

The Hawaii Inter-County Input-Output Study: 1997 Benchmark Report



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**Research and Economic Analysis Division
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ABOUT THIS REPORT

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I. INTRODUCTION

This report presents the Inter-County Input-Output (I-O) model for the State of Hawaii using 1997 baseline data. This is the first time that an inter-county I-O model has been produced for the state. This new model is, however, the latest refinement in a series of Hawaii inter-industry studies that began in the mid 1960s. Inter-industry or input-output models are accounting representations of the structure of an economy, which allow analysts to examine the possible impacts of changes in the demand for a region's goods and services. The technique was developed by Wassily Leontief in the 1930's for which he was awarded the Nobel Prize in Economics in 1973.¹

The inter-regional I-O accounting framework, first developed by Isard (1951), and later elaborated by Isard et al. (1960), Richardson (1972), and Miller and Blair (1985) provides the basic framework for building the inter-county I-O model for Hawaii. In an inter-regional input-output model, linkages between regions (in this case inter-county linkages) are made sector specific both in the supplying region and in the receiving region. Information on how an input-output model works can be found in the State Input-Output Study page of the DBEDT Website, <http://www.hawaii.gov/dbedt/97io>.

The inter-county model presented in this report is an extension of the 1997 I-O model for the state, published by DBEDT in April 2002. The state I-O model provides detailed information on sales and purchases of goods and services among industries, final consumers (households, visitors, government, and exports) and factors of production in the entire state. In addition to county-specific information not contained in the state I-O model, the inter-county I-O model also shows the value of goods and services flowing among the various economic sectors *within each county*, and it also accounts for flows that occur among the various sectors *between counties*. This characteristic of detailing the flows between counties is what differentiates an inter-county model from a set of single-county models and the state model and provides a valuable analytical advantage over a state or single-county model.

When an inter-county I-O model is used for economic impact analysis, the specification of the flows between counties permits the estimation of impacts that are not explicit in a state-level or a single-county model. These effects are described in Figure 1 below.

For example, if a new economic activity has been created which increases an industry's final demand in Region 1, the increased demand in Region 1 will create increased output in that region. This increased output in Region 1 will also necessitate new flows of goods and services from Region 2 and Region 3, resulting in increased output in those regions. These effects are referred to as the *spillover effects*. In order to meet Region 1's new demand of goods and services, industries in Regions 2 and 3 will have to expand their production. This may, in turn, create new demand for goods and services produced in Region 1. As a result, output in Region 1 may increase again as a result of increased activity in the first place. These additional effects are known as the *feedback effects*.

¹ Leading texts on input-output analysis are by Chenery and Clark (1959), Miernyk (1965), and Miller and Blair (1985).

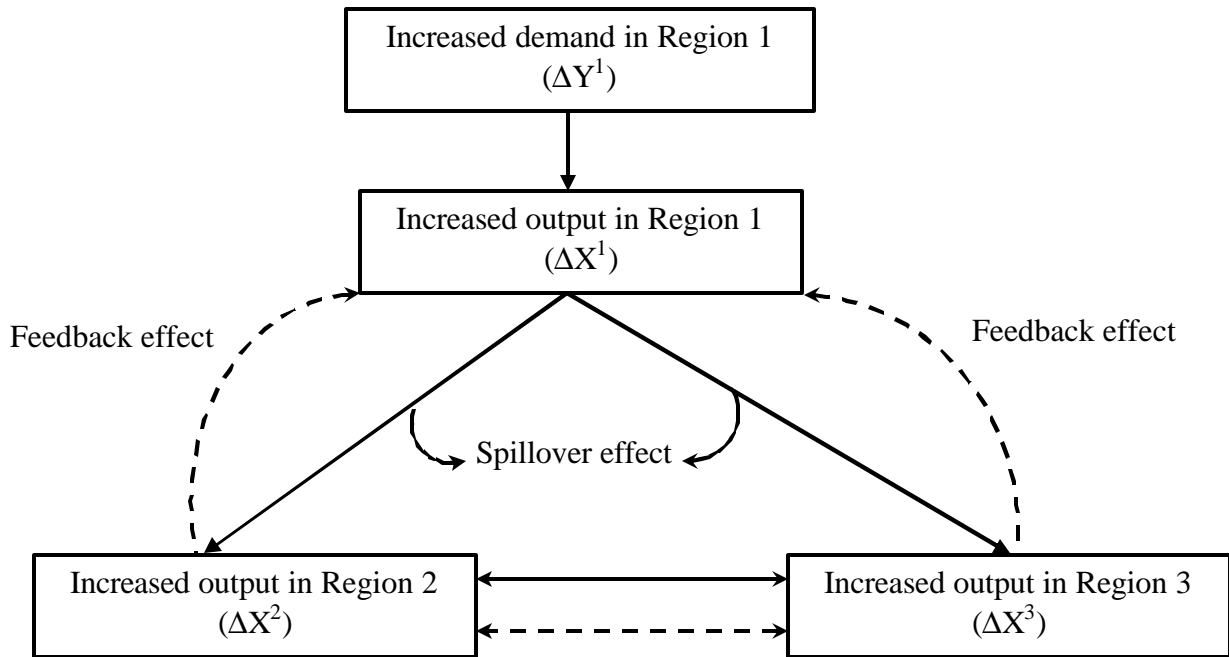


Figure 1. Spillover and Feedback Effects in a 3-region Model

As can be seen in the discussion in the next section, production and consumption patterns in a particular county can differ significantly from the state average patterns recorded in the state I-O table. Besides movements of goods and services between counties, inter-regional flows of factors, factor incomes, and transfers of all kinds can occur in both directions. This suggests that there are benefits in creating an accounting framework that captures interactions and linkages between counties within the context of the state as whole. Since Hawaii’s counties are geographically isolated, the potential problem of workers with different counties of residence and workplace is less important than it would be with adjoining counties.

There are several beneficial uses of the inter-county I-O model over the state model or the single-county model. First, it can be used to better assess impacts of county-specific economic activities. Individual I-O models of each of the counties are included within the larger inter-county I-O structure. The separate representation of each county's intermediate and final demand structure allows the user to account for the differences underlying production and consumption structures among counties.

Second, the inter-county model can provide a useful tool in assessing rural-urban linkages in the state economy. State government policy is sometimes focused on directing economic impacts to less-developed areas. In cases, such as the State of Hawaii, where much of the urban activity is geographically localized, an inter-regional I-O model permits observation and quantification of some urban-rural connections. The effects quantified by the model are the inter-regional spillover and feedback effects, as depicted in Figure 1.

Third, the inter-county I-O model provides an effective modeling framework for producing long-range economic and population forecasts for counties compared to the state I-O model. The inter-county I-O model presented here was used in the most recent update of the Hawaii long-range economic and

population forecasts for the state and its counties which eliminated the need for an additional mechanism to allocate state forecasts to the individual counties.

Despite the advantages of the inter-county model just described, there exist some drawbacks in building an inter-county I-O table. There are some institutions or activities of institutions, which are not easily attributable to a particular county, for instance, activities of the state or federal governments to provide public services. Another problem is posed by firms that have plants or offices in several counties, but their main office is located in one county. If company data are reported out of the main office, attributing the shares of the enterprise to different counties is problematic. Compared to the state I-O table, the inter-county table requires much more detailed data on flows of goods and services between sectors and between counties. The problem is that such data, especially bilateral flows of services and commodities across counties and institutional transfers, are not readily available or do not exist. The lack of sufficient data to produce this Hawaii inter-county I-O model was overcome by using various mathematical approaches to estimate inter-regional commodity and service flows.

The model presented in this report uses the data from the 1997 Economic Census of Hawaii industries produced by the U.S. Bureau of the Census. When complete data for the 2002 Economic Census are available the models will be updated to reflect relationships for that year.

Section II of this report summarizes the inter-county I-O table in terms of the inter-industry transactions table and different multipliers. Section III illustrates the use of the inter-county I-O table using two examples, one dealing with impacts of visitor expenditures and other relating to agricultural linkages in a multiregional context. Mathematical details of constructing an inter-regional (in this case inter-county) I-O model are provided in Appendix A. Industry classification, data sources, and estimation procedures of different components of the I-O table are discussed in Appendix B. The estimation of inter-county transactions table and the balancing procedures are described in Appendix C.

II. RESULTS AND DISCUSSION

This section highlights differences among counties in terms of their production and consumption patterns as shown by the inter-county transactions table, followed by a description of various I-O multipliers derived from that table. In view of space limitations, an aggregated 5-sector 4-county table is presented here. More detailed county-specific data are provided in a series of Appendix Tables. The complete 20 sector 4-county transactions table, direct requirements table, and total requirements tables are available along with this report on the DBEDT website

Various types of multipliers are provided both for the 5-sector and 20-sector models. For comparison, these multipliers are computed for three different types of I-O models: the single region state I-O model, the inter-county (inter-regional) I-O model, and four single region I-O models for each of the four counties. The multipliers derived from the state I-O table can be bigger or smaller than those derived from the inter-county and single region county I-O tables, depending on differences in industries' production and consumption patterns between individual counties and the state as a whole. However, the multipliers obtained from the single region county I-O tables will always be smaller than those obtained from the inter-county I-O table. The reason is that the inter-county table accounts for both inter-regional spill-over and feedback effects, while the single region county table does not account for such inter-regional effects.

The Inter-county Transactions Table

Output, Labor Income and Employment

Output, income and total employment for the five aggregated sectors by county are summarized in Table 1. Accordingly, in 1997, Honolulu County accounted for 78 percent of total output, 80 percent of total labor income, and 75 percent of total jobs in the state. Maui and Hawaii Counties each accounted for about 7–10 percent and Kauai about 4–5 percent of the state total output, income and employment.

Except for agriculture, Honolulu accounted for more than 70 percent of total output, total income and total jobs in the state for all the aggregated sectors in Table 1. For the government sector, Honolulu's share was more than 85 percent of the state totals. Honolulu also accounted for most of total agricultural (including commercial fishery and agricultural and fishery services) output (43 percent), labor income (52 percent), and employment (37 percent), although these shares were smaller compared to those for the other four industries.

As expected, other counties' shares of total agriculture's contributions to the state economy were substantially higher than those for other industries. For instance, Hawaii County accounted for 27 percent of total output, 21 percent of labor income, and 35 percent of total jobs in agriculture in the state. Kauai accounted for about 10 percent and Maui accounted for about 20 percent of total agricultural output in the state.

Counties also differed significantly in terms of sectoral composition of their total output, labor income and employment. For example, as shown in Table 1a, agriculture contributed to about 5 percent of total output, about 4 percent of total labor income, and 10 percent of total jobs in Hawaii County, compared to just less than 1 percent of total output, labor income, and jobs in Honolulu. The

government is another sector in which counties differed significantly. The government sector accounted for 17 percent of total output, 34 percent of labor income, and 26 percent of total jobs in Honolulu, compared to 10 percent of total output, 21 percent of labor income, and 13 percent of total jobs on average in other three counties combined. More detailed industries' contributions to total output, labor income, and value added and jobs are presented in Appendix Tables A-1 through A-4.

Inter-industry Purchases and Sales

As can be seen in Tables 2 and 3, Honolulu County supplied a sizable portion of total input purchases by industries located in the other three counties. For instance, Honolulu accounted for about 15 percent of total input purchases (mostly materials and services) by the construction industry in other counties. For other industries, the share purchased from Honolulu was consistently less than 15 percent. Except for some inputs to the manufacturing (food processing) industry, the flows of industries' inputs among Hawaii, Kauai and Maui Counties were quite small.

In terms of the 5-sector model as shown in Table 3, except for services, the shares of intermediate inputs in total input purchases were generally higher in other counties than in Honolulu, especially for manufacturing. This is a function of local sugar, pineapple, macadamia nuts and other agricultural products used as inputs to food processing on the neighbor islands. In contrast, except for manufacturing, the shares of value added in total input purchases were usually lower in other counties. This may be related to lower labor costs (lower wages) in neighbor island counties. Shares of both intermediate inputs and value added in total purchases of manufacturing were lower in Honolulu, mainly because of a higher share of imported inputs from outside Hawaii. For example, imports from outside the state accounted for more than half (53 percent) of total manufacturing input purchases in Honolulu, compared to 14–30 percent in the other three counties. The shares of intermediate inputs, intermediate sales, labor income, and value added in total input purchases for 20 industries are provided in Appendix Tables A-7 to A-10.

For some industries, Honolulu purchased sizable amounts of inputs from other counties. For example, Honolulu purchases accounted for about 35 percent of total intermediate sales of agriculture (Table 2, first row, \$39.6 million) and 61 percent of intermediate manufacturing sales in Hawaii County (Table 2, third row, \$46.1 million) and a little over one-third of total intermediate manufacturing sales in Maui and Kauai counties. Maui County accounted for about 8–10 percent of total intermediate sales of agriculture in Hawaii, Honolulu, and Kauai Counties. Similarly, Hawaii County accounted for about 10–12 percent of total intermediate manufacturing sales of other three counties.

Final Demand

Table 4 summarizes total final demand and their major components by county. Of \$44.2 billion of total final demand in 1997, Honolulu accounted for 77 percent, Maui 10 percent, Hawaii County 8 percent, and Kauai 4 percent. Except for Maui, personal consumption expenditures (PCE) had the highest share in total final demand in all counties. For Maui, visitor expenditures accounted for most of total final demand (39 percent), followed by PCE (34 percent). Visitor expenditures carried larger shares of total final demand in other counties than in Honolulu. Another notable difference among counties was a significantly larger share of federal government expenditures in the City and County of Honolulu than in other counties (16 percent vs. 1–3 percent), mainly because of the military bases on Oahu. While the shares of out-of-state exports in total final demand were similar across counties, the

out-of-county but within-state export shares were appreciably larger for neighbor island counties than for Honolulu (~7 percent vs. 2 percent).

Of total PCE of \$25.2 billion for the state in 1997, Honolulu accounted for 79 percent, Maui and Hawaii Counties each about 9 percent, and Kauai 4 percent. Similarly, of total visitor expenditures of \$10.7 billion, Honolulu accounted for 63 percent, Maui 20 percent, Hawaii County 10 percent, and Kauai 6 percent.

Besides shares of PCE and visitor expenditures in total demand, counties also differed in terms of their sectoral composition, especially the sectoral composition of visitor expenditures. Industries' shares in total PCE and those for visitor expenditures are presented in Appendix Tables A-5 and A-6, respectively.

Except for considerably higher shares of within-state imports and somewhat lower shares of finance and insurance in other counties, industries' shares in total PCE were fairly similar across counties. For all counties, as well as the state as a whole, real estate and rentals accounted for the largest share of total PCE, followed by health services, retail trade, finance and insurance, and eating and drinking. Out-of-state imported goods and services made about 20 percent of total PCE.

As can be seen in Appendix Table A-6, in terms of industries' proportions, visitor expenditure patterns were significantly different across counties. Although the hotel sector accounted for the largest share of total visitor expenditures in all counties, the hotel share for Honolulu was much smaller than that for other counties. The second largest sector was retail trade for Hawaii, Maui and Kauai counties, but it was transportation for the City and County of Honolulu, accounting for almost one-fourth of total visitor expenditures. The retail sector ranked fourth for Honolulu after eating and drinking. The next largest sectors in other counties included real estate and rentals, transportation, and eating and drinking.

Multipliers

Type I and Type II final demand multipliers for output, earnings² and total jobs calculated from the 5-sector state, inter-county, and single-region county I-O models are given in Table 5. As explained more fully in Appendix A, final demand multipliers are the volume of economic activity related to a dollar change in final demand. A Type I multiplier shows the economic activity produced by the initial final demand change (called the direct effect) and the purchases of inputs from local industries necessary to supply the final demand change (called the indirect effect). A Type II multiplier accounts for the direct effect, the indirect effect, plus the economic activity produced by the consumption spending related to the earnings generated by the direct and indirect effects of the final demand change (called the induced effect).

In all cases, multipliers obtained from the single-region county models are smaller than those obtained from the inter-county model. Except for a few cases (manufacturing output multiplier for Kauai and agriculture and construction earnings multipliers for Honolulu), single-region county output and earnings multipliers are also generally lower than the corresponding state output and earnings multipliers. However, no particular pattern could be observed for job multipliers.

² Following BEA's RIMS II methodology (BEA, 1997), earnings is calculated as the sum of wages and salaries, proprietors' income, directors' fees, employer contribution to health insurance less personal contribution to social insurance. Earnings for Hawaii sectors are typically about 15 percent less than the sum of employee compensation and proprietors' income, which is traditionally known as labor income.

Referring to Table 5 it can be seen that the differences between the inter-county multipliers and the single-county multipliers are much larger for other counties than for Honolulu. This is because industries in other counties are more dependent for their inputs on Honolulu than the other way around. As a result, not accounting for inter-county flows in single-region county I-O models would have bigger impacts in other counties than in Honolulu.

Type II multipliers are larger than Type I multipliers in all cases because the former also account for induced effects in addition to the indirect effects. Relative to Type I, Type II multipliers are generally higher in Honolulu than in other counties. This is because higher labor income per unit of output in Honolulu produces higher induced effects.

A notable advantage of an inter-regional I-O model over a single-region model is its ability to estimate impacts of a demand change not only in a particular region where demand change has occurred, but also the impacts on other regions supplying inputs to that region. The Type I inter-county output multiplier of agriculture for Hawaii County is 1.48, meaning that every dollar increase in final demand in agriculture in Hawaii County would increase the total output in the economy by \$1.48. Table 6 shows that, of the \$1.48 in additional output, \$1.31 (88.7 percent) is output of Hawaii County, \$0.16 (10.7 percent) of Honolulu output, and \$0.01 (0.4 percent) of Maui output. Note that Type I single-county output multiplier of agriculture in Hawaii County is 1.31, the same as that county's contribution to the output multiplier in the inter-county model. The same relationship holds for other multipliers, as well as other industries.

Table 7 shows the relationships between multipliers obtained from the inter-county I-O table and the state I-O table for the 5-sector model. When the inter-county multipliers are weighted by counties' output shares, inter-county weighted output multipliers are virtually identical to the state multipliers. Earnings and employment multipliers are also very close, although not identical, when they are weighed by earnings and employment shares of counties.

The various final-demand multipliers obtained from the 20-sector state, inter-county and single region county I-O models are presented in Tables 8–13. Important points from these tables are summarized below.

Both Type I and Type II output multipliers from the single region county models are not only smaller than those obtained from the inter-county model, but they are almost all smaller than those from the state I-O model, especially for Maui, Kauai and Hawaii Counties. In most cases, this is also true for final demand earnings multipliers. Inter-county multipliers are usually somewhere in between the state and single county multipliers.

While final demand earnings multipliers for most of the industries are higher in Honolulu than in other counties in both inter-county and single region county I-O models, the reverse is true for final demand jobs multipliers. Across all counties, the more labor intensive industries, such as agriculture, business services, educational services, other services, arts and entertainment, and retail trade have higher final demand job multipliers and more capital intensive industries, such as utilities, information, real estate and rentals, and finance and insurance, and transportation have lower final demand job multipliers.

Final demand state tax multipliers follow the pattern of final demand earning multipliers as state tax collections are largely functions of income.

III. EXAMPLES OF USING THE INTER-COUNTY I-O MODEL

The usefulness of the inter-county I-O model is illustrated below using two examples. One involves estimating the economic impacts of visitor spending associated with a hypothetical one-week long sporting event or conference that attracts 1,000 out-of-state visitors to the Big Island, while the other example demonstrates the use of the model to analyze agriculture's linkages across industries and counties.

Impacts of 1,000 Out-of-State Visitors to Big Island

To estimate the economic impacts of such an event to the Big Island and the other counties in the state, one has to follow a sequence of analytical tasks: (1) estimate the spending by the visitors on the Big Island, (2) allocate the spending to the industries that produce the goods and services, (3) multiply the vector of spending by industry times the appropriate multipliers or the total requirements matrix to estimate the total economic impacts, and (4) interpret the results.

To illustrate this hypothetical example, task (1) was accomplished using data on visitor composition by market type and their respective per-person-per-day spending of Big Island visitors in 2002. For this example, length of stay was assumed to be 7 days for all visitors. The data on distribution of 1,000 visitors, visitor days, their per-person-per-day spending, and total visitor spending by market type are presented in Table 14.

