THE INFLUENCE OF TOURISM GROWTH ON THE PRODUCTION STRUCTURE OF ISLAND ECONOMIES

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In many small economies one of the major problems is to sustain economic expansion while exports are often made up of a few primary products with inelastic external demand. For island economies of the Pacific and in the West Indies it has often been suggested that tourism be vigorously developed to supplement agricultural activities with the anticipation that the latter will also benefit from the economic expansion induced by additional trade.

Agriculture in these economies is generally composed of two very distinct segments: a plantation sector made up of large scale commercial units producing mostly for exports and a diversified sector consisting of smaller units of independent producers serving the local economy. While the expansion of the plantation sector is a function of a generally inelastic external demand, it is expected that diversified agriculture will benefit much from development of tourism activities because it will enjoy an expanding local market. Domestic consumption of agricultural products is expected to be at least trade-neutral to economic expansion.

This paper presents a quantitative analysis of the role of tourism trade in the expansion of the Hawaiian economy. It analyzes the effect of the economic expansion generated by tourism on the structure of production and consumption separately. It evaluates patterns of change to see whether growth has been pro-trade biased, anti-trade biased or neutral to trade. It presents an interpretation of the linkage between tourism expansion and domestic production. The analysis includes a detailed investigation at the micro-economic level of the changes in the structure of demand and supply both for the traditional agricultural exports as well as for the other agricultural products serving the local economy to trace more fully the influence of tourism on the traditional agricultural production structure.

AGGREGATE ANALYSIS OF HAWAII'S TRADE

Since 1950 the economy of Hawaii has experienced an overall rate of growth of more than 4.5 percent per year in real terms. Real per capita personal income has increased from $1.830 in 1949 to $3,318 in 1969. The growth of the local economy has been influenced by its greater integration with the mainland economy under the impact of changing transportation technology and of new jet mass transportation in particular. An important institutional barrier was also removed with the advent of statehood in 1959. Hawaii's balance of payments during this period of expansion can be described briefly before discussing the effects of economic growth.

Hawaii's Balance of Payments

Hawaii's interregional trade with the mainland can be conveniently summarized with the help of the annual Balance of Payments Accounts published by the Bank of Hawaii for the period 1949-1969 [1] and analyzed with the joint use of the Income and Expenditures Accounts recently compiled for the more

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limited period 1958-1968 [13]. The accounts presented in Appendix Table 1 are broken down into four major categories: commodities, services, federal government and investment. The net investment component reported has been consistently small. Commodity exports which consist mostly of sugar and pineapple products have increased by one-third in current value and appear to have reached a stable level in recent years, while commodity imports have increased rapidly and more than tripled during the same period. Services exports which consist mostly of tourism earnings have grown from 30 to 720 millions in current dollars. Services imports have grown less rapidly so that the servies has moved from negative to largely positive. While the exact role of the federal government cannot be ascertained from the aggregate figures available, the ratio of federal expenditures to total receipts decreased over time. Outside the military, the economy of Hawaii at the beginning of the period was completely specialized in agricultural commodities.[1]

THE EFFECTS OF ECONOMIC GROWTH

The effect of economic growth is to shift the production possibility frontier outwards. The gross state product increases and so does the overall level of community satisfaction. Economic expansion is accompanied by changes in the structure of consumption, production and trade. On an aggregate basis it is important to determine whether growth increases the demand for imports more than proportionately to the increase in the values of state product, in the same proportion or less. These three possibilities have been summarized by H. G. Johnson [7]and]into three basic types: pro-trade biased growth, with supply of exports and demand for imports increasing more rapidly than the state product; "neutral" or unbiased growth, where demand for imports and supply of exports grow proportionately with output; and anit-trade biased growth where output rises faster than external exchanges. In general, it is not possible to analyze quantitatively the nature of a state's economic growth; in the case of Hawaii data are available. While they cover only the latter half of the period, it is possible to compute the output elasticity of imports and exports with respect to the growth of the state output or product. From the regressions reported in Table 1 it is found that on a net basis the output elasticity of commodity imports was $e_i = 1.6$ for the period 1958-1968 and that of services exports $e_x = 3.2$.[2]

These two results imply that the economy of Hawaii is strongly pro-trade biased and that its dependence on trade with the mainland which was already very significant at the beginning of the period has increased over time. However, they do not show the respective changes in consumption and production because the output elasticities are computed from net figures. Agricultural commodity exports and commodity imports (which include food products) as well as tourist services exports and non-tourist services imports can be separated with the data available.

