



Agriculture's Contribution to Hawaii's Economy—An Update

PingSun Leung* and Matthew K. Loke**

*Department of Molecular Biosciences and Bioengineering, and **Hawaii Department of Agriculture

This publication¹ updates and refines a previous study on the same subject (*Agriculture's Contribution to Hawaii's Economy*, CTAHR Economic Issues publication EI-2, February 2000). That publication emphasized that estimates of agriculture's contributions vary depending on what is defined as agriculture and on the methodology used to develop the estimates. As we define it here, agriculture includes farm production, forestry, fisheries, agricultural services, and food processing² (Table 1). Related distribution margins (transportation, wholesale, and retail) involved in delivering these agricultural products and services to the final consumers are also included.³

As in the previous analysis, three measures of contribution by an industry are used—industry sales, value added (industry's gross state product), and employment. In the present analysis, we also include labor income.

Industry sales value is the most common measure of economic activities. For example, the Hawaii Department of Agriculture routinely reports the farmgate values of production agriculture. However, sales value does not provide a comprehensive measure of the contribution of an industry to the economy due to double counting. Despite its double-counting problem, sales value measures the size of economic transactions of an industry based on which sales taxes generally are collected.

To avoid double counting, economists use the value-added concept to measure the contribution of an industry. An industry's gross state product (GSP) is the value added in production by the labor and property utilized in the industry. It is equivalent to the value of production minus the value of intermediate goods that producers buy from other producers. Alternately, it can be defined as the sum of employees' compensation, property-type income (proprietors' income, net interest, rental income, profits, and depreciation), and indirect business tax and nontax liability. Summing the value-added by

all the industries in an economy, within a given time period (usually a year), gives the gross state product (GSP), a commonly accepted measure of the size of a state economy. GSP is often considered the state counterpart of the nation's gross domestic product (GDP).

Table 1. Sectors making up Hawaii agriculture.

Sector	Standard Industrial Classification Code
Farm production	
Sugarcane	0133
Vegetables	0161
Tree nuts	0173
Pineapple	0179
Coffee	0179
Other fruits	Other 0170–0179
Flowers, ornamentals, nursery plants	0180–0189
Dairy farm products	0240–0249
Poultry and eggs	0250–0259
Cattle and calves	0211, 0212
Hogs	0213
Misc. livestock (goats, sheep etc.)	0214, Other 021
Aquaculture	0273
Other agricultural products	Other 01, 02
Agricultural services, forestry, and fisheries	
Forestry and forest products	0811, 0831
Commercial fishing	0912–0919
Agricultural, forestry, fishery services	0711–0779, 0851
Landscape and yard care services	0780–0789
Food processing	
Pineapple processing	Part of 2030–2038
Other canned vegetables and fruits (except pineapple)	2030–2038
Sugar processing	2061–2063
Confectionery products	2064–2067
Salted/roasted nuts, roasted coffee	2068, 2095
Meat products	2010–2019
Milk products	2021–2029
Grain and bakery products	2040–2059
Beverages	2080–2089
Other food products	Other 20, 2100

Employment (the number of full and part-time jobs) provides another good indicator for measuring the contribution of an industry to the economy. Labor income, primarily consisting of the income received by people's participation in production, provides yet another measure of an industry's contribution to the economy.

To further understand the contribution of an industry to the economy, economists often use an economic input-output model to provide measures of inter-industry linkages within the economy. However, as argued by Leung and Pooley⁴, input-output analysis might not add much to the contribution question posed, other than to provide some measures of the inter-industry linkages. Indeed, the traditional ratio measures of an industry's sales, value-added (contributions to gross product), and employment to the economy's totals, as described above, may be more appropriate in addressing the contribution question rather than application of the more detailed input-output multipliers. The same sentiment was shared by Taylor and Smith⁵ in their study on the economic importance of agribusiness in Alabama. They had emphasized in their study that economic multipliers were so often misused, misunderstood, and misinterpreted that a simple application of direct measure was preferable.