For this example, the observed proportion of visitors from various market areas and their average per-person-per-day spending were used as bases to estimate visitor spending.³ As can be seen from Table 14, U.S. West accounted for the largest share (38 percent) of visitors coming to Big Island, followed by U.S. East (30 percent), and Japan (18 percent). Assuming a length of stay of 7 days for each visitor type, the hypothetical event accounted for about 7,000 visitor days. Using the average per-person-per-day spending as shown in Table 14, this translates to direct visitor spending of about \$1.2 million. The assumption that the visitors are from out-of-state assures that the direct economic impact is an addition to Big Island and Hawaii state final demand and avoids the complication of netting out the spending alternatives of Hawaii-resident visitors.

Task (2), allocating the visitor spending by industry, is performed by multiplying the \$1.2 million expenditure by the sector percentages calculated from the Hawaii County visitor expenditure vector in the 1997 inter-county model.⁴ This allocation produces a vector of direct visitor spending in which \$.9 million (or 77.6 percent) was spent on goods and services produced by Big Island, about \$60,000 (4.9 percent) was spent on imports from other Hawaii counties, and \$0.2 million (or 17.5 percent) was spent on out-of-state imported goods and services. The shares spent on goods and services produced in Hawaii are shown in Table 15.

As shown in Table 15, of total direct visitor spending in Hawaii County, the hotel sector received most of the direct visitor spending accounting for 47.1 percent of direct spending, followed by retail

³ DBEDT Website, Statistics and Economic Information, Visitor Statistics, Neighbor Island Visitor Statistics, ni-2002-yearend.xls.

⁴ Dividing each element in the Hawaii County visitor expenditure vector by its total produces a vector of industry and import shares. Multiplying each element in this share vector by \$1.2 million allocates the total visitor spending by industry.

trade (16.3 percent), real estate and rentals (8.9 percent), transportation (8.7 percent), and eating and drinking (7.9 percent). Of total spending by Big Island's visitors on goods and services produced by industries in other counties, transportation was the most dominant sector, followed by wholesale trade and manufacturing.

Task (3), computing the estimated total output impacts by industry by county, is performed by multiplying the Type II inter-county total requirements table by the visitor expenditures vector generated in tasks (1) and (2). Using Excel, this calculation is done most efficiently by copying the total requirements matrix from the DBEDT website into a file where the visitor expenditure vector is stored as a row. The total output impacts by industry are then produced by multiplying each element in the visitor expenditure vector by the corresponding element in each row of the total requirements matrix. Total output impact estimates can also be calculated using the appropriate multiplier vector, such as found in Table 8. If the four columns, one for each county, in the Type II inter-county section are combined into one vector corresponding to the county order in the visitor expenditure vector, and each element in the two vectors are multiplied, the same total impact estimate is generated. However, the individual products do not represent the output in each industry, but the total output in the economy attributable to each industry.

Labor income and total job impacts can be computed by multiplying the total output vector from the previous step by labor income to output and job to output ratio vectors calculated from the transactions table. By summing rows 87 and 88, Compensation of Employees and Proprietors' Income, and dividing by row 92, Output, a labor income to output vector is created. Multiplying this vector by the total output vector produces a set of estimates of total labor income impacts by industry. The sum of the vector is the total labor income impact estimate. The same thing can be done to estimate a jobs impact by dividing row 94 by row 92 to create a job-to-output vector. The results of these operations are summarized in Table 16.

As can be seen in Table 16, a conference or sporting event attracting 1,000 visitors to Big Island would generate total impacts of about \$1.85 million in output, \$0.64 million in labor income, and 27 jobs in the state economy. About 80 percent of total output, 82 percent of total labor income, and 86 percent of total jobs generated from the event would occur in Hawaii County. Honolulu would account for 18 percent of total output, 17 percent of labor income, and 12 percent of total job impacts. The shares of total impacts were smaller than the shares of direct impacts for the Big Island suggesting some dependence of Big Island industries in meeting visitor demand on their counterparts from other counties, especially from Honolulu.

Looking at total impacts by sector in Table 17, the same sectors with the highest direct impacts stood out, but their shares were considerably less, while some other sectors with no direct visitor spending responded with large indirect and induced effects. Prominent sectors in this latter category include finance and insurance, real estate and rentals, professional and business services, and health services.

Measuring Agricultural Linkages

In a typical economy, agriculture is linked with other sectors in two ways:

- (1) it procures non-agricultural inputs from the economy and the final demand for agricultural products contributes to output, income, and employment in non-agricultural sectors. The measures of such impacts on non-agricultural sectors arising from agricultural final demand are referred to as *backward* linkages, and
- (2) it provides inputs to non-agricultural sectors and non-agricultural final demand provides an impetus for agricultural output, value added, income, and employment. Such effects are called *forward* linkages.

The I-O approach provides a suitable framework for measuring industry linkages in the economy.⁵ For this example, agriculture is defined to include farm production (agricultural, forestry and fishery production and related services), food processing, and forward-linked trade and transportation service margins involved in the delivery of fresh and processed farm products to final consumers.

In 1997, final demand for Hawaii produced fresh and processed farm products totaled \$1,157 million or 2.6 percent of the total final demand in the state, including \$362 million for farm production and \$795 million for food processing (Table 18). In addition, the forward-linked trade and distribution margins for final demand of fresh and processed farm products totaled \$517 million or 1.2 percent of total final demand.

Of total final demand for fresh farm products, Honolulu accounted for 42 percent, Hawaii County 31 percent, Maui 18 percent, and Kauai 9 percent. Corresponding figures for processed products were 55 percent, 14 percent, 23 percent, and 8 percent, respectively. Sixty-one percent of forward-linked agricultural margins were attributed to Honolulu.

Honolulu's share of forward linked agricultural trade and distribution margins was much higher than that of total final demand for farm products, because Honolulu accounts for a sizeable share of agricultural demand from other counties and their retail trade margins were attributed to Honolulu.

Fresh and processed farm products and related trade and distribution services contributed to 7–8 percent of total final demand for Hawaii, Maui and Kauai Counties, compared to just about 2.6 percent for Honolulu.

Output, Income and Employment Contributions of Agricultural Final Demand

Direct and total output contributions of final demand for fresh and processed farm products and associated trade and distribution services are presented in Table 19, which shows that final demand for fresh farm processed products (including related margins) accounted for \$2,504 million or 4.3 percent of total output in Hawaii's economy in 1997. Of this, farm production accounted for \$523 million (21 percent), food processing \$1,305 million (52 percent), and food trade and distribution services \$676 million (27 percent). Honolulu accounted for \$ 1,312 million (52 percent) of total output generated by agricultural final demand and related margins in the state, followed by Maui \$532 million (21 percent), Hawaii County \$436 million (17 percent), and Kauai \$224 million (9 percent).

⁵ For example, Sharma et al. (1999) employed a final demand-based I-O approach to measure the interdependence between agricultural and other sectors, as well as to estimate agriculture's contributions to Hawaii's economy.

As shown in Table 19a, the counties' own shares in total output contribution of final demand of fresh farm products ranged from about 87 percent for Kauai to 98 percent for Honolulu. Honolulu accounted for about 11–13 percent of total output generated by final demand of fresh farm products in the neighbor island counties. Counties' own shares in total output contributions of final demand of processed food products were slightly lower, ranging from 79 percent for Maui County to about 95 percent for Honolulu. Almost all of output generated by forward-linked food margins in Honolulu and about 92 percent of that in other three counties stayed within counties themselves.

Direct and total labor income contributions of agricultural final demand and their trade and distribution services are presented in Table 20. Including trade and distribution services, final demand for fresh and processed farm products generated a total of \$768 million or 3.2 percent of total state labor income in 1997. Of this, farm production accounted for \$190 million (25 percent), food processing \$321 million (42 percent), and related trade and distribution services \$257 million (34 percent). Honolulu accounted for the highest share (55 percent), followed by Maui (21 percent), Hawaii County (16 percent), and Kauai (8 percent).

Counties' own shares in total labor income contribution of final demand of fresh and processed farm products and related margins ranged from about 83 percent in Maui to 97 percent in Honolulu. Honolulu accounted for about 11–14 percent of total income generated by agricultural final demand in the neighbor island counties (Table 20a).

Direct and total job contributions of agricultural final demand and their trade and distribution services are shown in Table 21. Agricultural final demand plus related trade and distribution margins generated a total of more than 35,300 jobs or 4.8 percent of total jobs in the state (Table 22). Of this, farm production accounted for 33 percent (11,800 jobs), food processing 38 percent (13,500 jobs), and trade and distribution services 28 percent (10,000 jobs). Honolulu accounted for the highest share (47 percent), followed by Hawaii County (23 percent), Maui (21 percent), and Kauai (9 percent).

Counties' own shares in total job contribution of final demand of fresh and processed farm products and related margins were similar to output and income shares, except for that Honolulu's shares in jobs contributions for Hawaii and Kauai counties were a little smaller (Table 21a).

Decomposition of Agricultural Output, Labor Income, and Employment

The total output, labor income, and employment of farm production and food processing sectors in each county were decomposed to direct and indirect contributions of their own farm production and food processing final demand and indirect contributions of other final demand in that county as well as in other counties (Tables 22 to 24). These results are summarized for the state in Table 25.

Agriculture contributed \$1,878 million or 3.2 percent of Hawaii's total output in 1997 (Table 25). Of this, \$824 million (44 percent) came from farm production and \$1,055 million (56 percent) from food processing. Of total farm production output, Honolulu accounted for \$357 million (43 percent), Hawaii County \$224 million (27 percent), Maui \$161 million (20 percent) and Kauai \$82 million (10 percent). These figures for food processing were \$641 million (61 percent), \$140 million (13 percent), \$205 million (19 percent), and \$69 million (7 percent), respectively (Table 22).

Agriculture contributed \$525 million or 2.2 percent of Hawaii's total labor income in 1997 (Table 25). Of this, \$324 million (62 percent) came from farm production and \$201 million (38 percent) from food processing. Of total labor income from agriculture (production plus processing), Honolulu

accounted for \$295 million (56 percent), Hawaii County \$89 million (17 percent), Maui \$107 million (20 percent), and Kauai \$33 million (6 percent) (Table 23)

Farm production accounted for 21,197 jobs and food processing for 7,020, with total agricultural jobs of 28,217 or 3.8 percent of Hawaii's total jobs in 1997 (Table 25). Of this, Honolulu accounted for 12,182 jobs (43 percent), Hawaii County 8,504 jobs (30 percent), Maui 5,156 jobs (18 percent), and Kauai 2,375 jobs (8 percent) (Table 24).

Tables 22–24 provide numerous aspects of interesting information relating to the characteristics of farm production and food processing sectors in each county. Own total agricultural and other final demand accounted for most of total farm production output, income and employment in each county. Total agricultural final demand alone (both fresh and processed products) contributed to about 80–90 percent of total farm output, labor income, and jobs generated by all final demand in the neighbor islands and 60 percent in Honolulu. In other words, about 10–20 percent of total farm output in the neighbor islands and as much as 40 percent of that in Honolulu was involved to meet non-agricultural final demand.

Compared to farm output, income and jobs, own total final demand (agricultural and others) accounted for higher shares of food processing output, income and jobs in each county, ranging from about 83 percent in Hawaii County to 98 percent in Maui. Food processing final demand alone contributed to more than 90 percent of total food processing activity generated by all final demand in the neighbor islands. The corresponding figure for Honolulu was 75 percent.

Table 1. Output, Income and Total Employment by Industry and by County - County Shares

	Hawaii County		Honolulu County		Kauai County		Maui County		State Total	
	Value	%	Value	%	Value	%	Value	%	Value	%
Output (\$ mil.)										
Agriculture	224.0	27.2	356.6	43.3	82.0	10.0	160.9	19.5	823.5	100.0
Construction	380.6	10.8	2,585.5	73.4	204.0	5.8	354.3	10.1	3,524.3	100.0
Manufacturing	205.1	6.0	2,865.0	83.9	82.1	2.4	264.2	7.7	3,416.4	100.0
Services	3,332.1	7.9	32,507.9	77.4	1,748.5	4.2	4,423.8	10.5	42,012.2	100.0
Government	543.4	6.1	7,656.6	86.2	235.5	2.7	441.8	5.0	8,877.4	100.0
Total	4,685.2	8.0	45,971.5	78.4	2,352.1	4.0	5,645.0	9.6	58,653.8	100.0
Income (\$ mil.)										
Agriculture	66.5	20.6	166.6	51.5	25.8	8.0	64.6	20.0	323.6	100.0
Construction	131.4	8.8	1,171.5	78.6	58.2	3.9	128.9	8.7	1,490.0	100.0
Manufacturing	40.6	7.2	450.5	80.2	11.5	2.0	59.2	10.5	561.7	100.0
Services	1,063.5	7.6	10,890.0	77.8	593.1	4.2	1,448.1	10.3	13,994.8	100.0
Government	445.9	6.1	6,379.8	86.9	178.4	2.4	339.9	4.6	7,344.0	100.0
Total	1,748.0	7.4	19,058.4	80.4	866.9	3.7	2,040.8	8.6	23,714.2	100.0
Total jobs* (no.)										
Agriculture	7,440	35.1	7,899	37.3	2,039	9.6	3,819	18.0	21,197	100.0
Construction	4,031	12.1	23,555	70.6	1,996	6.0	3,783	11.3	33,365	100.0
Manufacturing	2,032	11.3	13,297	73.7	582	3.2	2,134	11.8	18,045	100.0
Services	49,382	9.8	370,454	73.7	24,484	4.9	58,575	11.6	502,895	100.0
Government	11,440	6.9	141,957	85.1	4,637	2.8	8,716	5.2	166,750	100.0
Total	74,325	10.0	557,162	75.1	33,738	4.5	77,026	10.4	742,251	100.0

*Includes wage/salary and proprietors' jobs.

Table 1a. Output, Income and Total Employment by Industry and by County - Sector Shares

	Hawaii County		Honolulu County		Kauai County		Maui County		State Total	
	Value	%	Value	%	Value	%	Value	%	Value	%
Output (\$ mil.)										
Agriculture	224	4.8	356.6	0.8	82	3.5	160.9	2.9	823.5	1.4
Construction	380.6	8.1	2,585.50	5.6	204	8.7	354.3	6.3	3,524.30	6.0
Manufacturing	205.1	4.4	2,865.00	6.2	82.1	3.5	264.2	4.7	3,416.40	5.8
Services	3,332.10	71.1	32,507.90	70.7	1,748.50	74.3	4,423.80	78.4	42,012.20	71.6
Government	543.4	11.6	7,656.60	16.7	235.5	10.0	441.8	7.8	8,877.40	15.1
Total	4,685.20	100.0	45,971.50	100.0	2,352.10	100.0	5,645.00	100.0	58,653.80	100.0
Income (\$ mil.)										
Agriculture	66.5	3.8	166.6	0.9	25.8	3.0	64.6	3.2	323.6	1.4
Construction	131.4	7.5	1,171.50	6.1	58.2	6.7	128.9	6.3	1,490.00	6.3
Manufacturing	40.6	2.3	450.5	2.4	11.5	1.3	59.2	2.9	561.7	2.4
Services	1,063.50	60.8	10,890.00	57.1	593.1	68.4	1,448.10	71.0	13,994.80	59.0
Government	445.9	25.5	6,379.80	33.5	178.4	20.6	339.9	16.7	7,344.00	31.0
Total	1,748.00	100.0	19,058.40	100.0	866.9	100.0	2,040.80	100.0	23,714.20	100.0
Total jobs* (no.)										
Agriculture	7,440	10.0	7,899	1.4	2,039	6.0	3,819	5.0	21,197	2.9
Construction	4,031	5.4	23,555	4.2	1,996	5.9	3,783	4.9	33,365	4.5
Manufacturing	2,032	2.7	13,297	2.4	582	1.7	2,134	2.8	18,045	2.4
Services	49,382	66.4	370,454	66.5	24,484	72.6	58,575	76.0	502,895	67.8
Government	11,440	15.4	141,957	25.5	4,637	13.7	8,716	11.3	166,750	22.5
Total	74,325	100.0	557,162	100.0	33,738	100.0	77,026	100.0	742,251	100.0

Table 2. Inter-county Transactions Table (\$ million)

		Hawaii County					Honolulu County				
		Agri- culture	Const- ruction	Manufac- -turing	Services	Govern- ment	Agri- culture	Const- ructon	Manufac- -turing	Services	Govern- ment
Hawaii County	Agriculture	30.7	2.3	18.6	11.4	0.4	0.7	0.0	28.5	10.4	0.0
	Construction	1.0	2.0	3.1	23.4	2.1	0.0	0.0	0.0	0.0	0.0
	Manufacturing	1.3	2.0	2.3	13.9	0.2	1.1	3.8	6.1	34.6	0.5
	Services	19.7	70.8	23.1	569.5	13.0	0.5	11.7	2.7	39.1	1.3
	Government	1.3	0.4	0.4	46.2	0.4	0.0	0.0	0.0	0.0	0.0
Honolulu County	Agriculture	0.0	0.0	1.0	0.0	0.0	27.0	7.8	46.4	100.4	2.4
	Construction	0.0	0.0	0.0	0.0	0.0	1.6	15.1	23.9	217.5	18.5
	Manufacturing	12.4	24.8	10.6	96.8	1.6	19.9	123.7	130.7	718.1	20.1
	Services	8.7	30.8	10.0	130.7	3.7	49.1	634.3	343.4	7,739.6	192.0
	Government	0.0	0.0	0.0	0.0	0.0	1.4	2.5	5.2	377.2	4.7
Kauai County	Agriculture	0.0	0.0	0.5	0.0	0.0	0.5	0.0	0.9	0.9	0.0
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Manufacturing	0.1	0.2	0.2	1.3	0.0	0.1	0.6	0.7	3.8	0.1
	Services	0.2	0.7	0.3	3.8	0.1	0.3	2.9	1.6	30.6	0.9
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maui County	Agriculture	0.0	0.0	0.9	0.0	0.0	0.5	0.0	0.8	0.8	0.0
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Manufacturing	0.5	0.9	0.4	3.9	0.1	0.4	3.0	3.0	16.0	0.4
	Services	0.2	0.6	0.3	3.6	0.1	0.6	4.4	2.4	36.7	1.0
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Inter. input	76.2	135.5	71.7	904.4	21.6	103.9	809.8	596.3	9,325.5	241.9
	Value added	125.6	158.0	71.3	2,096.6	513.5	224.2	1,362.5	742.4	20,963.9	7,328.9
	Income	66.5	131.4	40.6	1,063.5	445.9	166.6	1,171.5	450.5	10,890.0	6,379.8
	Others	57.7	26.5	30.8	1,043.6	67.6	59.2	191.3	292.5	10,027.1	949.1
	Imports	23.6	87.1	62.1	320.6	8.3	26.8	412.8	1,525.7	2,265.2	85.8
	Total input	224.0	380.6	205.1	3,332.1	543.4	356.6	2,585.5	2,865.0	32,507.9	7,656.6
	Total jobs	7,440	4,031	2,032	49,382	11,440	7,899	23,555	13,297	370,454	141,957

Table 2. Inter-county Transactions Table (\$ million) - Contd.

