STATE OF HAWAI'I • DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

Measuring Economic Diversification in Hawai‘i

RESEARCH & ECONOMIC ANALYSIS DIVISION
DBEDT • STATE OF HAWAI'I

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This report was prepared by Mustafa Shirzad, Economist, under the direction of Seth Colby Ph.D., Chief Economist, and Joseph Roos, Ph.D., Economic Research Program Manager. Laura Viso, Economist, provided valuable comments on this report.

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Executive Summary

This report measures changes to Hawai‘i’s economic diversification between 2001 and 2024. The analysis shows that Hawai‘i’s economy has become more diversified in terms of employment across industries, while economic output diversification remained steady during the same period.

The largest employment growth was in the Real Estate, Rental, and Leasing sector (90.7%). This was followed by Transportation and Warehousing sector (68.5%), Finance and Insurance sector (58.4%), Management of Companies and Enterprises sector (58.3%), Construction sector (56.6%), and Health Care and Social Assistance (51.1%). The largest gains in absolute job numbers were in Health Care and Social Assistance (30,426), Real Estate and Rental and Leasing (27,280), Accommodation and Food Services (20,970) and Transportation and Warehousing (19,665). Employment gains and GDP growth in most sectors were higher from 2001 to 2013 than from 2013 to 2024. The losses associated with the COVID-19 pandemic contributed to the lower growth outcomes of the latter period.

The second part of the report uses different indices to estimate the level of economic diversification and changes over time. The Entropy and Herfindahl-Hirschman indices, two measures of economic diversification, show that employment diversification increased while economic diversification remained stable. This implies that Hawai‘i’s workforce has become more evenly distributed across sectors. On the other hand, there is still a heavy reliance on a few high-output industries such as Tourism, Defense, and Real Estate.

The report employs the Hachman Index and Location Quotient (LQ) methodology to provide a comparative assessment of Hawai‘i’s employment and economic output structure across industries relative to a peer-composite group of state economies. The peer states—New Hampshire, Maine, Idaho, Delaware, and West Virginia—were selected based on their similar levels of gross domestic product (GDP) and overall economic scale. This composite serves as a reference framework for assessing how closely Hawai‘i’s employment and economic output composition across industries align with comparable state economies.

The Hachman Index, which estimates how closely a region’s industrial structure is a reference economy, indicates that Hawai‘i’s employment structure is closer to the reference economy than its GDP structure. This highlights differences in productivity levels and value-added contributions across industries.

The Location Quotient (LQ), which compares a region’s employment and real GDP structure with that of the reference economy, shows that Hawai‘i has a relatively higher share of employment in tourism related industries, the Construction industry,

and the Utility industry compared to the reference economy. In contrast, Hawai'i exhibits lower share of employment in tradable and produce-servicing sectors (e.g. Manufacturing, Finance, Professional Services, and Health Care Services). GDP-based LQs tells the same story, Hawai'i has higher real GDP share across tourism related industries, Construction and Utilities and lower share in tradable and produce-servicing sectors compared to the reference economy.

1. Introduction

This report estimates various measures of economic diversification, performance and stability, and examines their patterns over period of 2001 – 2024 for Hawai'i. It is a follow up to two previous ones issued in 2008 and 2020. The analysis compares industries' share of total economic activity (employment and GDP) between Hawai'i and the U.S. and examines changes in economic diversification in Hawai'i for the analysis period of 2001 to 2024.

Well diversified economies are more resilient to cyclical downturns and exogenous shocks. Diversified economies are less vulnerable to fluctuations in any single industry because risks are spread across multiple sectors. When some industries struggle, stronger ones can sustain overall growth. This variety also creates opportunities for employment in expanding sectors, helping to offset job losses in declining ones.

Diversified economies tend to be more resilient, but diversification should not be a goal in itself. Other factors like embracing comparative advantage and geographic endowments are also important determinants of economic prosperity. Higher sectoral diversification supports stability and growth (Kort, 1979; Siegel et al, 1994). Smith and Gibson (1998) show that diversification generally enhances cyclical stability. Additionally, other factors such as industry mix play an important role. The study found that agriculture and non–resource-based manufacturing tended to stabilize employment, whereas resource-based manufacturing increased instability because it is tied to volatile resource markets.

Akpadock (1996) finds that economic diversity does not always guarantee stability, growth, or low unemployment. This is often true in small island economies like Hawai'i, where there are strong incentives to specialize in just a few industries to exploit comparative advantage. Small islands lack the necessary scope and size, making it harder to summon the resources required to compete in multiple industries. Comparing Hawai'i's island economy to solely the continental scale economy of the U.S. may not provide meaningful analysis due to the significant differences in scale, resource availability, and economic structure. For this reason, this report compares Hawai'i's performance to a composite set of peer states with similar GDP and economic size.

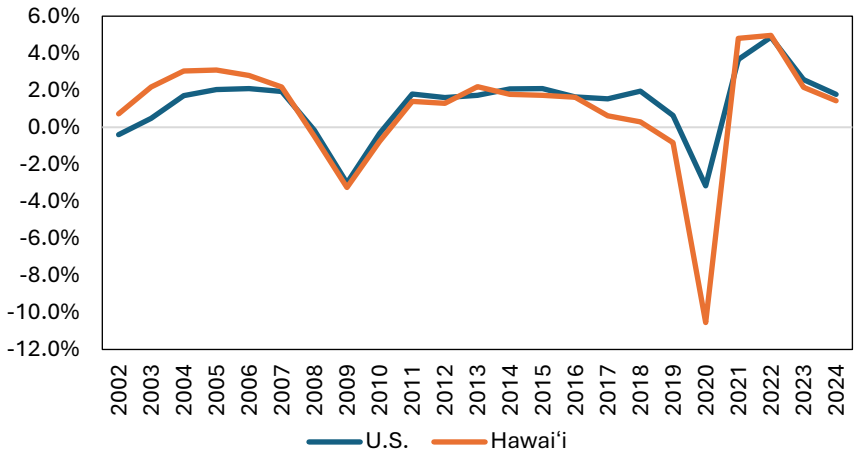
1.1 Recent Economic Trends for Hawai'i and the U.S.

Most research on economic diversification research uses employment or GDP-based indices to measure regional performance and stability. Hawai'i has a unique economic

structure that includes tourism dependence, federal/military presence, market size, cost structure, and a higher-risk exposure to exogenous shocks that arise from being a smaller island economy. It is important to note these characteristics when interpreting the industry diversification measurements. Employment-or-GDP-based diversification indices can overstate diversification when labor-intensive, low–value-added sectors dominate or understate volatility buffered by exogenous, non-market stabilizers such as federal spending. Hawai‘i’s small economy and geographic isolation limit the types of tradable industries it can support and magnify the impact of changes in visitor demand, supply-chain disruptions, natural disasters, and global shocks

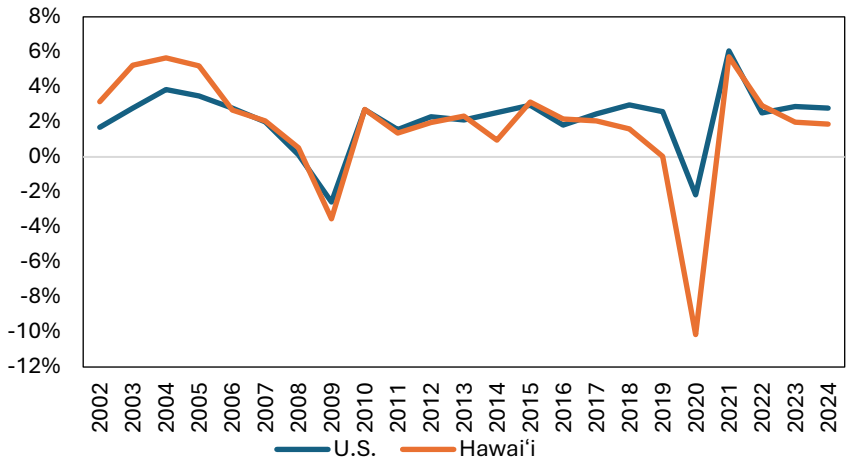
Over the last two decades, Hawai‘i experienced significant fluctuations in total job growth and real GDP growth. Figures 1 and 2 compare Hawai‘i and the U.S. in terms of annual total job growth rate and real GDP growth rate. COVID-19 seriously disrupted employment growth and real GDP, resulting in declines of 10.5% in job growth and 10% in real GDP growth in 2020. However, these trends were followed by recoveries in real GDP growth from 2020 to 2021, and employment from 2021 to 2022. While growth rates for employment and real GDP remained positive afterward, they declined slightly from 2022 to 2024.

