland	0.068	0.070	0.079	0.084	0.081	0.080	0.084	0.094	0.080
7	Thailand	0.056	0.057	0.060	0.063	0.066	0.078	0.073	0.075	0.066
8	Indonesia	0.035	0.048	0.062	0.063	0.059	0.068	0.068	0.064	0.058
9	Taiwan	0.056	0.053	0.053	0.055	0.057	0.058	0.059	0.067	0.057
10	Korea	0.048	0.047	0.051	0.053	0.059	0.065	0.069	0.060	0.057
11	Australia	0.044	0.049	0.054	0.061					0.052
12	France	0.035	0.037	0.045	0.050	0.050	0.051	0.056	0.060	0.048

Notes: ¹ Energy end-use prices including taxes, converted using exchange rates.

Sources: Country data are from the International Energy Agency, Energy Prices & Taxes—Quarterly Statistics, Fourth Quarter 2009, Part II, Section D, Table 21; and Part III, Section B, Table 18, 2008.

Hawai'i data are from the United States Energy Information Administration, *Monthly Energy Review*, May 2010, Table 9.9.

Table 5A. Fertilizer Prices – Urea¹ (U.S. Dollars per Metric Ton)

Rank ²	Country ³	1998	1999	2000	2001	2002	Average
1	Myanmar	13,860	13,973	13,533	13,010	39,686	18,812
2	Slovakia	10,037	8,748	7,979	8,627	9,772	9,033
3	Madagascar		3,408	2,971	3,389		3,256
4	Syrian Arab Republic	1,491	1,491	1,491	1,491	1,317	1,456
5	Guinea	1,363					1,363
6	Burundi	1,311	1,582	1,267	1,100		1,315
7	Equatorial Guinea				890	1,560	1,225
8	Nigeria	2,185		628	566		1,127
9	Seychelles		1,424	1,332	1,299	1,388	1,089
10	Norway	1,071					1,071
-/-							
37	U.S.	467	422	478	672	459	500

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank.

² Ranking is based on average for the period 1998–2002. There were a total of 88 countries with available data, but others were not shown for brevity purposes.

³ Turkey and Ghana experienced hyperinflation during the period covered and thus were excluded from the list of countries.

Source: FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>)

39th, but if Hawai'i were ranked as a separate country, it would have the 5th-highest electricity price. In addition, while electricity prices have risen at an annual average rate of 4.7% for the nation, prices have risen by almost three times that much in Hawai'i, 12.9% for the period 2001–2008. Hence, while U.S. mainland farmers may enjoy relative advantages in energy costs, Hawai'i farmers, in contrast, are caught in a spiraling disadvantage. This is further confirmed in Tables 4B and 4C. Hawai'i ranks 3rd relative to its U.S. mainland competitors and 1st relative to its Japanese market competitors in terms of energy price. Hawai'i's dependence on oil for electricity generation⁴ largely explains the energy cost disadvantage of Hawai'i relative to its competitors.

C. Fertilizer

ERS-USDA (2011) reported that U.S. fertilizer prices rose steadily between 2002 and 2008, with annual average prices rising by 264%. Due to a higher demand for fertilizers and the rising price of oil, fertilizer expenses

are expected to continue to climb in 2011 and beyond. Tables 5A, 5B, and 5C show the prices of the three most commonly used fertilizers, namely, urea, superphosphate, and muriate of potash.⁵ Among the 88 countries with available price data for urea, the U.S. ranks 37th; among the 46 countries with available data for superphosphate,⁶ the U.S. ranks 23rd; and among the 52 countries with available data for potassium chloride (muriate of potash),⁷ the U.S. ranks 34th. Relative to Hawai'i's U.S. mainland competitors, Table 5D shows that the U.S. ranks 5th highest in urea prices, while relative to Japanese market competitors, Table 5E shows that the U.S. ranks 2nd. Relative to Japanese market competitors of Hawai'i, the U.S. ranks 5th as having the highest price of muriate of potash,⁸ as seen in Table 5F.

Overall, fertilizer prices in Hawai'i are even higher when shipping cost is considered. In June 2011, Matson Navigation, the leading cargo shipper to Hawai'i, raised its fuel surcharge to 47.5%, or well over \$1,000 for every Hawai'i container.⁹ Since different crops use different fertilizers in different proportions, it is expected that farmers will have different fertilizer costs. Nevertheless, increases in the price of fertilizers will, on average, reduce the returns of farmers if farm gate prices cannot be increased to cover the additional costs.

D. Land

Data on agricultural land costs that are comparable across countries are difficult to find. According to Brown (2003), land costs are fundamentally dependent on location, topography, and a range of other geographic and economic factors (for instance, soil productivity, potential yields of alternative crops, and relative proximity to infrastructure and markets); naturally, therefore, any land cost index will suffer considerable variations and deviations, and thus be difficult to compare with others with much certainty. Therefore, our national estimates of land costs are very crude averages and must be interpreted with caution.