		Kauai County					Maui County					Total intermed. demand	Total final demand	Total output (sales)
		Agri-culture	Const-ruktion	Manuf-acturing	Servi-ces	Govern-ment	Agri-culture	Const-ruktion	Manuf-acturing	Services	Govern-ment			
Hawaii County	Agriculture	0.0	0.0	0.1	0.2	0.0	0.0	0.0	5.4	3.3	0.0	112.0	112.0	224.0
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.6	349.0	380.6
	Manufacturing	0.0	0.2	0.5	1.2	0.0	0.3	0.8	0.7	5.9	0.1	75.5	129.7	205.1
	Services	0.0	0.1	0.6	1.4	0.0	0.3	1.3	0.5	8.0	0.2	763.9	2,568.2	3,332.1
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.8	494.6	543.4
Honolulu County	Agriculture	0.0	0.0	1.8	0.3	0.0	0.0	0.0	16.5	2.4	0.0	206.0	150.5	356.6
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	276.6	2,308.8	2,585.5
	Manufacturing	5.4	14.2	2.3	41.4	0.6	9.2	25.0	16.3	120.9	2.2	1,396.1	1,468.9	2,865.0
	Services	5.0	17.6	3.1	51.2	1.1	7.0	26.7	11.2	199.3	4.3	9,468.7	23,039.2	32,507.9
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	390.9	7,265.8	7,656.6
Kauai County	Agriculture	5.4	0.9	27.5	6.0	0.1	0.0	0.0	3.9	0.8	0.0	47.3	34.6	82.0
	Construction	1.2	2.2	1.0	18.6	1.5	0.0	0.0	0.0	0.0	0.0	24.5	179.5	204.0
	Manufacturing	0.3	0.4	0.5	5.0	0.0	0.1	0.1	0.1	1.5	0.0	15.1	67.0	82.1
	Services	15.7	43.8	10.2	323.9	7.1	0.1	0.8	0.3	5.2	0.1	448.5	1,300.0	1,748.5
	Government	0.3	0.3	0.3	25.8	0.2	0.0	0.0	0.0	0.0	0.0	26.8	208.7	235.5
Maui County	Agriculture	0.0	0.0	3.1	0.6	0.0	18.8	1.6	48.8	19.6	0.3	95.6	65.3	160.9
	Construction	0.0	0.0	0.0	0.0	0.0	1.1	2.1	3.2	30.1	2.7	39.1	315.1	354.3
	Manufacturing	0.1	0.4	0.1	1.2	0.0	0.9	2.2	2.4	24.3	0.2	60.3	203.9	264.2
	Services	0.1	0.4	0.1	1.6	0.0	14.7	52.8	22.4	653.3	13.1	808.4	3,615.4	4,423.8
	Government	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.6	66.4	0.5	68.5	373.3	441.8
	Intermed. input	33.5	80.5	51.2	478.2	10.7	53.2	113.8	132.0	1,140.8	23.8	14,404.4	44,249.4	58,653.8
	Value added	37.5	74.9	19.5	1,122.7	221.8	88.1	154.2	84.1	2,741.3	405.8	38,537.0		38,537.0
	Income	25.8	58.2	11.5	593.1	178.4	64.6	128.9	59.2	1,448.1	339.9	23,714.2		23,714.2
	Others	11.6	16.6	7.9	536.8	43.4	23.3	25.1	24.4	1,322.2	65.9	14,822.8		14,822.8
	Imports	11.0	48.8	11.6	140.4	3.1	19.8	86.5	48.6	512.6	12.3	5,712.4	8,476.4	14,188.8
	Total input	82.0	204.0	82.1	1,748.5	235.5	160.9	354.3	264.2	4,423.8	441.8	58,653.8	52,725.7	111,379.5
	Total jobs	2,039	1,996	582	24,484	4,637	3,819	3,783	2,134	58,575	8,716	742,251		742,251

Table 3. Inter-county Transactions Table (percent of total input)

		Hawaii County					Honolulu County				
		Agriculture	Construction	Manufacturing	Services	Government	Agriculture	Construction	Manufacturing	Services	Government
Hawaii County	Agriculture	13.7	0.6	9.1	0.3	0.1	0.2	0.0	1.0	0.0	0.0
	Construction	0.4	0.5	1.5	0.7	0.4	0.0	0.0	0.0	0.0	0.0
	Manufacturing	0.6	0.5	1.1	0.4	0.0	0.3	0.1	0.2	0.1	0.0
	Services	8.8	18.6	11.3	17.1	2.4	0.1	0.5	0.1	0.1	0.0
	Government	0.6	0.1	0.2	1.4	0.1	0.0	0.0	0.0	0.0	0.0
Honolulu County	Agriculture	0.0	0.0	0.5	0.0	0.0	7.6	0.3	1.6	0.3	0.0
	Construction	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.8	0.7	0.2
	Manufacturing	5.5	6.5	5.2	2.9	0.3	5.6	4.8	4.6	2.2	0.3
	Services	3.9	8.1	4.9	3.9	0.7	13.8	24.5	12.0	23.8	2.5
	Government	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.2	1.2	0.1
Kauai County	Agriculture	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Manufacturing	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Services	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maui County	Agriculture	0.0	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Manufacturing	0.2	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.0	0.0
	Services	0.1	0.2	0.1	0.1	0.0	0.2	0.2	0.1	0.1	0.0
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Inter. input	34.0	35.6	35.0	27.1	4.0	29.1	31.3	20.8	28.7	3.2
	Value added	56.1	41.5	34.8	62.9	94.5	62.9	52.7	25.9	64.5	95.7
	Income	29.7	34.5	19.8	31.9	82.1	46.7	45.3	15.7	33.5	83.3
	Others	25.8	7.0	15.0	31.3	12.4	16.6	7.4	10.2	30.8	12.4
	Imports	10.5	22.9	30.3	9.6	1.5	7.5	16.0	53.3	7.0	1.1
	Total input	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 3. Inter-county Transactions Table (percent of total input) - Contd.

		Kauai County					Maui County					Total	Total	Total
		Agriculture	Construction	Manufacturing	Services	Government	Agriculture	Construction	Manufacturing	Services	Government	intermed. demand	final demand	output (sales)
Hawaii County	Agriculture	0.0	0.0	0.1	0.0	0.0	0.0	0.0	2.0	0.1	0.0	0.2	0.2	0.2
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.3
	Manufacturing	0.0	0.1	0.6	0.1	0.0	0.2	0.2	0.3	0.1	0.0	0.1	0.2	0.2
	Services	0.0	0.0	0.7	0.1	0.0	0.2	0.4	0.2	0.2	0.0	1.3	4.9	3.0
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	0.5
Honolulu County	Agriculture	0.0	0.0	2.2	0.0	0.0	0.0	0.0	6.2	0.1	0.0	0.4	0.3	0.3
	Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	4.4	2.3
	Manufacturing	6.6	7.0	2.8	2.4	0.3	5.7	7.1	6.2	2.7	0.5	2.4	2.8	2.6
	Services	6.1	8.6	3.8	2.9	0.5	4.4	7.5	4.2	4.5	1.0	16.1	43.7	29.2
	Government	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	13.8	6.9
Kauai County	Agriculture	6.6	0.4	33.5	0.3	0.0	0.0	0.0	1.5	0.0	0.0	0.1	0.1	0.1
	Construction	1.5	1.1	1.2	1.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2
	Manufacturing	0.4	0.2	0.6	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1
	Services	19.1	21.5	12.4	18.5	3.0	0.1	0.2	0.1	0.1	0.0	0.8	2.5	1.6
	Government	0.4	0.1	0.4	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2
Maui County	Agriculture	0.0	0.0	3.8	0.0	0.0	11.7	0.5	18.5	0.4	0.1	0.2	0.1	0.1
	Construction	0.0	0.0	0.0	0.0	0.0	0.7	0.6	1.2	0.7	0.6	0.1	0.6	0.3
	Manufacturing	0.1	0.2	0.1	0.1	0.0	0.6	0.6	0.9	0.5	0.0	0.1	0.4	0.2
	Services	0.1	0.2	0.1	0.1	0.0	9.1	14.9	8.5	14.8	3.0	1.4	6.9	4.0
	Government	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.2	1.5	0.1	0.1	0.7	0.4
	Intermed. input	40.9	39.5	62.4	27.3	4.5	33.1	32.1	50.0	25.8	5.4	24.6	83.9	52.7
	Value added	45.7	36.7	23.8	64.2	94.2	54.8	43.5	31.8	62.0	91.9	65.7	0.0	34.6
	Income	31.5	28.5	14.0	33.9	75.8	40.1	36.4	22.4	32.7	76.9	40.4	0.0	21.3
	Others	14.1	8.1	9.6	30.7	18.4	14.5	7.1	9.2	29.9	14.9	25.3	0.0	13.3
	Imports	13.4	23.9	14.1	8.0	1.3	12.3	24.4	18.4	11.6	2.8	9.7	16.1	12.7
	Total input	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4. Composition of Total Final Demand by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State Total
Total final demand (\$ million)	3,653.4	34,233.2	1,789.8	4,573.0	44,249.4
Share (%)					
Personal consumption expenditures	40.3	45.0	37.1	33.8	45.6
Visitor expenditures	23.4	17.3	26.6	38.8	21.0
GPI and inventories change	7.6	5.2	8.9	5.9	5.6
State and local government	13.7	9.4	12.0	8.8	9.8
Federal government	2.6	15.8	2.2	0.8	12.6
Exports - within state	7.3	2.1	6.9	6.0	0.0
Exports - out of state	5.0	5.2	6.4	5.8	5.3

GPI = gross private investment

Table 5. Final Demand Output, Earnings and Total Job Multipliers in State, Inter-county, and County I-O Models

	Agriculture		Construction		Manufacturing		Services		Government	
	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II	Type I	Type II
Output multipliers										
State model	1.45	2.00	1.45	2.02	1.35	1.63	1.39	1.86	1.05	1.84
Inter-county model										
Hawaii	1.48	1.92	1.49	1.98	1.49	1.83	1.37	1.81	1.05	1.82
Honolulu	1.40	2.02	1.43	2.04	1.29	1.54	1.39	1.88	1.04	1.84
Kauai	1.57	2.07	1.54	2.02	1.93	2.38	1.37	1.86	1.06	1.80
Maui	1.46	2.01	1.44	1.94	1.71	2.17	1.35	1.79	1.07	1.81
County model										
Hawaii	1.31	1.59	1.25	1.56	1.29	1.50	1.25	1.54	1.04	1.59
Honolulu	1.38	1.96	1.41	1.98	1.26	1.49	1.38	1.84	1.04	1.80
Kauai	1.36	1.68	1.30	1.59	1.64	1.90	1.27	1.60	1.05	1.57
Maui	1.28	1.65	1.20	1.52	1.37	1.63	1.22	1.52	1.05	1.58
Earnings multiplier										
State model	0.46	0.62	0.48	0.65	0.23	0.31	0.40	0.53	0.66	0.89
Inter-county model										
Hawaii	0.37	0.50	0.42	0.56	0.29	0.39	0.37	0.49	0.65	0.87
Honolulu	0.52	0.70	0.50	0.68	0.21	0.28	0.40	0.54	0.66	0.89
Kauai	0.41	0.56	0.39	0.53	0.37	0.50	0.40	0.54	0.61	0.82
Maui	0.47	0.62	0.42	0.57	0.39	0.53	0.38	0.50	0.62	0.83
County model										
Hawaii	0.34	0.42	0.37	0.45	0.24	0.30	0.34	0.43	0.65	0.80
Honolulu	0.51	0.68	0.50	0.67	0.20	0.27	0.40	0.53	0.66	0.88
Kauai	0.36	0.46	0.33	0.42	0.29	0.37	0.37	0.47	0.60	0.76
Maui	0.43	0.53	0.37	0.46	0.30	0.38	0.34	0.43	0.61	0.77
Job multiplier										
State model	32.3	38.9	14.5	21.4	10.0	13.3	16.5	22.2	19.3	28.8
Inter-county model										
Hawaii	42.2	48.2	16.7	23.4	18.1	22.7	19.8	25.8	21.8	32.4
Honolulu	27.3	34.5	13.8	20.8	8.0	11.0	15.9	21.4	19.0	28.2
Kauai	32.6	39.1	16.3	22.5	23.7	29.5	18.9	25.3	20.5	30.3
Maui	30.5	37.5	15.6	22.0	19.9	25.8	17.6	23.2	20.6	30.0
County model										
Hawaii	40.7	45.0	14.5	19.2	16.2	19.3	18.6	23.0	21.6	29.9
Honolulu	26.9	33.5	13.5	20.0	7.4	10.1	15.7	20.9	19.0	27.6
Kauai	30.7	35.1	14.0	18.1	20.0	23.5	17.9	22.5	20.3	27.7
Maui	28.9	33.8	13.4	17.7	15.1	18.7	16.2	20.3	20.3	27.5

Table 6. Counties' Percentage Contributions to Output Multiplier in Inter-county I-O Model

	Agriculture		Construction		Manufacturing		Services		Government	
	Multiplier	%	Multiplier	%	Multiplier	%	Multiplier	%	Multiplier	%
Type I										
Hawaii	1.48	100.0	1.49	100.0	1.49	100.0	1.37	100.0	1.05	100.0
Hawaii	1.31	88.7	1.26	84.5	1.30	87.0	1.25	91.2	1.04	98.3
Honolulu	0.16	10.7	0.22	14.8	0.17	11.7	0.11	8.3	0.02	1.6
Kauai	0.00	0.2	0.00	0.3	0.01	0.5	0.00	0.2	0.00	0.0
Maui	0.01	0.4	0.01	0.5	0.01	0.8	0.00	0.3	0.00	0.1
Honolulu	1.40	100.0	1.43	100.0	1.29	100.0	1.39	100.0	1.04	100.0
Hawaii	0.01	0.8	0.01	0.7	0.02	1.5	0.01	0.4	0.00	0.0
Honolulu	1.38	98.4	1.41	98.8	1.26	98.1	1.38	99.3	1.04	99.9
Kauai	0.00	0.3	0.00	0.2	0.00	0.2	0.00	0.1	0.00	0.0
Maui	0.01	0.5	0.00	0.3	0.00	0.3	0.00	0.2	0.00	0.0
Kauai	1.57	100.0	1.54	100.0	1.93	100.0	1.37	100.0	1.06	100.0
Hawaii	0.00	0.2	0.00	0.3	0.02	1.1	0.00	0.3	0.00	0.1
Honolulu	0.20	12.9	0.23	15.0	0.21	11.0	0.09	6.7	0.01	1.3
Kauai	1.36	86.6	1.30	84.3	1.64	85.2	1.27	92.8	1.05	98.6
Maui	0.01	0.3	0.01	0.4	0.05	2.8	0.00	0.3	0.00	0.0
Maui	1.46	100.0	1.44	100.0	1.71	100.0	1.35	100.0	1.07	100.0
Hawaii	0.01	0.5	0.01	0.7	0.04	2.1	0.01	0.5	0.00	0.1
Honolulu	0.17	11.4	0.22	15.1	0.28	16.1	0.12	8.9	0.03	2.3
Kauai	0.00	0.2	0.00	0.3	0.02	1.4	0.00	0.2	0.00	0.1
Maui	1.28	87.9	1.20	83.9	1.37	80.3	1.22	90.3	1.05	97.5
Type II										
Hawaii	1.92	100.0	1.98	100.0	1.83	100.0	1.81	100.0	1.82	100.0
Hawaii	1.60	83.4	1.57	79.2	1.51	82.2	1.54	85.3	1.59	87.2
Honolulu	0.30	15.5	0.39	19.5	0.29	16.0	0.25	13.6	0.21	11.6
Kauai	0.01	0.3	0.01	0.4	0.01	0.6	0.01	0.4	0.01	0.3
Maui	0.01	0.8	0.02	0.8	0.02	1.1	0.01	0.7	0.01	0.8
Honolulu	2.02	100.0	2.04	100.0	1.54	100.0	1.88	100.0	1.84	100.0
Hawaii	0.02	1.2	0.02	1.1	0.03	1.8	0.01	0.8	0.01	0.8
Honolulu	1.97	97.4	1.99	97.7	1.50	97.4	1.84	98.3	1.81	98.1
Kauai	0.01	0.5	0.01	0.4	0.00	0.3	0.01	0.3	0.01	0.4
Maui	0.02	0.9	0.02	0.8	0.01	0.6	0.01	0.6	0.01	0.8
Kauai	2.07	100.0	2.02	100.0	2.38	100.0	1.86	100.0	1.80	100.0
Hawaii	0.01	0.6	0.01	0.7	0.03	1.3	0.01	0.7	0.01	0.7
Honolulu	0.37	17.9	0.40	19.9	0.37	15.7	0.24	12.7	0.21	11.5
Kauai	1.68	80.8	1.59	78.7	1.90	79.7	1.60	85.9	1.57	86.9
Maui	0.02	0.8	0.02	0.8	0.08	3.3	0.01	0.7	0.01	0.8
Maui	2.01	100.0	1.94	100.0	2.17	100.0	1.79	100.0	1.81	100.0
Hawaii	0.02	1.0	0.02	1.1	0.05	2.4	0.02	0.9	0.01	0.8
Honolulu	0.33	16.5	0.38	19.7	0.45	20.8	0.25	14.1	0.21	11.5
Kauai	0.01	0.4	0.01	0.5	0.03	1.5	0.01	0.4	0.01	0.4
Maui	1.65	82.2	1.53	78.7	1.64	75.3	1.52	84.5	1.58	87.3

Table 7. Type I State and Weighted Inter-county Multipliers

	Agriculture	Construction	Manufacturing	Services	Government
Output					
State	1.45	1.45	1.35	1.39	1.05
Weighted inter-county	1.45	1.44	1.35	1.39	1.05
Earnings					
State	0.46	0.48	0.23	0.40	0.66
Weighted inter-county	0.47	0.49	0.24	0.40	0.66
Total jobs					
State	32.3	14.5	10.0	16.5	19.3
Weighted inter-county	33.6	14.5	11.1	16.6	19.3

Table 8. Final Demand Output Multipliers for the State, Inter-county and County I-O Models

	State mode	Inter-county mode				County mode			
		Hawaii	Oahu	Kauai	Maui	Hawaii	Oahu	Kauai	Maui
Type I									
Agriculture	1.44	1.47	1.40	1.56	1.45	1.30	1.37	1.36	1.28
Mining and construction	1.43	1.47	1.41	1.52	1.42	1.25	1.40	1.29	1.20
Food processing	1.63	1.53	1.56	2.01	1.78	1.32	1.47	1.71	1.41
Other manufacturing	1.21	1.39	1.20	1.44	1.38	1.22	1.19	1.27	1.19
Transportation	1.45	1.50	1.44	1.52	1.47	1.24	1.42	1.30	1.20
Information	1.31	1.28	1.32	1.25	1.22	1.18	1.31	1.18	1.14
Utilities	1.48	1.47	1.48	1.49	1.48	1.10	1.45	1.12	1.10
Wholesale trade	1.27	1.21	1.28	1.22	1.17	1.14	1.27	1.15	1.10
Retail trade	1.32	1.37	1.31	1.37	1.33	1.30	1.31	1.31	1.24
Finance and insurance	1.46	1.43	1.47	1.45	1.34	1.26	1.46	1.31	1.18
Real estate and rentals	1.32	1.27	1.33	1.32	1.24	1.21	1.32	1.25	1.17
Professional services	1.35	1.33	1.36	1.23	1.30	1.23	1.35	1.18	1.20
Business services	1.30	1.25	1.31	1.28	1.23	1.16	1.30	1.21	1.15
Educational services	1.36	1.56	1.33	1.42	1.58	1.45	1.33	1.33	1.44
Health services	1.40	1.37	1.42	1.39	1.26	1.25	1.41	1.31	1.17
Arts and entertainment	1.46	1.42	1.51	1.42	1.30	1.32	1.50	1.34	1.22
Hotels	1.43	1.35	1.48	1.35	1.40	1.25	1.47	1.27	1.26
Eating and drinking	1.49	1.50	1.49	1.48	1.42	1.30	1.46	1.35	1.26
Other services	1.49	1.47	1.50	1.42	1.45	1.35	1.49	1.33	1.31
Government	1.05	1.06	1.04	1.06	1.07	1.04	1.04	1.05	1.04
Type II									
Agriculture	1.98	1.90	2.00	2.03	1.98	1.58	1.94	1.64	1.63
Mining and construction	2.01	1.98	2.03	2.01	1.92	1.57	1.98	1.58	1.52
Food processing	2.03	1.84	1.94	2.45	2.26	1.51	1.80	1.94	1.67
Other manufacturing	1.43	1.78	1.41	1.90	1.77	1.47	1.39	1.56	1.44
Transportation	1.89	1.89	1.90	1.94	1.82	1.46	1.85	1.56	1.41
Information	1.68	1.60	1.69	1.69	1.56	1.39	1.67	1.47	1.36
Utilities	1.75	1.75	1.75	1.76	1.74	1.25	1.71	1.26	1.23
Wholesale trade	1.75	1.69	1.77	1.63	1.63	1.46	1.74	1.42	1.42
Retail trade	1.86	1.84	1.87	1.90	1.80	1.61	1.83	1.67	1.56
Finance and insurance	1.89	1.81	1.91	1.84	1.75	1.49	1.88	1.55	1.44
Real estate and rentals	1.50	1.44	1.52	1.51	1.47	1.31	1.50	1.38	1.32
Professional services	2.06	1.99	2.08	2.03	1.94	1.68	2.03	1.72	1.63
Business services	1.97	1.95	1.98	2.02	1.88	1.65	1.93	1.71	1.60
Educational services	2.11	2.18	2.10	2.18	2.19	1.88	2.06	1.85	1.86
Health services	2.07	2.00	2.08	2.09	1.95	1.68	2.04	1.79	1.64
Arts and entertainment	2.02	1.96	2.07	2.03	1.87	1.69	2.02	1.75	1.62
Hotels	1.95	1.91	1.99	1.94	1.90	1.62	1.95	1.66	1.59
Eating and drinking	2.00	1.96	2.02	1.99	1.89	1.60	1.95	1.68	1.56
Other services	2.09	2.04	2.11	2.12	2.00	1.73	2.07	1.81	1.69
Government	1.82	1.82	1.83	1.80	1.79	1.58	1.79	1.56	1.56

Note: Output multiplier shows the total dollar change in output in all row industries that results from a \$1 change in final demand in the corresponding row industry.