Figure 1. Annual Total Job Year-over-Year (YoY) Growth Rate, 2002-2024



Source: Lightcast. READ estimates.

Figure 2. Annual Real GDP YoY Growth Rate, 2002-2024



Source: Bureau of Economic Analysis, Real GDP (chained 2017 dollars). READ estimates.

1.2 Industrial Structure Changes in Hawai'i vs. the U.S

This section compares the industrial structures of Hawai'i and the U.S. using both total jobs data and real GDP data. The analysis utilizes North American Industry Classification (NAICS) data at the two-digit level from 2001 to 2024.

Job growth was higher for the U.S. compared to Hawai'i. Table 1 illustrates changes in industrial structure based on total jobs for 2001, 2013 and 2024 between the U.S. and Hawai'i. From 2001 to 2024, total job growth in Hawai'i was 23.6%, 9.4%, lower than the national total job growth rate at 33.0%.

Table 1. Total Employment by Industry for the U.S. and Hawai‘i, 2001, 2013 and 2024

U.S.	Employment Total			Cumulative Change %			2001 - 2024	% in Total Addition
	2001	2013	2024	2001-2013	2013-2024	2001 - 2024	Change	(2001-2024)
Agriculture, Forestry, Fishing and Hunting	3,901,744	3,629,981	3,646,627	-7.0%	0.5%	-6.5%	-255,117	-0.5%
Mining, Quarrying, and Oil and Gas Extraction	809,014	1,611,209	1,080,404	99.2%	-32.9%	33.5%	271,390	0.5%
Utilities	617,888	577,770	643,862	-6.5%	11.4%	4.2%	25,974	0.0%
Construction	9,810,723	9,230,474	12,414,791	-5.9%	34.5%	26.5%	2,604,068	4.7%
Manufacturing	17,155,220	12,783,703	13,577,218	-25.5%	6.2%	-20.9%	-3,578,002	-6.5%
Wholesale Trade	6,230,425	6,334,601	6,961,225	1.7%	9.9%	11.7%	730,800	1.3%
Retail Trade	18,188,316	18,285,551	19,656,353	0.5%	7.5%	8.1%	1,468,037	2.7%
Transportation and Warehousing	5,531,314	6,126,781	12,410,012	10.8%	102.6%	124.4%	6,878,698	12.5%
Information	4,098,460	3,299,947	3,919,596	-19.5%	18.8%	-4.4%	-178,863	-0.3%
Finance and Insurance	7,961,376	9,902,418	13,907,595	24.4%	40.4%	74.7%	5,946,219	10.8%
Real Estate and Rental and Leasing	5,645,923	8,054,514	12,915,180	42.7%	60.3%	128.8%	7,269,257	13.2%
Professional, Scientific, and Technical Services	10,123,166	12,527,620	16,529,860	23.8%	31.9%	63.3%	6,406,694	11.6%
Management of Companies and Enterprises	1,835,787	2,267,575	3,114,166	23.5%	37.3%	69.6%	1,278,379	2.3%
Administrative and Support and Waste Management and Remediation Services	9,851,208	11,355,016	12,790,843	15.3%	12.6%	29.8%	2,939,635	5.3%
Educational Services	3,129,420	4,529,973	5,307,188	44.8%	17.2%	69.6%	2,177,768	3.9%
Health Care and Social Assistance	15,254,246	20,513,274	25,577,042	34.5%	24.7%	67.7%	10,322,795	18.7%
Arts, Entertainment, and Recreation	3,178,575	4,044,487	4,789,094	27.2%	18.4%	50.7%	1,610,519	2.9%
Accommodation and Food Services	10,795,294	13,088,067	15,487,048	21.2%	18.3%	43.5%	4,691,754	8.5%
Other Services (except Public Administration)	9,763,335	11,152,437	12,351,279	14.2%	10.7%	26.5%	2,587,943	4.7%
Government	23,263,022	24,116,286	25,294,498	3.7%	4.9%	8.7%	2,031,476	3.7%
Total	167,144,455	183,431,685	222,373,879	9.7%	21.2%	33.0%	55,229,424	100.0%
Hawai‘i	2001	2013	2024	2001-2013	2013-2024	2001-2024	2001 - 2024 change	% in Total Addition (2001-2024)
Agriculture, Forestry, Fishing and Hunting	16,085	16,108	15,603	0.1%	-3.1%	-3.0%	-483	-0.3%
Mining, Quarrying, and Oil and Gas Extraction	488	1,027	692	110.7%	-32.6%	42.0%	205	0.1%
Utilities	2,765	4,087	4,075	47.8%	-0.3%	47.4%	1,310	0.7%
Construction	33,083	42,013	51,599	27.0%	22.8%	56.0%	18,516	10.3%
Manufacturing	19,627	18,509	16,415	-5.7%	-11.3%	-16.4%	-3,212	-1.8%
Wholesale Trade	19,906	21,841	22,193	9.7%	1.6%	11.5%	2,287	1.3%
Retail Trade	83,509	87,919	84,544	5.3%	-3.8%	1.2%	1,035	0.6%
Transportation and Warehousing	28,689	30,722	48,344	7.1%	57.4%	68.5%	19,655	10.9%
Information	13,535	10,986	11,125	-18.8%	1.3%	-17.8%	-2,410	-1.3%
Finance and Insurance	23,924	29,495	37,892	23.3%	28.5%	58.4%	13,969	7.8%
Real Estate and Rental and Leasing	30,087	39,301	57,368	30.6%	46.0%	90.7%	27,280	15.2%
Professional, Scientific, and Technical Services	36,740	45,509	51,700	23.9%	13.6%	40.7%	14,960	8.3%
Management of Companies and Enterprises	6,101	8,635	9,660	41.5%	11.9%	58.3%	3,559	2.0%
Administrative and Support and Waste Management and Remediation Services	46,412	61,055	51,945	31.6%	-14.9%	11.9%	5,533	3.1%
Educational Services	16,591	22,966	22,420	38.4%	-2.4%	35.1%	5,829	3.2%
Health Care and Social Assistance	59,489	76,815	89,915	29.1%	17.1%	51.1%	30,426	16.9%
Arts, Entertainment, and Recreation	19,343	22,476	23,267	16.2%	3.5%	20.3%	3,924	2.2%
Accommodation and Food Services	91,344	103,980	112,314	13.8%	8.0%	23.0%	20,970	11.6%
Other Services (except Public Administration)	42,827	48,146	50,999	12.4%	5.9%	19.1%	8,172	4.5%
Government	170,736	185,041	179,221	8.4%	-3.1%	5.0%	8,485	4.7%
Total	761,282	876,633	941,292	15.2%	7.4%	23.6%	180,010	100.0%