Against this background, the purpose of this publication is to summarize and compare the four measures described above—sales, value-added or GSP, employment, and personal income—in assessing the contribution of agriculture to Hawaii's economy for the three benchmark years 1992, 1997, and 2000.⁶

Sales of agriculture and related sectors

In the year 2000, following a decline in 1997, total farm production bounced back to the 1992 level in terms of sales value (Table 2). During the period 1992–2000, sugarcane production declined drastically at an annual rate of more than 10%, while pineapple production remained stable at \$102 million after a slight decline in 1997. The continual decrease in sugarcane production was largely offset by the tremendous growth of diversified agriculture (including seed crops, coffee, macadamia nuts, fruits, vegetables, flowers and nursery products), which increased at an annual rate of 3.8%. Sales value of diversified agriculture increased from just over 50% of total farm production in 1992 to almost 70% in 2000. Diversified agriculture posted record sales of \$357 million in 2000. While sales values of fisheries and for-

estry remained stable during the period, sales of agricultural and related services has increased at an annual rate of 2.4% to \$285 million in 2000. Within the food processing sector, both sugar and pineapple processing decreased steadily at annual rates of 12.6% and 10.0%, respectively. Part of these large decreases is made up by a slight increase in other food processing. However, value of the overall food processing sector declined 2.6% annually.

Total agriculture sales (including farm production, agricultural service, forestry and fisheries, and food processing) decreased from \$2,140 million in 1992 to \$1,874 million in 1997 but bounced back to \$1,938 million in 2000. The share of agricultural sales as compared to total sales in Hawaii decreased from 4.5% in 1992 to 3.6% in 1997 and slightly again to 3.3% in 2000. When distribution margins are included, these shares become 5.6, 4.5, and 4.1%, respectively, in 1992, 1997, and 2000. In other words, total agriculture sales including distribution margins amount to 4.1% of the total sales in the Hawaii's economy in 2000.

Agriculture's contribution to gross state product (GSP)

As mentioned previously, value added by each industry provides a more precise indicator of the contribution of that industry to the economy, or each industry's contribution to GSP. The U.S. Department of Commerce's Bureau of Economic Analysis (BEA) provides a consistent data series of the contribution of the various industry sectors to GSP. To account for inflation, a data series expressed in constant 1996 dollars is also made available by BEA. Table 3 shows the trend of the contribution of agriculture to GSP since 1992 for the same three groups of sectors as in the above analysis of sales value. Unfortunately, more detailed industry breakdown of GSP similar to the sales value are not available.

Between 1992 and 1997, Hawaii's economy as measured by total GSP decreased slightly, at an annual rate of 0.8%, but it had returned to the 1992 level by 2000. Hawaii agriculture's GSP also decreased in the 1992–1997 period, although at a higher annual rate of 2.3%, but it rebounded strongly with an annual increase of 2.5% from 1997 to 2000. This strong increase is primarily a result of expansion of farm production, which increased 6.1% annually between 1997 and 2000. When comparing to the growth of the entire economy during the same

Table 2. Sales of agriculture and related sectors, 1992, 1997, and 2000.

	1992	1997	2000
Sales (\$ million)			
Farm production			
Sugarcane	154	86	63
Pineapple	102	92	102
Diversified agriculture	264	327	357
Subtotal farm production	520	505	521
Agricultural services, forestry, and fisheries			
Fisheries and forestry	58	53	59
Agricultural and related services	236	270	285 ^e
Subtotal agric. services, forestry, and fisheries	294	323	344
Food processing			
Sugar processing	281	133	96
Pineapple processing	142	73	61
Other food processing	903	841	916 ^e
Subtotal food processing	1,326	1,046	1,072
Total agriculture sales	2,140	1,874	1,938
Total Hawaii sales ^a	47,394	52,283 ^e	58,592 ^e
Percent of total agriculture sales			
Farm production			
Sugarcane	7.2	4.6	3.2
Pineapple	4.8	4.9	5.2
Diversified agriculture	12.4	17.5	18.4
Subtotal farm production	24.3	26.9	26.9
Agricultural services, forestry, and fisheries			
Fisheries and forestry	2.7	2.8	3.1
Agricultural and related services	11.0	14.4	14.7
Subtotal agric. services, forestry, and fisheries	13.8	17.3	17.8
Food processing			
Sugar processing	13.1	7.1	4.9
Pineapple processing	6.6	3.9	3.1
Other food processing	42.2	44.9	47.3
Subtotal food processing	61.9	55.8	55.3
Percent of total Hawaii sales			
Total Agriculture sales	4.52	3.58	3.31
Average annual growth rate (%)			
	1992–1997	1997–2000	1992–2000
Farm production			
Sugarcane	-11.1	-9.8	-10.6
Pineapple	-2.1	3.4	-0.1
Diversified agriculture	4.4	2.9	3.8
Subtotal farm production	-0.6	1.1	0.0
Agricultural services, forestry, and fisheries			
Fisheries and forestry	-1.8	3.6	0.2
Agricultural and related services	2.7	1.8	2.4
Subtotal agric. services, forestry, and fisheries	1.9	2.1	2.0
Food processing			
Sugar processing	-13.9	-10.2	-12.6
Pineapple processing	-12.4	-5.9	-10.0
Other food processing	-1.4	3.2	0.2
Subtotal food processing	-4.6	1.1	-2.6
Total agriculture sales	-2.6	1.3	-1.2
Total Hawaii sales	2.0	3.9	2.7
Including distribution margins (\$ million)			
Total agriculture sales	2,140	1,874	1,938
Distribution margins ^e	532	465	481
TOTAL agricultural sales including margins	2,672	2,340	2,419
Percent of total Hawaii sales	5.64	4.47	4.13