Table 9. Final Demand Earnings Multipliers for the State, Inter-county and County Models

	State model	Inter-county model				County model			
		Hawaii	Oahu	Kauai	Maui	Hawaii	Oahu	Kauai	Maui
Type I									
Agriculture	0.45	0.37	0.51	0.39	0.46	0.33	0.51	0.34	0.42
Mining and construction	0.49	0.43	0.52	0.41	0.44	0.38	0.51	0.35	0.38
Food processing	0.34	0.27	0.33	0.36	0.41	0.22	0.30	0.28	0.30
Other manufacturing	0.18	0.34	0.18	0.38	0.34	0.30	0.17	0.34	0.30
Transportation	0.37	0.33	0.39	0.35	0.30	0.27	0.38	0.30	0.25
Information	0.31	0.27	0.32	0.36	0.29	0.25	0.31	0.35	0.27
Utilities	0.23	0.24	0.23	0.22	0.22	0.18	0.23	0.16	0.16
Wholesale trade	0.41	0.41	0.41	0.34	0.40	0.39	0.41	0.32	0.38
Retail trade	0.45	0.40	0.47	0.44	0.41	0.38	0.47	0.42	0.38
Finance and insurance	0.37	0.33	0.37	0.33	0.35	0.28	0.37	0.29	0.31
Real estate and rentals	0.16	0.14	0.16	0.16	0.19	0.12	0.16	0.14	0.17
Professional services	0.61	0.56	0.61	0.65	0.55	0.53	0.61	0.64	0.51
Business services	0.57	0.61	0.56	0.61	0.56	0.58	0.56	0.59	0.54
Educational services	0.64	0.54	0.65	0.63	0.54	0.51	0.65	0.61	0.50
Health services	0.56	0.54	0.56	0.58	0.59	0.51	0.56	0.56	0.57
Arts and entertainment	0.47	0.46	0.46	0.50	0.50	0.44	0.46	0.48	0.48
Hotels	0.44	0.47	0.43	0.48	0.43	0.44	0.43	0.46	0.39
Eating and drinking	0.43	0.40	0.44	0.43	0.40	0.35	0.44	0.39	0.36
Other services	0.51	0.49	0.51	0.58	0.48	0.46	0.51	0.56	0.44
Government	0.66	0.65	0.66	0.61	0.62	0.65	0.66	0.60	0.61
Type II									
Agriculture	0.60	0.48	0.68	0.52	0.61	0.40	0.67	0.42	0.52
Mining and construction	0.66	0.57	0.69	0.55	0.58	0.46	0.68	0.43	0.47
Food processing	0.45	0.36	0.43	0.49	0.54	0.27	0.40	0.34	0.38
Other manufacturing	0.25	0.44	0.23	0.51	0.45	0.36	0.23	0.42	0.37
Transportation	0.50	0.43	0.52	0.47	0.40	0.33	0.50	0.38	0.30
Information	0.42	0.36	0.42	0.49	0.39	0.30	0.42	0.43	0.34
Utilities	0.31	0.32	0.31	0.30	0.30	0.22	0.30	0.20	0.20
Wholesale trade	0.55	0.54	0.55	0.46	0.53	0.48	0.54	0.40	0.47
Retail trade	0.60	0.53	0.63	0.58	0.54	0.46	0.62	0.52	0.48
Finance and insurance	0.49	0.43	0.50	0.44	0.47	0.34	0.49	0.36	0.38
Real estate and rentals	0.21	0.18	0.21	0.22	0.26	0.15	0.21	0.18	0.22
Professional services	0.81	0.74	0.82	0.88	0.73	0.64	0.80	0.79	0.63
Business services	0.76	0.80	0.75	0.82	0.75	0.71	0.74	0.73	0.66
Educational services	0.85	0.71	0.87	0.85	0.71	0.62	0.86	0.75	0.62
Health services	0.75	0.72	0.75	0.78	0.79	0.62	0.74	0.69	0.70
Arts and entertainment	0.63	0.61	0.62	0.67	0.66	0.53	0.61	0.59	0.59
Hotels	0.59	0.62	0.58	0.65	0.57	0.54	0.56	0.57	0.48
Eating and drinking	0.58	0.62	0.52	0.62	0.59	0.62	0.58	0.62	0.54
Other services	0.68	0.64	0.68	0.78	0.64	0.56	0.67	0.69	0.55
Government	0.88	0.86	0.88	0.82	0.82	0.79	0.87	0.75	0.76

Note: Final demand earnings multiplier shows the total change in earnings received by households from all row industries that results from a \$1 change in final demand in the corresponding row industry.

Table 10. Final Demand Total Job Multipliers for the State, Inter-county and County Models

	State model	Inter-county model				County model			
		Hawaii	Oahu	Kauai	Maui	Hawaii	Oahu	Kauai	Maui
Type I									
Agriculture	31.7	41.7	27.0	31.2	30.0	40.4	26.6	29.6	28.6
Mining and construction	14.7	17.2	14.0	16.4	16.2	15.1	13.8	14.2	14.1
Food processing	16.5	17.5	14.5	23.1	20.5	15.4	12.2	19.0	15.0
Other manufacturing	6.8	19.4	6.0	23.3	17.5	18.0	5.9	21.8	16.0
Transportation	12.5	14.3	12.2	14.8	12.7	12.3	11.9	13.1	10.7
Information	9.7	9.9	9.6	9.1	10.2	9.0	9.5	8.5	9.4
Utilities	5.9	6.5	5.8	5.9	5.9	4.2	5.4	3.6	3.6
Wholesale trade	14.8	18.9	14.2	16.2	16.5	18.2	14.1	15.4	15.8
Retail trade	24.0	25.9	24.1	26.3	22.0	25.1	24.0	25.7	21.1
Finance and insurance	13.0	16.9	12.4	15.7	16.6	15.2	12.3	14.4	15.1
Real estate and rentals	6.9	8.7	6.3	8.6	8.8	8.1	6.2	8.0	8.1
Professional services	19.9	26.7	18.8	22.3	25.8	25.5	18.6	21.7	24.6
Business services	28.9	44.7	27.3	24.1	37.7	43.8	27.1	23.4	36.7
Educational services	32.9	43.4	31.4	48.3	45.4	42.3	31.3	47.2	44.0
Health services	17.4	22.2	16.6	19.0	20.7	21.0	16.4	18.2	19.7
Arts and entertainment	29.1	30.3	29.1	33.0	27.2	29.4	28.9	32.2	26.4
Hotels	16.7	19.9	15.5	20.1	17.0	18.9	15.3	19.3	15.4
Eating and drinking	27.3	30.4	27.2	30.5	24.6	28.5	26.6	29.1	22.7
Other services	27.3	31.5	26.0	34.5	31.1	30.3	25.8	33.7	29.7
Government	19.3	21.7	19.0	20.4	20.6	21.6	19.0	20.2	20.3
Type II									
Agriculture	37.9	47.4	33.8	37.2	36.8	44.4	32.8	33.4	33.4
Mining and construction	21.5	23.9	20.9	22.6	22.6	19.6	20.1	18.1	18.3
Food processing	21.2	21.7	18.9	28.6	26.4	18.0	16.0	22.1	18.4
Other manufacturing	9.3	24.6	8.3	29.2	22.5	21.5	8.0	25.6	19.3
Transportation	17.6	19.4	17.3	20.2	17.1	15.5	16.7	16.5	13.5
Information	14.0	14.1	13.8	14.8	14.6	11.9	13.4	12.3	12.4
Utilities	9.0	10.2	8.9	9.2	9.2	6.4	8.2	5.4	5.4
Wholesale trade	20.4	25.3	19.7	21.5	22.5	22.9	19.2	19.0	20.1
Retail trade	30.2	32.2	30.3	33.0	28.0	29.7	29.8	30.4	25.4
Finance and insurance	18.0	22.0	17.3	20.7	63.0	18.6	16.9	17.6	18.6
Real estate and rentals	9.0	10.9	8.4	11.1	11.6	9.6	8.2	9.6	10.0
Professional services	28.2	35.5	26.9	32.5	33.9	31.9	26.2	28.7	30.3
Business services	36.6	54.2	34.7	33.6	46.0	50.8	34.0	29.9	42.8
Educational services	41.7	51.8	40.0	58.1	53.3	48.4	39.4	53.9	49.6
Health services	25.1	30.7	24.0	28.0	29.5	27.1	23.3	24.4	26.1
Arts and entertainment	35.6	37.6	35.2	40.8	34.6	34.6	34.6	37.5	31.8
Hotels	22.7	27.3	21.2	27.6	23.3	24.2	20.6	24.5	19.8
Eating and drinking	33.2	36.6	33.0	37.1	30.6	32.7	31.9	33.5	26.7
Other services	34.2	39.1	32.7	43.5	38.3	35.7	32.1	39.9	34.8
Government	28.3	32.0	27.7	29.8	29.8	29.4	27.1	26.9	27.2

Note: Final-demand total job multiplier shows the total change in number of total jobs (wage and salary and proprietors' jobs) in all row industries that results from a \$1 million change in final demand in the corresponding row industry.

Table 11. Final Demand State Tax Multipliers for the State, Inter-county and County Models

	State model	Inter-county model				County model			
		Hawaii	Oahu	Kauai	Maui	Hawaii	Oahu	Kauai	Maui
Type I									
Agriculture	0.05	0.04	0.06	0.05	0.05	0.04	0.06	0.04	0.04
Mining and construction	0.08	0.08	0.09	0.08	0.08	0.07	0.08	0.07	0.07
Food processing	0.04	0.04	0.04	0.05	0.04	0.03	0.04	0.03	0.03
Other manufacturing	0.02	0.04	0.02	0.05	0.04	0.03	0.02	0.04	0.03
Transportation	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.04
Information	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Utilities	0.09	0.07	0.09	0.08	0.07	0.06	0.09	0.07	0.06
Wholesale trade	0.14	0.10	0.14	0.13	0.11	0.09	0.14	0.12	0.11
Retail trade	0.15	0.14	0.15	0.14	0.14	0.14	0.15	0.14	0.13
Finance and insurance	0.06	0.03	0.06	0.03	0.04	0.03	0.06	0.02	0.03
Real estate and rentals	0.04	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.04
Professional services	0.09	0.08	0.09	0.07	0.08	0.07	0.09	0.07	0.07
Business services	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.08
Educational services	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.08	0.08
Health services	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.06	0.07
Arts and entertainment	0.08	0.08	0.09	0.09	0.08	0.08	0.09	0.08	0.08
Hotels	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10
Eating and drinking	0.08	0.08	0.08	0.08	0.08	0.07	0.08	0.07	0.07
Other services	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.07	0.06
Government	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Type II									
Agriculture	0.08	0.07	0.09	0.08	0.08	0.05	0.09	0.06	0.06
Mining and construction	0.12	0.11	0.12	0.11	0.11	0.09	0.11	0.09	0.09
Food processing	0.06	0.05	0.06	0.07	0.07	0.04	0.06	0.05	0.04
Other manufacturing	0.03	0.06	0.03	0.07	0.06	0.05	0.03	0.05	0.05
Transportation	0.07	0.07	0.07	0.08	0.07	0.06	0.07	0.06	0.05
Information	0.08	0.08	0.08	0.09	0.08	0.07	0.07	0.08	0.07
Utilities	0.10	0.09	0.11	0.09	0.08	0.07	0.11	0.08	0.07
Wholesale trade	0.16	0.12	0.17	0.15	0.13	0.11	0.16	0.14	0.12
Retail trade	0.18	0.17	0.18	0.17	0.16	0.16	0.18	0.16	0.15
Finance and insurance	0.08	0.05	0.09	0.05	0.06	0.04	0.08	0.04	0.04
Real estate and rentals	0.05	0.05	0.05	0.06	0.06	0.04	0.05	0.05	0.05
Professional services	0.12	0.11	0.13	0.11	0.11	0.10	0.12	0.10	0.09
Business services	0.12	0.12	0.12	0.13	0.12	0.11	0.12	0.11	0.10
Educational services	0.13	0.12	0.13	0.13	0.12	0.10	0.12	0.11	0.10
Health services	0.10	0.10	0.10	0.10	0.11	0.09	0.10	0.09	0.09
Arts and entertainment	0.11	0.11	0.11	0.12	0.11	0.10	0.11	0.10	0.10
Hotels	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.13	0.12
Eating and drinking	0.11	0.10	0.11	0.11	0.10	0.08	0.10	0.09	0.08
Other services	0.10	0.10	0.10	0.11	0.10	0.08	0.10	0.09	0.08
Government	0.08	0.08	0.08	0.08	0.08	0.07	0.08	0.06	0.07

Note: Final-demand state tax multiplier shows the total change in state tax revenues (excludes county and federal taxes and includes income taxes on earnings) from households and all row industries that results from a \$1 change in final demand in the corresponding row industry.

Table 12. Direct Effect Earnings Multipliers for the State, Inter-county and County Models

	State model	Inter-county model				County model			
		Hawaii	Oahu	Kauai	Maui	Hawaii	Oahu	Kauai	Maui
Type I									
Agriculture	1.35	1.45	1.28	1.49	1.35	1.31	1.26	1.31	1.24
Mining and construction	1.37	1.47	1.34	1.65	1.40	1.27	1.32	1.40	1.21
Food processing	2.13	2.04	1.94	4.02	2.36	1.65	1.80	3.08	1.77
Other manufacturing	1.43	1.44	1.43	1.43	1.41	1.26	1.42	1.28	1.23
Transportation	1.52	1.71	1.49	1.73	1.68	1.41	1.47	1.50	1.36
Information	1.36	1.38	1.37	1.25	1.27	1.25	1.36	1.19	1.17
Utilities	1.70	1.60	1.72	1.81	1.70	1.19	1.67	1.30	1.21
Wholesale trade	1.21	1.16	1.22	1.22	1.14	1.10	1.21	1.16	1.08
Retail trade	1.22	1.32	1.19	1.29	1.30	1.25	1.19	1.24	1.23
Finance and insurance	1.48	1.53	1.48	1.62	1.38	1.30	1.47	1.43	1.20
Real estate and rentals	2.06	2.15	2.13	2.27	1.60	1.89	2.12	2.03	1.44
Professional services	1.19	1.21	1.19	1.13	1.21	1.13	1.18	1.10	1.14
Business services	1.22	1.15	1.23	1.18	1.16	1.11	1.22	1.14	1.11
Educational services	1.12	1.25	1.10	1.16	1.33	1.18	1.10	1.12	1.24
Health services	1.22	1.21	1.22	1.22	1.15	1.13	1.21	1.17	1.09
Arts and entertainment	1.32	1.27	1.37	1.26	1.19	1.20	1.36	1.21	1.14
Hotels	1.36	1.24	1.41	1.24	1.36	1.17	1.40	1.19	1.23
Eating and drinking	1.38	1.43	1.37	1.36	1.39	1.26	1.34	1.25	1.24
Other services	1.29	1.30	1.29	1.21	1.32	1.21	1.29	1.17	1.22
Government	1.02	1.02	1.02	1.03	1.03	1.02	1.02	1.02	1.02
Type II									
Agriculture	1.80	1.91	1.71	2.00	1.80	1.59	1.67	1.62	1.54
Mining and construction	1.82	1.94	1.78	2.21	1.85	1.55	1.74	1.74	1.50
Food processing	2.84	2.69	2.58	5.39	3.13	2.01	2.37	3.81	2.19
Other manufacturing	1.91	1.89	1.91	1.92	1.87	1.54	1.87	1.59	1.53
Transportation	2.02	2.25	1.99	2.32	2.23	1.71	1.94	1.85	1.69
Information	1.81	1.82	1.83	1.68	1.68	1.52	1.80	1.47	1.45
Utilities	2.27	2.11	2.30	2.42	2.26	1.45	2.20	1.60	1.50
Wholesale trade	1.61	1.53	1.63	1.64	1.51	1.35	1.60	1.43	1.34
Retail trade	1.63	1.74	1.59	1.73	1.73	1.52	1.57	1.54	1.52
Finance and insurance	1.97	2.01	1.98	2.18	1.83	1.59	1.94	1.77	1.49
Real estate and rentals	2.74	2.83	2.85	3.05	2.12	2.30	2.79	2.51	1.78
Professional services	1.58	1.59	1.59	1.51	1.61	1.38	1.56	1.36	1.41
Business services	1.62	1.51	1.64	1.59	1.54	1.35	1.61	1.41	1.37
Educational services	1.49	1.65	1.47	1.56	1.77	1.44	1.45	1.38	1.54
Health services	1.62	1.59	1.63	1.64	1.53	1.38	1.60	1.45	1.36
Arts and entertainment	1.76	1.68	1.84	1.70	1.58	1.46	1.80	1.50	1.41
Hotels	1.81	1.64	1.89	1.67	1.80	1.42	1.85	1.47	1.53
Eating and drinking	1.84	1.88	1.83	1.83	1.85	1.53	1.77	1.55	1.53
Other services	1.72	1.71	1.73	1.63	1.76	1.48	1.70	1.44	1.51
Government	1.36	1.34	1.36	1.38	1.37	1.24	1.34	1.27	1.27

Note: Direct-effect earnings multiplier shows the total change in earnings received by households from all row industries that results from a \$1 change in earnings received by households directly from the corresponding row industry.

Table 13. Direct Effect Total Job Multipliers for the State, Inter-county and County Models

	State model	Inter-county model				County model			
		Hawaii	Oahu	Kauai	Maui	Hawaii	Oahu	Kauai	Maui
Type I									
Agriculture	1.23	1.26	1.22	1.26	1.26	1.22	1.20	1.19	1.21
Mining and construction	1.55	1.63	1.54	1.68	1.52	1.43	1.51	1.45	1.32
Food processing	2.48	2.30	2.18	4.72	3.13	2.02	1.83	3.89	2.30
Other manufacturing	1.46	1.31	1.48	1.25	1.31	1.21	1.46	1.17	1.19
Transportation	1.61	1.71	1.59	1.64	1.65	1.46	1.56	1.45	1.39
Information	1.46	1.52	1.46	1.42	1.35	1.38	1.45	1.31	1.24
Utilities	2.58	2.44	2.59	2.98	2.69	1.59	2.43	1.84	1.63
Wholesale trade	1.24	1.17	1.25	1.19	1.15	1.13	1.24	1.13	1.10
Retail trade	1.15	1.22	1.13	1.17	1.22	1.18	1.13	1.15	1.17
Finance and insurance	1.50	1.42	1.50	1.44	1.32	1.29	1.49	1.32	1.19
Real estate and rentals	2.03	1.86	2.12	1.93	1.68	1.73	2.09	1.79	1.54
Professional services	1.22	1.20	1.23	1.15	1.20	1.15	1.22	1.11	1.14
Business services	1.16	1.10	1.17	1.18	1.10	1.07	1.16	1.15	1.07
Educational services	1.09	1.15	1.08	1.09	1.16	1.12	1.08	1.07	1.12
Health services	1.28	1.24	1.29	1.28	1.18	1.17	1.28	1.22	1.12
Arts and entertainment	1.21	1.21	1.23	1.16	1.16	1.17	1.22	1.13	1.12
Hotels	1.40	1.30	1.47	1.24	1.44	1.23	1.44	1.19	1.31
Eating and drinking	1.23	1.24	1.22	1.21	1.27	1.16	1.19	1.15	1.17
Other services	1.20	1.21	1.20	1.14	1.21	1.17	1.20	1.11	1.15
Government	1.03	1.03	1.02	1.03	1.04	1.02	1.02	1.03	1.03
Type II									
Agriculture	1.47	1.43	1.53	1.49	1.55	1.34	1.48	1.34	1.41
Mining and construction	2.27	2.26	2.29	2.31	2.12	1.85	2.21	1.85	1.72
Food processing	3.18	2.85	2.83	5.85	4.04	2.36	2.39	4.53	2.82
Other manufacturing	2.00	1.66	2.05	1.57	1.68	1.46	1.99	1.38	1.44
Transportation	2.27	2.31	2.26	2.23	2.23	1.85	2.18	1.83	1.75
Information	2.11	2.17	2.10	2.29	1.93	1.83	2.04	1.91	1.65
Utilities	3.99	3.84	3.99	4.66	4.17	2.41	3.69	2.74	2.45
Wholesale trade	1.71	1.57	1.73	1.58	1.57	1.42	1.68	1.40	1.40
Retail trade	1.45	1.51	1.42	1.47	1.56	1.39	1.40	1.36	1.41
Finance and insurance	2.08	1.85	2.10	1.90	1.73	1.57	2.04	1.61	1.47
Real estate and rentals	2.68	2.33	2.83	2.49	2.22	2.05	2.75	2.16	1.91
Professional services	1.73	1.60	1.76	1.67	1.57	1.44	1.71	1.48	1.41
Business services	1.47	1.33	1.49	1.65	1.35	1.25	1.46	1.47	1.25
Educational services	1.38	1.37	1.38	1.31	1.36	1.28	1.36	1.22	1.26
Health services	1.85	1.71	1.87	1.88	1.68	1.51	1.81	1.64	1.49
Arts and entertainment	1.47	1.49	1.48	1.43	1.47	1.38	1.46	1.32	1.35
Hotels	1.91	1.78	2.01	1.70	1.97	1.58	1.94	1.51	1.68
Eating and drinking	1.50	1.49	1.48	1.47	1.58	1.33	1.43	1.32	1.38
Other services	1.51	1.51	1.52	1.44	1.48	1.38	1.49	1.32	1.35
Government	1.51	1.52	1.50	1.52	1.51	1.39	1.46	1.37	1.38

Note: Direct-effect total job multiplier shows the total change in number of jobs (wage and salary plus proprietors' jobs) in all row industries that results from a change of one job in the corresponding row industry.