Table 5B. Fertilizer Prices – Phosphate Concentrate¹ (U.S. Dollars per Metric Ton)

Rank ²	Country ³	1998	1999	2000	2001	2002	Average
1	Myanmar	15,585	24,995	24,208	23,272	23,664	22,345
2	Madagascar		5,092				5,092
3	Bahrain	2,314	2,250				2,282
4	Syrian Arab Republic	1,607		1,607	1,584	1,584	1,596
5	Austria	1,593	1,527	1,431	1,632		1,546
6	Burundi	1,390	1,617	1,418			1,475
7	Jamaica	1,261	1,180				1,221
8	Malta	1,007	943				975
9	Algeria	907					907
10	United Republic of Tanzania	857	870	847	814	775	832
-/-							
23	U.S.	607	611	559	565	530	574

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank. Phosphate concentrate was used as a substitute for superphosphate. ² Ranking is based on average for the period 1998–2002. There were a total of 46 countries with available data, but others were not shown for brevity purposes. ³ Turkey and Ghana experienced hyperinflation during the period covered and thus were excluded from the list of countries. **Source:** FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>)

The World Bank's *Global Approach to Environmental Analyses*, or GAEA (1999), attempted to estimate average land prices across different countries. A country's land value was estimated to be a multiple of its per-capita income, adjusted to incorporate broader factors.¹⁰ Table 6A (p. 11) displays the estimated land prices based on the GAEA analysis. The table reveals that the U.S. belongs to the group of countries having land values between \$20,001 and \$30,000 per hectare.¹¹ This range is the 2nd highest among the 13 land-value brackets considered in the study. A majority of the competitors of Hawai'i, meanwhile, have land values below \$15,000 per hectare,¹² as shown in Tables 6B and 6C (p. 12).

Brown (2003) and Breustedt and Habermann (2008) explain that most countries value agricultural land based on the income that the farmers of the land are expected to generate. In addition, both suggest that crop yield has a positive impact on the price of land.¹³ Given the foregoing, cereal (grain) yield was used as a proxy for the value of land. Data on cereal yield provided rankings consistent with those of World Bank GAEA (1999).

Table 7A (p. 13) displays the ranking of countries based on their cereal yield: Among a sample of 178 countries, the U.S. ranks 10th as having the highest cereal yield in the period 1998–2008. Relative to the competitors of Hawai'i in the U.S. mainland and Japanese markets, U.S. ranks 2nd and 4th, respectively, as shown in Tables 7B and 7C (pp. 14 and 15). Whether land cost is based on the estimates provided by World Bank GAEA (1999) or the proxy variable crop yield, the U.S. is undoubtedly classified as having high agricultural land prices.

Looking at land costs, it is important to distinguish the value of agricultural land derived from agricultural production income and that derived as asset/capital gains appreciation value. Given its relative scarcity of land, Hawai'i has high real estate values that make agricultural land a prime target for conversion to urban use and, subsequently, highly lucrative property development. Analyzing U.S. Census of Agriculture data, Arita et al. (2011) find that an acre of Hawai'i agricultural real estate is approximately four times more valuable than U.S. mainland agricultural land.¹⁴ Thus using broad

Table 5C. Fertilizer Prices – Muriate Over 45% K₂O (Potash)¹ (U.S. Dollars per Metric Ton)

Rank ²	Country ³	1998	1999	2000	2001	2002	Average
1	Myanmar	8,767	8,838	17,637	16,956	17,241	13,888
2	Slovakia	6,682	6,535	6,773	7,154	7,854	7,000
3	Madagascar		2,672	2,586			2,629
4	Austria	2,362	2,346	2,087	2,112	3,820	2,545
5	Burundi	1,359	1,582		923		1,288
6	Japan	665	803	841			770
7	United Republic of Tanzania	677					677
8	Saint Lucia	573	580				577
9	Norway	562					562
10	Germany	690	654	580	571	311	561
-/-							
34	U.S.	300	308	303	312	302	305

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank. Muriate over 45% K₂O (potash) was used as a substitute for potassium chloride (muriate of potash).

² Ranking is based on average for the period 1998–2002. There were a total of 52 countries with available data, but others were not shown for brevity purposes.

³ Turkey and Ghana experienced hyperinflation during the period covered and thus were excluded from the list of countries.

Source: FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>)

Table 5D. Fertilizer Prices – Urea,¹ U.S. Mainland Competitors of Hawai'i (U.S. Dollars per Metric Ton)

Rank	Country	1998	1999	2000	2001	2002	Average
1	Dominican Republic	563	665	703	681	721	667
2	Mexico	597					597
3	South Africa	537	449	523	561	503	515
4	Kenya		680	445	415	497	509
5	U.S.	467	422	478	672	459	500
6	Australia	520	468	469	499	457	483
7	Colombia	358	282	469	463		393
8	Philippines	389	349	360	375	358	366
9	Thailand	410	335	345	327	340	351
10	Brazil	298	230	279	305	278	278

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank.

Source: FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>)

Table 5E. Fertilizer Prices – Urea,¹ Japanese Market Competitors of Hawai'i (U.S. Dollars per Metric Ton)

Rank	Country	1998	1999	2000	2001	2002	Average
1	Switzerland	708	711	611	684	738	691
2	Kenya		680	445	415	497	509
3	United Kingdom	611	518	428	413	532	500
4	U.S.	467	422	478	672	459	500
5	Australia	520	468	469	499	457	483
6	Korea	411	485	509	446		463
7	Singapore	364	423	498	470		439
8	Malaysia		407	451	435		431
9	France	429	354	405	449	429	413
10	Colombia	358	282	469	463		393
11	Philippines	389	349	360	375	358	366
12	Thailand	410	335	345	327	340	351
13	China	339			332		336
14	Brazil	298	230	279	305	278	278
15	Indonesia	98	309	310	212		232

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank.

Source: FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>)

Table 5F. Fertilizer Prices – Muriate Over 45% K₂O (Potash),¹ Japanese Market Competitors of Hawai'i (U.S. Dollars per Metric Ton)

Rank	Country	1998	1999	2000	2001	2002	Average
1	Colombia			407			407
2	Switzerland	418	407	364	371	398	392
3	Indonesia	333	350	376			353
4	South Korea	306	361	379			349
5	U.S.	300	308	303	312	302	305
6	Philippines	278	305	286	284	297	290
7	China				271		271
8	Malaysia		333	366	360		265
9	Singapore	259					259
10	Brazil	209	215	232	229	263	229

Notes: ¹ Published data are in local currency units. Conversion to U.S. dollars was done using the published official exchange rate from the World Bank. Muriate over 45% K₂O (potash) was used as a substitute for potassium chloride (muriate of potash).