Sources: Hawaii Agricultural Statistical Services, Hawaii Dept. of Business, Economic Development and Tourism, *The State of Hawaii Data Book*, various years, *The 1992 Hawaii Input-Output Study*, and preliminary estimates from *The 1997 Hawaii Input-Output Study*.

^e Denotes authors' estimates.

^a Total output from the 1992 Hawaii State Input-Output Table is used to represent total sales. It should be noted that since the output estimate from the 1997 Input-Output Table is not comparable to the 1992 estimate, the authors estimated the total sales for 1997 and 2000 based on the growth of the general excise and use tax base.

Table 3. Agriculture's contribution to Hawaii's real gross state product (GSP), 1992, 1997, and 2000.

	1992	1997	2000 ^e
GSP (1996 \$ million)			
Farm production	369	329	393
Agricultural services, forestry, and fisheries	213	174	183
Food processing	348	323	313
Total agriculture GSP	930	826	890
Total Hawaii GSP	39,120	37,668	39,636
Percent of total agriculture GSP			
Farm production	39.7	39.8	44.2
Agricultural services, forestry, and fisheries	22.9	21.1	20.6
Food processing	37.4	39.1	35.2
Percent of total Hawaii GSP			
Total agriculture GSP	2.38	2.19	2.24
Average annual growth rate (%)			
	1992–1997	1997–2000	1992–2000
Farm production	-2.3	6.1	0.8
Agricultural services, forestry, and fisheries	-3.9	1.7	-1.8
Food processing	-1.5	-1.0	-1.3
Total agriculture GSP	-2.3	2.5	-0.6
Total Hawaii GSP	-0.8	1.7	0.2
Including distribution margins (1996 \$ million)			
Total agriculture GSP	930	826	890
Distribution margins ^e	356	312	322
Total agriculture GSP including margins	1,286	1,138	1,212
Percent of total Hawaii GSP	3.29	3.02	3.06

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

^eAuthors' estimates.

period, agriculture GSP grew at a faster rate, 2.5% vs. 1.7%, indicating that agriculture is contributing more to the growth of the economy than other sectors. This higher growth rate also suggests that the general price level of agriculture is not increasing as fast as the price level for the rest of the economy. Thus the “real” growth of agriculture was stronger than that of the rest of the economy during the 1997–2000 period.

The contribution of agriculture when measured as its share of GSP appears to be quite stable during 1992–2000. The share of agriculture declined slightly from 2.38% of total GSP in 1992 to 2.19% in 1997, but it increased a little to 2.24% in 2000. While agricultural services, forestry and fisheries, and food processing have declined during the period, farm production has increased at a modest annual rate of 0.8%, but the increase

was not enough to compensate for the declines in the other two sectors, thus resulting in an annual decrease of 0.6% for the whole agriculture sector.

When distribution margins are included, agriculture contributes to 3% of Hawaii's GSP, and that has been rather steady since 1992. Thus, agriculture has been a steady contributor to Hawaii's economy.