When output elasticities are computed on a gross basis it can be seen that consumption is almost perfectly trade-neutral to output expansion. Both the elasticities of commodity imports and services imports are very close to unity. From the regression in linear form the output elasticity at the mean is $e_1 = 1.09$ for commodity imports (or 1.00 on a constant elasticity basis using a logarithmic regression). For services imports the output elasticity is $e_3 = 1.04$ (or 1.10 on a constant elasticity basis). With a trade-neutral consumption, Hawaii's growth has been pro-trade biased overall because of the production side and in addition most of it is attributable to the tourist sector. Commodity exports (i.e., sugar and pineapple) have been output inelastic: $e_2 = 0.51$ (both on a linear and constant elasticity basis), while services ex-

ports (i.e, tourism) have been strongly output elastic: $e_4 = 1.74$ (or 1.66 on a constant elasticity basis).[3]

The combination of a trade-neutral consumption pattern with a pro-trade production pattern makes the economic growth of Hawaii pro-trade biased overall. The neutrality of consumption implies the ability of the Hawaiian economy to expand locally the production of consumption goods and services in step with the expansion of output. It remains to estimate the demand and supply characteristics of the export sector and to see whether diversified agriculture which produced for the domestic market has followed the same pattern of neutrality to trade than the group of consumption goods as a whole.

STRUCTURAL CHARACTERISTICS OF DEMAND AND SUPPLY FOR THE EXPORT SECTOR

Choice of Models for Agricultural Products

The results of the aggregate analysis are consistent with the characteristics of demand and supply for the three significant export items: sugar, pineapple and tourism. The models chosen for commodity analysis are the dynamic Houthakker-Taylor model for demand and the Nerlove distributed-lag model for supply. They are also used later for the study of diversified agriculture.

The Houthakker-Taylor model is a dynamic model of consumption demade which can be applied both to durable goods and nondurable components of consumption like agricultural products [6]. It is very similar in spirit to the Nerlove supply model in handling the impact of changes in predictors. As a deviation from the original model, quantities consumed have been substituted for expenditures in the analysis.

For the different commodities studies, the most appropriate forms are found to be distributed-lag variants of the basic model (they are labeled $\delta = 2$, $\delta = -2$ in Appendix Tables 2 and 3). The basic model and its variants yield both short-run and long-run income elasticity coefficients η and η'. While price elasticities can also be obtained through the introduction of price variables, it appears to be a feature of the H-T model to be somewhat insensitive to changes in the price level. For Hawaii, in many cases the price variable is not significant--this eliminates problems of serial-correlation and over-identification which appear when additional predictors are introduced in the basic model.[4] Besides its value for structural analysis this model exhibits excellent projecting qualities [6].

To investigate the impact of economic growth on diversified agriculture (which we could also define as non-corporate farming), the influence of the farm-nonfarm wage differential on supply is explicitly introduced in the Nerlove model. Recent studies of the mobility of farm workers are based on the premise that the shift to nonfarm occupations is a function of the ratio of the current nonfarm wage ratio to the current wage rate in farming [3], [9]. In one of these studies, the forecasting structure is based on the fact that "relative future income in farming and in nonfarm occupations plays a major role in shaping the decisions of the farm workers to remain or move but of farming" [3]. In the estimation of the supply function an additional explanatory variable, L_t, representing the ratio of the farm to the contract construction wage in Hawaii, is introduced.[5]

When the dynamic form of the demand and supply models is not statistically satisfactory an alternative static form is used.