Source: FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>)

measures, such as those based on expected agricultural income, is likely to understate Hawai'i's true land value and thus the cost of land as an agricultural input.

E. Agricultural Machinery and Water Prices

We found no cross-country data for machinery costs. However, Lazarus (2009) showed that fuel and oil costs account for the highest share of total machinery cost, as shown in Table 8 (p. 16). Similarly, we found no cross-country data for water prices, but Yu et al. (2006) suggest the use of energy cost of irrigation as proxy of water price. Thus, for both agricultural machinery and water prices, the reader is referred back to section B (p. 2).

F. Transportation Cost

Being an island economy, Hawai'i is commonly perceived as having a maritime transportation cost disadvantage.¹⁵ Tables 9A and 9B (p. 17) show the estimated cost of shipping agricultural goods to the U.S. mainland (Los Angeles, California) and Japan from different countries and Hawai'i. Notable is that while Hawai'i is nearest to Los Angeles relative to its U.S. mainland competitors, it faces the highest per-mile maritime transportation cost compared to its farther competitors. For instance, Thailand is about three times farther away from the U.S. mainland than Hawai'i, but its cost per container is lower than Hawai'i's. Brazil is about twice as far from the U.S. mainland as Hawai'i, but its cost per container is only slightly higher than Hawai'i's.¹⁶ Thus, despite being geographically closer to the U.S. market, Hawai'i products seem to receive no transportation cost advantages over their foreign competitors.

While Hawai'i's maritime transportation cost to the U.S. mainland market seems to fall within a narrow band above the costs faced by its competitors, the picture, in contrast, is quite different in the Japanese market. Here Hawai'i faces a very large disadvantage relative to its Asian competitors, as the cost of shipping goods from Hawai'i to Japan is about four to five times higher than the cost from the Asian countries to Japan. Hence, regardless of whether Hawai'i is compared to its U.S. mainland or Japan competitors, it is quite apparent that Hawai'i faces a disadvantage in maritime transportation cost.

G. Cost of Financing Loans

Many studies have shown that access to and cost of credit are crucial factors for the agricultural sector. Credit is a major determinant of farmers' capacity to purchase various farm machines, equipment, and other supplies (seeds, fertilizers, etc.).¹⁷ We use the prime lending rate as a proxy variable for the cost of financing faced by farmers. In most countries, this rate is used as a benchmark on many types of loans. Table 10A (p. 18) shows the 10 countries with the highest prime lending rate: Among the countries with available data, the U.S. ranks 148th.

Table 6A. Estimated International Land Prices (U.S. Dollars per Hectare)

Price of Land	Country
Greater than 30,000	Denmark, Japan, Luxembourg
20,001–30,000	Austria, Finland, France, Germany, Italy, Netherlands, Sweden, Switzerland, U.S.
15,001–20,000	Belgium, Norway, Spain, United Kingdom
10,001–15,000	Australia, Canada
5,001–10,000	Argentina, Bahamas, Barbados, Brunei Darussalam, Channel Islands, Cyprus, French Polynesia, Gabon, Greece, Guadeloupe, Iceland, Ireland, Israel, South Korea, Malta, New Zealand, Portugal, Puerto Rico, Singapore, Slovenia, Suriname, United Arab Emirates
3,001–5,000	New Caledonia, Martinique, Aruba, Netherland Antilles, Hungary, Qatar, Seychelles, Kuwait, Mauritius, Antigua and Barbuda, Malaysia, Trinidad and Tobago, Reunion, St. Kitts and Nevis, Czech Republic, Mexico, Saudi Arabia, Uruguay
2,001–3,000	Bahrain, Belarus, Botswana, Brazil, Costa Rica, Dominica, Estonia, Fiji, Grenada, Namibia, Panama, Poland, Russian Federation, St. Lucia, St. Vincent and the Grenadines, Thailand, Tonga, Turkey, Venezuela
1,001–2,000	Albania, American Samoa, Belize, Bulgaria, Chile, Colombia, Cuba, Dominican Republic, Ecuador, El Salvador, Iran, Kazakhstan, North Korea, Latvia, Lebanon, Lithuania, Marshall Islands, Micronesia, Moldova, Paraguay, Romania, Samoa, Slovak Republic, South Africa, Syrian Arab Republic, Tunisia, Turkmenistan, Ukraine, Vanuatu, Yugoslavia
501–1,000	Angola, Azerbaijan, Bolivia, Cameroon, Comoros, Dem. Rep. of Congo, Rep. of Comorro, Djibouti, Georgia, Guatemala, Indonesia, Iraq, Jamaica, Kiribati, Kyrgyz Republic, Morocco, Myanmar, Oman, Papua New Guinea, Peru, Philippines, Senegal, Solomon Islands, Sri Lanka, Swaziland, Uzbekistan
301–500	Afghanistan, Algeria, Armenia, Cape Verde, Cote d'Ivoire, Guinea, Honduras, India, Lesotho, Libya, Mongolia, Tajikistan, Togo, Zaire, Zimbabwe
201–300	Bangladesh, Benin, Central African Republic, Gambia, Ghana, Haiti, Jordan, Liberia, Nicaragua, Pakistan, Rwanda, Sao Tome and Principe
101–200	Burkina Faso, Burundi, Cambodia, China, Equatorial Guinea, Guinea-Bissau, Kenya, Laos, Madagascar, Malawi, Maldives, Nigeria, Somalia, Yemen, Zambia
less than 100	Bhutan, Chad, Egypt, Ethiopia, Guyana, Mali, Mauritania, Mozambique, Nepal, Niger, Sierra Leone, Sudan, Tanzania, Uganda, Vietnam

