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The Linkages of Agriculture to Hawaii's Economy

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The CTAHR Economic Issues publication EI-3, *Agriculture's Contribution to Hawaii's Economy—An Update*, reported that in year 2000 agriculture contributed 3.3 percent of total Hawaii sales, 2.2 percent of total real GSP, 3.8 percent of employment, and 2.2 percent of labor income. That publication measured the contribution of agriculture in terms of its size relative to the entire Hawaii economy in a given time period.

The present publication focuses on the significance of agriculture's relations to the rest of the economy.[Z] In particular, we measure both the backward and forward linkages of agriculture to other sectors in Hawaii's economy. These linkage measurements allow us to estimate how development of agriculture might be transmitted to other sectors in the economy. We also construct linkage indices to compare the linkage strength of agriculture sectors to those of other sectors. Knowing the relative strength of sectors' linkages provides us with an alternative view in assessing the relative importance of agriculture as a whole and its various sub-sectors compared to other sectors in Hawaii's economy. Finally, we simulate the possible backward linkage impacts of the disappearance of the entire agriculture sector.

Economic linkages

In an interdependent economy, a sector is linked to other sectors by its direct and indirect purchases and sales. A sector's linkage through its direct and indirect purchases is called its backward linkage.

For example, in producing canned pineapples, the pineapple processing sector purchases pineapples from the pineapple sector and cans from the fabricated metal products sector. Although the pineapple processing sector requires no services from the agricultural services sector, it is indirectly backward-linked to that sector through the use of those services by the pineapple sector.

As opposed to backward linkage, a sector is forward-linked to other sectors through its direct and indirect sales to them. For example, the pineapple sector is directly forward-linked to the pineapple processing sector through its pineapple sales. The sales of canned pineapples from the pineapple processing sector to the eating-and-drinking sector indirectly forward-links the pineapple sector to the eating-and-drinking sector.

Considering the complexity of the inter-linkages among sectors, it would be an enormous task to trace and measure the entire agriculture sector's direct and indirect backward and forward relations to other sectors. Fortunately, economists have devised a simple procedure to trace the entire backward (or forward) relationship using the input-output (I-O) model. It allows us to calculate the total output change of the entire economy resulting from a $1 output change in a particular sector, both from a backward and a forward point of view. In the following sections, we will use this approach to measure the backward and forward linkages of Hawaii's agriculture sectors.

It should be noted that backward and forward linkages of a sector are two different perspectives of looking at its relationship with other sectors—backward or forward linkage traces the relationship backward or forward. Furthermore, the backward (or forward) linkage measures only a *potential* effect. For example, in assessing the backward linkage effects of a $1 output expansion of a sector, we assume there are no input constraints for all sectors; i.e., all sectors would have enough labor, capital, and land for their expansions. Similarly, in assessing the forward linkage effects of a $1 output reduction of a sector, we assume that other sectors that rely on outputs of this sector as their inputs would have to reduce their outputs, as there are no available substitutes. In light of these assumptions, we can view the

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backward or forward linkage effect for a sector as the upper bound of the possible influence of the sector on the rest of the economy. We take the upper bound backward or forward linkage effect of every sector as its benchmark linkage measurements so as to have a systematic and comparable assessment of the sector's backward and forward linkages.

In the next section, we apply the measurement approach described above to backward and forward linkages based on the 1992 Hawaii I-O model to discern the relationships between agriculture and the other sectors in Hawaii's economy.[Y] Backward and forward linkages are evaluated both for agriculture as a whole and individual agriculture sectors.

Agriculture's linkages in Hawaii's economy

Hawaii's entire agriculture sector comprised 28 sectors in the 1992 I-O model (Table 1), including 16 production sectors (#1–16),[X] 2 services sectors (#17 and 18) and 10 food processing sectors (#27–36).