Interpretation of Empirical Estimates

The demand and supply estimates for the export commodities are reported in Appendix Table 2. The distributed-lag variant of the H-T model yields very small income elasticity estimates for the U.S. sugar demand suggesting consumer saturation. The long-run income elasticity is only 0.11. In the case of pineapple where only aggregate static demand estimates are obtainable both income and price elasticities are small and equal to 0.28 and -.43 respectively. These unfavorable demand conditions explain the output inelasticity found for agricultural exports in the presence of tourism as a new export base.

On the supply side the Nerlove model yields low price elasticity estimates implying theat local supply is irresponsive to price consitions. For sugar this is a result of the quota system [2], for pineapple it is a consequence of the development of third-country supplies for the mainland market, and for both a result of the shift of factor supplies away from agriculture.

Characteristics of Tourism in Hawaii

It is not possible to present estimates of demand and supply relations for tourism in Hawaii in a manner comparable to that used for other products. At the national level we have estimates of dynamic per capita functions for airline travel and foreign travel by U.S. residents [6]. They exhibit very large income elasticities of 4.5 and 5.9 respectively. Additional analyses specific to Hawaii show that the price elasticity of visits to the island is of the order of -1.4 (see [10], p. 225) so that the continuous decline in fare prices and travel time together with rising income levels has contributed significantly to the expansion of tourism. On the basis of current information the number of vistor-days which was 13,936,500 in 1970 is expected to increase further in the coming years.[6]

LINKAGE BETWEEN TOURISM EXPANSION AND DOMESTIC PRODUCTION

Before attempting a quantitative analysis of changes in the agricultural sector generated by the expansion of the tourism sector it is useful to provide a more specific analysis of the linkage effects between the two sectors. This can be done with a simple model. In a given year Hawaii's income can be described by the accounting relation:

$$Y = I + C + G + E - M_i - M_c \qquad (1)$$

where

Y = Hawaii's income

$I = I(Y, E, G)$ local investment

$C = C(Y)$ consumption expenditures

G = federal and state expenditures (including the military)

E = exports (tourism, pineapple, sugar, etc.)

$M_c = M(C)$ imports of consumer goods

$M_i = M(I)$ imports of producer goods

The export multiplier for tourism can be obtained by the methods of comparative statics through differentiation of equation (1). To isolate the effect of tourism we can hold federal expenditures constant.[7] A change in tourism expenditures will affect income and consumption expenditures.

$$dC = C'(Y)\, dY \tag{2}$$

A change in consumption expenditures will affect the importation of consumer goods:

$$dM_c = M'_c(C)\, dC \tag{3}$$

A change in income and tourist expenditures will affect investment:

$$dI = I'_y(Y, E)\, dY + I'_e(Y, E)\, dE \tag{4}$$

A change in investment will affect the importation of producer goods:

$$dM_i = M'_i(I)\, dI$$

The final relationship between a change in tourist expenditures and a change in income can be established by substitution into the differentiated form of equation (1). The result is:

$$\frac{dY}{dE} = \frac{1 + [1 - M'_i(I)]\, I'_e(Y, E)}{1 - [1 - M'_i(I)]\, I'_y(Y, E) - [1 - M'_c(C)]\, C'(Y)} \tag{5}$$

or

$$\frac{dY}{dE} = \frac{1 + U}{1 - V - W} \tag{6}$$

The relationship between the development of the Hawaii tourist industry and its impact on output elsewhere in the economy can be explored through expression (6). In the case of consumer goods (of which agricultural products are only a part) consider the term W:

$$W = [1 - M'_c(C)]\, C'(Y) \tag{7}$$

It represents the marginal propensity to consume locally produced consumer goods because $C'(Y)$ is the marginal propensity to consumer when income grows and $M'_c(C)$ represents the marginal propensity to impact consumer goods. In this present study we are interested in the marginal propensity to import consumer goods $M'_c(C)$. A high value of $M'_c(C)$ is equivalent to weak linkages between the development of the tourist industry and the structure of local production (in particular for agricultural products). However, the information contained in trade accounts does not permit a direct evaluation of the direction of change in $M'_c(C)$ and it must be inferred indirectly from the behavior of the local sector. It can be verified that when $M'_c(C)$ is small, the term W is larger and so is the tourist multiplier.