Source: World Bank Global Approach to Environmental Analyses (1999)

Table 6B. Estimated International Land Prices, U.S. Mainland Competitors of Hawai'i (U.S. Dollars per Hectare)

Rank	Country	Price of Land
1	Italy	20,001–30,000
	Netherlands	
	U.S.	
2	Australia	10,001–15,000
	Canada	
3	Mexico	3,001–5,000
4	Brazil	2,001–3,000
	Costa Rica	
	Thailand	
5	Belize	1,001–2,000
	Colombia	
	Ecuador	
	Dominican Republic	
6	Guatemala	501–1,000
	Philippines	
7	Kenya	101–200
	Malawi	

Source: Table 6A

Table 6C. Estimated International Land Prices, Japanese Market Competitors of Hawai'i (U.S. Dollars per Hectare)

Rank	Country	Price of Land
1	France	20,001–30,000
	Switzerland	
	U.S.	
2	United Kingdom	15,001–20,000
3	Australia	10,001–15,000
4	Singapore	5,001–10,000
	Korea	
5	Malaysia	3,001–5,000
6	Brazil	2,001–3,000
	Thailand	
7	Colombia	1,001–2,000
8	Philippines	501–1,000
9	China	101–200

Source: Table 6A

Relative to Hawai'i's competitors in the U.S. mainland and Japan, the U.S. has one of the lowest prime lending rates, as seen in Tables 10B and 10C (pp. 19 and 20). Hawai'i's farmers are also able to take advantage of government subsidy programs that may further strengthen their financing ability.

Discussion

Among the seven input costs considered in the previous sections, Hawai'i farmers face higher costs of labor, electricity, fertilizer, land, and transportation relative to their U.S. mainland and Japanese market competitors. Thus, it is apparent that Hawai'i farmers face a disadvantage relative to their competitors in most of the factors used in agricultural production. Nevertheless, Hawai'i farmers face lower costs for diesel fuel and loan financing. These can help mitigate the higher costs of other production inputs, provided that access to diesel fuel and financing remains affordable in the future.

Table 11 (p. 21) shows the various input prices and rankings of Hawai'i versus its competition in all countries, on the U.S. mainland, and in Japan. Hawai'i's input price rankings on the U.S. mainland and in Japan were in the top 50th percentile of all input prices reviewed except for diesel fuel and financing.

In order to increase the competitiveness of Hawai'i farmers and livestock producers, the following strategies may be considered:

- In terms of labor, which represents 35–40% of agricultural production costs, this primary source of Hawai'i's competitive disadvantage can be alleviated by substituting capital for labor to increase farm productivity. The adoption of machinery and technology, also called "capital," along with more highly skilled and technically oriented workers, may also attract and retain labor participation in the agricultural sector.
- In terms of energy/electricity, alternate, off-grid sources of energy to generate electricity for farm use are an important consideration. Potential sources of alternate energy in Hawai'i include solar, wind, hydro, geothermal, and biodiesel. Many of these alternate sources are already in farm and commercial use.
- In terms of fertilizer, farmers should review alternate sources of recyclable waste materials available locally to offset the existing volume of fertilizers

Table 7A. Cereal Yield¹ (Kilograms per Hectare)

Rank ²	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Belgium			8021	8218	8501	8531	9185	8650	8207	7887	8576	8420
2	Netherlands	7307	7470	7906	7280	7691	8324	8411	8204	8192	6940	8308	7821
3	Ireland	6343	7170	7841	7628	6597	7158	8159	7015	7465	7188	7597	7287
4	France	7390	7268	7240	6740	7470	6136	7540	6983	6802	6546	7293	7037
5	United Kingdom	6662	7044	7165	6292	7076	7029	7031	7196	7277	6634	7419	6984
6	New Zealand	6277	6169	6273	6484	6440	6913	7169	7401	7020	7916	7380	6858
7	Germany	6339	6698	6453	7052	6251	5749	7357	6723	6487	6183	7119	6583
8	South Korea	6089	6367	6436	6560	6087	5729	6497	6376	6401	6110	7064	6338
9	Switzerland	6774	5791	6601	6161	6431	5087	6732	6300	6156	6418	6510	6269
10	U.S.	5676	5733	5854	5893	5549	6025	6851	6452	6405	6704	6624	6161

Notes: ¹ Cereal yield, measured as kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only. Cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing are excluded. ² Ranking is based on the average for 178 countries in the period 1998–2008. Values were not shown for other countries for brevity purposes.

