

# Tourism and Fluctuations in the Hawaiian Economy

by

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## **Abstract**

Time series methods are used to investigate the importance of tourism to the State of Hawaii. The Hawaiian economy exhibits substantial comovement between the number of tourists and income and employment, especially at long-run frequencies. Tourism has its most immediate impact on gross state product, followed in a few months by personal income. Employment is affected after a lag of one year. The Oahu and Kauai economies are most sensitive to fluctuations in the volume of tourism. The Maui economy is correlated with agricultural shocks while the Big Island fluctuates most strongly with earnings from federal government employment.

## Tourism and Fluctuations in the Hawaiian Economy

The modern era of tourism in Hawaii began with the introduction of commercial jet service in 1959. By reducing the money and time costs of traveling to Hawaii the jet plane touched off an era of rapid growth in tourism to Hawaii. Visitor arrivals increased from 171,367 in 1958 to 242,994 in 1959. The number of visitors topped one million in 1967, two million in 1972, three million in 1976, and six million in 1988. The economic recession of 1990-91 and the stagnation experienced by the Japanese economy throughout the 1990's led to a steep slowdown in the growth of tourism to Hawaii that has lasted up to the present day. Nearly seven million people now visit the Hawaiian Islands each year. These visitors in the aggregate spend around \$10,000 million in Hawaii.

As the structure of the Hawaiian economy has evolved over the past 45 years, the state has become increasingly reliant on tourism. Visitor expenditures equaled just 14 percent of total exports from Hawaii in 1960; by 1992, the export share of visitor expenditures was 56 percent (Hawaii Department of Business, Economic Development and Tourism, 1995). Tourism to Hawaii now accounts for as much as 33 percent of gross state product and nearly half of total employment in the state (Hawaii Department of Business, Economic Development and Tourism, 1999). Waikiki alone is responsible for 8 percent of gross state product and 11 percent of all civilian jobs in the state (Hawaii Department of Business, Economic Development and Tourism, 2003).

The purpose of the paper is to assess the importance of tourism as a driver of economic activity in Hawaii. Many studies of the importance of tourism for an economy such as Archer's paper on Bermuda (1995), Archer and Fletcher (1996), and the State of Hawaii's own analyses (Hawaii Department of Business, Economic Development and Tourism 1995;

1999; 2003) utilize input-output models to measure the shear impact of tourism. Others, like the Sugiyarto, Blake, and Sinclair (2003) and Dwyer et al. (2003), use a general equilibrium model to examine the economic effects of tourism. This paper takes a time series approach to the relationship between tourism and the economy and investigates the sensitivity of the Hawaiian economy to fluctuations in the amount of tourism. If the vitality of the Hawaiian economy is strongly linked to fluctuations in the volume of tourist trade, then the state ought to display significant comovement over time of employment and income with the amount of tourism. A measure of dynamic correlation among time series developed by Croux, Forni, and Reichlin (2001) is used to investigate the comovement of tourism and the Hawaiian economy.

#### Dynamic Correlation

Comovement between two variables means something like correlation across time. Investigations of comovement are most often couched in terms of co-integration. Co-integration of two variables implies that they move together over time so that deviations from their long-term trend will be corrected over time (Engle and Granger, 1987). Each variable may have its own trend, but the difference between the variables remains constant over time. Lack of co-integration between two variables is taken to imply that there exists no long-run relationship between them.

However, co-integration has at least two serious limitations as a measure of comovement (Croux, Forni, and Reichlin, 2001, p. 232). First, high correlation between time series neither implies nor is implied by co-integration. Second, two variables are either co-integrated or not. Co-integration does not indicate the degree of association. For these reasons, Croux, Forni, and Reichlin (2001) propose a measure of dynamic comovement called dynamic correlation. Dynamic correlation is defined in the frequency domain and is obtained

using spectral methods. Spectral analysis is a method of decomposing the variance of a time series into the variance accounted for by each of the cyclic components of the series (see Warner, 1998). Dynamic correlation indicates the percentage of shared variance between two time series at a particular frequency. Dynamic correlation at frequency  $\lambda$  is defined as