The behavior of the producer goods sector is summarized by terms U and V. $M'_i(I)$ represents the marginal propensity to import producer goods into Hawaii. In terms of regional development the size of the local industry is reflected in the value of $M'_i(I)$: the closer it is to one the greater the proportion of imported goods and the weaker is the linkage between the growth

of the tourist industry and the growth of local industry production.

The relationship between the expansion of tourism and changes in investment can also be discussed within the framework of equation (5) to show that symmetric to the consumption linkage between tourism and the local production of consumer goods we have a linkage between tourism and the production of producer goods. The weaker the linkage, the smaller the local production of such goods and also the overall tourism multiplier. At present most producer goods are imported.

Under ideal conditions, we want to investigate the marginal propensity to import consumer goods (distinguishing between food and non-food items) and the marginal propensity to import producer goods. A further refinement would consist of isolating the impact of the military. Unfortunately, the trade accounts available do not permit such a distinction and we have to proceed in an indirect way. The aggregate analysis has already established that commodity imports including both food and non-food products are neutral to expansion. An examination of the agricultural sector for which information is available will indicate whether this sector has also expanded in a neutral fashion, more specifically whether the linkage between tourism and the local food sector is strong.

CHANGES IN DOMESTIC CONSUMPTION AND RESPONSE OF DIVERSIFIED AGRICULTURE

For diversified agriculture the number of commodities included in the analysis is limited by the nature and the quality of the information available. Seventeen products are studied. They can be conveniently grouped into three categories: vegetable and animal products under direct competition from mainland and tropical crops, which are less subject to outside competition. The first group includes head cabbage, cucumbers, lettuce, snap beans and tomatoes; the second group includes beef, pork, milk, chicken, and eggs; and the last group avocados, bananas, coffee, macadamia nuts, papayas, taro and passion fruit. The analysis covers 96 percent of diversified agriculture marketings in value (Appendix Table 3 and 4).

When we look at the demand situation for each commodity separately, a convergence with mainland consumption patterns is clearly in evidence. The long-run income elasticity of demand for fresh vegetables is negative (except for lettuce) and varies between -.5 and 2.3. This implies that the level of per capita demand will continue to decrease. These trends in consumption are similar to those on the mainland.[8] Consumer preferences are shifting away from fresh vegetable products, while demand for additional services in the form of processed frozen foods increases with income. This implies a worsening of trade for Hawaii since frozen and processed foods are imported. The only exception is lettuce which has a large positive long-run income elasticity. Its level of demand is expected to increase on a per capita basis as well as in total volume.

Unfavorable income elasticities on the demand side are matched with unfavorable supply conditions for the supply of vegetable products. The farm-to-nonfarm wage ratio plays a significant role (the coefficient of L_{t-1} is positive) and contributes to the explanation of the decline of local production of vegetables. Producers appear to be moving to other types of activity. The level of local supply is not increasing sufficiently and there is a need for greater imports.

In the case of animal products, the mainland consumption pattern is also evident. The long-run income elasticity of demand is always found posi-

tive. Consequently, the volume of demand for beef and veal ($\eta' = .77$), pork ($\eta' = .22$), chicken ($\eta' = 1.9$), eggs ($\eta' = .67$) and milk ($\eta' = .26$) will increase with both income and population. Local producers are expected to expand their production significantly. But, due to the projected rapid rise in demand, the current need for imports from the mainland will not be reduced. Total demand will be increasingly satisfied through imports.