Table 2 shows the sectors that are the most strongly linked by the agriculture sector as a whole.[W] The left columns show the 20 sectors that are the most strongly backward-linked by the entire agriculture sector. These sectors are important input suppliers to the agriculture sector: wholesale trade (#63) helps to distribute agricultural inputs, fabricated metal products (#47) provides packaging for agricultural products, and so on. The right column of Table 2 shows the 20 sectors that are the most strongly forward-linked to the agriculture sector. They are sectors that use domestic agricultural products as inputs: eating and drinking (#64), hotels and lodging places (#77) and hospitals (#102) all use a significant amount of agricultural products, such as meats, milk products, and fruits. Owner-occupied dwellings (#75) and real estate (#76) are the major users of landscaping services.

Besides calculating the linkages of the entire agriculture sector as a whole, we have also calculated those of each of the 28 agriculture sectors. The results (not shown here[V]) also indicate that there are strong intersectoral linkages among the 28 agriculture sectors.

In the next section, we construct linkage indices to assess the relative linkage strength of agriculture sectors to those of other sectors.

Relative linkage strength analysis: agriculture sectors vs. other sectors

A backward-linkage (BL) index can be constructed to measure the relative BL strength of sectors—a sector's BL index is calculated by dividing its BL measure by the average of the BL measures of all 118 sectors in Hawaii's economy. Similarly, a forward-linkage (FL) index can also be constructed to measure sectors' relative FL strengths. Thus, a sector with its BL (or FL) index greater than 1 is of above-average BL (or FL).

Based on the BL and FL indices, the 118 sectors can be grouped into four categories:

- Key sectors: BL >1 and FL >1
- Strong BL (weak FL) sectors: BL >1 and FL <1
- Strong FL (weak BL) sectors: BL <1 and FL >1
- Weak linkage sectors: BL <1 and FL <1.

Table 3 and Figure 1 show the distribution of the 118 sectors according to the above categorization. The distribution shows that, in general, the agriculture sectors have *above-average* linkages. Although 24 percent of the sectors in Hawaii's economy (28 out of 118) are agriculture sectors, 44 percent of key sectors are agriculture sectors (7 out of 16). Furthermore, 37 percent of the strong-BL sectors are agriculture sectors (14 out of 38), while only 17 percent of strong-FL sectors are agriculture sectors (5 out of 30). Only 6 percent of weak-linkage sectors are agriculture sectors (2 out of 34).

Of the 28 agriculture sectors, seven (25%) belong to key sectors, 14 (50%) are strong-BL sectors, five (18%) are strong-FL sectors and only two (7%) are weak-linkage sectors (Figure 2).

As shown in Figure 2 and Table 3, the seven key-sector agriculture sectors (in 1992) were sugarcane (#1), tree nuts (#3), coffee (#6), dairy farm products (#8), cattle (#10), hogs (#11), and commercial fishing (#14). These sectors have both strong backward and forward linkages because, while they use a significant amount of other sectors' outputs as their inputs, considerable amounts of their outputs are also sold to other sectors as their inputs.

Four production sectors, poultry and eggs (#9), other fruits (#5), greenhouse and nursery products (#7), and other agricultural products (#16), have strong BL but weak FL because, although they use a substantial amount of other sectors' products as inputs, most of their products are sold for final consumption.

Table 1. A profile of Hawaii's agriculture industries (1992).