Table 14. Number of Visitors, Average Daily Spending and Expenditures by Market Type in Big Island

Market type	No. of visitors	Visitor days ¹	Average spending/ person/day (\$) ²	Total expenditures (\$)	% of total expenditures
U.S. West	383	2,682	159	426,317	35.0
U.S. East	304	2,131	181	385,892	31.7
Japan	183	1,284	204	262,392	21.6
Canada	36	253	136	34,300	2.8
Other	93	649	167	108,244	8.9
Total	1,000	7,000	174	1,217,145	100.0

Note. 1. For this example length of stay is assumed to be one week (7 days) for all visitor types. But in 2002 average length of stay of Big Island visitors varied from 3 days for Japanese visitors to 8 days for visitors from the U.S. West.

2. These average spending rates are for 2002, the latest year for which these data are available.

Table 15. Direct Spending of 1,000 Out-of-State Big Island Visitors by County and by Industry

	Hawaii County	Honolulu County	Kauai County	Maui County	State Total
Total direct spending (\$)	944,556	50,457	3,653	5,434	1,004,099
Sector share (%)					
Agriculture	0.2	1.7	3.8	5.2	0.3
Mining and construction	0.0	0.0	0.0	0.0	0.0
Food processing	0.3	7.1	10.9	14.6	0.8
Other manufacturing	0.0	14.7	1.1	3.5	0.8
Transportation	8.7	49.5	80.2	74.0	11.4
Information	0.2	0.0	0.0	0.0	0.2
Utilities	0.0	0.0	0.0	0.0	0.0
Wholesale trade	1.8	27.0	4.0	2.7	3.1
Retail trade	16.3	0.0	0.0	0.0	15.4
Finance and insurance	0.0	0.0	0.0	0.0	0.0
Real estate and rentals	8.9	0.0	0.0	0.0	8.4
Professional services	0.3	0.0	0.0	0.0	0.3
Business services	1.7	0.0	0.0	0.0	1.6
Educational services	0.0	0.0	0.0	0.0	0.0
Health services	0.8	0.0	0.0	0.0	0.8
Arts and entertainment	5.0	0.0	0.0	0.0	4.7
Hotels	47.1	0.0	0.0	0.0	44.3
Eating and drinking	7.9	0.0	0.0	0.0	7.4
Other services	0.6	0.0	0.0	0.0	0.6
Government	0.1	0.0	0.0	0.0	0.1

Table 16. Economic Impacts of a Hypothetical Event Attracting 1,000 Out-of-State Visitors to Big Island

	Visitor expenditures (\$)	Output (\$)		Labor income (\$)		Total jobs (no.)	
		Direct	Total	Direct	Total	Direct	Total
State total	1,004,099	1,004,099	1,861,392	370,990	641,694	16.1	27.3
Hawaii County	944,556	944,556	1,494,487	353,455	523,610	15.6	23.5
Honolulu County	50,457	50,457	333,219	15,411	107,405	0.4	3.3
Kauai County	3,653	3,653	12,752	861	4,151	0.0	0.2
Maui County	5,434	5,434	20,934	1,263	6,527	0.0	0.3
County share (%)							
Hawaii County	94.1	94.1	80.3	95.3	81.6	96.9	86.1
Honolulu County	5.0	5.0	17.9	4.2	16.7	2.6	12.3
Kauai County	0.4	0.4	0.7	0.2	0.6	0.2	0.6
Maui County	0.5	0.5	1.1	0.3	1.0	0.3	1.0

Table 17. Direct and Total Output, Income and Employment Impacts (by industry) of 1,000 Out-of-State Visitors to Big Island

	Output (\$)		Income (\$)		Total jobs (no.)	
	Direct	Total	Direct	Total	Direct	Total
Total	1,004,099	1,861,392	370,990	641,694	16.1	27.3
Agriculture	2,800	19,481	1,007	6,655	0.1	0.6
Mining and construction	0	11,609	0	4,197	0.0	0.1
Food processing	7,953	31,057	1,435	5,802	0.1	0.2
Other manufacturing	7,865	59,514	1,198	9,361	0.0	0.3
Transportation	114,262	148,458	28,372	37,687	0.9	1.2
Information	2,175	41,165	510	10,172	0.0	0.3
Utilities	0	54,132	0	9,785	0.0	0.1
Wholesale trade	30,767	69,714	12,633	28,494	0.4	0.9
Retail trade	154,286	218,976	55,583	80,337	3.3	4.7
Finance and insurance	0	69,875	0	19,291	0.0	0.7
Real estate and rentals	84,250	268,738	6,330	20,587	0.4	1.2
Professional services	2,556	45,217	1,350	25,155	0.1	0.9
Business services	16,150	50,414	9,884	30,014	0.7	1.9
Educational services	0	8,408	0	5,179	0.0	0.3
Health services	7,621	78,570	4,043	41,954	0.1	1.3
Arts and entertainment	46,891	57,158	19,967	24,302	1.2	1.4
Hotels	444,931	449,086	200,515	202,119	6.8	6.9
Eating and drinking	74,522	99,044	24,674	33,165	1.8	2.4
Other services	5,932	48,923	2,557	21,269	0.2	1.2
Government	1,138	31,853	934	26,168	0.0	0.7
Share by sector (%)						
Agriculture	0.3	1.0	0.3	1.0	0.5	2.1
Mining and construction	0.0	0.6	0.0	0.7	0.0	0.4
Food processing	0.8	1.7	0.4	0.9	0.3	0.8
Other manufacturing	0.8	3.2	0.3	1.5	0.2	1.1
Transportation	11.4	8.0	7.6	5.9	5.8	4.4
Information	0.2	2.2	0.1	1.6	0.1	1.0
Utilities	0.0	2.9	0.0	1.5	0.0	0.5
Wholesale trade	3.1	3.7	3.4	4.4	2.7	3.5
Retail trade	15.4	11.8	15.0	12.5	20.4	17.1
Finance and insurance	0.0	3.8	0.0	3.0	0.0	2.6
Real estate and rentals	8.4	14.4	1.7	3.2	2.4	4.4
Professional services	0.3	2.4	0.4	3.9	0.4	3.2
Business services	1.6	2.7	2.7	4.7	4.1	6.8
Educational services	0.0	0.5	0.0	0.8	0.0	1.0
Health services	0.8	4.2	1.1	6.5	0.8	4.8
Arts and entertainment	4.7	3.1	5.4	3.8	7.3	5.3
Hotels	44.3	24.1	54.0	31.5	42.4	25.2
Eating and drinking	7.4	5.3	6.7	5.2	11.4	8.8
Other services	0.6	2.6	0.7	3.3	1.0	4.6
Government	0.1	1.7	0.3	4.1	0.1	2.4

Table 18. Agricultural and Rest of the Final Demand by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State Total
Total final demand (\$ million)	3,653.4	34,233.2	1,789.8	4,573.0	44,249.4
Agriculture and related margins	300.9	907.1	131.0	334.6	1,673.6
Farm production	112.0	150.5	34.6	65.3	362.4
Food processing	107.6	439.4	61.7	185.9	794.5
Trade and distribution margins	81.3	317.2	34.7	83.4	516.6
Rest of the economy	3,352.5	33,326.1	1,658.8	4,238.4	42,575.8
County share of state total (%)					
Total final demand	8.3	77.4	4.0	10.3	100.0
Agriculture and related margins	18.0	54.2	7.8	20.0	100.0
Farm production	30.9	41.5	9.5	18.0	100.0
Food processing	13.5	55.3	7.8	23.4	100.0
Trade and distribution margins	15.7	61.4	6.7	16.1	100.0
Rest of the economy	7.9	78.3	3.9	10.0	100.0
Sector share of county total (%)					
Agriculture and related margins	8.2	2.6	7.3	7.3	3.8
Farm production	3.1	0.4	1.9	1.4	0.8
Food processing	2.9	1.3	3.4	4.1	1.8
Trade and distribution margins	2.2	0.9	1.9	1.8	1.2
Rest of the economy	91.8	97.4	92.7	92.7	96.2
County total	100.0	100.0	100.0	100.0	100.0

**Table 19. Direct and Total Output Contributions of Agricultural and Rest of the Final Demand
(\$ million)**

	Direct contri- butions	Total output contributions					% of Total State Output
		Hawaii County	Honolulu County	Kauai County	Maui County	Total	
Hawaii County	3,653.4	4,471.2	410.8	9.3	14.0	4,905.4	8.4
Agriculture and related margins	300.9	386.7	45.6	1.4	2.4	436.1	0.7
Farm production	112.0	146.1	17.4	0.2	0.6	164.3	0.3
Food processing	107.6	142.4	19.3	0.9	1.5	164.1	0.3
Trade & distribution margins	81.3	98.2	9.0	0.2	0.3	107.7	0.2
Rest of the economy	3,352.5	4,084.5	365.2	8.0	11.6	4,469.3	7.6
Honolulu County	34,233.2	173.4	44,810.5	54.2	83.3	45,121.4	76.9
Agriculture and related margins	907.1	34.0	1,269.8	3.2	4.7	1,311.7	2.2
Farm production	150.5	1.7	206.8	0.6	0.9	210.1	0.4
Food processing	439.4	31.5	648.0	2.1	3.1	684.7	1.2
Trade & distribution margins	317.2	0.8	414.9	0.4	0.7	416.8	0.7
Rest of the economy	33,326.1	139.4	43,540.7	51.0	78.6	43,809.7	74.7
Kauai County	1,789.8	5.6	181.1	2,271.2	9.5	2,467.3	4.2
Agriculture and related margins	131.0	1.5	23.4	195.0	4.2	224.1	0.4
Farm production	34.6	0.0	6.9	46.9	0.2	54.0	0.1
Food processing	61.7	1.2	13.7	105.3	3.9	124.0	0.2
Trade & distribution margins	34.7	0.3	2.9	42.8	0.1	46.1	0.1
Rest of the economy	1,658.8	4.0	157.7	2,076.2	5.3	2,243.2	3.8
Maui County	4,573.0	35.0	569.1	17.3	5,538.2	6,159.6	10.5
Agriculture and related margins	334.6	8.7	74.2	5.7	443.5	532.1	0.9
Farm production	65.3	0.4	10.5	0.1	83.4	94.4	0.2
Food processing	185.9	8.0	55.3	5.4	263.1	331.8	0.6
Trade & distribution margins	83.4	0.4	8.4	0.2	97.1	106.0	0.2
Rest of the economy	4,238.4	26.2	494.9	11.7	5,094.7	5,627.5	9.6
State Total	44,249.4	4,685.2	45,971.5	2,352.1	5,645.0	58,653.8	100.0
Agriculture and related margins	1,673.6	431.0	1,413.0	205.2	454.8	2,504.0	4.3
Farm production	362.4	148.3	241.6	47.9	85.1	522.8	0.9
Food processing	794.5	183.1	736.2	113.7	271.6	1,304.6	2.2
Trade & distribution margins	516.6	99.7	435.1	43.6	98.2	676.5	1.2
Rest of the economy	42,575.8	4,254.1	44,558.6	2,146.9	5,190.2	56,149.8	95.7

Table 19a. Counties' Shares in Total Output Contributions of Agricultural and Rest of the Final Demand

	Total output contributions (\$ million)	County shares in total output contributions (%)			
		Hawaii County	Honolulu County	Kauai County	Maui County
Hawaii County	4,905.4	91.1	8.4	0.2	0.3
Agriculture and related margins	436.1	88.7	10.5	0.3	0.6
Farm production	164.3	88.9	10.6	0.1	0.4
Food processing	164.1	86.8	11.7	0.6	0.9
Trade & distribution margins	107.7	91.2	8.3	0.2	0.3
Rest of the economy	4,469.3	91.4	8.2	0.2	0.3
Honolulu County	45,121.4	0.4	99.3	0.1	0.2
Agriculture and related margins	1,311.7	2.6	96.8	0.2	0.4
Farm production	210.1	0.8	98.4	0.3	0.4
Food processing	684.7	4.6	94.6	0.3	0.5
Trade & distribution margins	416.8	0.2	99.5	0.1	0.2
Rest of the economy	43,809.7	0.3	99.4	0.1	0.2
Kauai County	2,467.3	0.2	7.3	92.1	0.4
Agriculture and related margins	224.1	0.7	10.4	87.0	1.9
Farm production	54.0	0.1	12.7	86.9	0.3
Food processing	124.0	1.0	11.0	84.8	3.2
Trade & distribution margins	46.1	0.6	6.2	93.0	0.2
Rest of the economy	2,243.2	0.2	7.0	92.6	0.2
Maui County	6,159.6	0.6	9.2	0.3	89.9
Agriculture and related margins	532.1	1.6	13.9	1.1	83.3
Farm production	94.4	0.4	11.1	0.1	88.3
Food processing	331.8	2.4	16.7	1.6	79.3
Trade & distribution margins	106.0	0.3	7.9	0.1	91.6
Rest of the economy	5,627.5	0.5	8.8	0.2	90.5
Overall Total	58,653.8	8.0	78.4	4.0	9.6
Agriculture and related margins	2,504.0	17.2	56.4	8.2	18.2
Farm production	522.8	28.4	46.2	9.2	16.3
Food processing	1,304.6	14.0	56.4	8.7	20.8
Trade & distribution margins	676.5	14.7	64.3	6.4	14.5
Rest of the economy	56,149.8	7.6	79.4	3.8	9.2

Table 20. Direct and Total Labor Income Contributions of Agricultural and Rest of the Final Demand (\$ million)

	Direct contributions	Total labor income contributions					% of Total State Income
		Hawaii County	Honolulu County	Kauai County	Maui County	Total	
Hawaii County	1,422.8	1,678.3	124.2	3.7	4.7	1,810.9	7.6
Agriculture and related margins	79.7	106.7	12.8	0.4	0.8	120.8	0.5
Farm production	33.3	43.6	4.5	0.1	0.2	48.3	0.2
Food processing	17.2	28.2	5.7	0.3	0.5	34.8	0.1
Trade & distribution margins	29.2	34.8	2.6	0.1	0.1	37.6	0.2
Rest of the economy	1,343.1	1,571.6	111.4	3.3	3.9	1,690.2	7.1
Honolulu County	15,444.1	56.2	18,706.8	22.7	30.5	18,816.0	79.3
Agriculture and related margins	294.3	10.0	413.2	1.1	1.7	426.0	1.8
Farm production	70.3	0.5	89.1	0.2	0.3	90.2	0.4
Food processing	88.3	9.2	158.6	0.7	1.1	169.6	0.7
Trade & distribution margins	135.7	0.3	165.5	0.2	0.2	166.2	0.7
Rest of the economy	15,149.8	46.1	18,293.5	21.6	28.8	18,390.1	77.5
Kauai County	675.9	1.9	53.5	834.1	3.5	893.0	3.8
Agriculture and related margins	29.1	0.5	6.9	49.1	1.6	58.1	0.2
Farm production	10.9	0.0	1.8	14.2	0.1	16.1	0.1
Food processing	6.6	0.4	4.2	20.4	1.5	26.6	0.1
Trade & distribution margins	11.6	0.1	0.8	14.4	0.0	15.4	0.1
Rest of the economy	646.7	1.4	46.7	785.0	1.9	834.9	3.5
Maui County	1,667.4	11.6	174.0	6.4	2,002.2	2,194.2	9.3
Agriculture and related margins	95.3	2.7	23.1	1.8	135.7	163.2	0.7
Farm production	26.2	0.1	2.7	0.0	32.6	35.5	0.1
Food processing	38.4	2.4	18.0	1.7	67.5	89.5	0.4
Trade & distribution margins	30.7	0.1	2.5	0.1	35.6	38.2	0.2
Rest of the economy	1,572.1	9.0	150.9	4.7	1,866.5	2,031.0	8.6
State Total	19,210.1	1,748.0	19,058.4	866.9	2,040.8	23,714.2	100.0
Agriculture and related margins	498.4	119.9	456.0	52.4	139.8	768.1	3.2
Farm production	140.7	44.2	98.2	14.6	33.2	190.1	0.8
Food processing	150.4	40.3	186.5	23.1	70.6	320.6	1.4
Trade & distribution margins	207.2	35.4	171.4	14.7	36.0	257.4	1.1
Rest of the economy	18,711.7	1,628.1	18,602.4	814.5	1,901.1	22,946.1	96.8

Table 20a. Counties' Shares in Total Labor Income Contributions of Agricultural and Rest of the Final Demand

	Total income contributions (\$ million)	County shares in total labor income contributions (%)			
		Hawaii County	Honolulu County	Kauai County	Maui County
Hawaii County	1,810.9	92.7	6.9	0.2	0.3
Agriculture and related margins	120.8	88.3	10.6	0.4	0.7
Farm production	48.3	90.2	9.3	0.2	0.4
Food processing	34.8	81.2	16.4	0.8	1.6
Trade & distribution margins	37.6	92.6	6.9	0.2	0.3
Rest of the economy	1,690.2	93.0	6.6	0.2	0.2
Honolulu County	18,816.0	0.3	99.4	0.1	0.2
Agriculture and related margins	426.0	2.4	97.0	0.3	0.4
Farm production	90.2	0.5	98.9	0.2	0.4
Food processing	169.6	5.4	93.5	0.4	0.6
Trade & distribution margins	166.2	0.2	99.6	0.1	0.2
Rest of the economy	18,390.1	0.3	99.5	0.1	0.2
Kauai County	893.0	0.2	6.0	93.4	0.4
Agriculture and related margins	58.1	0.9	11.8	84.5	2.7
Farm production	16.1	0.1	11.4	88.2	0.3
Food processing	26.6	1.6	15.9	76.9	5.7
Trade & distribution margins	15.4	0.5	5.4	93.9	0.2
Rest of the economy	834.9	0.2	5.6	94.0	0.2
Maui County	2,194.2	0.5	7.9	0.3	91.2
Agriculture and related margins	163.2	1.6	14.2	1.1	83.1
Farm production	35.5	0.4	7.6	0.1	91.9
Food processing	89.5	2.7	20.1	1.8	75.4
Trade & distribution margins	38.2	0.3	6.4	0.2	93.1
Rest of the economy	2,031.0	0.4	7.4	0.2	91.9
Overall Total	23,714.2	7.4	80.4	3.7	8.6
Agriculture and related margins	768.1	15.6	59.4	6.8	18.2
Farm production	190.1	23.3	51.6	7.7	17.4
Food processing	320.6	12.6	58.2	7.2	22.0
Trade & distribution margins	257.4	13.7	66.6	5.7	14.0
Rest of the economy	22,946.1	7.1	81.1	3.5	8.3

Table 21. Direct and Total Job Contributions of Agricultural and Rest of the Final Demand (no. of jobs)