$$(1) \quad \rho_{xy}(\lambda) = \frac{C_{xy}(\lambda)}{(S_x(\lambda)S_y(\lambda))^{1/2}},$$

where  $S_x(\lambda)$  and  $S_y(\lambda)$  are the spectral density functions of time series  $x$  and  $y$  at frequency  $\lambda$  and  $C_{xy}(\lambda)$  is the cospectrum for series  $x$  and  $y$  at frequency  $\lambda$ . Dynamic correlation, like the familiar correlation coefficient, takes values between -1 and +1. Dynamic correlation over the frequency band  $\Lambda_+ = [\lambda_1, \lambda_2]$ ,  $0 \leq \lambda_1 < \lambda_2 \leq \pi$ , is

$$(2) \quad \rho_{xy}(\Lambda_+) = \frac{\int_{\Lambda_+} C_{xy}(\lambda) d\lambda}{(\int_{\Lambda_+} S_x(\lambda) d\lambda \int_{\Lambda_+} S_y(\lambda) d\lambda)^{1/2}}.$$

### Comovement of Tourism and the State Economy

This section examines the correlation between movements in the amount of tourism and the overall Hawaiian economy. Two measures of the volume of tourism are analyzed, the natural log of the annual number of visitors to the State of Hawaii and the natural log of total visitor expenditures for the years 1969 through 2001. A visitor is an “out-of-state traveler who stayed in Hawaii for a period of time between one night but less than one year” (Hawaii Department of Business, Economic Development and Tourism, 2001, p. 98). The Research and Economic Analysis Division of the Hawaiian Department of Business, Economic Development and Tourism compiled the data. Three measures of the Hawaiian economy are utilized: gross state product, total employment, and personal income per capita. In particular,

the data analyzed are the natural log of gross state product for the years 1977-2001 and the natural logs of total full-time and part-time employment and personal income per capita for each of the years 1969 to 2001. The data are taken from the Commerce Department's REIS database. Figure 1 plots the untransformed data. All dollar amounts are deflated by the

[Figure 1 about here]

Honolulu CPI. The series are each pre-whitened to eliminate the serial correlation by using ordinary least squares to remove the constant, a linear time trend, and one or two lagged values of the variable. This is done to ensure that any correlation between the series is not due to some spurious source such as shared trends or shared cycles. Any remaining correlation may be due to the causal influence of one series upon the other. A Bartlett window with a span equal to five, a period roughly the corresponding to frequency of the typical business cycle, is used to produce the spectral density estimates on the resulting residuals.

[Figure 2 about here]

Figure 2 depicts the estimated dynamic correlations at each frequency. The Hawaiian economy comoves most strongly with the volume of tourism at long-run frequencies, cycles longer than five years. At short-run frequencies, there is a negative correlation between tourism and movements in employment and output, suggesting that the Hawaiian economy, particularly employment, reacts slowly to fluctuations in the tourist trade. Indeed, the lower limits of the unreported 95 percent confidence limits for the estimated correlations are below zero at all but long-run frequencies. These confidence limits are derived using the block bootstrapping method advocated by Berkowitz and Killian (1996), with 200 replications and a block size equal to 12 years.

[Table 1 about here]

Except in the very short-run, the Hawaiian economy is more strongly correlated with the total number of visitors than with the amount of spending by these visitors. The estimated dynamic correlations over the entire frequency band between the two measures of the volume of tourism and the Hawaiian economy are presented in Table 1. The correlations with gross state product, employment, and personal income per capita are 0.47, 0.30, and 0.40 for the annual number of visitors. The respective dynamic correlations for visitors expenditures with the state economy are 0.22, 0.22, and 0.29. The fact that the Hawaiian economy is more sensitive to fluctuations in the number of tourists than to fluctuations in visitor spending indicates that efforts devoted to increasing the absolute number of visitors will be more effective in boosting employment and income in Hawaii than simply squeezing more dollars out of each tourist.