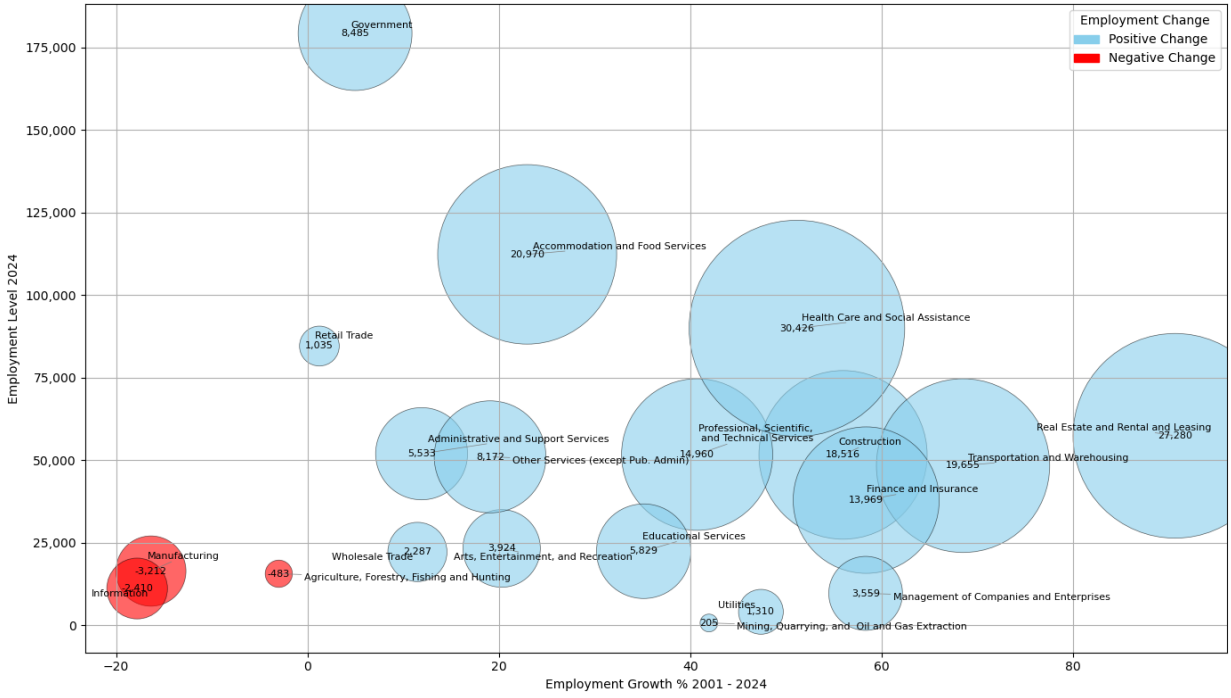
Source: Lightcast. READ estimates.

Most of Hawai‘i’s total job growth occurred from 2001 to 2013, with a 15.2% increase, while total jobs grew at around half that rate at 7.4% from 2013 to 2024. Comparing the periods 2013 to 2024 with 2001 to 2013, only four industries showed higher job growth in the latter period: Transportation and Warehousing, Finance and Insurance, Information and Real Estate, Rentals and Leasing. From 2001 to 2024, about 16.9% (30,426 jobs) of the 180,010 increase was in the Health Care and Social Assistance industry. This was followed by Real Estate and Leasing at 15.2% (27,280 jobs), Accommodation and Food Services at 11.6% (20,970 jobs), Transportation and Warehousing at 10.9% (19,655 jobs) and Construction at 10.3% (18,516 jobs). These five industries accounted for 65% of total additional jobs in Hawai‘i between 2001 and 2024.

For the U.S. average, the top five sectors that added jobs were Health Care and Social Assistance at 18.7%, Real Estate at 13.2%, Transportation and Warehousing at 12.5%, Professional, Scientific, and Technical Services at 11.6% and Finance and Insurance at 10.8%. Together, these five industries accounted for 66.7% of the total additional jobs between 2001 and 2024.

Employment levels and growth varied across industries during 2001–2024, with notable gains in several service sectors and declines in a few others. Figure 3 displays employment levels by growth, with the size of the bubble representing the magnitude of employment change during the period of 2001-2024. The industries with the highest employment level and growth were Health Care and Social Assistance, Real Estate and Rental Leasing, and Transportation and Warehousing, Government, and Accommodation and Food Services industries. Three industries experienced a significant loss in their employment levels and growth during this period: Information industry employment decreased by 2,410 (-17.8%), Manufacturing employment decreased by 3,211(-16.4%), and Agriculture, Forestry, Fishing and Hunting industry decreased by 482 (-3.0%).

Figure 3. Hawai‘i Employment Growth 2001-2024 vs. Employment Level 2024 by Industry

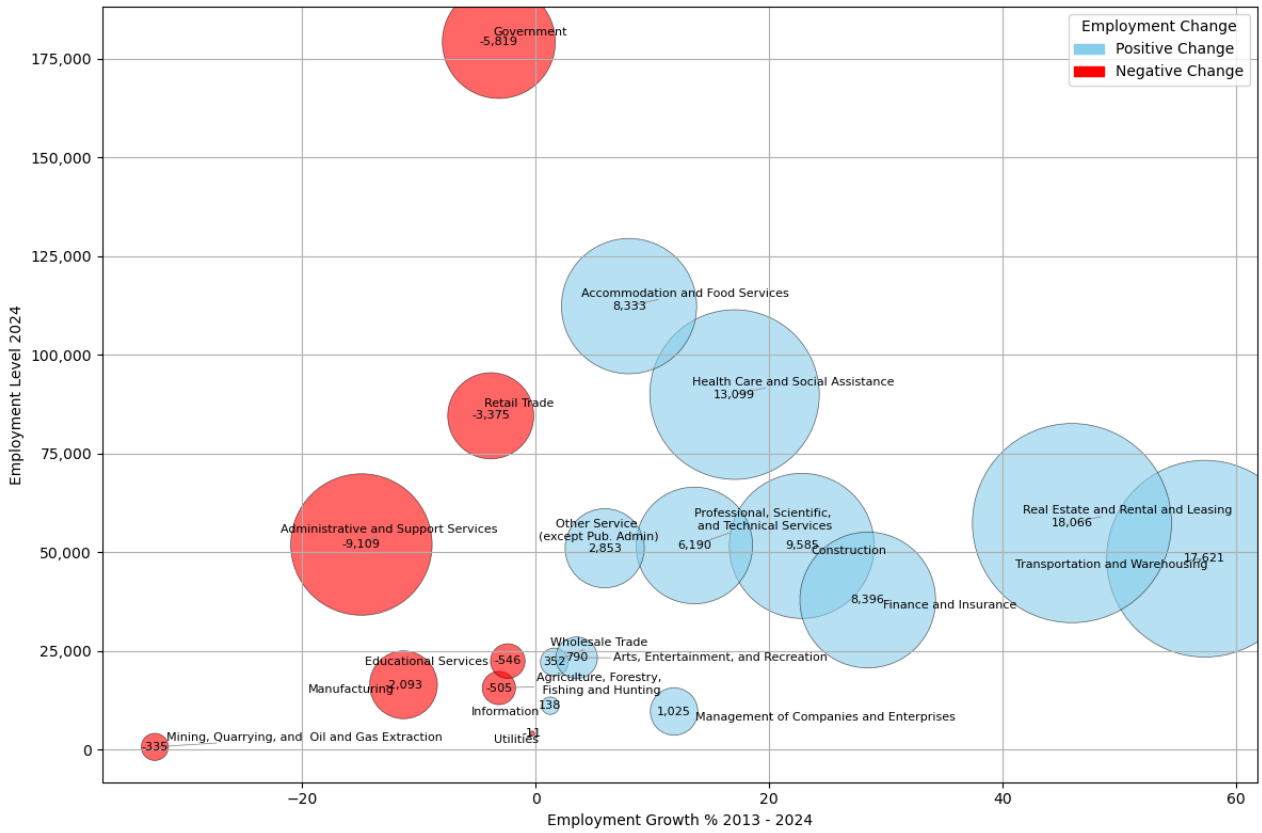


Source: Lightcast. READ Estimates.