As for tropical crops which enjoy a technical advantage over the mainland, the only two products of great potential, locally and for exports, are macadamia nuts and papayas. Their long-run income elasticity appears to be very large ($\eta' = 6.6$ for macadamia nuts) and demand and supply are expected to increase rapidly. Passion fruit also had a large positive income elasticity, but as a crop it is not economically very significant. The income elasticities of the other products are negative and their level of demand is projected to decline significantly.

Overall, diversified agriculture does not appear to be in a position to take advantage of the projected increase in the level of income and population. The only sector that will benefit is the animal products sector. But even in this case the level of imports is expected to increases. The structure of the local economy is projected to require greater reliance on mainland imports of food projects. As the theoretical analysis of section IV shows, the weak linkage between tourism expansion and agricultural output contributes to the dampening of the impact of tourism on the level of aggregate output.

CONCLUSION

The case of Hawaii clearly demonstrates the potential of tourism as a factor of development for small island economies. It also shows that the development of the tourist industry (and the existence of a sizable military establishment) has had no stimulating impact on agricultural output. A lack of detailed information has prevented the analysis of the impact of tourism on nonagricultural production directly.

The lack of response of local agriculture to tourism expansion raises the question of why linkage effects are so weak. Different and compatible answers can be suggested. As we have shown there has been a shift in taste away from the consumption of local fresh products in favor of mainland frozen products. In addition, the extremely high concentration in the local land tenure system together with the lack of entrepreneurship in the diversified agricultural sector as well as the limited access of capital sources to small producers have contributed to the persistent lag of the diversified agricultural sector behind the growth of the tourist sector. The small scale of local production has prevented the local supply of the added services demanded by consumers. Since there is no trade protection available to an open region the weak linkage between the size of the diversified agricultural sector and the large increases in the volume of consumption expenditures for food and non-food products stimulated by tourism persists. Due to faster and easier means of transportation, products incorporating the desired new services are imported and force the shift of agricultural resources to other sectors. Thus, the experience of Hawaii indicates that the rapid expansion of the tourist industry simply generates a switch from an export-led growth based on agriculture to one based on tourism without the possibility of a simulaneous expansion of both sectors. Overall, the growth of the islands has been pro-trade biased and the increased level of local output has not been accompanied by a strong increase in internal integration.

Table 1. HAWAII ESTIMATES OF EXPORT AND IMPORTS OUTPUT ELASTICITIES ON A NET AND GROSS BASIS, 1958-1968

Dependent Variable	Equation Type	Constant Term	Hawaii GSP	Output Elasticity Estimates	R^2
Net Commdities Imports	Linear	-215.6586	0.2586 (0.0318)	at the mean $e_i = 1.6$	.8803
	Log-log	0.06775	1.4113 (0.1915)	constant elasticity $e_i' = 1.4$	.8578
Net Services Exports	Linear	-228.1049	0.1476 (0.0212)	$e_x = 3.2$	.8438
	Log-log	-7.9475	2.9406 (0.4724)	$e_x' = 2.9$	.8115
Commodity Imports	Linear	-61.5505	0.3305 (0.0282)	$e_1 = 1.09$	.9386
	Log-log	-0.5339	1.0042 (0.0934)	$e_1' = 1.00$	.9276
Commodity Exports (Agriculture)	Linear	154.1021	0.0718 (0.0076)	$e_2 = 0.51$	.9034
	Log-log	0.7678	0.5174 (0.0539)	$e_2' = 0.51$	.9109
Services Imports	Linear	-9.2490	0.1011 (0.0072)	$e_3 = 1.04$	.9560
	Log-log	-1.3544	1.1013 (0.0771)	$e_3' = 1.10$	.9578
Services Exports (Tourism)	Linear	-237.3525	0.2487 (0.0159)	$e_4 = 1.74$	.9642
	Log-log	-3.0736	1.6601 (0.0882)	$e_4' = 1.66$	.9577

APPENDIX

Table 1. BALANCE OF PAYMENTS ACCOUNTS (EXCLUDING CAPITAL MOVEMENTS) FOR THE STATE OF HAWAII AND ESTIMATES OF THE GROSS STATE PRODUCT