Sector No.	Sector	Output ($ miilion)	Contributior to GSP ($ million)	Labor Income ($ million)	Employ-ment (No. of workers)
Production					
1	Sugarcane	153.7	104.0	75.2	3,353
2	Vegetables	36.6	19.9	11.1	1,589
3	Tree nuts	32.5	18.1	10.5	1,410
4	Pineapple	102.2	68.0	33.6	1,512
5	Other fruits	22.5	12.2	6.8	1,232
6	Coffee	4.2	2.2	1.3	158
7	Greenhouse and nursery products	69.7	42.6	24.8	1,923
8	Dairy farm	32.5	10.0	7.4	808
9	Poultry& eggs	15.6	5.5	4.1	280
10	Cattle and calves	29.2	10.5	7.8	833
11	Hogs, pigs, & swine	6.5	2.3	1.7	300
12	Misc. livestock4	.2	1.5	1.1	150
13	Aquaculture	6.4	2.5	1.9	155
14	Commercial fishing	62.6	30.5	14.8	1,683
15	Forestry and forest products	3.0	0.8	0.5	42
16	Other agricultural products	14.1	7.6	4.3	369
Services					
17	Agricultural, forestry, and fishery services	94.0	64.4	52.3	2,979
18	Landscape and horticultural services	141.9	97.3	79.0	4,014
Food Processing					
27	Pineapple processing	141.8	43.5	32.4	1,209
28	Other canned and frozen fruits & vegetables	83.9	19.4	12.5	468
29	Sugar processing	280.4	80.6	57.7	2,222
30	Confectionery products	69.7	16.1	10.4	389
31	Salted & roasted nuts and seeds	98.6	22.8	14.7	550
32	Meat products	69.2	12.9	9.9	472
33	Milk products	122.7	31.0	23.0	525
34	Grain & bakery products	91.8	40.5	30.9	1,078
35	Beverages	204.2	44.9	25.9	710
36	Other food and tobacco products	163.2	37.7	24.3	910
	Total	2,156.9	849.3	579.9	31,323

Three production sectors, pineapple (#4), miscellaneous livestock (#12), and forestry (#15), have strong FL because a large portion of their outputs are sold to intermediate demand but weak BL because they import a large portion of their inputs or they do not purchase a substantial amount from other sectors.

Two production sectors, vegetables (#2) and aquaculture (#13), are weak linkage sectors because both of them use (relative to other sectors) a large portion of imported inputs, and most of their products are sold for final consumption.

As Figure 2 and Table 3 show, all of the 10 food processing sectors are strongly backward-linked, which is not surprising because the inputs they process are mostly domestic agricultural products.

The two services sectors, agriculture services (#17)

Table 2. Linkages of entire agriculture sector as a whole to other sectors (1992).

Sector No.	Sectors Strongly Backward-Linked by Agricutlture	Backward Linkage Effect*($)	Sector No.	Sectors Strongly Forward-Linked by Agricutlture	Forward Linkage Effect*($)
63	Wholesale trade	0.0409	64	Eating and drinking	0.0440
47	Fabricated metal	0.0205	75	Owner-occupied dwellings	0.0292
43	Petroleum	0.0179	77	Hotels and lodging places	0.0157
76	Real estate	0.0153	76	Real estate	0.0153
52	Transportation & warehousing	0.0133	102	Hospitals	0.0088
114	State enterprises	0.0104	97	Misc. amusement services	0.0012
60	Electricity	0.0092	66	General merchandise stores	0.0010
53	Water transportation	0.0084	63	Wholesale trade	0.0009
72	Banking and credit	0.0064	72	Banking and credit agencies	0.0007
41	Printing & publishing	0.0062	113	Other services	0.0005
40	Paper products	0.0059	38	Lumber and wood products	0.0005
84	Photofinishing	0.0057	39	Furniture & fixtures	0.0005
56	Telephone, beeper, cellular	0.0057	26	Maintenance & repairs	0.0005
42	Chemicals products	0.0054	74	Insurance	0.0004
86	Equipment rental	0.0052	54	Air transportation	0.0004
49	Transportation equipment	0.0044	108	Membership organizations	0.0004
110	Accounting	0.0033	56	Telephone, beeper, cellular	0.0003
74	Insurance	0.0031	22	New buildings	0.0003
26	Maintenance & repairs	0.0030	20	Single family construction	0.0003
90	Other business services	0.0026	114	State enterprises	0.0003

*The backward (forward) linkage effect of agriculture as a whole to sector X is measured by the output change in X resulting from $1 change in total agriculture output transferred through agriculture's backward (forward) linkage. For example, $1 output change in agriculture would cause $0.0205 output change in the Fabricated metal sector through agriculture's backward linkage, and $0.0105 output change in Hotel and lodging places sector through its forward linkage. The greater the backward (forward) effect on a sector, the stronger the sector is backward (forward) linked by the entire agriculture sector as a whole.

and landscape and horticultural services (#18), are strongly forward-linked because they provide services to other agriculture sectors and the real estate sector. Their weak backward linkages are due to the nature of service sectors, which use more labor than material inputs.