During the 2013-2024 period, as shown in Figure 4, the Real Estate and Leasing and Transportation and Warehousing industries had the most employment growth and positive change. The Government industry remained the industry with the highest

employment level, however, it experienced decreased employment growth of 5,819 employees. The next top industries in terms of employment and growth were Accommodation and Food Services (increased 8.0%) and Health Care and social assistance (increased 17.1%). During this period, industries that experienced the lowest employment level and growth were Mining, Quarrying, and Oil and Gas Extraction (decreased 32.6%), Manufacturing (decreased 11.3%), Administrative, Support, Waste Management, and Remediation Services (decreased 14.9%), Education Services (decreased 2.4%), Retail Trade (decreased 3.8%), Agriculture, Forestry, Fishing and Hunting (decreased 3.1%) and Utilities (decreased 0.3%).

Figure 4. Hawai‘i Employment Growth 2013-2024 vs. Employment Level 2024 by Industry



Source: Lightcast. READ Estimates.

From 2001 to 2024, real GDP in Hawai‘i increased by 60.7%, 13.9% lower than the national rate of 74.6%. Table 2 compares changes to industrial structure between the U.S. and Hawai‘i based on real GDP from 2001, 2013 and 2024. From 2001 to 2024, the Real Estate and Rental and Leasing industry accounted for about 19.8% of the $34,509 million additional real GDP generated in Hawai‘i. In contrast, the Real Estate and Rental and Leasing industry accounted for about 15.5% of additional real GDP for the overall U.S. The Government sector accounted for 15.0% in Hawai‘i and 6.5% for the nation; the Health

Care and Social Assistance sector accounted for 11.7% in Hawai‘i and 10.1% for the nation; the Retail trade sector accounted for 8.5% in Hawai‘i and 3.3% for the nation.

Table 2. Real GDP by Industry for the U.S. and Hawai‘i, 2001, 2013 and 2024

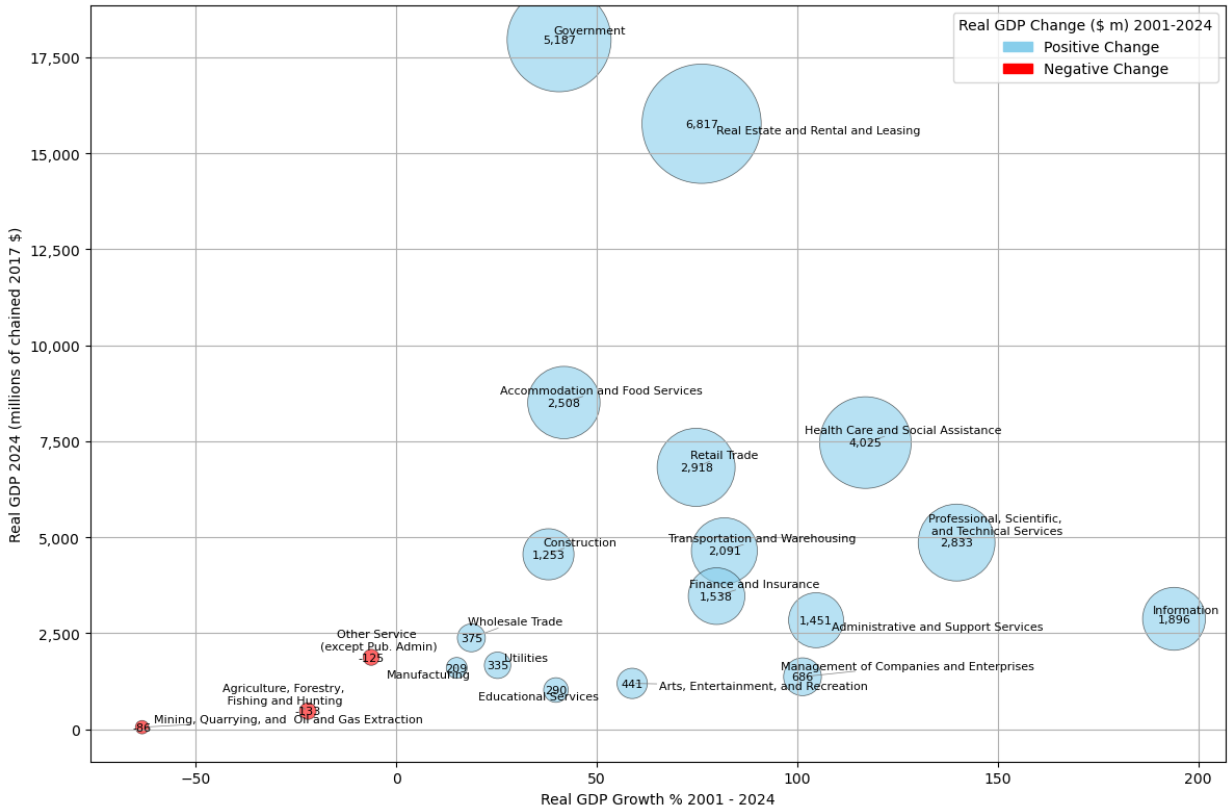
U.S.	Real GDP (2017 Chained $)			Cumulative Change %			2001-2024 Change	% in Total Addition (2011-2024)
	2001	2013	2024	2001-2013	2013-2024	2001-2024		
Agriculture, forestry, fishing and hunting	156,155	163,692	203,544	4.8%	24.3%	30.3%	47,389	0.5%
Mining, quarrying, and oil and gas extraction	273,325	250,264	343,567	-8.4%	37.3%	25.7%	70,242	0.7%
Utilities	215,356	296,317	350,770	37.6%	18.4%	62.9%	135,414	1.3%
Construction	767,199	703,853	873,793	-8.3%	24.1%	13.9%	106,594	1.1%
Manufacturing	1,607,455	2,046,756	2,406,837	27.3%	17.6%	49.7%	799,382	7.9%
Wholesale trade	824,442	1,103,443	1,182,400	33.8%	7.2%	43.4%	357,958	3.5%
Retail trade	850,113	989,552	1,474,390	16.4%	49.0%	73.4%	624,277	6.2%
Transportation and warehousing	396,304	559,579	730,513	41.2%	30.5%	84.3%	334,209	3.3%
Information	447,000	790,193	1,695,991	76.8%	114.6%	279.4%	1,248,991	12.3%
Finance and insurance	973,849	1,430,005	1,620,216	46.8%	13.3%	66.4%	646,367	6.4%
Real estate and rental and leasing	1,613,086	2,478,788	3,179,038	53.7%	28.2%	97.1%	1,565,952	15.5%
Professional, scientific, and technical services	871,479	1,270,673	2,226,382	45.8%	75.2%	155.5%	1,354,903	13.4%
Management of companies and enterprises	288,642	320,771	548,494	11.1%	71.0%	90.0%	259,852	2.6%
Administrative and support and waste management and remediation services	342,567	545,722	745,557	59.3%	36.6%	117.6%	402,990	4.0%
Educational services	156,590	244,224	269,910	56.0%	10.5%	72.4%	113,320	1.1%
Health care and social assistance	855,535	1,307,236	1,873,284	52.8%	43.3%	119.0%	1,017,749	10.1%
Arts, entertainment, and recreation	129,981	200,616	259,016	54.3%	29.1%	99.3%	129,035	1.3%
Accommodation and food services	413,811	549,873	645,295	32.9%	17.4%	55.9%	231,484	2.3%
Other services (except government and government enterprises)	388,803	403,072	407,259	3.7%	1.0%	4.7%	18,456	0.2%
Government and government enterprises	1,997,765	2,403,520	2,653,128	20.3%	10.4%	32.8%	655,363	6.5%
Total	13,569,457	18,058,149	23,689,384	33.1%	31.2%	74.6%	10,119,927	100.0%
Hawai‘i	2001	2013	2024	2001-2013	2013-2024	2001-2024	2001-2024 Change	% in Total Addition (2011-2024)
Agriculture, forestry, fishing and hunting	603	435	470	-27.9%	8.1%	-22.0%	-133	-0.4%
Mining, quarrying, and oil and gas extraction	136	62	50	-54.2%	-20.0%	-63.4%	-86	-0.3%
Utilities	1,328	2,076	1,663	56.4%	-19.9%	25.3%	335	1.0%
Construction	3,301	4,322	4,554	30.9%	5.4%	38.0%	1,253	3.6%
Manufacturing	1,386	1,393	1,595	0.5%	14.5%	15.1%	209	0.6%
Wholesale trade	2,002	2,581	2,377	28.9%	-7.9%	18.7%	375	1.1%
Retail trade	3,902	5,462	6,820	40.0%	24.9%	74.8%	2,918	8.5%
Transportation and warehousing	2,555	4,103	4,646	60.6%	13.2%	81.8%	2,091	6.1%
Information	978	1,541	2,874	57.6%	86.5%	194.0%	1,896	5.5%
Finance and insurance	1,926	2,814	3,464	46.1%	23.1%	79.9%	1,538	4.5%
Real estate and rental and leasing	8,953	14,735	15,770	64.6%	7.0%	76.1%	6,817	19.8%
Professional, scientific, and technical services	2,027	3,376	4,860	66.5%	44.0%	139.7%	2,833	8.2%
Management of companies and enterprises	677	1,000	1,364	47.6%	36.4%	101.3%	686	2.0%
Administrative and support and waste management and remediation services	1,386	2,863	2,836	106.6%	-0.9%	104.7%	1,451	4.2%
Educational services	728	1,013	1,018	39.0%	0.6%	39.8%	290	0.8%
Health care and social assistance	3,440	5,229	7,464	52.0%	42.8%	117.0%	4,025	11.7%
Arts, entertainment, and recreation	750	973	1,191	29.8%	22.4%	58.8%	441	1.3%
Accommodation and food services	5,999	7,520	8,507	25.4%	13.1%	41.8%	2,508	7.3%
Other services (except government and government enterprises)	1,995	1,923	1,870	-3.6%	-2.7%	-6.3%	-125	-0.4%
Government and government enterprises	12,772	17,467	17,959	36.8%	2.8%	40.6%	5,187	15.0%
Total	56,842	80,884	91,351	42.3%	12.9%	60.7%	34,509	100.0%

Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimates.

Industries leading Hawai‘i’s real GDP level and growth from 2001–2024 were Real Estate and Rental and Leasing, Government, Health Care and Social Assistance, and Professional, Scientific, and Technical Services, while Mining, Agriculture, and Other Services declined. As shown in Figure 5, real GDP levels are displayed by growth, with the

size of the bubble representing the magnitude of real GDP change during the period of 2001-2024. Industries that led in real GDP level and growth were Real Estate and Rental and Leasing (increased 76.1%), Government (increased 40.6%), Health Care and Social Assistance (increased 117%), Accommodation and Food Services (increased 41.8%) and Professional, Scientific, and Technical Services (increased 139.7%). Conversely, industries such as Mining, Quarrying, and Oil and Gas Extraction (decreased 63%), Agriculture, Forestry, Fishing and Hunting (decreased 22%), and Other Services (except Public Administration) (decreased 6.3%) experienced the lowest growth and levels during the same period.

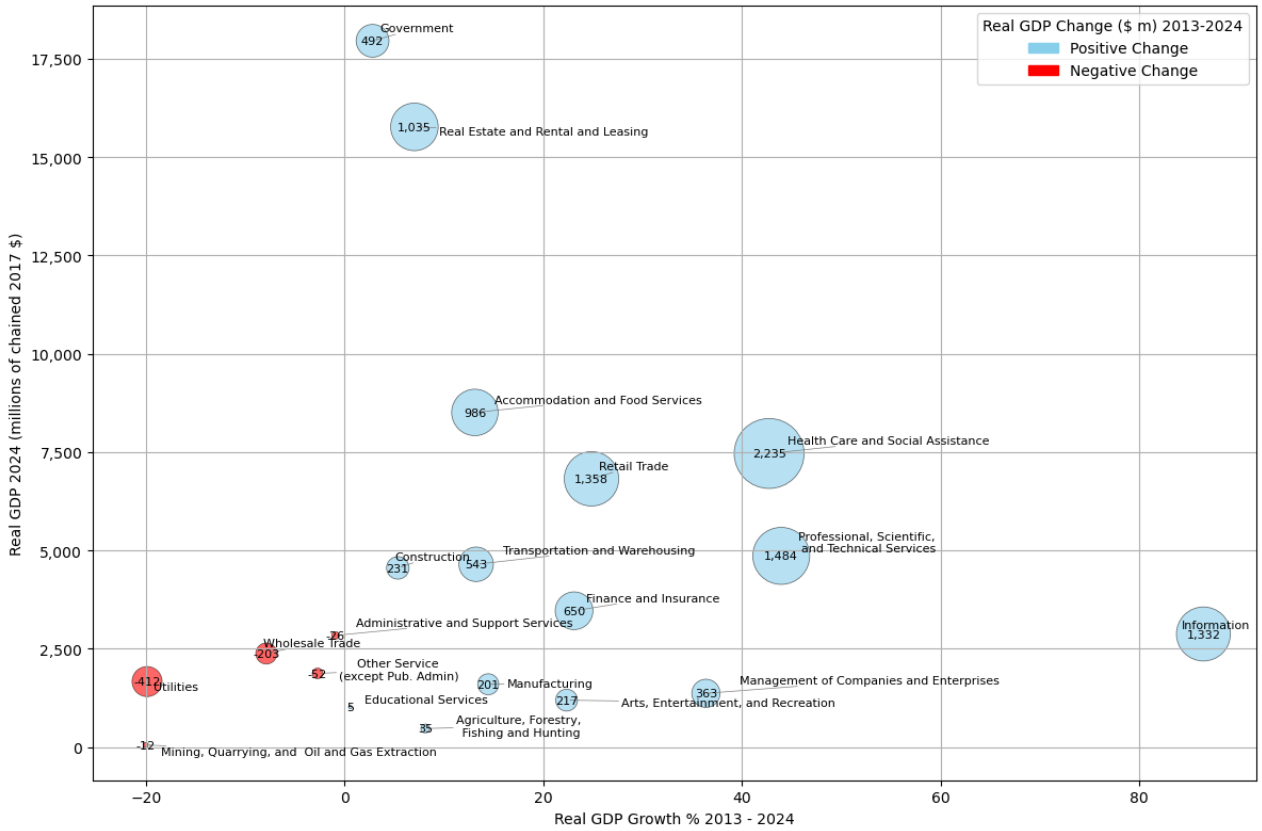
Figure 5. Hawai'i Real GDP Growth 2001-2024 vs. Real GDP Level 2024 by Industry



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimates.

For the period 2013-2024, as shown in Figure 6, industries demonstrating both high growth rates and high employment include Professional, Scientific, and Technical Services (increased 44%), Accommodation and Food Services (increased 13%) and Health Care and Social Assistance (increased 42.8%). In contrast, industries that experienced low negative growth and low employment include Utilities (decreased 19.9%), Mining, Quarrying, and Oil and Gas Extraction (decreased 20.0%), and Wholesale Trade (decreased 7.9%) during the same period.