Year	Commodities[a]		Services[a]		Federal Government[a]		Investment[a]		Gross State Product[b]
	Imports	Exports	Expenditures	Receipts	Expenditures	Receipts	Overseas	In Hawaii	
	(in millions of current dollars)								
1949	325	212	58	30	175	93	10	10	--
1950	358	229	69	51	214	91	18	16	--
1951	400	238	79	61	272	127	22	17	--
1952	349	240	78	62	306	154	22	16	--
1953	403	266	89	76	331	150	29	19	--
1954	370	263	85	80	306	152	24	24	--
1955	421	270	105	94	338	145	25	28	--
1956	430	286	105	113	357	164	32	37	--
1957	488	278	110	130	385	183	34	40	--
1958	460	253	130	152	421	191	33	40	1,424
1959	521	276	141	194	447	219	37	46	1,609
1960	566	264	165	230	486	259	49	46	1,825
1961	573	282	176	219	530	278	51	50	1,917
1962	548	294	197	229	530	314	59	61	2,007
1963	572	334	225	263	536	314	66	72	2,098
1964	653	322	242	313	602	337	73	82	2,302
1965	713	336	251	354	647	343	86	93	2,450
1966	796	351	262	415	751	382	90	104	2,725
1967	982	373	287	528	847	414	101	114	2,954
1968	1,074	378	311	615	911	527	113	130	3,305
1969	1,196	368	318	720	986	634	124	155	--

[a] Bank of Hawaii, annual reports [1].

[b] Shang, et al. [13].

APPENDIX

Table 2. ESTIMATES OF DEMAND AND SUPPLY RELATIONS FOR SUGAR AND PINEAPPLE

a. U.S. Demand Estimates

H-T Demand Model	A_0	Lagged Demand Q_{t-1}	Current Income Y_t	Short-Run MPC α	Long-Run MPC α'	S.R. Income Elasticity η	L.R. Income Elasticity η'	R^2
1. Sugar (δ=2)	119.6043	-0.3114 (0.1825)	0.00038 (.00015)	0.00296	0.00564	0.0606	0.1156	.3314
Static Demand Model	**Constant Term**		**Current Income DPI**	**Current Price P_t**	**Income Elasticity η_y**	**Price Elasticity η_p**		**R^2**
2. Pine-apple	15108.98		9.9262 (1.5657)	-754.5447 (425.5757)	.2858	-.4334		.8932

b. Hawaii Supply Estimates

Nerlove Model	Constant Term β_0	Lagged Price P_{t-1}	Lagged Supply Q_{t-1}	Structural Parameters			Supply Price Elasticity	R^2
				λ	a	b		
1. Sugar	198.4775	3.3411 (2.0784)	0.4249 (0.2109)	.5770	343.94	5.7897	.6927	.4461
2. Pine-apple	82.03	7.2998 (20.3381)	0.5730 (0.2178)	.4270	192.107	17.0955	.7775	.450

APPENDIX

Table 3. ESTIMATES OF THE HOUTHAKKER-TAYLOR DEMAND RELATIONS AND DISTRIBUTED-LAG VARIANTS FOR DIVERSIFIED AGRICULTURE, 1950-1967, REGRESSION COEFFICIENTS AND THEIR STANDARD ERRORS