With such strong linkages, the development of Hawaii's agriculture could potentially have large effects on the rest of the economy. In the next section we will simulate the linkage effects of the entire agriculture sector on the rest of economy by assuming that it disappears from the economy. Following traditional approaches in linkage analysis, we chose to simulate the linkage effects by assuming the disappearance rather than the expansion of agriculture. They are equivalent, in essence: if X dollars of outputs would be lost from other sectors following the disappearance of agriculture, we would expect an increase of X dollars more of outputs from other sectors if agriculture doubles its size. Again, readers are reminded that the estimated impacts are *potential* rather than *actual*, as discussed previously.

Simulating the impacts of the disappearance of the entire agriculture sector

In this section, the total impact on Hawaii's economy is simulated assuming that the entire 28 agriculture sectors disappear at the same time. This will provide another measure of the importance of agriculture from a "what-if" perspective.[U]

Only the backward-linkage effect is traced in this simulation exercise, because while the backward-linkage effect is relatively straightforward to interpret, the same cannot be said about the forward-linkage effect. For example, it is safe to assume that the reduction of agriculture production would reduce production of its suppliers, such as fabricated metal product sector that provides package materials (e.g., cans) for agricultural products. However, the forward-linkage impact is generally less well defined and trickier. For example, we would need to know whether, deprived of local agricultural supplies, restaurants would reduce their total sales or simply replace the reduction of local produce by im-

Table 3. Linkage distribution of Hawaii's economic sectors (1992).

Sectors with Strong BL and Weak FL

Non-Agriculture Sectors				Agriculture Sectors			
Sector No.	Non-Agri. Sectors	BL Index*	FL Index*	Sector No.	Agriculture Sectors	BL Index*	FL Index*
22	New buildings	1.00	0.70	**Production:**			
23	Hotel construction	1.01	0.70	5	Other fruits	1.04	0.79
24	Road construction	1.05	0.70	7	Nursery products	1.04	0.77
25	Other construction	1.01	0.70	9	Poultry & eggs	1.20	0.79
51	Taxies	1.07	0.83	16	Other products	1.19	0.83
53	Water transportation	1.03	0.89	**Food Processing:**			
54	Air transportation	1.10	0.74	27	Pineapple processing	1.41	0.70
55	Transport services	1.09	0.97	28	Fruits & vege. process	1.18	0.71
63	Wholesale trade	1.05	0.94	29	Sugar processing	1.47	0.76
65	Building materials	1.22	0.75	30	Confectionery prod.	1.09	0.74
66	Merchandise stores	1.22	0.75	31	Nuts processing	1.16	0.74
69	Apparel stores	1.18	0.75	32	Meat products	1.21	0.85
70	Furniture stores	1.08	0.75	33	Milk products	1.22	0.79
74	Insurance	1.03	0.90	34	Grain products	1.13	0.86
75	Owner dwellings	1.22	0.70	35	Beverages	1.12	0.79
77	Hotels	1.12	0.71	36	Other food products	1.14	0.97
91	Auto rental	1.03	0.95				
92	Auto repairs	1.00	0.98				
97	Amusement services	1.07	0.70				
99	Museums	1.07	0.70				
101	Nursing care	1.07	0.70				
102	Hospitals	1.10	0.70				
103	Medical services	1.01	0.71				
108	Membership org.	1.20	0.72				