Source: The World Bank (<http://data.worldbank.org/topic/agriculture-and-rural-development>)

Table 7B. Cereal Yield,¹ U.S. Mainland Market Competitors of Hawai'i (Kilograms per Hectare)

Rank	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Netherlands	7,307	7,470	7,906	7,280	7,691	8,324	8,411	8,204	8,192	6,940	8,308	7,821
2	U.S.	5,676	5,733	5,854	5,893	5,549	6,025	6,851	6,452	6,405	6,704	6,624	6,161
3	Italy	5,078	5,047	4,994	4,821	4,959	4,307	5,444	5,361	5,316	5,256	5,275	5,078
4	Dominican Republic	3,581	3,996	4,139	4,305	4,343	3,995	3,819	4,623	4,271	4,360	4,246	4,152
5	Colombia	3,060	3,147	3,290	3,335	3,394	3,794	3,868	3,801	3,992	3,993	4,154	3,621
6	Costa Rica	3,769	3,677	3,626	3,550	3,683	3,171	3,059	3,189	3,424	3,072	3,803	3,457
7	Brazil	2,580	2,720	2,661	3,149	2,846	3,385	3,132	2,883	3,211	3,553	3,829	3,086
8	Mexico	2,640	2,708	2,761	2,856	2,914	2,964	3,079	3,131	3,214	3,354	3,454	3,007
9	Canada	2,783	3,088	2,806	2,447	2,375	2,760	3,142	3,216	3,046	2,967	3,387	2,910
10	Philippines	2,241	2,465	2,581	2,668	2,731	2,823	2,992	3,049	3,181	3,320	3,334	2,853
11	Thailand	2,565	2,537	2,719	2,725	2,700	2,734	2,921	3,002	2,963	3,044	3,014	2,811
12	South Africa	2,180	2,195	2,759	2,422	2,771	2,536	2,778	3,307	3,140	2,786	3,807	2,789
13	Belize	2,459	2,806	2,420	3,101	2,454	2,956	2,524	3,042	2,510	2,640	2,428	2,667
14	Ecuador	1,955	2,123	2,235	1,899	2,444	2,617	2,922	2,842	2,842	3,154	2,991	2,548
15	Australia	1,986	2,111	1,962	2,219	1,088	2,090	1,705	2,087	1,054	1,172	1,650	1,739
16	Guatemala	1,680	1,737	1,773	1,825	1,727	1,631	1,574	1,344	1,500	1,624	1,624	1,640
17	Kenya	1,590	1,428	1,375	1,639	1,488	1,594	1,806	1,646	1,659	1,787	1,417	1,584
18	Malawi	1,322	1,745	1,675	1,175	1,046	1,209	1,021	778	1,445	2,467	1,599	1,407

Notes: ¹ Cereal yield, measured as kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only. Cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing are excluded.

Source: The World Bank (<http://data.worldbank.org/topic/agriculture-and-rural-development>)

Table 7C. Cereal Yield,¹ Japanese Market Competitors of Hawai'i (Kilograms per Hectare)

Rank	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	France	7,390	7,268	7,240	6,740	7,470	6,136	7,540	6,983	6,802	6,546	7,293	7,037
2	United Kingdom	6,662	7,044	7,165	6,292	7,076	7,029	7,031	7,196	7,277	6,634	7,419	6,984
3	Switzerland	6,774	5,791	6,601	6,161	6,431	5,087	6,732	6,300	6,156	6,418	6,510	6,269
4	U.S.	5,676	5,733	5,854	5,893	5,549	6,025	6,851	6,452	6,405	6,704	6,624	6,161
5	China	4,954	4,947	4,756	4,802	4,890	4,878	5,190	5,226	5,313	5,315	5,535	5,073
6	Indonesia	3,817	3,896	4,026	4,045	4,170	4,248	4,274	4,311	4,366	4,465	4,694	4,210
7	Colombia	3,060	3,147	3,290	3,335	3,394	3,794	3,868	3,801	3,992	3,993	4,154	3,621
8	Korea	3,147	2,898	2,443	3,112	3,327	3,452	3,547	3,489	3,692	3,432	3,698	3,294
9	Malaysia	2,843	2,910	3,040	3,108	3,232	3,347	3,315	3,407	3,384	3,325	3,557	3,224
10	Brazil	2,580	2,720	2,661	3,149	2,846	3,385	3,132	2,883	3,211	3,553	3,829	3,086
11	Philippines	2,241	2,465	2,581	2,668	2,731	2,823	2,992	3,049	3,181	3,320	3,334	2,853
12	Thailand	2,565	2,537	2,719	2,725	2,700	2,734	2,921	3,002	2,963	3,044	3,014	2,811
13	Australia	1,986	2,111	1,962	2,219	1,088	2,090	1,705	2,087	1,054	1,172	1,650	1,739

Notes: ¹ Cereal yield, measured as kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat, and mixed grains. Production data on cereals relate to crops harvested for dry grain only. Cereal crops harvested for hay or harvested green for food, feed, or silage and those used for grazing are excluded.

Source: The World Bank (<http://data.worldbank.org/topic/agriculture-and-rural-development>)

Table 8. Machinery Cost Estimates

Tractor or Combine HP	Net Cost of New Power Unit (in US\$)	Annual Hours of Use	Per Hour				% Share			
			Fuel & Oil Cost	Maintenance & Repair Cost	Depreciation Cost	Overhead Cost ¹	Fuel & Oil Cost	Maintenance & Repair Cost	Depreciation Cost	Overhead Cost*
40	19,000	400	6.78	0.64	2.52	2.46	54.68%	5.16%	20.32%	19.84%
60	25,000	400	10.16	0.84	3.32	3.20	57.99%	4.79%	18.95%	18.26%
75	29,000	400	12.71	1.03	3.73	3.75	59.90%	4.85%	17.58%	17.67%
105 MFWD	71,000	450	17.79	2.13	7.65	8.12	49.85%	5.97%	21.43%	22.75%
130 MFWD	91,000	450	22.02	2.73	12.28	9.42	47.41%	5.88%	26.44%	20.28%
160 MFWD	111,000	500	27.10	3.70	13.56	10.37	49.52%	6.76%	24.78%	18.95%
200 MFWD	138,000	500	33.88	4.60	16.85	12.84	49.70%	6.75%	24.72%	18.84%
225 MFWD	158,000	400	38.12	4.21	23.84	18.49	45.03%	4.97%	28.16%	21.84%
260 MFWD	163,000	400	38.32	2.61	24.60	19.06	45.30%	3.09%	29.08%	22.53%
310 MFWD	172,000	400	45.69	2.75	25.95	20.09	48.36%	2.91%	27.47%	21.26%
360 MFWD	190,000	400	53.06	3.04	28.67	22.15	49.63%	2.84%	26.81%	20.72%
425 MFWD	222,000	400	62.64	3.55	33.50	25.81	49.91%	2.83%	26.69%	20.57%
225 Tracked Tractor	147,000	400	38.12	2.35	22.18	17.23	47.72%	2.94%	27.77%	21.57%
275 HP Combine	206,000	300	46.59	34.37	45.06	30.95	29.68%	21.90%	28.71%	19.72%
340 HP Combine	233,000	300	57.60	38.87	50.97	35.11	31.55%	21.29%	27.92%	19.23%
315 HP SP Forage Harvester Base Unit	175,000	200	29.11	13.26	50.94	42.42	21.45%	9.77%	37.53%	31.25%
570 HP SP Forage Harvester Base Unit	265,000	200	52.67	20.08	77.14	63.37	24.70%	9.42%	36.17%	29.71%
Average							44.84%	7.18%	26.50%	21.47%