In order to provide benchmarks for evaluating the strength of the comovement between tourism and the Hawaiian economy, estimates were made of the dynamic correlations with the overall state economy for Hawaii's two other major industries, the federal government and agriculture. The natural log of total earnings from federal government civilian and military employment in the State of Hawaii and the natural log of farm income for the years 1969 to 2001 are used to proxy these two sectors. The resulting dynamic correlation estimates over the entire frequency band are also reported in Table 1.

These correlations indicate that the Hawaiian economy is most sensitive to fluctuations in the volume of tourism. Both gross state product and total employment comove most strongly with the annual number of visitors. Although federal government employment accounts for 17 percent of total earnings statewide, fluctuations in total earnings from federal government civilian and military employment are not correlated with fluctuations in total employment and

income in Hawaii. Aggregate income is sensitive to fluctuations in agricultural income in the short run, but agricultural shocks have little impact on overall employment in the state.

[Figure 3 about here]

Figure 3 plots the estimated dynamic correlations at each frequency for Hawaii's three major industries, using the annual number of visitors to represent the tourist trade, with gross state product, employment, and per capita personal income. Tourism is not the most significant source of short-run fluctuations in income and employment; that would be agriculture for income and the federal government for employment. But, compared to shocks from the agricultural and federal government sectors, the Hawaiian economy strongly comoves in the medium and long run with the volume of tourism.

[Table 2 about here]

The phase relationship between cycles in the tourist, agriculture, and federal government sectors and cycles in the Hawaiian economy can be used as a means of detecting any time-lagged dependence between the state economy and its three most important sectors. Table 2 reports the estimated lags between cycle peaks averaged across the entire frequency band, with each observation weighted by the dynamic correlation at that frequency. Tourism has its most immediate impact on gross state product, followed in a few months by personal income. Employment is affected after a lag of about one year. Cycles in the agricultural sector correspond most closely with cycles in the state economy, but agriculture tends to lag the state economy as a whole. However, the 95 percent confidence intervals for the agricultural phase estimate ranges from negative to positive values, indicating that little confidence can be placed in the state economy's lead or lag relationship with its agricultural sector.

## Fluctuations in Tourism and the Oahu and Neighbor Island Economies

The majority of the nearly seven million annual visitors to the State of Hawaii come to Oahu and around 70 percent of these Oahu visitors stay exclusively on that island. Indeed, about 44 percent of visitors to the state on an average day in 2002 were based in Waikiki (Hawaii Department of Business, Economic Development and Tourism, 2003). However, over the last 45 years the visitor industry in Hawaii has become more geographically diverse with the Neighbor Islands receiving an increasing share of visitors to the state. Maui attracts over two million visitors annually and the Big Island and Kauai each receive more than one million tourists. This section investigates the sensitivity of the Oahu and Neighbor Island economies to fluctuations in the volume of tourism.

The data examined is the natural log of the number of annual visitors to each of the four Hawaiian counties (Maui County consists of the islands of Maui, Lanai, and Molokai) for the years 1990-2001, along with county-level versions of the agriculture and federal government variables employed in the previous section. Three proxies of the Oahu and Neighbor Island economies are utilized: total earnings by place of work, total employment, and personal income per capita. As before, the variables are pre-whitened to remove the serial dependence. Table 3 presents the estimated dynamic correlations computed using equation (2).

[Table 3 about here]

Oahu accounts for the majority of statewide tourism, income, and employment. So, it is not surprising that its dynamic correlations with tourism are similar to the statewide estimates presented in the previous section. All three measures of the Oahu economy comove most strongly with fluctuations in the volume of tourism. However, the estimated correlations for the Neighbor Islands are a bit inconsistent. While Kauai tends to comove most