Strong BL Sectors Statistics

Total:	*38*
Agriculture	*14 (37%)*
Non-Agriculture	*24 (63%)*

Key Sectors

Non-Agriculture Sectors				Agriculture Sectors			
Sector No.	Non-Agri. Sectors	BL Index*	FL Index*	Sector No.	Agriculture Sectors	BL Index*	FL Index*
41	Printing & publishing	1.04	1.22	**Production:**			
42	Chemicals	1.08	1.20	1	Sugarcane	1.04	1.46
52	Freight & warehouse	1.01	1.19	3	Tree nuts	1.08	1.45
61	Gas prod. & distribute	1.19	1.41	6	Coffee	1.16	1.21
62	Water & sanitary serv.	1.28	1.22	8	Dairy farm products	1.32	1.53
73	Security brokers	1.07	1.13	10	Cattle and calves	1.12	1.09
83	Advertising	1.14	1.41	11	Hogs, pigs & swine	1.14	1.42
111	Consulting services	1.01	1.18	14	Commercial fishing	1.08	1.04
114	Local govt. enterprises	1.27	1.34				

Key Sectors Statistics

Total:	*16*
Agriculture	*7 (44%)*
Non-Agriculture	*9 (56%)*

Sectors with Weak Linkages

Non-Agriculture Sectors				Agriculture Sectors			
Sector No.	Non-Agri. Sectors	BL Index*	FL Index*	Sector No.	Agriculture Sectors	BL Index*	FL Index*
20	Single construction	0.99	0.70	**Production:**			
21	Multiple construction	0.99	0.70	2	Vegetables	0.86	0.73
37	Apparel & textiles	0.89	0.76	13	Aquaculture	0.94	0.82
39	Furniture & fixtures	0.95	0.72				
50	Manufacture products	0.89	0.83				
57	Cable TV	0.83	0.70				
64	Eating & drinking	0.94	0.75				
67	Food stores	0.89	0.75				
68	Auto dealers	0.81	0.75				
71	Misc. retail	0.86	0.75				
72	Banking & credit	0.98	0.91				
76	Real estate	0.91	0.86				
78	Laundry	0.80	1.00				
80	Beauty and barber	0.79	0.70				
81	Funeral services	0.83	0.70				
82	Personal services	0.81	1.00				
93	Electric repair services	0.86	0.91				
94	Misc. repair services	0.95	0.99				
95	Video rental	0.85	0.88				
96	Theatrical services	0.99	0.74				
98	Sports and recreation	0.91	0.76				
100	Doctors	0.96	0.70				
104	Legal services	0.93	0.95				
105	Educational services	0.85	0.75				
106	Day care services	0.87	0.70				
107	Residential care	0.96	0.70				
109	Engineering services	0.98	0.96				
113	Other services	0.94	0.93				
115	Fed govt. enterprises	1.00	0.90				
116	Fed govt: military	0.78	0.70				
117	Fed: nonmilitary	0.78	0.70				
118	State & local govt.	0.78	0.70				