Notes: ¹Overhead costs include interest, insurance, and housing.

Source: Lazarus (2009)

imported into the state. Some of these recyclable waste materials include chicken manure, which is utilized in the Natural Farming technique popularized by Master Cho; compost from food waste; fish waste; and tree trimmings, including pods from monkey pod trees.

- In terms of land, the designation of Important Agricultural Lands (IAL) should be sought to preserve

the availability of agriculturally suitable lands into the foreseeable future. Additional acreage in state and county agricultural parks should also be established to improve farmers' access to affordable farmland, and long-term leases should be established to support commercial agricultural production.

- In terms of agricultural machinery and water prices, the findings are complementary to fuel and electric-

Table 9A. Transportation Cost Estimates, U.S. Mainland Market Competitors of Hawai'i (U.S. Dollars)

Rate/Origin	Hawai'i (Honolulu)	Brazil (Rio de Janeiro)	Thailand (Bangkok)	Australia (Sydney)	Netherlands (Rotterdam)
Freight (Base Rate)	2,612.00	3,883.60	3,850.00	2,870.00	2,451.40
BAF (Bunker Adjustment Factor) Charges	1,136.22	450.00	450.00	450.00	544.00
Wharfages	237.00	52.61		52.61	52.61
Bill of Lading		50.00	50.00	50.00	50.00
AMS (Automated Manifest Service) Filing Fee		35.00			
Terminal Handling Charges	535.00	400.00		400.00	400.00
TOTAL COST	4,520.22	4,871.21	4,350.00	3,822.61	3,498.01
Distance (Miles) From Origin to Los Angeles, CA	2,555	6,301	8,267	7,489	5,580
Cost per mile (TOTAL COST/ Distance)	1.77	0.77	0.53	0.51	0.63

Notes: Estimates are based on 40' dry container with total volume weight of 40,000 pounds, from origin (Hawai'i or competitor country) to Los Angeles, California. Commodity assumed to be transported is partially processed macadamia nuts.

Sources: Data on other countries' rate to Los Angeles are from <http://www.freight-calculator.com> (last accessed April 22, 2011). Estimates for Hawai'i to Los Angeles rates are from Matson Navigation Co. (BAF charges are adjusted to 43.5% based on http://www.staradvertiser.com/news/breaking/Matson_to_raise_fuel_sucharge_to_435_highest_on_record.html)

Table 9B Transportation Cost Estimates, Japanese Market Competitors of Hawai'i (U.S. Dollars)

Rate/Origin	Hawai'i	China	Malaysia	Philippines	Thailand
TOTAL	2,111.34	769.35	400.00	450.00	468.06

Notes: Estimates are based on 20' dry container from origin (Hawai'i or competitor country) to Japan.

Sources: Data on other countries' rates to Japan are from the various countries' Web sites (Shanghai Shipping Exchange, Malaysia Industrial Development Authority, Philippine Shippers' Bureau, Thailand Board of Investment). Hawai'i to Japan data is from Matson Navigation Co., the breakdown of which is as follows: freight (base rate), \$1,830; documentation fee, \$25; and destination fees, \$256.34.

ity, and so the strategy mentioned above is applicable here, as well.

- In terms of transportation cost, the production of crops that can be sold in local markets should be encouraged. High transportation costs render crops intended for the local market more competitive than

comparable imports. Additionally, local substitutes for imported livestock feed and other factor inputs should be sought out to lower Hawai'i's dependency on imports and subsequently lower the spending on transportation. As for financing loans, prudent utilization is needed to offset the above-mentioned

Table 10A. Prime Lending Rates (%)

Rank ¹	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Zimbabwe	42.06	55.39	68.21	38.02	36.48	97.29	278.92	235.68	496.46	578.96		192.75
2	Angola	45.00	80.30	103.16	95.97	97.34	96.12	82.33	67.72	19.51	17.70	12.53	65.24
3	Brazil	86.36	80.44	56.83	57.62	62.88	67.08	54.93	55.38	50.81	43.72	47.25	60.30
4	Congo, Dem. Rep.									46.44	47.00	43.15	45.53
5	Malawi	37.67	53.58	53.13	56.17	50.54	48.92	36.83	33.08	32.25	27.72	25.28	41.38
6	Uruguay	54.39	50.03	46.06	48.56	118.38	58.94	23.68	13.61	9.25	8.94	12.45	40.39
7	Sao Tome and Principe	55.58	40.33	39.67	37.00	37.42	29.59	29.77	29.77	29.30	32.40	32.40	35.75
8	Kyrgyz Republic	73.44	60.86	51.90	37.33	24.81	19.13	29.27	26.60	23.20	25.32	19.86	35.61
9	Romania	55.32	65.64	53.85	45.40	35.43	25.44	25.61	19.60	13.98	13.35	14.99	33.51
10	Mongolia	48.05	44.01	36.95	37.35	35.52	31.91	31.47	30.57	26.94	21.83	20.58	33.20
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148	U.S.	8.35	7.99	9.23	6.92	4.68	4.12	4.34	6.19	7.96	8.05	5.09	6.63

Notes: ¹ Ranking is based on average for the period 1998–2008. There were a total of 170 countries with available data, but others were not shown for the sake of brevity.