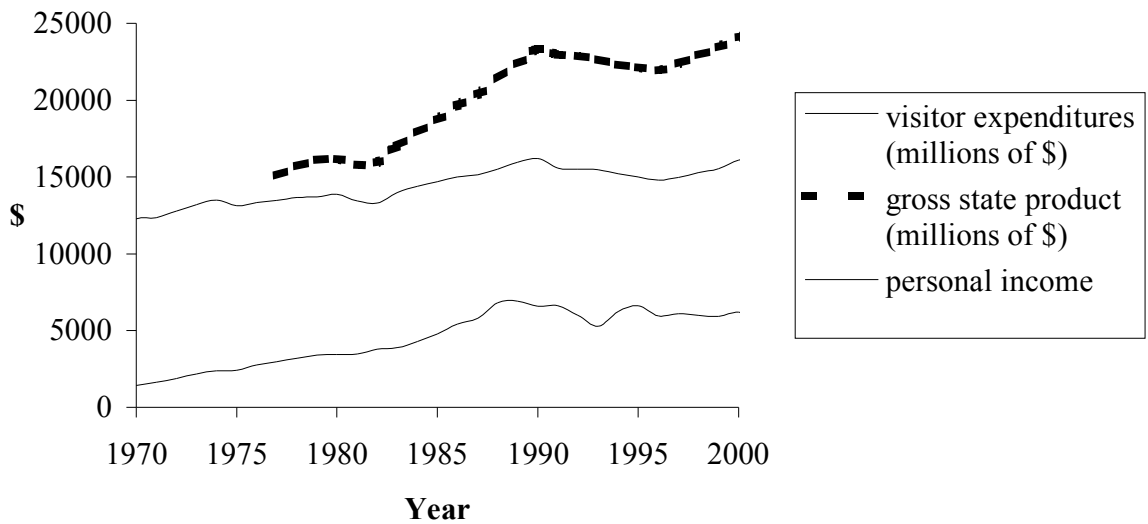
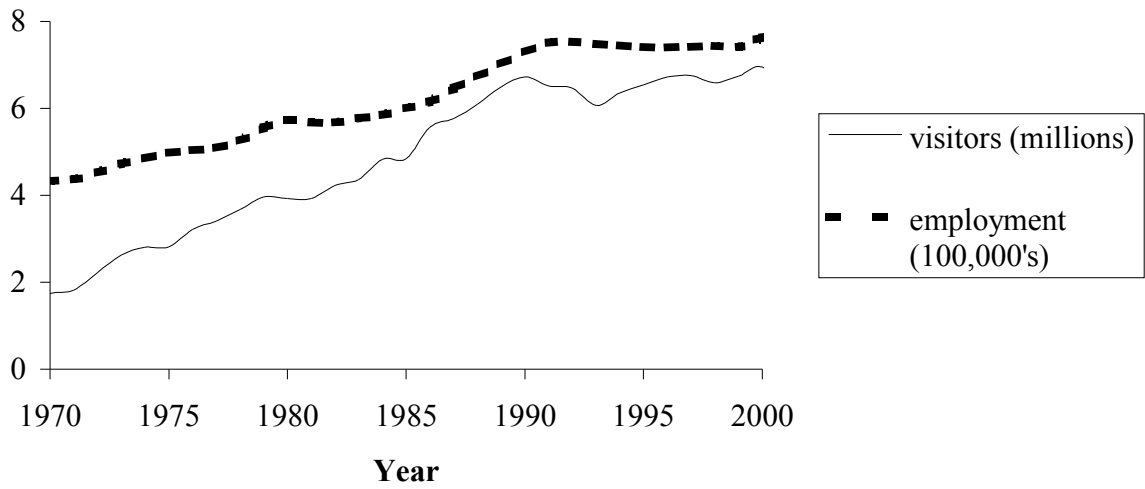
consistently with tourism, both Maui and the Big Island have negative estimates of the correlation over time between tourism and their economies. These negative correlations are driven by highly negative long run correlations. The confidence intervals for these estimates are very wide, indicating that little reliance can be placed in the exact magnitude of the spot estimates provided in Table 3. The Maui economy, especially county employment, is most sensitive to agricultural shocks, even though farm earnings are just two percent of total earnings on the island. On the Big Island, the economy is only reliably correlated with fluctuations in earnings from federal government employment. As with Maui and agriculture, earnings from the federal government sector comprise only two percent of total earnings on the Big Island. Clearly, the strong sensitivity of the Hawaiian economy to fluctuations in the amount of tourism is due to the substantial comovement between tourism and employment and income on the Island of Oahu.