Commodity	A_0	Lagged Demand Q_{t-1}	Current Price P_t	Lagged Income y_{t-1}	Current Income y_t	Short-Run MPC γ	Long-Run MPC γ'	Short-Run Income Elasticity η	Long-Run Income Elasticity η'	R^2
1. Head Cabbage (δ = -2)	10.9734	0.5688 (0.1977)		-0.0019 (0.0011)		.0012	-.0045		-.7886	.7804
2. Cucumbers (δ = -2)	5.9216	0.5245 (0.1977)		-0.0012 (0.0005)		.0008	-.0026		-1.0705	.7683
3. Lettuce (δ = 2)	-3.1623	0.7998 (0.2285)			0.0024 (0.0014)	.0013	.0118	.2790	2.5116	.8926
4. Snap Beans (δ = -2)	4.5784	0.5386 (0.2274)		-0.0013		.0008	-.0028		-2.3649	.7869
5. Tomatoes (δ = 2)	13.2200	0.3163 (0.2288)			-0.0017 (0.0006)	-.0013	-.0026	-.2590	-.4987	.5632
6. Beef and Veal (δ = 2)	5.2975	0.7739 (0.1398)			0.0498 (0.0060)	.0028	.0220	.0984	.7722	.9020
7. Pork[a] (δ = 2)	15.8681	0.2752 (0.1771)			0.0018 (0.0013)	.0014	.0024	.1273	.2240	.3661
8. Chicken (δ = -2)	-2.5567	0.7822 (0.1648)		0.0028 (0.0024)		-.0015	.0128		1.9250	.9399
9. Eggs (δ = 2)	1.9478	0.7747 (0.0928)			0.0012 (0.0012)	.0006	.0052	.0850	.6704	.9598
10. Milk (δ = -2)	69.7400	0.4401 (0.2531)		0.0113 (0.0102)		-.0076	.01964		.2678	.6044

Table 3. (continued)

Commodity	A_0	Lagged Demand Q_{t-1}	Current Price P_t	Lagged Income y_{t-1}	Current Income y_t	Short-Run MPC γ	Long-Run MPC γ'	Short-Run Income Elasticity η	Long-Run Income Elasticity η'	R^2
11. Avocados (δ = 2)	1.1228	0.5867 (0.2119)			0.0002 (0.0001)	.0001	.0004	-.1562	-.5981	.6958
12. Bananas [b]										
13. Coffee [c]										
14. Macadamia Nuts (δ = -2)	-8.0057	0.5946 (0.1935)		0.0040 (0.0016)		-.0025	.0098		6.5866	.9177
15. Papayas [d]										
16. Taro (δ = -2)	14.6263	0.6988 (0.1431)		-0.0041 (0.0020)		-.0024	.0013		-2.4061	.9453
17. Passion Fruit (δ = 2)	15.8520	0.6303 (0.3983)	-3.848 (1.209)		0.0035 (0.0014)	.0021	.0095		1.4938	.6588

[a] Due to the low quality of this equation the following trend equation was also estimated for pork on an aggregate basis:

$$Q_t = -17097.5234 + \underset{(44.0261)}{581.4116}T, \quad R^2 = .9208 \quad F = 174.40 \quad Sy{\cdot}x = 889.28 .$$

[b] The dynamic model fails for bananas, the following static model is used:

$$Q_t = 42.8697 - \underset{(0.00092)}{0.00289}\, y_t - \underset{(0.4739)}{2.1461}\, P_t, \quad R^2 = .6496 \quad F = 12.967 \quad Sy{\cdot}x = 1.030 .$$

[c] The coffee industry is now submarginal in Hawaii and no model could account for its erratic behavior.

[d] The papaya industry is an export industry and there is no statistically significant model for the Hawaii demand for this commodity.

APPENDIX

Table 4. ESTIMATES OF SUPPLY RELATIONS FOR DIVERSIFIED AGRICULTURE, 1950-1967, REGRESSION COEFFICIENTS AND THEIR STANDARD ERRORS