	Direct contributions	Total job contributions					% of Total State Jobs
		Hawaii County	Honolulu County	Kauai County	Maui County	Total	
Hawaii County	57,411	69,878	3,700	145	204	73,926	10.0
Agriculture and related margins	5,835	7,727	391	23	40	8,181	1.1
Farm production	3,719	4,525	131	4	8	4,668	0.6
Food processing	819	1,659	182	17	28	1,887	0.3
Trade & distribution margins	1,297	1,542	77	3	4	1,626	0.2
Rest of the economy	51,576	62,151	3,310	121	163	65,745	8.9
Honolulu County	443,775	3,594	546,379	822	1,297	552,093	74.4
Agriculture and related margins	11,589	941	15,649	55	76	16,721	2.3
Farm production	3,335	35	4,008	12	15	4,070	0.5
Food processing	2,935	891	5,410	37	50	6,388	0.9
Trade & distribution margins	5,319	15	6,231	6	11	6,262	0.8
Rest of the economy	432,187	2,654	530,730	767	1,221	535,372	72.1
Kauai County	26,235	100	1,637	32,463	172	34,373	4.6
Agriculture and related margins	1,709	26	222	2,840	89	3,176	0.4
Farm production	861	1	54	1,024	2	1,081	0.1
Food processing	301	22	143	1,173	85	1,422	0.2
Trade & distribution margins	547	4	25	642	1	673	0.1
Rest of the economy	24,526	73	1,416	29,623	84	31,196	4.2
Maui County	61,119	753	5,446	308	75,353	81,859	11.0
Agriculture and related margins	3,965	237	829	118	6,051	7,235	1.0
Farm production	1,549	6	80	2	1,870	1,958	0.3
Food processing	1,214	224	675	113	2,791	3,803	0.5
Trade & distribution margins	1,202	6	74	2	1,391	1,473	0.2
Rest of the economy	57,154	516	4,617	190	69,301	74,625	10.1
State Total	588,541	74,325	557,162	33,738	77,026	742,251	100.0
Agriculture and related margins	23,098	8,931	17,090	3,036	6,256	35,313	4.8
Farm production	9,464	4,567	4,274	1,041	1,895	11,778	1.6
Food processing	5,269	2,796	6,410	1,341	2,954	13,501	1.8
Trade & distribution margins	8,365	1,567	6,406	654	1,407	10,034	1.4
Rest of the economy	565,443	65,394	540,072	30,702	70,770	706,939	95.2

Table 21a. Counties' Shares in Total Job Contributions of Agricultural and Rest of the Final Demand

	Total job contributions	County shares in total job contributions (%)			
		Hawaii County	Honolulu County	Kauai County	Maui County
Hawaii County	73,926	94.5	5.0	0.2	0.3
Agriculture and related margins	8,181	94.4	4.8	0.3	0.5
Farm production	4,668	96.9	2.8	0.1	0.2
Food processing	1,887	88.0	9.7	0.9	1.5
Trade & distribution margins	1,626	94.8	4.8	0.2	0.3
Rest of the economy	65,745	94.5	5.0	0.2	0.2
Honolulu County	552,093	0.7	99.0	0.1	0.2
Agriculture and related margins	16,721	5.6	93.6	0.3	0.5
Farm production	4,070	0.9	98.5	0.3	0.4
Food processing	6,388	13.9	84.7	0.6	0.8
Trade & distribution margins	6,262	0.2	99.5	0.1	0.2
Rest of the economy	535,372	0.5	99.1	0.1	0.2
Kauai County	34,373	0.3	4.8	94.4	0.5
Agriculture and related margins	3,176	0.8	7.0	89.4	2.8
Farm production	1,081	0.1	5.0	94.7	0.2
Food processing	1,422	1.5	10.0	82.5	6.0
Trade & distribution margins	673	0.6	3.7	95.5	0.2
Rest of the economy	31,196	0.2	4.5	95.0	0.3
Maui County	81,859	0.9	6.7	0.4	92.1
Agriculture and related margins	7,235	3.3	11.5	1.6	83.6
Farm production	1,958	0.3	4.1	0.1	95.5
Food processing	3,803	5.9	17.8	3.0	73.4
Trade & distribution margins	1,473	0.4	5.0	0.2	94.4
Rest of the economy	74,625	0.7	6.2	0.3	92.9
Overall Total	742,251	10.0	75.1	4.5	10.4
Agriculture and related margins	35,313	25.3	48.4	8.6	17.7
Farm production	11,778	38.8	36.3	8.8	16.1
Food processing	13,501	20.7	47.5	9.9	21.9
Trade & distribution margins	10,034	15.6	63.8	6.5	14.0
Rest of the economy	706,939	9.3	76.4	4.3	10.0

Table 22. Decomposition of Output of Production Agriculture and Food Processing (\$ million)

	Hawaii County		Honolulu County		Kauai County		Maui County	
	Farm production	Food processing	Farm production	Food processing	Farm production	Food processing	Farm production	Food processing
Direct effects	112.0	107.6	150.5	439.4	34.6	61.7	65.3	185.9
Total effects								
Hawaii County								
Farm production	129.9	0.2	0.1	0.5	0.0	0.0	0.0	0.0
Food processing	17.0	108.9	1.1	2.5	0.4	0.1	0.8	0.1
Rest of the economy	18.1	7.3	1.7	15.9	0.3	0.5	0.3	0.7
Subtotal	164.9	116.5	2.8	18.9	0.7	0.5	1.1	0.9
Percent of overall total	73.6	83.4	0.8	2.9	0.9	0.8	0.7	0.4
Honolulu County								
Farm production	0.6	0.3	163.1	2.7	0.3	0.0	0.3	0.0
Food processing	23.9	2.1	35.5	454.9	0.8	0.1	0.8	0.3
Rest of the economy	23.2	18.0	131.2	152.3	2.1	1.2	2.3	2.4
Subtotal	47.7	20.5	329.8	609.9	3.2	1.3	3.4	2.7
Percent of overall total	21.3	14.7	92.5	95.1	3.9	1.9	2.1	1.3
Kauai County								
Farm production	0.0	0.0	0.0	0.0	37.1	0.1	0.0	0.0
Food processing	0.1	0.0	1.8	0.3	26.6	62.1	3.2	0.0
Rest of the economy	0.4	0.2	0.7	2.0	8.9	3.8	0.9	0.2
Subtotal	0.5	0.2	2.6	2.3	72.6	66.0	4.1	0.2
Percent of overall total	0.2	0.1	0.7	0.4	88.6	95.8	2.5	0.1
Maui County								
Farm production	0.0	0.0	0.0	0.0	0.0	0.0	74.0	0.0
Food processing	5.8	0.2	16.4	0.9	3.8	0.1	50.4	186.8
Rest of the economy	5.1	2.3	5.0	9.3	1.6	0.9	27.9	14.1
Subtotal	10.9	2.6	21.4	10.2	5.4	1.0	152.3	201.0
Percent of overall total	4.9	1.8	6.0	1.6	6.6	1.5	94.6	98.2
Overall total	224.0	139.7	356.6	641.2	82.0	68.8	160.9	204.8
Percent of state total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 23. Decomposition of Labor Income of Production Agriculture and Food Processing (\$ million)

	Hawaii County		Honolulu County		Kauai County		Maui County	
	Farm production	Food processing	Farm production	Food processing	Farm production	Food processing	Farm production	Food processing
Direct effect	33.3	17.2	70.3	88.3	10.9	6.6	26.2	38.4
Total effect								
Hawaii County								
Farm production	38.6	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Food processing	5.0	17.4	0.5	0.5	0.1	0.0	0.3	0.0
Rest of the economy	5.4	1.2	0.8	3.2	0.1	0.0	0.1	0.1
Subtotal	49.0	18.6	1.3	3.8	0.2	0.1	0.5	0.2
Percent of overall total	21.9	13.3	0.4	0.6	0.3	0.1	0.3	0.1
Honolulu County								
Farm production	0.2	0.1	76.2	0.5	0.1	0.0	0.1	0.0
Food processing	7.1	0.3	16.6	91.4	0.3	0.0	0.3	0.1
Rest of the economy	6.9	2.9	61.3	30.6	0.7	0.1	0.9	0.5
Subtotal	14.2	3.3	154.1	122.5	1.0	0.1	1.4	0.6
Percent of overall total	6.3	2.3	43.2	19.1	1.2	0.2	0.9	0.3
Kauai County								
Farm production	0.0	0.0	0.0	0.0	11.7	0.0	0.0	0.0
Food processing	0.0	0.0	0.9	0.1	8.4	6.6	1.3	0.0
Rest of the economy	0.1	0.0	0.3	0.4	2.8	0.4	0.4	0.0
Subtotal	0.1	0.0	1.2	0.5	22.9	7.0	1.6	0.0
Percent of overall total	0.1	0.0	0.3	0.1	27.9	10.2	1.0	0.0
Maui County								
Farm production	0.0	0.0	0.0	0.0	0.0	0.0	29.7	0.0
Food processing	1.7	0.0	7.6	0.2	1.2	0.0	20.3	38.6
Rest of the economy	1.5	0.4	2.4	1.9	0.5	0.1	11.2	2.9
Subtotal	3.2	0.4	10.0	2.0	1.7	0.1	61.2	41.5
Percent of overall total	1.4	0.3	2.8	0.3	2.1	0.2	38.0	20.3
Overall total	66.5	22.4	166.6	128.8	25.8	7.3	64.6	42.3
Percent of state total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 24. Decomposition of Total Jobs of Production Agriculture and Food Processing

	Hawaii County		Honolulu County		Kauai County		Maui County	
	Farm production	Food processing	Farm production	Food processing	Farm production	Food processing	Farm production	Food processing
Direct effect	3,719	819	3,335	2,935	861	301	1,549	1,214
Total effect								
Hawaii County								
Farm production	4,313	2	1	3	0	0	0	0
Food processing	564	830	24	17	11	0	19	1
Rest of the economy	601	56	38	106	7	2	7	5
Subtotal	5,477	887	63	126	18	3	27	6
Percent of overall total	73.6	83.4	0.8	2.9	0.9	0.8	0.7	0.4
Honolulu County								
Farm production	20	3	3,613	18	7	0	6	0
Food processing	794	16	786	3,038	20	1	19	2
Rest of the economy	770	137	2,906	1,017	52	6	55	15
Subtotal	1,584	156	7,305	4,073	79	7	81	17
Percent of overall total	21.3	14.7	92.5	95.1	3.9	1.9	2.1	1.3
Kauai County								
Farm production	0	0	0	0	923	0	0	0
Food processing	3	0	40	2	661	303	76	0
Rest of the economy	13	1	16	13	222	18	21	1
Subtotal	16	1	57	15	1,806	322	97	1
Percent of overall total	0.2	0.1	0.7	0.4	88.6	95.8	2.5	0.1
Maui County								
Farm production	0	0	0	0	0	0	1,756	0
Food processing	192	2	363	6	95	0	1,197	1,220
Rest of the economy	170	18	111	62	40	5	661	92
Subtotal	362	19	474	68	135	5	3,615	1,313
Percent of overall total	4.9	1.8	6.0	1.6	6.6	1.5	94.6	98.2
Overall total	7,440	1,064	7,899	4,283	2,039	336	3,819	1,337
Percent of state total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 25. Decomposition of State Total Agricultural Output, Labor Income, and Total Jobs

	Farm production	Percent of state total	Food processing	Percent of state total	Total (production + processing)	Percent of state total
Output¹ (\$ million)						
Farm production	405.3	0.7	4.0	0.0	409.3	0.7
Food processing	188.4	0.3	819.5	1.4	1,007.9	1.7
Rest of the economy	229.8	0.4	231.0	0.4	460.7	0.8
Total	823.5	1.4	1,054.5	1.8	1,877.9	3.2
Labor income² (\$ million)						
Farm production	156.6	0.7	0.8	0.0	157.4	0.7
Food processing	71.6	0.3	155.2	0.7	226.9	1.0
Rest of the economy	95.4	0.4	44.8	0.2	140.1	0.6
Total	323.6	1.4	200.8	0.8	524.4	2.2
Total jobs³ (no. of jobs)						
Farm production	10,641	1.4	27	0.0	10,668	1.4
Food processing	4,864	0.7	5,438	0.7	10,302	1.4
Rest of the economy	5,692	0.8	1,555	0.2	7,247	1.0
Total	21,197	2.9	7,020	0.9	28,216	3.8

1. Total state output in 1997 was \$58,653.8 million.
2. Total state income in 1997 was \$23,714.2 million.
3. Total number of jobs in 1997 was 742,251.

APPENDIX A

MATHEMATICAL FRAMEWORK FOR THE INTER-COUNTY I-O MODEL

The flow of inter-industry sales in the inter-regional transaction table can be expressed as a system of $n \times l$ equations, representing the distribution of each industry's total output (sales) in each of l regions to n industries and m final demand sectors in that region as well as other regions in the economy as⁶

$$X_i^r = \sum_{s=1}^l \sum_{j=1}^n Z_{ij}^{rs} + \sum_{s=1}^l \sum_{k=1}^m Y_{ik}^{rs} \quad (\text{A.1})$$

where

$r, s = 1, 2, \dots, l$ row and column regions;

$i, j = 1, 2, \dots, n$ selling and purchasing sectors;

$k = 1, 2, \dots, m$ final demand sectors;

$X_i^r =$ total output (sales) of the i th industry in the r th region, including the total inter-industry sales (the first term in the equation) and total final sales (the second term in the equation);

$Z_{ij}^{rs} =$ i th industry's inter-industry sales from row region r to the j th industry in column region s ; and

$Y_{ik}^{rs} =$ i th industry's final sales from region r to the k th final demand sector in region s .⁷

Similarly, the flow of inter-industry purchases can be expressed as a system of another set of $n \times l$ equations, showing the distribution of industry j 's total input (purchases) from n industries and l regions and imports, and payments to p final payments sectors as follows:

$$X_j^s = \sum_{r=1}^l \sum_{i=1}^n Z_{ji}^{sr} + M_j^s + \sum_{q=1}^p W_{qj}^s \quad (\text{A.2})$$

where

$r, s = 1, 2, \dots, l$ regions;

$i, j = 1, 2, \dots, n$ industries;

$q = 1, 2, \dots, p$ final payment sectors;

$X_j^s =$ total input (purchases) of the j th industry in column region s , including the total inter-industry purchases (the first term in the equation), imports as production inputs to industries (the second term in the equation) and total final payments (the third term in the equation);

$Z_{ji}^{sr} =$ inter-industry purchases by j th industry in region s from the i th industry in region r ;

$M_j^s =$ imports of r th region's industry j as intermediate input; and

⁶ Most of the mathematical expressions presented are adopted from Miller and Blair (1985) with some modifications.

⁷ Only personal consumption expenditures (PCE) and visitor expenditure components of industry's final demand are have been allocated to each of the four counties in this study, given the lack of information to do the same for other final demand.

$W_{qj}^s =$ j th industry's payments to the q th final payment sector in region s .⁸

Continuing with the above notations, a matrix of inter-industry flows of goods and services within region r may be represented as

$$Z^{rr} = [Z_{ij}^{rr}]_{n \times n} \quad (\text{A.3})$$

where Z_{ij}^{rr} shows i th sector's sales of goods and services in region r to the j th sector in that region.

Similarly, the matrix of inter-industry flows of goods and services between regions r and s (for $r \neq s$) is⁹

$$Z^{rs} = [Z_{ij}^{rs}]_{n \times n} \quad (\text{A.4})$$

where Z_{ij}^{rs} represents the i th sector's sales of goods and services in region r to the j th sector in region s .

With these notations, the complete inter-regional inter-industry transactions table for an n -sector, l -region economy can be represented as

$$Z = \begin{bmatrix} Z^{11} & Z^{12} & \dots & Z^{1l} \\ Z^{21} & Z^{22} & \dots & Z^{2l} \\ \vdots & \vdots & \vdots & \vdots \\ Z^{l1} & Z^{l2} & \dots & Z^{ll} \end{bmatrix}_{nl \times nl} \quad (\text{A.5})$$

The diagonal matrices are intra-regional inter-industry flows (i.e., within regions) and off-diagonal matrices are inter-regional flows of goods and services (i.e., between regions). Specifying Z would require detailed data on shipments (flows) of goods and services across sectors and between regions. When such data are not available, various mathematical approaches are employed to estimate inter-regional commodity and service flows.

In this study, given the lack of detailed information on intra- and inter-county flows of goods and services across industries, elements in Z are estimated using the direct-requirements or technology matrix (usually denoted as matrix 'A') from the 131-sector state I-O model and industry outputs (sales) for counties. This is done in two stages.

- i) Derive the preliminary estimates of diagonal elements of matrix Z as

$$\hat{Z}^{rr} = A \cdot X^r \quad (\text{A.6})$$

where \hat{Z}^{rr} is the preliminary estimate of Z^{rr} , A is the technical coefficients matrix for the state I-O model, and X^r is a diagonal matrix with its diagonal elements being industry outputs for region r . The resultant 131 x 131 industry matrix for each county was then aggregated to a 20 x 20 industry matrix. This procedure was repeated four times for each of the four counties. The resulting matrices account for all Hawaii intermediate inputs purchased in each county regardless of which county they came from.

⁸ Conceptually, one could also regionalize final payments components, but it is not done so in this study due to data limitations.

⁹ In the literature this is also referred to as inter-regional trade flow.

ii) \hat{Z}^{rr} was adjusted to account for inter-county trade flows of goods and services as

$$\begin{aligned} Z^{rr} &= \hat{Z}^{rr} \cdot \mathbf{a}_r \\ Z^{sr} &= \hat{Z}^{sr} \cdot \mathbf{a}_s \end{aligned} \quad (\text{A.7})$$

$$\mathbf{a}_r + \sum_{r \neq s=1}^l \mathbf{a}_s = I \text{ for all } i$$

where the first expression shows the intra- and inter-industry input purchases within the region, second expression denotes the region r 's inter-industry purchases from other regions, \mathbf{a}_r denotes the proportion of total inter-industry purchases from within the region and \mathbf{a}_s denotes the proportions supplied from other regions.

Like information on inter-regional flows of goods and services, information on proportions (\mathbf{a} s) of total regional inter-industry purchases supplied by different regions was not readily available. These proportions for manufacturing and agricultural sectors were based on inter-island waterborne commerce data obtained from the US Army Corps of Engineers and data on plane and ship arrivals of various agricultural products from neighbor islands to Honolulu market obtained from the State of Hawaii Department of Agriculture (DOA). Hawaii's inputs to certain industries, such as agriculture, construction, utilities, arts/entertainment, other services and government enterprises were assumed to come mostly from the purchasing county. For financial, professional and business service sectors, Oahu was assumed to supply some intermediate inputs to other three counties. For other manufacturing and hotel sectors, Oahu was assumed to supply most of the intermediate inputs to other counties.

The next step is to derive the inter-regional direct requirements table. In the case of an inter-regional I-O model, each column of the direct requirements table contains purchases within the region (a_{ij}^{rr}) and purchases from other regions (a_{ij}^{rs} where $r \neq s$). a_{ij}^{rr} represents the purchase of column sector j in region r from the i th sector in that region to produce a dollar of sector j 's output in region r . a_{ij}^{rs} represents the purchase of column sector j in region r from the i th sector in other regions ($r \neq s$) to produce a dollar of sector j 's output in region r . These coefficients are derived by dividing each column entry of the inter-regional transactions table, Z_{ij}^{rr} and Z_{ij}^{rs} ($r \neq s$) by the corresponding column total, X_j^s as

$$a_{ij}^{rr} = Z_{ij}^{rr} / X_j^s \quad a_{ij}^{rs} = Z_{ij}^{rs} / X_j^s \quad (\text{A.8})$$

Using equation (A.8), the system of inter-industry equations (A.1) can be rewritten as

$$X_i^r = \sum_{s=1}^l \sum_{j=1}^n a_{ij}^{rs} X_j^s + \sum_{s=1}^l \sum_{k=1}^m Y_{ik}^{rs} \quad (\text{A.9})$$

The sets of matrices showing the direct requirement coefficients among industries within the region is represented as

$$A^{rr} = [a_{ij}^{rr}]_{n \times n} \quad (\text{A.10})$$

Similarly the set of matrices showing the direct requirement coefficients among industries between regions r and s ($r \neq s$) is represented as

$$A^{rs} = \left[a_{ij}^{rs} \right]_{n \times n} \quad (\text{A.11})$$

For a l -region model, the complete direct coefficient matrix will be

$$A = \begin{bmatrix} A^{11} & A^{12} & \dots & A^{1l} \\ A^{21} & A^{22} & \dots & A^{2l} \\ \vdots & \vdots & \vdots & \vdots \\ A^{l1} & A^{l2} & \dots & A^{ll} \end{bmatrix}_{nl \times nl} \quad (\text{A.12})$$

For notational convenience, let us combine the various final demand sectors to form one aggregate final demand sector ($Y^r = \sum_{s=1}^l \sum_{k=1}^m Y_{ik}^{rs}$). Also let $X' = [X^1 \ X^2 \ \dots \ X^l]$ and

$Y' = [Y^1 \ Y^2 \ \dots \ Y^l]$ be the vectors of industry outputs and final demand sectors, respectively, where X^l is an $n \times 1$ vector of outputs and Y^l is a $n \times 1$ vector of final demand in region l . With these notations, the system of equations (A.9) can be written in a compact form as

$$X = AX + Y \quad (\text{A.13})$$

where X represents a $nl \times 1$ vector of industry total outputs, A represents an $nl \times nl$ matrix of direct requirements coefficients (also known as the technology matrix), and Y is an $nl \times 1$ vector of total final demand.