### Conclusions

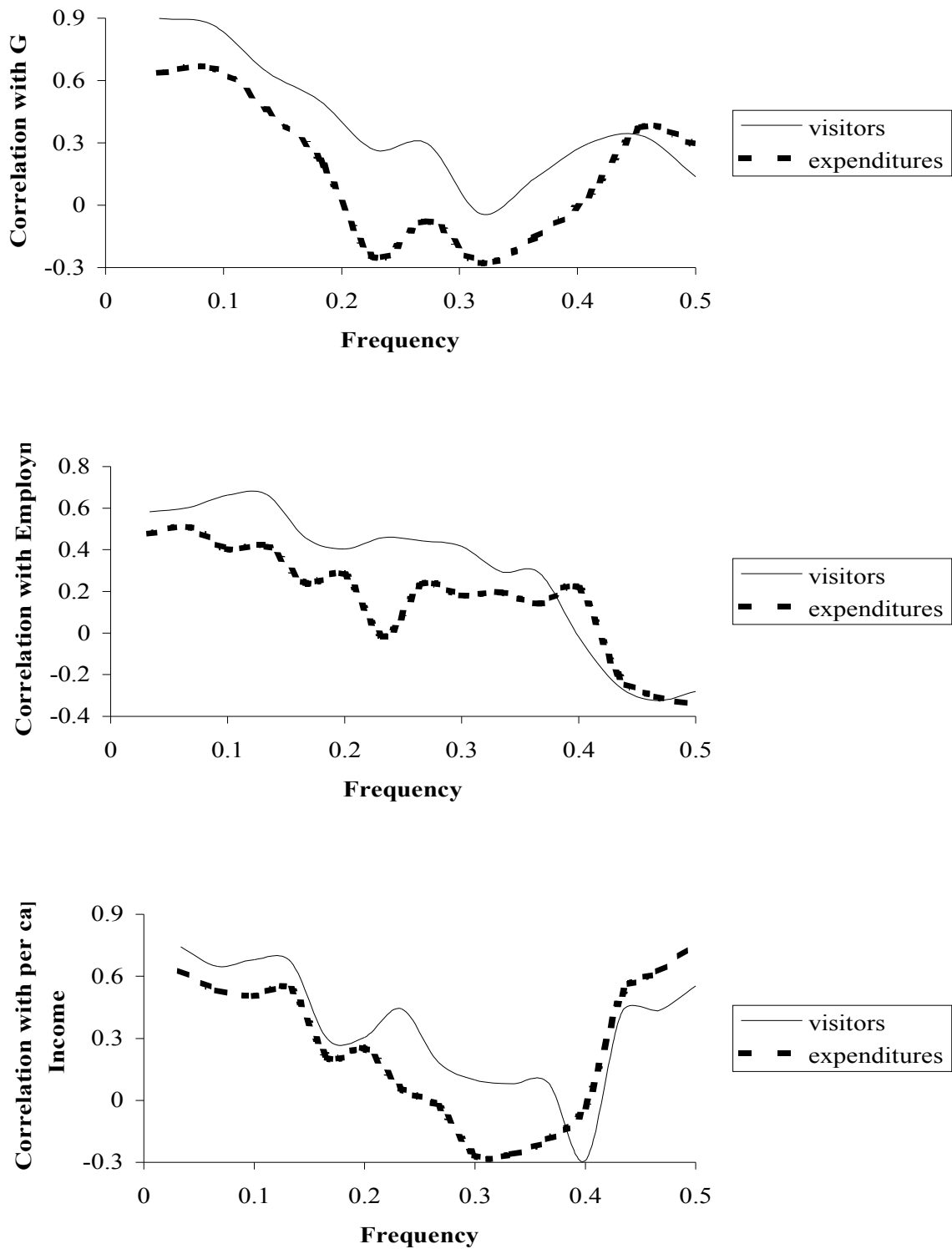
Tourism accounts for as much as a third of all economic activity in the Hawaiian Islands. Compared to the state's other major industries, federal government activities and agriculture, Hawaii shows substantial comovement over time between the volume of tourists and income and employment. Fluctuations in the Hawaiian economy are strongly correlated with fluctuations in the number of tourists. The correlation between tourism and the vitality of the Hawaiian economy is especially strong at long-run frequencies. On an island-by-island economy basis, Oahu, the most heavily populated and touristed island, is, despite a large military presence, strongly sensitive to fluctuations in the number of visitors. The Neighbor Islands exhibit varying degrees of comovement with tourism. The Kauai economy comoves strongly with tourism while the Maui economy is most substantially correlated on average