Source: <http://data.worldbank.org/indicator/FR.INR.LEND>

Table 10B. Prime Lending Rates, U.S. Mainland Market Competitors of Hawai'i (%)

Rank ¹	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Brazil	86.36	80.44	56.83	57.62	62.88	67.08	54.93	55.38	50.81	43.72	47.25	60.30
2	Malawi	37.67	53.58	53.13	56.17	50.54	48.92	36.83	33.08	32.25	27.72	25.28	41.38
3	Dominican Republic	25.64	25.05	26.80	24.26	26.06	31.39	32.63	24.11	19.48	15.83	19.95	24.65
4	Costa Rica	22.47	25.74	24.89	23.83	26.42	25.58	23.43	24.66	22.19	12.80	15.83	22.53
5	Colombia	42.24	25.77	18.79	20.72	16.33	15.19	15.08	14.56	12.89	15.38	17.18	19.47
6	Kenya	29.49	22.38	22.34	19.67	18.45	16.57	12.53	12.88	13.64	13.34	14.02	17.76
7	Ecuador	49.55	17.42	17.12	16.23	15.81	13.64	9.95	9.62	9.81	12.08		17.12
8	Guatemala	16.56	19.51	20.88	18.96	16.86	14.98	13.81	13.03	12.76	12.84	13.39	15.78
9	Belize	16.50	16.27	16.01	15.45	14.83	14.35	13.94	14.26	14.21	14.33	14.14	14.94
10	South Africa	21.79	18.00	14.50	13.77	15.75	14.96	11.29	10.63	11.17	13.17	15.13	14.56
11	Mexico	26.36	23.74	16.93	12.80	8.21	7.02	7.44	9.70	7.51	7.56	8.71	12.36
12	Philippines	16.78	11.78	10.91	12.40	9.14	9.47	10.08	10.18	9.78	8.69	8.75	10.72
13	Australia	8.15	7.99	9.27	8.66	8.16	8.41	8.85	9.06	9.41	8.20	8.91	8.64
14	Thailand	14.42	8.98	7.83	7.25	6.88	5.94	5.50	5.79	7.35	7.05	7.04	7.64
15	U.S.	8.35	7.99	9.23	6.92	4.68	4.12	4.34	6.19	7.96	8.05	5.09	6.63
16	Italy	8.64	6.35	7.02	7.29	6.54	5.83	5.51	5.31	5.62	6.33	6.84	6.48
17	Canada	6.60	6.44	7.27	5.81	4.21	4.69	4.00	4.42	5.81	6.10	4.73	5.46
18	Netherlands	6.50	3.46	4.79	5.00	3.96	3.00	2.75	2.77	3.54	4.60	4.60	4.09

Notes: ¹ Ranking is based on average for the period 1998–2008.

Source: <http://data.worldbank.org/indicator/FR.INR.LEND>

Table 10C. Prime Lending Rates, Japanese Market Competitors of Hawai'i (%)

Rank ¹	Country Name	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
1	Brazil	86.36	80.44	56.83	57.62	62.88	67.08	54.93	55.38	50.81	43.72	47.25	60.30
2	Colombia	42.24	25.77	18.79	20.72	16.33	15.19	15.08	14.56	12.89	15.38	17.18	19.47
3	Indonesia	32.15	27.66	18.46	18.55	18.95	16.94	14.12	14.05	15.98	13.86	13.60	18.57
4	Philippines	16.78	11.78	10.91	12.40	9.14	9.47	10.08	10.18	9.78	8.69	8.75	10.72
5	Australia	8.15	7.99	9.27	8.66	8.16	8.41	8.85	9.06	9.41	8.20	8.91	8.64
6	Korea, Rep.	15.28	9.40	8.55	7.71	6.77	6.24	5.90	5.59	5.99	6.55	7.17	7.74
7	Thailand	14.42	8.98	7.83	7.25	6.88	5.94	5.50	5.79	7.35	7.05	7.04	7.64
8	Malaysia	12.13	8.56	7.67	7.13	6.53	6.30	6.05	5.95	6.49	6.41	6.08	7.21
9	U.S	8.35	7.99	9.23	6.92	4.68	4.12	4.34	6.19	7.96	8.05	5.09	6.63
9	France	6.55	6.36	6.70	6.98	6.60	6.60	6.60					6.63
10	China	6.39	5.85	5.85	5.85	5.31	5.31	5.58	5.58	6.12	7.47	5.31	5.87
11	Singapore	7.44	5.80	5.83	5.66	5.37	5.31	5.30	5.30	5.31	5.33	5.38	5.64
12	United Kingdom	7.21	5.33	5.98	5.08	4.00	3.69	4.40	4.65	4.65	5.52	4.63	5.01
13	Switzerland	4.07	3.90	4.29	4.30	3.93	3.27	3.20	3.12	3.03	3.15	3.34	3.60

Notes: ¹ Ranking is based on average for the period 1998–2008.