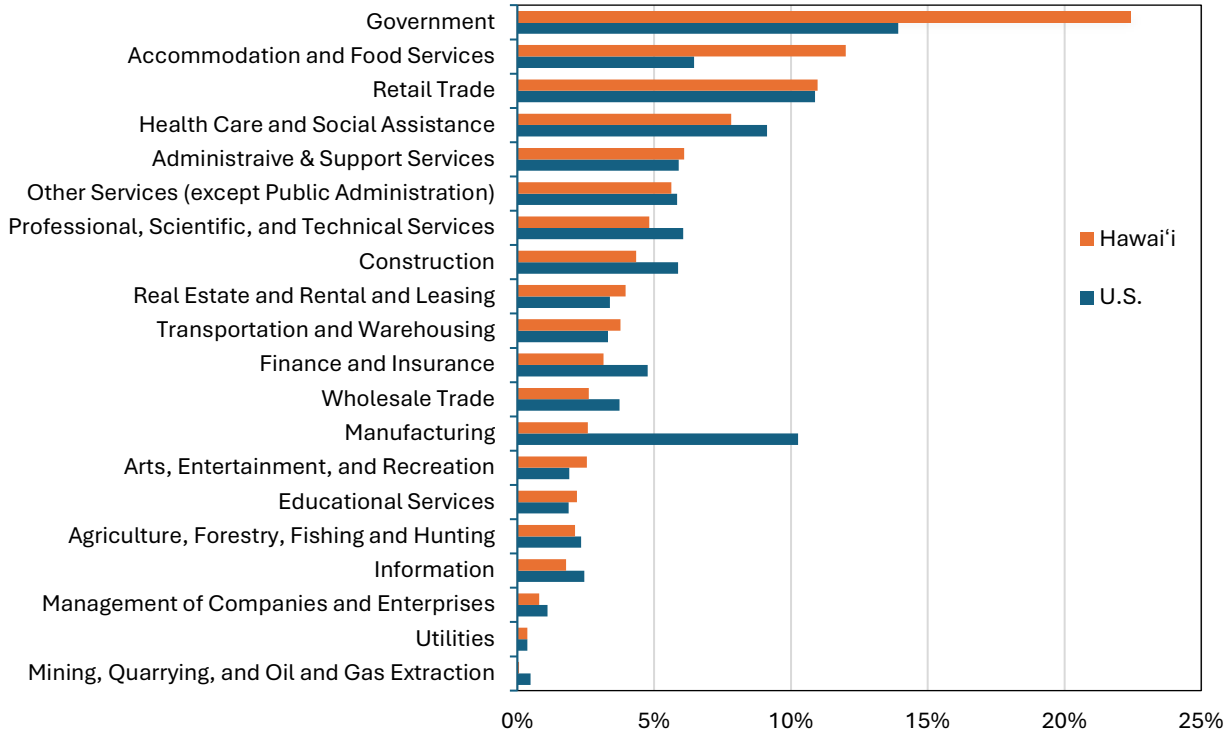
Figure 6. Hawai‘i Real GDP Growth 2013-2024 vs. Real GDP Level 2024 by Industry



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimates.

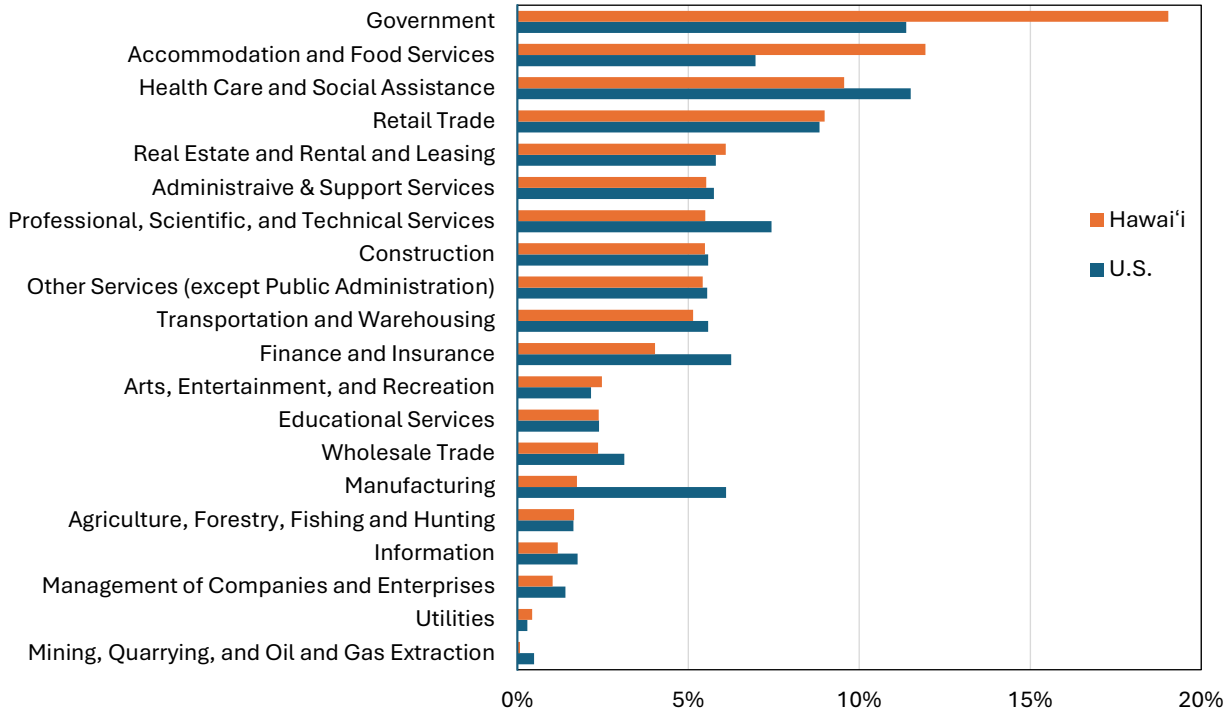
A comparison of sectoral employment distributions between Hawai‘i and U.S. provides further insights into differences in the industrial structure between the two economies. In terms of shares of total jobs, the Government sector was the largest sector in Hawai‘i and one of the largest in the U.S. in 2001 and 2024 (Figures 7 & 8). Tourism-related industries, especially Accommodation and Food Services and Retail Trade, had larger shares in total employment in Hawai‘i than in the U.S. The employment share for the remaining industries was similar or smaller than those in the U.S.

Figure 7. Employment Shares by Industry for the U.S. and Hawai‘i, 2001



Source: Lightcast. READ Estimates.