Agriculture's contribution to employment

Table 4 shows that the trends of employment for the economy, farm production, agricultural services, forestry and fisheries, and food processing are quite similar to the corresponding GSP trends. Total employment in Hawaii increased at an annual rate of 0.2%, from 753,976 jobs in 1992 to 766,589 jobs in 2000. However, total employment in agriculture decreased at an annual rate

Table 4. Agriculture's contribution to Hawaii's employment, 1992, 1997, and 2000.

	1992	1997	2000
Employment (number of jobs)			
Farm production	14,358	11,848	12,890
Agricultural services, forestry, and fisheries	8,694	9,249	9,443
Food processing	8,531	6,604	7,052
Total Agriculture employment	31,583	27,701	29,385
Total Hawaii employment	753,976	742,251	766,589
Percent of total agriculture employment			
Farm production	45.5	42.8	43.9
Agricultural services, forestry, and fisheries	27.5	33.4	32.1
Food processing	27.0	23.8	24.0
Percent of total Hawaii employment			
Total agriculture employment	4.19	3.73	3.83
Average annual growth rate (%)			
	1992–1997	1997–2000	1992–2000
Farm Production	–3.8	2.8	–1.3
Agricultural services, forestry, and fisheries	1.2	0.7	1.0
Food processing	–5.0	2.2	–2.4
Total agriculture employment	–2.6	2.0	–0.9
Total Hawaii employment	–0.3	1.1	0.2
Including distribution margins (number of jobs)			
Total agriculture employment	31,583	27,701	29,385
Distribution margins ^a	9,901	8,670	8,965
TOTAL agriculture employment including margins	41,484	36,371	38,350
Percent of total Hawaii employment	5.50	4.90	5.00

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

^aAuthors' estimates.

of 0.9%, from 31,583 jobs in 1992 to 29,385 jobs in 2000. The decrease can be attributed primarily to decreases in the food processing sector and on-farm production. Similar to the GSP trend, agriculture employment decreased from 1992 to 1997 and reversed its trend from 1997 to 2000.

In 1992, agriculture contributed 4.2% of total employment in Hawaii, but it declined slightly to 3.7% in 1997 and 3.8% in 2000. When distribution margins are included, agriculture contributed over 38,000 jobs statewide, or 5.0% of total employment in 2000. Although its share of employment has declined slightly, agriculture remains a major and continual contributor to Hawaii's employment.

Agriculture's contribution to labor income

Like the employment trends, trends of labor income in farm production, agricultural services, forestry and fisheries, and food processing closely follow the corresponding GSP trends. While the share of agriculture GSP is around 2.2–2.4% of total GSP, its employment share is much higher—around 3.7–4.2%. As a result, the share of labor income for agriculture would tend to be lower as expected, reflecting the lower income of agricultural jobs. As Table 5 shows, the contribution of agriculture labor income to total labor income declined from 2.6% in 1992 to 2.2% in 2000. When distribution margins are included, agriculture contributed 3.0% of the total labor income in 2000.

Table 5. Agriculture's contribution to Hawaii's labor income, 1992, 1997, and 2000.

	1992	1997	2000
Labor income (\$ x 1,000)			
Farm Production	188,324	163,601	199,709
Agricultural services, forestry, and fisheries	145,242	135,393	149,655
Food processing	241,958	185,902	195,716
Total agriculture personal income	575,524	484,896	545,080
Total Hawaii personal income	21,785,126	22,698,511	24,662,202
Percent of total agriculture labor income			
Farm production	32.7	33.7	36.6
Agricultural services, forestry, and fisheries	25.2	27.9	27.5
Food processing	42.0	38.3	35.9
Percent of total Hawaii labor income			
Total agriculture personal income	2.64	2.14	2.21
Average annual growth rate (%)			
	1992–1997	1997–2000	1992–2000
Farm production	–2.8	6.9	0.7
Agricultural services, forestry, and fisheries	–1.4	3.4	0.4
Food processing	–5.1	1.7	–2.6
Total agriculture personal income	–3.4	4.0	–0.7
Total Hawaii personal income	0.8	2.8	1.6
Including distribution margins (x 1,000 \$)			
Total agriculture labor income	575,524	484,896	545,080
Distribution margins ^e	217,232	190,227	196,688
TOTAL including margins	792,756	675,123	741,768
Percent of total Hawaii labor income	3.64	2.97	3.01

Source: Bureau of Economic Analysis, U.S. Department of Commerce.