with agricultural shocks. The Big Island is most sensitive to fluctuations in earnings from federal government employment.

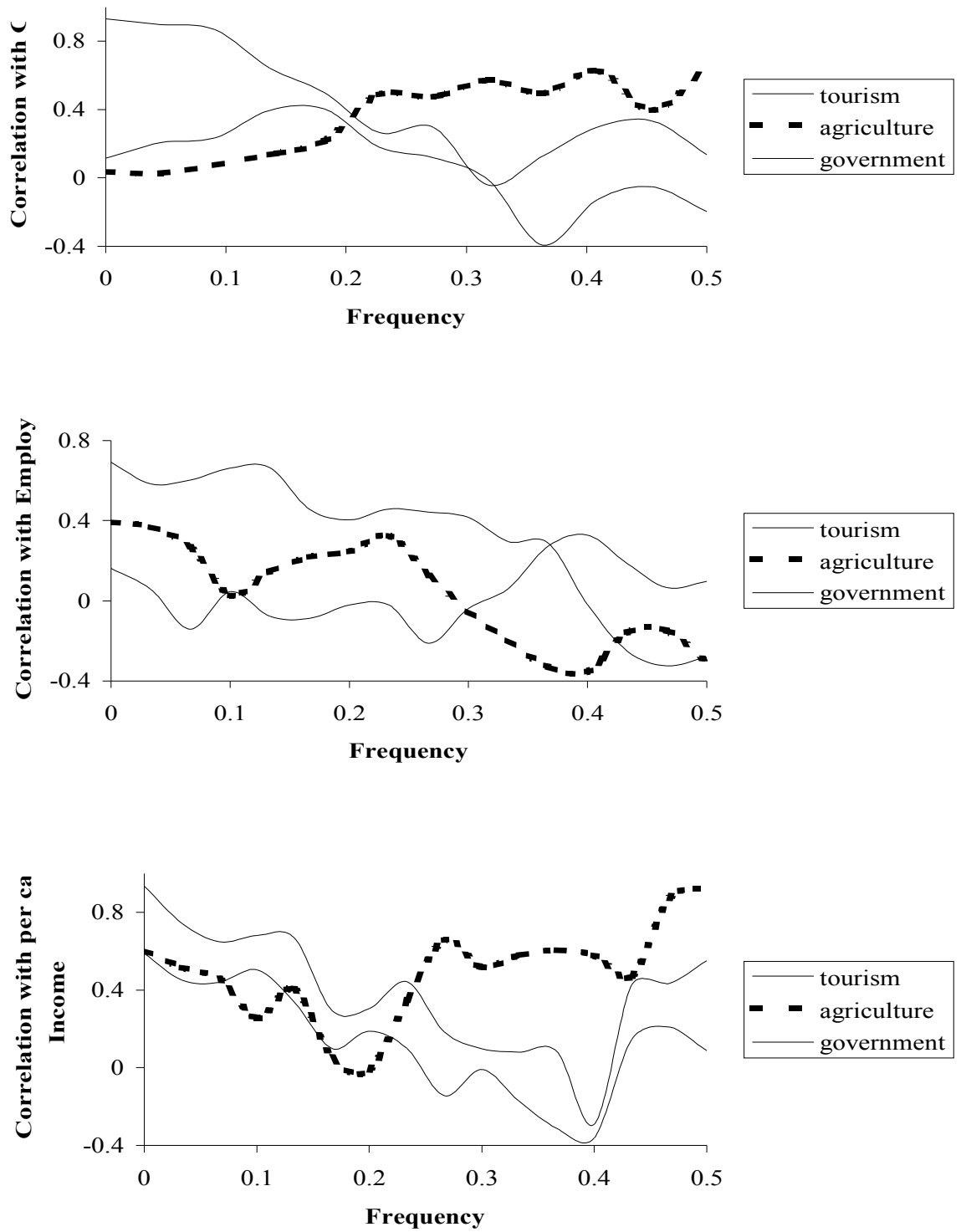
This paper has used a measure of comovement between time series proposed by Crous, Forni, and Reichlin (2001) to investigate the correlation between the Hawaiian economy and fluctuations in the volume of tourism. Such analysis is novel in the tourism research literature. Dynamic correlation can be decomposed by frequency and by frequency band. Hence, dynamic correlation is a valuable technique for the study of the short-run and long-run dynamic properties of time series variables of interest to tourism researchers. As an example, dynamic correlation analysis can be used to address whether tourism earnings instability has consequences for long run economic growth.