Weak Linkage Sectors Statistics

Total:	*34*
Agriculture	*2 (6%)*
Non-Agriculture	*32 (94%)*

Sectors with Strong FL and Weak BL

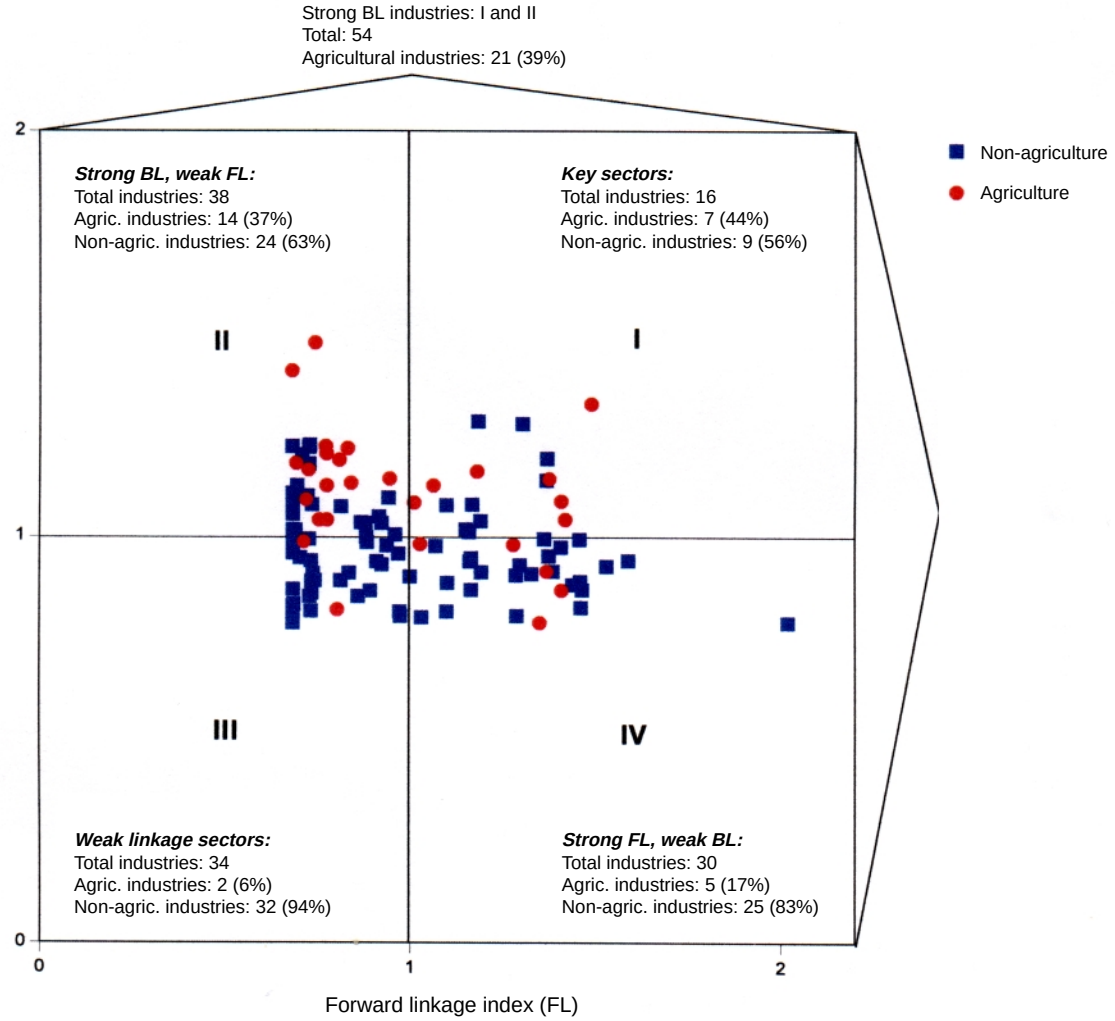
Non-Agriculture Sectors				Agriculture Sectors			
Sector No.	Non-Agri. Sectors	BL Index*	FL Index*	Sector No.	Agriculture Sectors	BL Index*	FL Index*
19	Mining	0.87	1.51	**Production:**			
26	Maintenance & repairs	0.93	1.33	4	Pineapple	0.98	1.05
38	Wood products	0.90	1.32	12	Misc. livestock	0.86	1.45
40	Paper products	0.88	1.48	15	Forestry	0.78	1.39
43	Petroleum products	0.80	1.32	**Services:**			
44	Rubber products	0.94	1.20	17	Agricultural services	0.91	1.41
45	Stone products	0.91	1.22	18	Landscape services	0.98	1.31
46	Primary metals	0.78	2.08				
47	Fabricated metal prod.	0.90	1.36				
48	Machinery & appliances	0.91	1.42				
49	Transport equipment	0.88	1.13				
56	Telephone	0.86	1.20				
58	Radio & TV	0.81	1.13				
59	Other communications	0.80	1.06				
60	Electricity	0.97	1.10				
79	Portrait photography	0.94	1.19				
84	Commercial photo	0.99	1.40				
85	Services to buildings	0.95	1.41				
86	Equipment rental	0.97	1.45				
87	Employment services	0.89	1.50				
88	Computer services	0.94	1.64				
89	Security services	0.82	1.50				
90	Other services	0.99	1.50				
110	Accounting	0.92	1.58				
112	R&D and testing	0.90	1.03				