^eDenotes authors' estimates.

Summary

The contribution of agriculture as measured in terms of sales, GSP, employment, and labor income exhibited a common trend, declining from 1992 to 1997 but recovering to the 1992 level in 2000. In 2000, agriculture contributed 3.3% of total Hawaii sales, 2.2% of total real GSP, 3.8% of employment, and 2.2% of labor income. When distribution margins are included, the contribution of agriculture to Hawaii's economy in 2000 is estimated to be 4.1% in terms of sales, 3.1% in terms of real GSP, 5.0% in terms of employment, and 3.0% in terms of labor income. Despite the continuing decline of sugar production, agriculture remains a vital and steady contributor to Hawaii's economy by providing a diversity of products and generating jobs and incomes.

The economic contribution of agriculture (including distribution margins) to Hawaii's economy in the year 2000.

Measure	Amount	Percent of Hawaii's economy
Sales (\$ million)	2,419	4.1
GSP or value added (1996 \$ million)	1,212	3.1
Employment (number of jobs)	38,350	5.0
Labor income (\$ million)	742	3.0

It should be mentioned that the present estimates of the contribution of agriculture differ slightly from previous estimates due to a slight definitional change and the methodology employed. The contribution of agriculture is thus estimated to be \$2.67 billion in terms of sales in 1992, compared to the previous estimate of \$2.91 billion.

The U.S. Department of Agriculture (USDA) Economic Research Service (ERS) also estimates the impact of agriculture on the entire domestic economy and, occasionally, for each state. ERS uses the national input-output table to assess the total economic activity (in terms of value-added, employment, and output) in providing food, clothing, tobacco, flowers, and other agricultural products to the final consumers. In 1997, total contribution of Hawaii agriculture in terms of value-added is estimated to be \$4.72 billion and employment of 114,431 jobs, corresponding to 12.3% of Hawaii's total value-added and 15.4% of total state employment⁷. These figures are obviously higher than the estimates we presented above, primarily due to the much expanded definition of agriculture used by ERS. The different methodology employed also contributed to the differences, but not to the extent that the definitional differences do. The definition we use above follows a much narrower scope, where only locally produced agricultural products and their related distribution to the final consumers are considered. In that respect, the economic activities associated with distributing imported agricultural products are excluded. Furthermore, the entire food service sector (restaurants and bars) and the fiber sector (garment and clothing) are excluded.

Although we use a narrower definition of agriculture than the ERS does, we feel that it provides a better portrayal of the contribution of locally produced agricultural products to the economy. Our current analysis again shows that estimates of the contribution of agriculture can vary significantly depending on the definition of agriculture used and the methodology employed. But one thing remains very clear: agriculture has been a stable and continual contributor to the economy of Hawaii, and it should not be overlooked as one of the major sectors with potential to increasingly diversify Hawaii's heavily tourism-based economy.

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² This definition differs slightly from the earlier publication in that fiber processing and farm input industries are excluded. This enhanced definition was chosen to facilitate comparisons among the major economic measures. It should also be noted that other non-market values of agriculture, such as the esthetic value of green space, are excluded in this analysis. Furthermore, while an expanded definition of agriculture will certainly produce different estimates, the estimates presented here can be considered as most conservative.

³ Including the distribution margins allows comparison with similar estimates in earlier publications. The updated estimates presented in the following text include the distribution margins for all economic

measures that were unavailable in the earlier publication. Also, a more direct methodology is used in the present analysis.

⁴ Leung, P.S., and S. Pooley. 2002. Regional economic impacts of reductions in fisheries production: a supply-driven approach. *Marine Resource Economics* 16(4), forthcoming.

⁵ Taylor, C.R., and A. Smith. 1996. The impact of agribusiness in Alabama. *Agricultural and Resource Policy Forum* 6(3), 2 pp.

⁶ The years 1992 and 1997 were chosen because detailed sales figures are only available for many of the economic sectors from the corresponding state input-output tables. Estimates from the 1997 input-output table are preliminary.

⁷ 1997 figures (the latest estimates available) were provided by Dr. William Edmondson, USDA-ERS.