Source: <http://data.worldbank.org/indicator/FR.INR.LEND>

Table 11. Summary Input Price Comparison

Input	Hawai'i vs. All Countries	Hawai'i vs. Competitors in U.S. Market	Hawai'i vs. Competitors in Japan Market
	Price/Rank		
Labor	4th out of 54 countries	1st out of 9 countries	3rd out of 9 countries
Top-10 Range	(\$798.59–\$3,317.06)	(\$82.22–\$2,062.50)	(\$50.61–\$3,317.06)
Energy – Diesel Fuel	117th out of 176 countries	N.A.	N.A.
Top-10 Range	(\$4.31–\$5.87/gallon)		
Energy – Electricity	5th out of 52 countries	3rd out of 13 countries	1st out of 12 countries
Top 10 Range	(\$0.11–\$0.21/kW hour)	(\$0.06 - \$0.21/kW hour)	(\$0.06–\$0.16/kW hour)
Fertilizer – Urea	37th out of 88 countries	5th out of 10 countries	4th out of 15 countries
Top 10 Range	(\$1,071–\$18,812/metric ton)	(\$278–\$667/metric ton)	(\$393–\$691/metric ton)
Fertilizer – Superphosphate	23rd out of 46 countries	N.A.	N.A.
Top-10 Range	(\$832–\$22,345/metric ton)		
Fertilizer – Potash	34th out of 52 countries	N.A.	5th out of 10 countries
Top-10 Range	(\$561–\$13,888/metric ton)		(\$229–\$407/metric ton)
Land	2nd out of 13 tiers	1st out of 7 tiers	1st out of 9 tiers
Range in Specified Tiers	(<\$100–>\$30,000/ha)	(<\$200–>\$20,000/ha)	(<\$200–>\$20,000/ha)
Land – Cereal Yield	10th out of 178 countries	2nd out of 18 countries	4th out of 13 countries
Top-10 Range	(6,161–8,420 kg/ha)	(2,853–7,821 kg/ha)	(3,086–7,037 kg/ha)
Maritime Transportation	N.A.	2nd out of 5 countries	1st out of 5 countries
Range of 5 Samples of Origin		(\$3,498–\$4,871/container)	(\$400–\$2,111/container)
Financing	148th out of 170 countries	15th out of 18 countries	9th out of 14 countries
Top-10 Range for Prime Lending Rate	(33.2%–192.75%)	(14.56%–60.3%)	(6.63%–60.3%)

Note: Top-10 range is shown for brevity purposes. Some inputs have many more countries' or competitors' data available.

factor input challenges; to achieve desirable crop yields and higher farm productivity; and to meet new market challenges such as food safety regulations and labeling requirements.

Because production costs are rather crop specific, the discussion above leans toward a more general overview assessment of input costs, which is nevertheless meaningful and insightful. Finally, it is important to keep in mind that our analysis has not addressed important demand-side factors influencing Hawai'i's overall export potential, such as quality and brand differences between

Hawai'i and its export competitors. Compared to their competitors, some Hawai'i products enjoy important brand recognition that allows them to command a price premium and target higher-end niche/gourmet markets. Thus despite facing several input cost disadvantages, some Hawai'i products may continue to be competitive in U.S. mainland and Japanese markets.

Notes

1. See, for instance, Cuong (2006) and Apergis and Rezitis (2003).
2. This range is applicable to vineyards, orchards,

vegetable production, and much animal agriculture, but does not apply to most agronomic crops such as safflower, corn, and other grains.

3. Includes only competitors with available data. Succeeding comparisons will also be based on competitors with available data.
4. Coffman (2008) reports that almost 80% of Hawai'i's electricity demand is met with oil, which needs to be shipped in oil tankers over long distances.
5. This was based on total volume of consumption obtained from FAOSTAT Fertilizers Archive (<http://faostat.fao.org/site/422/default.aspx#ancor>).
6. Price data on superphosphate were not available, so phosphate concentrate was used as a substitute.
7. Muriate over 45% K₂O (potash) was used as a substitute for potassium chloride (muriate of potash) since the latter did not have data for prices.
8. Due to limited data coverage, no comparison was presented for U.S. mainland competitors in muriate of potash and superphosphate prices.
9. See article in *Hawaii Reporter*, June 16, 2011 (<http://www.hawaiireporter.com/record-matson-fuel-surcharge-not-justified-by-oil-prices-analysis-shows/123>)
10. Such as proportions of pasture, cropland, forest land, and arid land in the total land area.
11. This is equivalent to about \$8,000–\$12,000 per acre.
12. This is equivalent to about \$6,000 per acre.
13. Farm size, labor, and capital endowments have no significant impact on the price of land.
14. While they find that Hawai'i's agricultural land commands significantly higher real estate value, its average rental rate of \$37.40 per acre in 2007 is comparable to the U.S. mainland average of \$37.30 per acre.
15. State of Hawaii Department of Agriculture FSMIP Final Report (2007).
16. Many have argued that the Jones Act has contributed to the high cost faced by Hawai'i agribusinesses, a cost which is not faced by Hawai'i's foreign competitors. The Jones Act is a United States Federal law that regulates maritime commerce in U.S. waters and between U.S. ports. It requires that all products transported between American ports must be shipped in American-made vessels by a crew that

is 75% American. It thus limits competition from foreign shippers, which raises the cost of doing business in Hawai'i. (<http://www.bastiatinstitute.org/wp-content/uploads/2009/08/Jones-Act-Study1.pdf>)

17. See, for instance, Desjardins International Development (2005) and Taylor (2009).

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