Strong FL Sectors Statistics

Total:	*30*
Agriculture	*5 (17%)*
Non-Agriculture	*25 (83%)*

* A sector with BL (FL) index equal to 1 has an average backward (forward) linkage strength. The greater a sector's BL (FL) index, the stronger its backward (forward) linkage relative to those of other sectors.

Figure 1. Linkages of Hawaii's 118 sectors. Note: This is a graphical depiction of Table 3, which contains more detailed information.

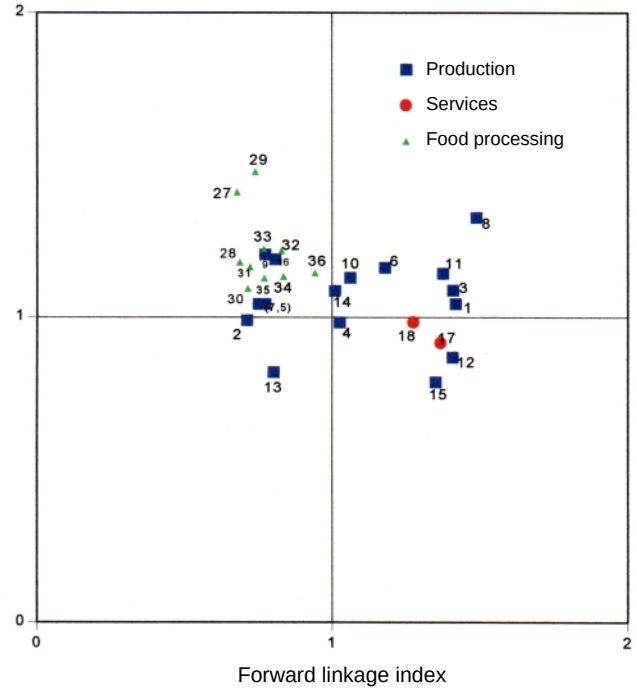


ports. And if import substitution is chosen, we need to figure out how it would affect prices of agricultural products, and hence those of meals at the restaurants, and thus final consumption. Tracing these types of effects are complicated and need more information than could be provided by an I-O table.

Similar issues arise for the distribution sectors. Unless we are willing to make assumptions, such as that a certain number of supermarkets will be closed due to the reduction in agricultural output, it is not meaningful to make a general economic assessment of these forward linkages. It is for the above reasons that only the backward-linkage effect will be assessed in this simulation.

If the 28 agriculture sectors (as they were constituted in 1992) were to have disappeared altogether, the total output of the Hawaii's economy would be reduced by $2,638 million (M), including $2,157M agricultural output and $481M output of other sectors that directly and indirectly provided inputs to these 28 agriculture sectors. From a development perspective, a $1 increase in agriculture output could potentially generate a $0.22 (481 ÷ 2,157) output increase in the rest of economy. If Hawaii's entire agriculture sector were to disappear, losses would include not only the $849M of gross state product (GSP) contributed directly by the sector, but also $261M of GSP generated indirectly from the rest of the economy in relation to agriculture. Thus, the total loss

Figure 2. Linkages of 28 agriculture sectors.
Note: The numbers in the graph represent the agricultural sector numbers given in Table 1.



in GSP would amount to $1,110M. Similarly, the total job and labor income loss would amount to 36,705 and $739M, respectively, including 31,323 agricultural and 5,382 non-agricultural jobs and $580M agricultural and $159M non-agricultural labor income. These results are summarized in Table 4.