**Figure 1. Annual number of visitors expenditures, total employment, annual visitor expenditures, gross state product, and personal income per capita in the State of Hawaii.**



**Figure 2. Dynamic correlations for the State of Hawaii between the annual number of visitors and visitor expenditures with gross state product (top), total employment (center), and per capita personal income (bottom).**



**Figure 3. Dynamic correlations for the State of Hawaii between the annual number of visitors, farm income, and earnings from federal government employment with gross state product (top), total employment (center) and per capita personal income (bottom).**

**Table 1**

**Dynamic Correlations for Gross State Product, Employment, and Personal Income per Capita**

The table reports the estimated dynamic correlations over the entire frequency band between gross state product, employment, and personal income per capita and the annual number of visitors, annual visitor expenditures, total earnings from federal government jobs, and total farm income.

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	<u>Gro</u> <u>ss State Product</u>	<u>Employ</u> <u>ment</u>	<u>Personal Income</u> <u>per Capita</u>
Annual Number of Visitors	0.47	0.30	0.40
Annual Visitor Expenditures	0.22	0.22	0.29
Federal Government	0.08	0.04	0.20
Agriculture	0.33	0.03	0.44

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**Table 2**

**Phase Relationships Between the State Economy and the Tourism, Agricultural, and Federal Government Sectors**

The table reports the estimated time lags between cycle peaks in the Hawaiian economy and cycle peaks in the volume of visitors, agricultural income, and earnings from federal government employment. The reported lags are averaged across the entire frequency band with each observation weighted by the dynamic correlation at that frequency. A positive sign indicates that sector cycle peaks occur before peaks in the state economy.

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	Time Lag (months)		
	<u>Gross State Product</u>	<u>Employment</u>	<u>Personal Income per Capita</u>
Tourism	1	12	6
Agriculture	-2	-1	1
Federal Government	6	10	17

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**Table 3**

**Dynamic Correlations by Island for Total Earnings, Employment,  
and Personal Income per Capita**

The table reports the estimated dynamic correlations over the entire frequency band for total earnings, employment, and personal income per capita with the annual number of visitors, total earnings from federal government jobs, and total farm income for each county.

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Oahu	<u>Total Earnings</u>	<u>Employment</u>	Per Capita Personal <u>Income</u>
Tourism	0.43	0.40	0.47
Federal Government	0.42	0.13	0.36
Agriculture	-0.03	0.07	0.06
Maui			
Tourism	-0.14	-0.05	-0.10
Federal Government	0.62	0.32	0.73
Agriculture	0.61	0.60	0.70
Big Island			
Tourism	-0.29	-0.03	-0.12
Federal Government	0.43	0.02	0.77
Agriculture	0.39	-0.09	0.69
Kauai			
Tourism	0.25	0.52	0.17
Federal Government	-0.01	0.20	-0.04
Agriculture	-0.23	0.40	0.79

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