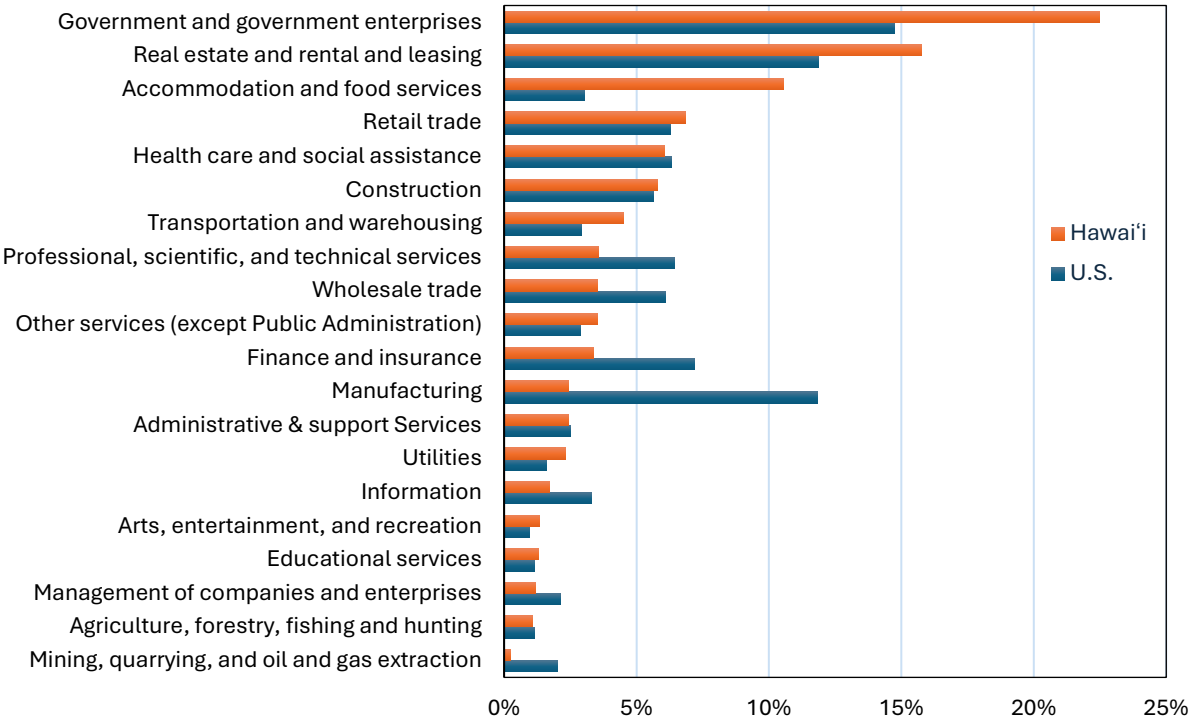
Figure 8. Employment Shares by Industry for the U.S. and Hawai‘i, 2024



Source: Lightcast. READ Estimates.

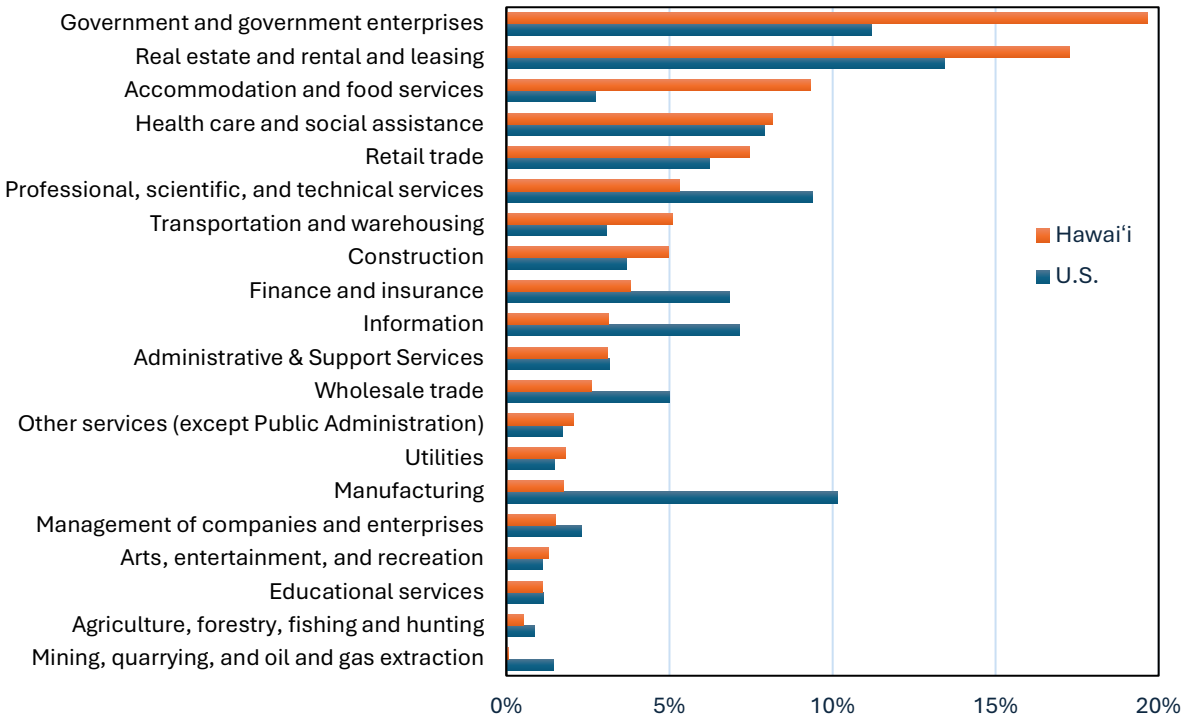
The shares of Government, Real Estate, Rental and Leasing, Construction, Retail Trade and Accommodation and Food Services in real GDP were much higher in Hawai'i compared to those sectors' shares nationally. The industrial distributions of 2001 and 2024 real GDP in the U.S. and Hawai'i are shown in Figure 9 and 10. Notably, the share of real estate in real GDP was about 4 times higher than that sector's share in total employment in 2001 and 3 times higher in 2024. One of the reasons for this is the inclusion of imputed rent of owner-occupied dwellings in total GDP, even if it makes no contribution to total employment. On the other hand, GDP shares of Accommodation and Food Service, Health Care, and Retail Trade were considerably smaller than their respective employment share. This could perhaps be due to higher proportions of part-time jobs and generally lower wages in these sectors. The real GDP shares in the rest of the sectors in Hawai'i were similar or smaller than the U.S.

Figure 9. Real GDP Shares by Industry for the U.S. and Hawai'i, 2001



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimates.

Figure 10. Real GDP Shares by Industry for the U.S. and Hawai‘i, 2024



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimate.

2. Measure of Economic Diversity in Hawai‘i

This report uses multiple indices to estimate the level of economic diversification in Hawai‘i. The Entropy Index and Herfindahl Index provide measures of industrial concentration and diversification, grounded in Industrial Organization Theory and highly relevant for an economy reliant on a few dominant industries such as tourism and defense. The Hachman Index and Location Quotients, central to Economic Base Theory, evaluate how closely Hawai‘i’s economic structure resembles that of the reference economy and identify sectors in which Hawai‘i holds disproportionately large shares of employment and economic output. A detailed description of these methods is provided in the appendix.

2.1 Entropy Index and Herfindahl Indices

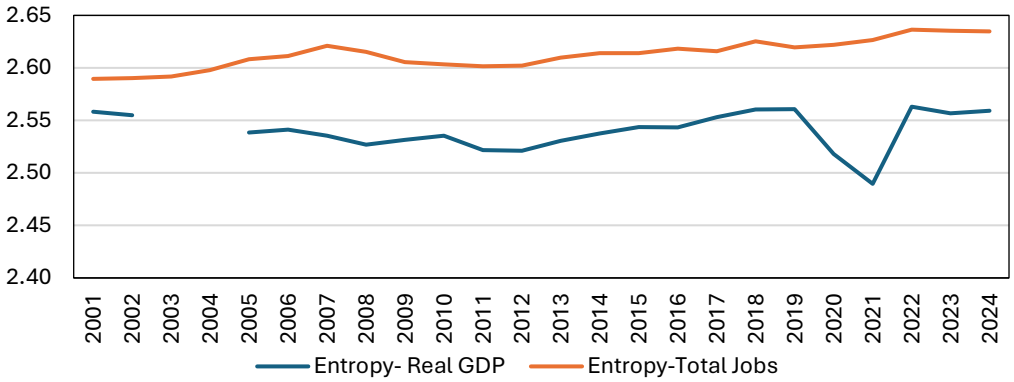
This section presents the trends of the Entropy and Herfindahl (also known as Herfindahl Hirschman Index HHI) indices for Hawai‘i, focusing on both total jobs and real GDP at the industry and state levels. Total jobs statistics (QCEW, non-QCEW, self-Employed, & extended proprietors) were sourced from Lightcast. Real GDP statistics, categorized by two-digit North American Industry Classification System (NAICS) industries, were obtained from the Bureau of Economic Analysis (BEA). These indices of economic diversity for Hawai‘i were computed for the period of 2001 to 2024. In this report, the unclassified category of industry was excluded from analysis.