Besides being linked to the rest of the economy through inter-industry purchases and sales, agriculture has another link through the labor income it provides. If the agriculture sector in Hawaii were to disappear, agricultural workers would lose their employment and income. This loss of income would cause another ripple effect: having lost their incomes, unemployed agricultural workers would cut their consumption, which would force related sectors to produce less. As a result, more workers would lose their jobs and income, which would cause further consumption reduction—a vicious cycle. Initially caused by the loss of agricultural labor income, these multiplier effects are called income-induced effects and are shown in the last two rows in Table 4. The role of the income-induced effects in the economic model is summarized in Table 5.

Summary

Although agriculture's share of the Hawaii's economy is not very large, it has a very strong linkage to the economy both in a backward-linkage sense (by purchasing significant amounts of inputs from other sectors), and a forward-linkage sense (by selling significant amounts of its products to local industry sectors). Furthermore, if we assume that the entire 28-sector agriculture industry were to have disappeared from the economy in 1992, the estimated losses to Hawaii's economy (including the income-induced effects due to backward linkages) amount to $3,610M of outputs, $1,727M of GSP, $1,098M of labor income, and 50,014 jobs. These losses correspond to 7.6 percent of the total economic output, 5.7 percent of the total gross state product, 5.4 percent of the total labor income, and 6.6 percent of the jobs in Hawaii.[T]

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Notes to the text

[Z]The views expressed in this publication are those of the authors and do not necessarily reflect the position of the UH College of Tropical Agriculture and Human Resources, the University of Hawaii at Manoa, or the Hawaii Department of Agriculture.

[Y]The 1992 I-O model was the latest information available at the time of this study. The Hawaii Department of Business, Economic Development and Tourism recently released the 1997 I-O data.

[X]The number in parenthesis after each sector description is the corresponding sector number in the 1992 I-O table.

[W]The backward (or forward) linkage of the agriculture sector as a whole to other industries is measured by the

Table 4. Simulated effects of agriculture disappearance.

Effects	Output ($ million)	GSP ($ million)	Labor Income ($ million)	Employment (No. of workers)
Direct Loss	2,156.9 (4.6%)*	849.3 (2.8%)	579.9 (2.9%)	31,323 (4.1%)
Indirect Loss	480.8 (1.0%)	260.9 (0.9%)	158.9 (0.8%)	5,382 (0.7%)
Total Loss (income-induced loss NOT included)	2,637.7 (5.6%)	1,110.2 (3.7%)	738.8 (3.7%)	36,705 (4.8%)
Income-Induced Loss	972.6 (2.0%)	616.8 (2.0%)	358.8 (1.7%)	13,309 (1.8%)
Total Loss (income-induced loss included)	3,610.3 (7.6%)	1,727.1 (5.7%)	1,097.6 (5.4%)	50,014 (6.6%)

*Pecentages in parentheses are the ratios to Hawaii's total output, gross state product (GSP), labor income, or employment respectively.

Table 5. Summary of losses associated with a disappearance of agriculture from Hawaii's economic base.

	Estimated total loss, percent of state total	
	With income-induced effects	Without income-induced effects
Output	7.6	5.6
GSP	5.7	3.7
Labor income	5.4	3.7
Employment	6.6	4.8

backward (or forward) linkage effect resulting from a $1 output change in the entire agriculture sector, distributed based on their relative output proportions in 1992.

[V]This information is available to interested readers from the authors.

[U]The size of a sector such as agriculture is customarily measured by its "contribution" to value-added and employment. The "what-if" perspective, through estimating what would have happened if the entire sector disappeared, measures the potential "impacts" of the sector, including not only its contribution but its impacts on the rest of economy through its linkages. It should be noted that the "impacts" of the agriculture sector contains partly the "contributions" made by other sectors, although the contributions might have not been possible without the existence of the agriculture sector. Thus, the sum of "contributions" made by all sectors in an economy equals precisely the total size of the economy, but it is not so for the sum of "impacts" of all the sectors.

[T]These percentages measure the "impacts" rather than "contributions" of the entire agriculture sector. See note U.