Commodity	Constant Term β_0	Current Price P_t	Lagged Price P_{t-1}	Lagged Supply Q_{t-1}	Current Wage-Ratio L_t	Lagged Wage-Ratio L_{t-1}	R^2
Head Cabbage	5.3712			0.0963		10.0757	.781
				(0.0162)		(2.1059)	
Cucumbers	0.1594		0.1216	0.6189			.649
			(0.0849)	(0.1997)			
Lettuce	-4006.42		362.6936	0.7344			.940
			(112.4897)	(0.1537)			
Snap Beans	-4.350		0.130	1.252	-2.680	2.879	.920
			(0.038)	(0.177)	(0.950)	(0.771)	
Tomatoes	16.2813	-0.4240				2.1058	.771
		(0.0950)				(1.5880)	
Beef and Veal	13690.5		-266.76	0.911			.877
			(177.11)	(0.107			
Pork [a]							
Chicken	1694.326	-22.923		.9667			.961
		(44.097)		(.1650)			
Eggs	7.7647		-0.0454	0.7620			.968
			(0.0489)	(0.1940)			
Milk	-29.425		4.1837	0.9756			.939
			(9.5558)	(0.0739)			
Avocados	421.862		-22.598	0.636	-307.851	653.183	.677
			(0.048)	(0.206)	(175.076)	(193.266)	
Bananas [b]							
Coffee [c]							
Macadamia Nuts	8.5284		-0.3589	0.8889			.977
			(0.1155)	(0.6231)			
Papayas	-7971.51		1853.7119	0.5958			.895
			(310.5600)	(0.1091)			
Taro	-4.2682		0.6981	0.9587			.942
			(0.3836)	(0.0636)			
Passion Fruit	-9.0544		1.7818	.9855			.815
			(.3339)	(.1726)			

[a] The quality of statistical information does not permit the estimation of a local supply function.

[b] Ibid.

[c] Ibid.

FOOTNOTES

[1]At the beginning of the period the overall trade balance of Hawaii was negative and the situation would have been worse had it not been for positive net receipts from the federal government in the form of military and civilian expenditures in Hawaii. The weak state of the economy was underscored by intense out-migration, which was of the order of 5 percent of the civilian population in 1950 [14]. The partial information available on capital outflows confirms also the existence of a structural interregional trade disequilibrium. At that time, the economy of Hawaii could be considered completely specialized in agricultural commodities since the net balance for services (i.e., tourism) was negative and receipts quite small in absolute value. At the end of two decades, the economy of Hawaii was in a booming state clearly indicated by the strong flow of in-migrants [14] and a reported large but unspecified inflow of capital.

[2]These figures exclude the federal government sector and the influence of the military. It will be noted also that the information available does not separate consumer goods from producer goods so that what is labeled consumption here consists predominantly but not exclusively of consumer goods.

[3]The larger values obtained for the elasticities computed on a net basis are due to the grouping of data into net commodities and net services instead of separating them into exports and imports items, which accentuates the direction of changes.

[4]In the present analysis of structural changes of demand in relation with population and income, the lack of significance of the price variables does not create major difficulties because we are mainly interested in changes in consumption due to shifting tastes and rising income.

[5]These two variables are reported by the State Department of Labor and Industrial Relations of Hawaii. The value of construction wage is used because of its ability to represent fairly directly the expansion of nonfarm activities in Hawaii in the fact of our limited information. It is also recognized that wages are not applicable to all persons employed by both industries while they do reflect income expectations in both activities. As a reflection of the opportunity cost of remaining in farming this wage ratio is an acceptable indicator since it concentrates attention on changing relative wage levels over time in the process of economic growth and not on the absolute wage level differential.

[6]The origin of visitors and the problems of projecting future demand for tourism go beyond the scope of the present discussion. The best study available points to the fact that in recent years the military and their dependents on R and R from Vietnam have contributed significantly to the annual expansion of the flow of visitors [10]. This is no longer such a dominent element and by now the fastest growing market is the Japanese one.

[7]The information concerning the military does not permit the separate analysis of its impact on the state at present.

[8]This is easily seen when per capita consumption levels for the U.S. and for Hawaii are plotted on the same graph for every commodity. In particular, it is most remarkable to observe that 1959, the year of Hawaii's statehood, coincides with an accelerated change in consumption. Objective reasons for this change have been the increase in air transportation, changes in the retail distribution system and patterns of living shifting with increases

in income levels and migration from the mainland. Lack of space precludes a graphical presentation of this information.

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