The expression of the inter-industry equations (A.13) can be rewritten as

$$X(I - A) = Y \quad (\text{A.14})$$

representing a set of l matrix equations

$$\begin{aligned} (I - A^{11})X^1 & - A^{12}X^2 - \dots & - A^{1l}X^l & = Y^1 \\ - A^{21}X^1 + (I - A^{22})X^2 & - \dots & - A^{2l}X^l & = Y^2 \\ \vdots & \vdots & \vdots & \vdots \\ - A^{l1}X^1 & - A^{l2}X^2 - \dots + (I - A^{ll})X^l & & = Y^l \end{aligned} \quad (\text{A.15})$$

where I is an identity matrix, which has ones on its diagonal and zeros elsewhere.

Thus, the vector of total industry outputs can be solved as:

$$X = (I - A)^{-1}Y = BY \quad (\text{A.16})$$

where $(I - A)^{-1} = B$ is the total requirements table, or Leontief inverse matrix. B is also referred to as the final-demand output multiplier table.

If the household sector is exogenous, the Type I final-demand output multiplier for the j th sector in region s (O_s^j) can be obtained by summing down the j th column of the Leontief matrix as

$$O_s^j = \sum_{r=1}^l \sum_{i=1}^n b_{ij}^{rs} \quad (\text{A.17})$$

where b_{ij}^{rs} are the elements of the final-demand output multiplier table, representing the change in output of sector i in region r due to a dollar change in final demand of sector j in region s .

A direct earnings coefficient (earnings to output ratio) matrix for region r (L^r) is represented as¹⁰

$$L^r = \begin{bmatrix} L_1^r & 0 & \cdots & 0 \\ 0 & L_2^r & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & L_n^r \end{bmatrix} \quad (\text{A.18})$$

where L_i^r represents the earnings to output ratio for sector i in region r . Then, the complete earnings to output coefficient matrix may be written as

$$L = \begin{bmatrix} L^1 & 0 & \cdots & 0 \\ 0 & L^2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & L^l \end{bmatrix} \quad (\text{A.19})$$

The final-demand earnings multiplier matrix (C) is obtained using the direct earnings coefficient matrix and the total requirements or Leontief matrix as

$$C = L \cdot B \quad (\text{A.20})$$

The Type I final-demand earnings multiplier for sector j in region s ($I_j^s(FD)$) is computed as:

$$I_j^s(FD) = \sum_{r=1}^l \sum_{i=1}^n c_{ij}^{rs} \quad (\text{A.21})$$

The Type I direct-effect earnings multiplier for sector j in region s ($I_j^s(DE)$) is derived as:

$$I_j^s(DE) = I_j^s(FD) / L_j^s \quad (\text{A.22})$$

A matrix of employment to output ratios or direct employment coefficients for region r (E^r) can be represented as

$$E^r = \begin{bmatrix} e_1^r & 0 & \cdots & 0 \\ 0 & e_2^r & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & e_n^r \end{bmatrix} \quad (\text{A.23})$$

where e_i^r represents the employment to output ratio for sector i in region r . Then, the complete direct employments coefficients matrix can be written as

¹⁰ See footnote 3.

$$E = \begin{bmatrix} E^1 & 0 & \dots & 0 \\ 0 & E^2 & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & E^l \end{bmatrix} \quad (\text{A.24})$$

The final-demand employment multiplier matrix (D) is derived using the direct employment coefficients matrix (E) and total requirements or Leontief matrix (B) as

$$D = E \cdot B \quad (\text{A.25})$$

The Type I final-demand employment multiplier for sector j in region s ($E_j^s(FD)$) is computed as

$$E_j^s(FD) = \sum_{r=1}^l \sum_{i=1}^n d_{ij}^{rs} \quad (\text{A.26})$$

The Type I direct-effect employment multiplier for sector j in region s ($E_j^s(DE)$) is derived as:

$$E_j^s(DE) = E_j^s(FD) / e_j^s \quad (\text{A.27})$$

Type II multipliers are obtained in exactly the same fashion as Type I multipliers except that households in each county are treated as an additional industry (i.e., as both suppliers of labor inputs to industries and purchasers of industries' outputs) to account for the effects of changes in household earnings and expenditures. Mathematically, this is done by adding both a household row and a household column to the inter-regional direct requirements matrix (A) in equation (A.13). Entries in the household row are the earnings to output ratios, and entries in the household column are industries' shares of total personal consumption expenditures, multiplied by the ratio of personal income less taxes and savings to personal income in order to account for the dampening effects of taxes and savings on expenditures. In computing output and employment multipliers, the entries in the household row of the resulting total requirements table are not included in the summation. Each entry in the household row of the total requirements matrix also happens to be the type II final-demand earnings multiplier of the column industry corresponding to the entry.

APPENDIX B

INDUSTRY CLASSIFICATION, DATA SOURCES, AND ESTIMATION PROCEDURE

Industry Classification

As in the state I-O model, the North American Industry Classification System (NAICS) was adopted in classifying industry sectors for the inter-county I-O model. Industries in the inter-county model were aggregated to 20 sectors as in the condensed version of the state I-O model. A more detailed table would be difficult to build using the inter-regional accounting framework due to lack of data and the geometric increase in the number of sectors. For example, an inter-regional inter-industry transactions table for a 20-sector 4-county model will have a total of 80 rows and 80 columns.

Output

Agriculture, Aquaculture, and Commercial Fishing

The output for the agriculture (crops and livestock) and aquaculture sectors was based on the values of agricultural and aquacultural sales published in the DOA Statistics of Hawaii Agriculture, with adjustments made for changes in inventories and inter-farm sales based on information obtained from the Bureau of Economic Analysis (BEA). The total state output of commercial fishing was based on information from the National Marine Fisheries Services (NMFS) Website and it was allocated to counties based on commercial fishing revenues by county provided by Hawaii Department of Aquatic Resources (HDAR).

Agricultural and Landscape Services

Given the lack of output data on agricultural and landscape services at the county level, output of these sectors for counties was estimated by allocating the state output of agricultural and landscape services in proportions to the sector's wage and salary jobs by county.

Mining and Construction

Mining output for counties was estimated by allocating mining output in the state I-O table using wage and salary employment in mining and related activities by county.

Construction output consists of the value of both private and government construction. The output of private construction (i.e., residential, hotel and commercial) was based on values of private construction permits by county compiled from Dodge reports and the corresponding construction outputs in the state I-O table.

The value of state and local government construction for counties was compiled from County Annual Financial Reports and the Supplemental Detail to the State Annual Financial Reports. Similarly, the value of federal construction for counties was obtained from the federal defense and federal civilian procurement data. The county construction estimate obtained from these sources was adjusted to add up to total construction output in the state I-O table.

Manufacturing

Except for a few sectors for the City and County of Honolulu, the Economic Census does not disclose detailed manufacturing sales by county. Output of sugar processing was based on the value of processed sugar found in Hawaii Statistics of Agriculture. Among other sectors, Honolulu outputs for bakeries and grain products, apparel and textile products, printing and miscellaneous products were based on the Economic Census. Outputs of these industries for other counties were estimated by allocating the difference between Honolulu output and total output for these industries in the state I-O table based on wage and salary jobs. Output of all other manufacturing industries by county was estimated by allocating total output in the state I-O table using wage and salary jobs for the relevant sector.

Transportation

Output of all transportation sectors for counties was obtained by allocating total output of transportation sectors in the state I-O table using respective transportation wage and salary jobs by county. The definition of air and water transportation output and its estimation procedure can be found in the 1997 benchmark I-O report for the state.

Information

For most industries (software, motion picture, and cable TV), output for Honolulu was based on the Economic Census, adjusted to make it consistent with the state I-O table, while output of these industries for Hawaii, Kauai and Maui Counties was estimated by allocating the difference between Honolulu output and total state output in the state I-O table using wage and salary jobs in relevant sectors. For publishing and telecommunications sectors, counties' output was obtained by allocating output of these industries in the state I-O table in proportions to wage and salary jobs in these sectors by county.

Utilities

Output of electricity and gas production by county was obtained from the Hawaii Data Book.

Trade

Output of wholesale and retail trade services was estimated based on wholesale and retail gross sales by county from the Economic Census and appropriate wholesale and retail margins. Because of the lack of information, the margins for counties were assumed to be the same as those for the state I-O table. Trade margins are described in the 1997 state I-O report.

Finance and Insurance

Output of finance and insurance industries for counties was obtained by allocating the finance and insurance output in the state I-O table using respective wage and salaries jobs by county. The definition of finance and insurance output and estimation procedures are provided in the state I-O report.

Real Estate and Rental

Real estate and rental output consists of the revenue of all rental activities, plus the revenue of real estate brokers and agents, plus the imputed value of the owner-occupied housing units. Real estate output was computed as the excise tax base for other rentals by county minus sales of lessors of real estate (the Economic Census) less sales of auto and other rental services (the Economic Census), adjusted to conform to the state I-O output for real estate. Output of equipment and auto rental activity was estimated based on the Economic Census, with adjustment made to correspond to the outputs of these sectors in the state I-O table.

Owner-occupied housing output was computed as the revenue that would be generated if all of the owner-occupied housing units were rented. This was estimated based on the number of owner-occupied housing units and average rent paid to comparable rental units by county. This information was obtained from the 1997 Housing Policy Study for Hawaii.

Services

Professional and Business Services

Output of legal services, architectural and engineering services, management, scientific and consulting services, and advertising services was based on the Economic Census for all counties. Output of all other professional services sectors was also based on the Economic Census for Honolulu, but for other counties it was estimated by allocating the difference between Honolulu output and total output in the state I-O table using wage and salary jobs.

For all four counties, output of business services sector was based on the Economic Census except for administrative and facilities support services for which the output was estimated by allocating the total output for this sector in the state I-O table using administrative and facilities support wage and salary jobs by county.

Educational Services

The Economic Census does not cover private educational institutions. Based on wage and salary income from ES202 data from the State of Hawaii Department of Labor and Industrial Relations (DLIR), 27% of the difference between total output in the state I-O table and the Economic Census total for the state was allocated to private universities/colleges in Honolulu. Of the remaining 73%, based on data obtained from the Hawaii Council of Private Schools 88.1% was allocated to private elementary and secondary schools in Honolulu, 5.3% to Hawaii, 5.2% to Maui, and 1.4% to Kauai based on private tuition shares and wage and salary income shares of each county.

Health and Social Assistance

Counties' output of doctors and dentists, nursing homes and social assistance programs was estimated based on the Economic Census for Honolulu, and for other counties it was computed by allocating the difference between Honolulu output and total output in the state I-O table using wage and salary jobs for these industries by county. Output of other medical services was obtained by allocating total output in the state I-O table using wage and salary jobs. Output of hospitals was estimated in terms of the number of private hospitals by county.

Arts and Entertainment

With some adjustments to correspond to total output in the state I-O table, output of arts, entertainment and related sectors for Honolulu was estimated based on the Economic Census and for other counties it was estimated by allocating the difference between Honolulu and state output in the 1997 I-O table based on arts and entertainment wage and salary jobs by county.

Accommodation

Accommodation output for counties was estimated based on the Economic Census, with some adjustments needed to conform to accommodation output in the state I-O table.

Food Services

Similar to accommodation, output of the food services sector was estimated based on the Economic Census and adjusted to correspond to food services output in the state I-O table.

Other Services

Except for parking lots, other personal services, and membership organizations, output of other services was based on the Economic Census, adjusted to conform to the state I-O table. Output of parking lots and other personal services was obtained by allocating total output in the state I-O table to counties using wage and salary jobs. For membership organizations, Honolulu output was based on the Economic Census and for other counties it was estimated by allocating the difference between Honolulu output and total output in the state I-O table using wage and salary jobs.

Government Enterprises

State and Local Government Enterprises: Water, Sewerage, and Public Transit

Output of water, sewage and public transit for counties was obtained from the Census of Governments (COG).

Other State and Local Government Enterprises (airports, harbors, housing, parking and H- power)

Airports output by county was estimated by allocating total state airport revenues to counties using shares of county airports expenditures. Output of harbors was estimated by allocating total state harbors revenues to counties using counties' shares in harbors expenditures. Harbors and airports expenditures data by county were compiled from the Supplemental Detail to the State Financial Reports.

Housing output by county was estimated as a sum of a portion of housing revenue for the state and county housing revenue. State housing revenue obtained from the COG was allocated to individual counties based on their housing revenue shares in the State Financial Reports. Housing revenue at the county level was obtained from the COG. Output of parking and H-Power was also based on COG.

Federal Government Enterprises: Postal Service

Postal output for counties was estimated by allocating the postal output in the state I-O table using the number of postal employees by county.

Other Federal Enterprises

Of the total output of other federal enterprises in the state I-O table, 99% was allocated to Honolulu and other 1% to the county of Hawaii.

Value Added

Value added is composed of four components: (i) compensation of employees, (ii) proprietors' income, (iii) indirect business taxes (IBT), and (iv) other capital costs.

Compensation of Employees

The compensation of employees consists of three components: wages and salaries, other labor income, and employer's contribution to social insurance. Wages and salaries and other labor income by industry are not published by BEA. Wages and salaries data by SIC industry are in SA07. Only the earnings by place of work (i.e., wages and salaries disbursements, other labor income and proprietors' income combined) are published. However, BEA provided special tabulations of both wages and salaries disbursements and other labor income data by industry and by county at the 2-digit SIC level. The BEA SIC data were broken down to the more detailed 4-digit SIC levels using the ES202 wages and salary income and then the resultant data were converted to NAICS using the SIC to NAICS bridge found in the NAICS manual.¹¹ The employer's contribution to social insurance was estimated based on wages and salary disbursements.

Proprietors' Income

Proprietors' income by industry and by county was also obtained in special tabulations from BEA at the two-digit SIC level. Converting the SIC-based personal income data to the NAICS format was not as straightforward as for wages and salaries and other income due to lack of proprietors' information in ES202 data. In most cases, the number of NAICS-based non-employer establishments from the Economic Census was used to convert to the NAICS format. For some industries BEA proprietors' income was adjusted to conform to output and value added.¹²

Indirect Business Taxes (IBT)

Indirect Business Taxes (IBTs) consist of various taxes and fees paid by businesses to the federal, state, and local governments. Components of IBT include general excise taxes (GET), transient accommodations taxes (TAT), fuel taxes, property taxes, customs duties, and certain types of non-tax fees. Most of these components are available by county. Industry assignment of these components was based on the state I-O model. The difference between total IBT that was available for counties and total IBT in the state I-O table was allocated to counties using industry outputs.

Other Capital Costs

Except for some government enterprises, information on other capital costs by industry and by county was not available. Thus, total other capital costs in the state I-O table was allocated to counties

¹¹ In cases where one SIC industry falls in multiple NAICS industries, the SIC industry was broken down to its NAICS components using the number of jobs or number of establishments of relevant NAICS industries from the Economic Census.

¹² Consequently, total proprietors' income in the I-O table is slightly lower than that published by BEA.

using industry outputs. For some industries, the other capital cost estimate thus obtained was adjusted in relation to value added and outputs.

Final Demand

Personal Consumption Expenditures (PCEs)

The PCEs for counties were estimated based on income, population, retail sales and industry outputs by county. The process involved several iterations. The total PCE of each industry in each county was broken down to four components, representing the spending on that industry's final goods and services by households in each of the four counties. Exports to other counties and spending by Hawaii residents from other counties were included in PCEs. As in the state model, PCEs were estimated in producers' prices with trade and transportation margins being assigned to relevant trade and transportation sectors.

Visitor Expenditures

Visitor expenditures for counties were computed based on total visitor days and total retail sales by county. Like PCEs, total expenditures by visitors on each industry's goods and services are broken down to four components, showing visitors' spending on that industry's goods and services in each of the four counties. Visitor expenditures were also valued at producers' prices with distribution margins being assigned to relevant distribution sectors.

Gross Private Investment

Gross private investment consists of value of new private construction (i.e., excluding government construction and maintenance and repairs construction) and household spending on producers' durable equipment (PDE). The construction portion of private investment was obtained in estimating the construction output by county. The PDE portion was estimated by allocating total private spending on PDE in the state I-O table to counties using industry outputs.

Changes in Inventories

Changes in inventories by county were computed by allocating total changes in inventories in the state I-O table using industry outputs by county.

State and Local Government Consumption and Investment

State and local government consumption consists of compensation of employees, consumption of fixed capital, and operating expenses. Employee compensation was based on ES202 income and BEA wages and salaries and other labor income, adjusted to account for state and local government enterprises. Information on consumption of fixed capital by county was not available. Total fixed capital in the state I-O table, estimated based on BEA, was allocated to counties based on compensation of state and local government employees by county. Similarly, information on detailed operating expenses by industry was not available for counties. Thus, the total operating expenses of state and local government (excluding operating expenses of the various government enterprises) in the state I-O table, estimated based on the special DAGS report and Census of Governments, was allocated to counties using industry outputs by county.

State and local government investment consists of the value of new state and local government construction and spending on durable equipment. The value of state and local government construction by county was estimated based on county financial reports and supplemental detail to the state financial reports, with adjustments made to conform to the state I-O model. The spending on durable equipment in the state I-O table was allocated to counties using industry outputs.

Federal Government Investment and Consumption: Military

Federal government military expenditures include investment and consumption expenditures. Investment comprises new construction spending and spending on producers' durable equipment. Construction spending was based on federal defense procurement data by county, while spending on durable equipment was estimated by allocating the total federal military durable spending in the state I-O table using industry outputs by county. Federal military consumption consists of purchases of goods and services from various industries, compensation of federal employees and consumption of fixed capital. Federal purchases of goods and services by industry were based on federal military procurement data by county and employees' compensation and capital consumption was obtained by adding the compensation of federal military employees and other capital costs of the federal military.

Federal Government Investment and Consumption: Civilian

Federal civilian investment and consumption were computed in the same way as the federal military investment and consumption, except for that it involved federal civilian procurement data and compensation of federal civilian employees and other nonmilitary capital costs of federal government.

Exports

Given the lack of data on industries' exports by county, exports were estimated by allocating total exports in the state I-O table to counties based on industry outputs by county.

Imports

Imports consist of out-of-state purchases of services and commodities by industries as inputs to production and by final users for consumption and investment. The value of total industries' imports was computed as a residual between total final demand and total value added, and allocated to industries in balancing the inter-regional inter-industry transactions table. The value of imports for each final demand sector was estimated as that sector's total expenditures on final goods and services at producers' prices less total final sales of goods and services to that sector by local industries. Given the lack of information, industries' imports by county were estimated by allocating total industries' inputs in the state I-O table using counties' shares in industries' outputs. Allocation of imports of goods and services by final demand sectors was done based on counties' total expenditures on each final demand.

Employment

Both wage and salary employment and proprietors' employment were based special employment tabulations by industry and by county provided by BEA. BEA employment data are available at the 2-digit SIC level, so they were bridged from SIC into NAICS. The wage and salary jobs were bridged in a similar fashion as the wage and salary income, and proprietors' jobs were bridged similarly to proprietors' income.

APPENDIX C

INTER-COUNTY INTER-INDUSTRY TRANSACTIONS TABLE AND BALANCING PROCEDURE

Inter-county Inter-industry Transactions Table

An inter-industry transactions table in an inter-regional context depicts the flow of goods and services across industries both within region and between regions. This information is not readily available, especially the flow of services. Here, an attempt was made to derive an inter-county transactions table using the existing state inter-industry table and limited information on inter-industry flows of goods and services between counties.

Inter-island water-borne commerce data obtained from the U.S. Army Corps of Engineers provide information on tonnages received by and shipped out from each county for major commodity types. However, the available data do not contain information on the various port-to-port movements due to disclosure restrictions. In order to better estimate the flow of commodities between counties, such data on bilateral flows by port would be necessary for each commodity type. Moreover, the values of the shipments are not reported. However, looking at total tonnages received in and shipped out of each county by commodity type provided some insights into the flows of commodities between counties. Besides water-borne commerce, data on plane and ship arrivals of various agricultural products to Honolulu from neighbor islands were obtained from the State Department of Agriculture (DOA). These data provided a basis for determining proportions of industries' commodity inputs supplied by various industries in different counties. There are significant flows of services between counties, but very little or no information exists on flows of services. Because of the lack of data to estimate the inter-county transactions table directly, as in other inter-regional I-O studies, an indirect approach is used to derive the inter-county transactions table.

As outlined in the mathematical section, the inter-county inter-industry transactions table was derived in two stages. First, for each county, a 131 by 131 inter-industry table was estimated using the detailed direct requirements matrix from the state I-O table and 131 industry outputs for that county. These 131 industries were then aggregated to 20 sectors. Each column of the resultant matrix represented the total inputs supplied by each of the row industries to produce the total column sector's output in each county. If all inputs were supplied from industries within a particular county, the resultant table would serve as the inter-industry transactions table for a single region I-O model for that county. However, when industries purchase inputs not only from industries within the county, but also from those in other counties, the resultant inter-industry table needs to be adjusted. This adjustment was done during the second stage. Total input purchases from a particular row industry were allocated to that industry in each of the four counties. The allocation of industries' total commodity inputs to different counties was done based on waterborne commerce data and DOA data on arrival of agricultural produce to Honolulu from outer islands. The allocation of services was based on a judgment of the proportions of services supplied within the county and those supplied by other counties depending upon the types of industries. Inter-industry supplies of inputs from certain industries, such as construction, real estate and rentals, utilities, arts/entertainment, other services and government enterprises were assumed to be mostly local.

Balancing Procedure

By definition, total output (sales) should equal total input (purchases) for each industry in each county. Because of the lack of information on inter-county inter-industry transactions, industries' sales (row totals) usually do not initially add up to their total purchases (column totals). Therefore, row and column elements of the transactions table need to be adjusted using a balancing procedure such that the row and the column corresponding to a particular industry add up to the same value. The inter-county model needs an additional adjustment such that relevant cells in the inter-county transactions table add up to the corresponding cell in the state I-O table.

One of the most popular techniques in balancing an I-O transactions table is the bi-proportional balancing procedure, which is also known as the RAS procedure. Traditionally, RAS is used to balance the direct requirements table. This study uses a modified tri-proportional RAS procedure to balance the inter-industry portion of the transactions table. None of the final demand and final payment sectors is changed in the balancing process.

Using equation (A.1), the control total for intermediate sales of sector i in region r (U_i^r) is calculated as

$$U_i^r = \sum_{s=1}^l \sum_{j=1}^n Z_{ij}^{rs} = X_i^r - \sum_{s=1}^l \sum_{k=1}^m Y_{ik}^{rs} \quad (C.1)$$

and the control total for inter-industry input (including intermediate import (M_j^s)) for sector j in region s (V_j^s) is calculated from equation (A.2) as

$$V_j^s = \sum_{r=1}^l \sum_{i=1}^n Z_{ji}^{sr} + M_j^s = X_j^s - \sum_{q=1}^p W_{qj}^s \quad (C.2)$$

where X_i^r is total sales or output for industry i in region r , X_j^s is total purchases or input for industry j in region s , Z_{ij}^{rs} is i th industry's inter-industry sales from row region r to the j th industry in column region s ; Y_{ik}^{rs} is i th industry's final sales from region r to the k th final demand sector in region s ; Z_{ji}^{sr} is inter-industry purchases by j th industry in region s from the i th industry in region r ; M_j^s is imports of s th region's industry j as intermediate input; and W_{qj}^s is j th industry's payments to the q th final payment sector in region s

The import row for intermediate use is represented as follows:

$$\sum_{s=1}^l \sum_{j=1}^n M_j^s = M \quad (C.3)$$

where M is the control total for intermediate imports computed based on relations between the value added and expenditure sides of the GSP account (i.e. total final demand less total value added gives total imports for intermediate use).

Initially none of the last three conditions hold. Thus, entries in each row and column need to be adjusted so that each row and each column add up to their corresponding control totals. The fourth balancing condition is that, for consistency, the sum of j th industry's purchases from i th industry in all

regions should add up to j th industry's purchases from i th industry in the state I-O model. Mathematically it can be expressed as

$$\sum_{s=1}^l \sum_{r=1}^l Z_{ij}^{rs} = \sum_{r=1}^l \sum_{s=1}^l Z_{ji}^{sr} = Z_{ij} \quad (\text{C.4})$$

Although, necessary for the construction of an I-O model, the last four equations (equations C.1 – C.4) are unlikely to be met by initial estimates. Thus, Z_{ij}^{rs} s and M_j^s need to be adjusted until each of the four equations is satisfied simultaneously. The balancing procedure was implemented using specifically designed macros in Microsoft Excel.

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Table A-1. Output Shares by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Total output (\$ million)	4,685.2	45,971.5	2,352.1	5,645.0	58,653.8
Sector share (%)					
Agriculture	4.8	0.8	3.5	2.9	1.4
Mining and construction	8.1	5.6	8.7	6.3	6.0
Food processing	3.0	1.4	2.9	3.6	1.8
Other manufacturing	1.4	4.8	0.6	1.1	4.0
Transportation	4.3	6.3	5.3	6.2	6.1
Information	2.7	3.5	3.5	2.3	3.3
Utilities	3.5	1.8	3.3	2.7	2.1
Wholesale trade	2.6	3.6	2.0	2.1	3.3
Retail trade	9.7	6.5	8.6	9.8	7.1
Finance and insurance	3.6	7.1	2.9	2.5	6.2
Real estate and rentals	15.2	16.1	17.0	15.6	16.0
Professional services	2.8	3.9	3.4	2.6	3.7
Business services	1.9	2.6	2.9	1.5	2.4
Educational services	0.5	0.9	0.2	0.4	0.8
Health services	6.1	6.9	6.5	4.3	6.6
Arts and entertainment	1.7	1.1	1.8	2.6	1.3
Hotels	9.8	3.9	9.5	17.2	5.9
Eating and drinking	3.6	3.6	4.8	5.6	3.9
Other services	3.1	2.8	2.5	2.9	2.8
Government	11.6	16.7	10.0	7.8	15.1

Table A-2. Labor Income Shares by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Total labor income (\$ million)	1,748.0	19,058.4	866.9	2,040.8	23,714.2
Sector share (%)					
Agriculture	3.8	0.9	3.0	3.2	1.4
Mining and construction	7.5	6.1	6.7	6.3	6.3
Food processing	1.3	0.7	0.8	2.1	0.8
Other manufacturing	1.0	1.7	0.5	0.8	1.5
Transportation	2.7	4.7	3.5	3.7	4.5
Information	1.7	2.3	3.2	1.8	2.2
Utilities	1.7	0.7	1.3	1.2	0.8
Wholesale trade	3.0	3.5	1.8	2.4	3.3
Retail trade	9.4	7.2	9.3	10.1	7.7
Finance and insurance	2.5	5.1	1.9	2.1	4.5
Real estate and rentals	3.1	3.2	3.8	5.9	3.5
Professional services	4.0	5.6	5.8	3.7	5.3
Business services	3.1	3.3	4.8	2.4	3.3
Educational services	0.7	1.6	0.4	0.5	1.4
Health services	8.6	9.0	9.9	7.3	8.9
Arts and entertainment	2.0	1.0	2.2	3.5	1.4
Hotels	11.8	3.4	11.8	17.7	5.6
Eating and drinking	3.2	3.4	4.9	5.4	3.6
Other services	3.6	3.1	3.8	3.3	3.2
Government	25.5	33.5	20.6	16.7	31.0

Table A-3. Value Added Shares by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Total value added (\$ million)	2,974.2	30,577.8	1,483.2	3,501.8	38,537.0
Sector share (%)					
Agriculture	4.2	0.7	2.5	2.5	1.2
Mining and construction	5.3	4.5	5.0	4.4	4.5
Food processing	1.5	0.7	0.9	1.8	0.9
Other manufacturing	0.9	1.7	0.4	0.6	1.5
Transportation	2.9	5.0	3.5	4.3	4.7
Information	2.4	3.1	3.6	2.2	3.0
Utilities	2.9	1.4	2.7	2.2	1.7
Wholesale trade	3.1	3.8	2.5	2.6	3.6
Retail trade	9.1	6.9	8.6	9.5	7.4
Finance and insurance	3.3	6.3	2.7	2.5	5.6
Real estate and rentals	18.5	18.1	20.0	19.7	18.3
Professional services	2.7	4.0	3.7	2.5	3.7
Business services	2.3	2.8	3.4	1.9	2.7
Educational services	0.4	1.0	0.3	0.3	0.9
Health services	5.8	6.3	6.5	4.8	6.1
Arts and entertainment	1.6	0.9	1.6	2.7	1.1
Hotels	10.6	3.6	10.6	17.2	5.6
Eating and drinking	2.7	2.9	4.0	4.5	3.1
Other services	2.5	2.3	2.5	2.3	2.3
Government	17.3	24.0	15.0	11.6	22.0

Table A-4. Total Job Shares by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Total jobs	74,325	557,162	33,738	77,026	742,251
Sector share (%)					
Agriculture	10.0	1.4	6.0	5.0	2.9
Mining and construction	5.4	4.2	5.9	4.9	4.5
Food processing	1.4	0.8	1.0	1.7	0.9
Other manufacturing	1.3	1.6	0.7	1.0	1.5
Transportation	2.3	4.0	3.3	3.5	3.7
Information	1.1	1.9	1.6	1.3	1.7
Utilities	0.6	0.3	0.5	0.4	0.4
Wholesale trade	2.7	3.4	1.9	2.2	3.1
Retail trade	13.0	11.3	13.4	12.9	11.8
Finance and insurance	2.7	4.8	2.2	2.3	4.2
Real estate and rentals	4.5	4.0	5.3	6.0	4.3
Professional services	3.9	5.0	4.6	4.1	4.8
Business services	4.8	4.9	4.1	3.8	4.8
Educational services	1.2	2.2	0.8	1.2	1.9
Health services	6.9	7.3	6.8	5.5	7.1
Arts and entertainment	2.7	2.1	3.5	4.4	2.5
Hotels	9.4	3.4	10.8	14.9	5.6
Eating and drinking	5.5	6.7	8.6	8.0	6.8
Other services	5.0	5.1	5.4	5.5	5.1
Government	15.4	25.5	13.7	11.3	22.5

Table A-5. Personal Consumption Expenditures (PCE) Shares by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Total PCE (\$ million)	2,172.1	19,856.5	998.2	2,199.2	25,226.1
Sector share (%)					
Agriculture	0.5	0.2	0.1	0.2	0.5
Mining and construction	0.0	0.0	0.0	0.0	0.0
Food processing	0.2	1.3	0.0	0.1	1.7
Other manufacturing	0.0	1.0	0.0	0.0	1.0
Transportation	1.3	2.3	1.3	1.5	2.5
Information	3.0	3.1	2.8	2.9	3.1
Utilities	3.0	1.3	2.7	2.5	1.6
Wholesale trade	1.8	2.6	1.5	1.6	2.7
Retail trade	9.7	8.7	8.2	9.4	9.2
Finance and insurance	4.2	6.9	3.2	3.5	6.4
Real estate and rentals	18.1	20.7	20.1	22.6	20.8
Professional services	1.0	1.5	1.4	1.1	1.5
Business services	0.3	0.5	0.2	0.3	0.4
Educational services	0.8	1.7	0.5	0.9	1.7
Health services	14.2	15.0	14.5	11.8	15.0
Arts and entertainment	1.6	1.1	1.4	1.8	1.3
Hotels	0.0	0.0	0.0	0.1	0.7
Eating and drinking	4.0	3.6	4.8	6.0	4.1
Other services	2.9	3.9	2.7	2.8	3.8
Government	1.0	2.1	1.1	1.0	1.9
Imports -within state	12.0	2.4	14.8	11.0	0.0
Imports -out of state	20.2	20.1	18.7	18.7	19.9

Table A-6. Visitor Expenditures (VE) Shares by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Total VE (\$ million)	1,103.6	6,811.1	636.5	2,187.8	10,739.0
Sector share (%)					
Agriculture	0.1	0.0	0.0	0.0	0.2
Mining and construction	0.0	0.0	0.0	0.0	0.0
Food processing	0.3	0.2	0.0	0.1	0.5
Other manufacturing	0.0	0.3	0.0	0.0	0.5
Transportation	6.8	23.6	5.3	8.4	19.1
Information	0.2	0.4	0.2	0.1	0.3
Utilities	0.0	0.0	0.0	0.0	0.0
Wholesale trade	1.4	1.4	1.4	1.0	1.8
Retail trade	12.7	9.2	13.1	10.8	10.1
Finance and insurance	0.0	0.0	0.0	0.0	0.0
Real estate and rentals	6.9	3.9	8.9	7.0	5.2
Professional services	0.2	0.5	0.2	0.1	0.4
Business services	1.3	2.8	0.7	0.7	2.1
Educational services	0.0	0.0	0.0	0.0	0.0
Health services	0.6	1.0	0.9	0.3	0.8
Arts and entertainment	3.9	3.7	4.0	4.7	4.0
Hotels	36.6	25.9	30.8	40.4	30.2
Eating and drinking	6.1	12.4	8.9	7.2	10.5
Other services	0.5	0.7	0.3	0.3	0.6
Government	0.1	0.6	0.1	0.1	0.4
Imports -within state	4.9	1.2	7.3	4.3	0.0
Imports -out of state	17.5	12.0	17.9	14.6	13.5

Table A-7. Total Intermediate Demand as a Percent of Total Output by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Agriculture	50.0	57.8	59.4	59.4	56.0
Mining and construction	8.3	10.7	11.0	11.0	10.5
Food processing	23.0	31.5	9.2	9.2	24.7
Other manufacturing	66.2	53.7	69.7	69.7	54.5
Transportation	16.9	17.7	16.2	16.2	17.7
Information	37.2	47.7	39.8	39.8	46.7
Utilities	49.3	45.9	54.6	54.6	48.0
Wholesale trade	37.6	41.9	26.8	26.8	40.4
Retail trade	13.6	13.8	11.3	11.3	13.3
Finance and insurance	29.8	46.7	29.6	29.6	45.1
Real estate and rentals	29.2	37.9	22.0	22.0	35.5
Professional services	64.1	55.6	66.1	66.1	57.2
Business services	63.0	57.3	62.4	62.4	58.8
Educational services	6.1	6.0	6.1	6.1	6.0
Health services	2.6	2.6	3.4	3.4	2.8
Arts and entertainment	4.5	7.0	5.3	5.3	6.2
Hotels	1.2	0.7	1.5	1.5	1.0
Eating and drinking	4.8	5.5	4.9	4.9	5.3
Other services	48.5	33.8	54.0	54.0	37.5
Government	9.0	5.1	15.5	15.5	6.0

Table A-8. Total Intermediate Purchases as a Percent of Total Output by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Agriculture	34.0	29.1	40.9	33.1	32.4
Mining and construction	35.6	31.3	39.5	32.1	32.3
Food processing	37.7	40.8	68.2	56.1	45.1
Other manufacturing	29.1	15.1	32.2	28.6	15.9
Transportation	38.4	33.8	39.2	36.2	34.5
Information	21.1	23.8	19.1	17.1	23.0
Utilities	37.1	37.7	38.9	38.5	37.8
Wholesale trade	15.7	20.9	16.7	13.1	20.0
Retail trade	29.0	23.6	28.5	25.6	24.7
Finance and insurance	31.3	33.5	33.1	25.4	33.1
Real estate and rentals	19.9	23.7	23.3	17.9	22.9
Professional services	25.0	26.4	17.7	23.1	25.8
Business services	18.7	23.7	21.3	18.0	22.9
Educational services	42.5	24.7	31.4	44.4	26.6
Health services	27.4	31.1	28.9	19.7	30.0
Arts and entertainment	31.0	37.4	30.8	22.2	33.5
Hotels	26.0	35.0	25.7	29.8	31.8
Eating and drinking	35.9	35.6	33.8	30.5	34.8
Other services	35.3	37.3	31.1	33.8	36.6
Government	4.0	3.2	4.5	5.4	3.4

Table A-9. Total Labor Income as a Percent of Total Output by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Agriculture	29.7	46.7	31.5	40.2	39.3
Mining and construction	34.5	45.3	28.5	36.4	42.3
Food processing	16.0	20.1	10.6	20.6	19.0
Other manufacturing	27.9	14.5	31.1	28.5	15.3
Transportation	23.1	31.1	24.4	21.7	29.5
Information	23.4	27.4	34.3	27.6	27.5
Utilities	18.2	16.2	14.6	15.8	16.3
Wholesale trade	42.0	40.0	32.6	41.6	40.0
Retail trade	36.0	46.3	39.9	37.2	43.7
Finance and insurance	25.3	29.6	23.6	29.9	29.3
Real estate and rentals	7.5	8.3	8.3	13.7	8.8
Professional services	52.8	59.0	63.9	51.2	58.3
Business services	61.2	53.4	59.9	56.2	54.3
Educational services	50.4	69.8	62.7	47.2	67.7
Health services	53.0	54.2	55.9	61.0	54.6
Arts and entertainment	42.6	39.2	45.7	49.3	41.8
Hotels	45.1	35.9	45.9	37.3	38.1
Eating and drinking	33.1	38.3	37.2	34.6	37.3
Other services	43.1	45.4	54.9	42.0	45.2
Government	82.1	83.3	75.7	76.9	82.7

Table A-10. Total Value Added as a Percent of Total Output by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Agriculture	55.5	63.3	45.7	54.6	57.7
Mining and construction	41.5	52.7	36.6	43.5	49.6
Food processing	31.1	35.2	19.9	30.1	32.6
Other manufacturing	42.6	23.3	42.6	37.0	24.3
Transportation	43.0	52.7	42.1	42.5	50.8
Information	56.3	59.9	65.7	59.5	59.9
Utilities	53.2	53.6	50.9	50.9	53.0
Wholesale trade	74.9	70.8	75.9	76.7	71.6
Retail trade	59.8	70.9	63.4	60.3	67.9
Finance and insurance	57.5	59.3	58.7	61.2	59.3
Real estate and rentals	77.4	74.4	74.1	78.7	75.0
Professional services	60.0	67.6	69.9	58.8	66.6
Business services	76.1	71.8	73.7	75.3	72.4
Educational services	55.0	74.4	67.3	51.7	72.3
Health services	60.8	60.7	62.4	69.1	61.3
Arts and entertainment	57.3	52.3	59.0	64.7	55.5
Hotels	68.9	60.4	70.4	61.9	62.6
Eating and drinking	47.9	53.2	52.0	49.3	52.2
Other services	51.1	53.4	61.2	49.6	53.1
Government	94.5	95.7	94.2	91.8	95.4

Table A-11. Total Jobs Per \$Million of Total Output by Sector and by County

	Hawaii County	Honolulu County	Kauai County	Maui County	State total
Agriculture	33.2	22.2	24.9	23.7	25.7
Mining and construction	10.6	9.1	9.8	10.7	9.5
Food processing	7.6	6.7	4.9	6.5	6.7
Other manufacturing	14.8	4.1	18.6	13.4	4.7
Transportation	8.4	7.6	9.0	7.7	7.7
Information	6.5	6.6	6.4	7.5	6.6
Utilities	2.7	2.2	2.0	2.2	2.3
Wholesale trade	16.1	11.4	13.6	14.4	11.9
Retail trade	21.3	21.3	22.4	18.0	20.9
Finance and insurance	11.9	8.3	10.9	12.7	8.6
Real estate and rentals	4.7	3.0	4.4	5.2	3.4
Professional services	22.2	15.3	19.4	21.5	16.3
Business services	40.8	23.4	20.4	34.2	24.9
Educational services	37.7	29.0	44.3	39.2	30.1
Health services	17.9	12.8	14.8	17.5	13.6
Arts and entertainment	25.2	23.8	28.5	23.5	24.1
Hotels	15.3	10.6	16.3	11.8	11.9
Eating and drinking	24.5	22.3	25.3	19.4	22.2
Other services	26.0	21.6	30.3	25.8	22.7
Government	21.1	18.5	19.7	19.7	18.8