As explained in methodology (see Appendix B), the Entropy index and Herfindahl-Hirschman Index (HHI) calculations do not involve a reference economy. A higher Entropy index indicates that the shares of all sectors in total employment or real GDP are more equal, reflecting greater diversification. Conversely, a higher HHI signifies less diversification among sectors.

Entropy Index

Job diversification increased by 1.7% according to the Entropy index (Figure 11), while the Entropy index of real GDP showed no change over the period of 2001-2024. The index for total jobs was stable during the Covid-19 period, but the index of real GDP declined sharply during the same period (2019-2021). This decline indicates less diversification during that time and reflects a disproportionate shock to value-added in tourism and hospitality related industries.

Figure 11. Entropy Index of total Jobs and Real GDP for Hawai‘i, 2001-2024



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars) & Lightcast. READ estimates. Data unavailable for real GDP 2003-2004.

The pattern suggests that the contraction of tourism related industries did not broaden the base of economic activity. Losing tourism related sector (export-oriented) without simultaneous growth in alternative industries tends to reduce diversification. We also examine how employment concentration (share) changed within major industries between 2001 and 2024 (see table 3). An increase in Entropy index across industries means the industry became more balanced across its sub-sectors. The Entropy index of Real Estate, Rental, Leasing, Transportation and Warehousing, Health Care and Social Assistance, Construction and Finance and Insurance increased from 2001-2024, reflecting increased diversification within these industries. While Retail trade, Manufacturing, Government, and Information experienced the largest decline in this index, reflecting decrease in diversification within these industries.

Table 3. Industry Contribution to Employment Entropy Index for Hawai'i, 2001 and 2024

Industry	Employment Share %		Entopy Index		
	2001	2024	2001	2024	Change 2001-2024
Real Estate and Rental and Leasing	4.0%	6.1%	0.128	0.171	0.043
Transportation and Warehousing	3.8%	5.1%	0.124	0.152	0.029
Health Care and Social Assistance	7.8%	9.6%	0.199	0.224	0.025
Construction	4.3%	5.5%	0.136	0.159	0.023
Finance and Insurance	3.1%	4.0%	0.109	0.129	0.021
Professional, Scientific, and Technical Services	4.8%	5.5%	0.146	0.159	0.013
Management of Companies and Enterprises	0.8%	1.0%	0.039	0.047	0.008
Educational Services	2.2%	2.4%	0.083	0.089	0.006
Utilities	0.4%	0.4%	0.020	0.024	0.003
Mining, Quarrying, and Oil and Gas Extraction	0.1%	0.1%	0.005	0.005	0.001
Accommodation and Food Services	12.0%	11.9%	0.254	0.254	-0.001
Arts, Entertainment, and Recreation	2.5%	2.5%	0.093	0.091	-0.002
Other Services (except Public Administration)	5.6%	5.4%	0.162	0.158	-0.004
Wholesale Trade	2.6%	2.4%	0.095	0.088	-0.007
Administrative and Support and Waste Management and Remediation Services	6.1%	5.5%	0.171	0.160	-0.011
Agriculture, Forestry, Fishing and Hunting	2.1%	1.7%	0.081	0.068	-0.014
Information	1.8%	1.2%	0.072	0.052	-0.019
Government	22.4%	19.0%	0.335	0.316	-0.019
Manufacturing	2.6%	1.7%	0.094	0.071	-0.024
Retail Trade	11.0%	9.0%	0.242	0.216	-0.026
Total	**100**	**100**	**2.590**	**2.635**	**0.045**

Source: Lightcast. READ Estimates.

In 2001, Hawai'i's real GDP Entropy index was 2.558, and this index value returned to about the same value in 2024 at 2.559, indicating no change in overall diversification during the period. Even though the total real GDP Entropy index didn't change much across the periods, there were changes to the composition of industry diversification across sub-sectors. The Information, Professional, Scientific, and Technical Services, and Health Care and Social Assistance industries experienced an increase in their Entropy index, reflecting increased diversification across their sub-sectors. Meanwhile, Other Services (except Government and Government Enterprises), Wholesale Trade, Manufacturing, and Agriculture, Forestry, Fishing and Hunting experienced the largest declines in this index, reflecting more specialization within these industries' sub-sectors.

Table 4.Industry Contribution to Real GDP Entropy Index for Hawai'i, 2001 and 2024

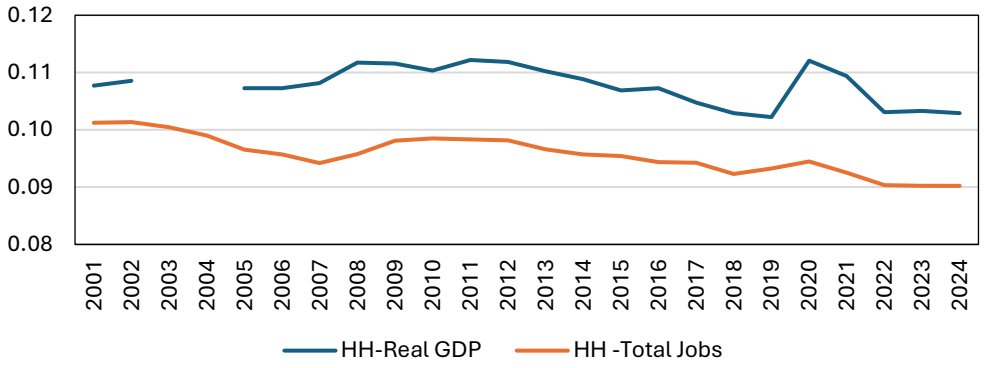
Industry	Real GDP Share %		Entropy Index		
	2001	2024	2001	2024	change 2001-2024
Information	1.7%	3.1%	0.070	0.109	0.039
Professional, scientific, and technical services	3.6%	5.3%	0.119	0.156	0.037
Health care and social assistance	6.1%	8.2%	0.170	0.205	0.035
Administrative and support and waste management and remediation services	2.4%	3.1%	0.091	0.108	0.017
Real estate and rental and leasing	15.8%	17.3%	0.291	0.303	0.012
Transportation and warehousing	4.5%	5.1%	0.139	0.151	0.012
Management of companies and enterprises	1.2%	1.5%	0.053	0.063	0.010
Retail trade	6.9%	7.5%	0.184	0.194	0.010
Finance and insurance	3.4%	3.8%	0.115	0.124	0.009
Arts, entertainment, and recreation	1.3%	1.3%	0.057	0.057	-0.001
Educational services	1.3%	1.1%	0.056	0.050	-0.006
Mining, quarrying, and oil and gas extraction	0.2%	0.1%	0.014	0.004	-0.010
Utilities	2.3%	1.8%	0.088	0.073	-0.015
Government and government enterprises	22.5%	19.7%	0.335	0.320	-0.016
Construction	5.8%	5.0%	0.165	0.149	-0.016
Accommodation and food services	10.6%	9.3%	0.237	0.221	-0.016
Manufacturing	2.4%	1.7%	0.091	0.071	-0.020
Agriculture, forestry, fishing and hunting	1.1%	0.5%	0.048	0.027	-0.021
Wholesale trade	3.5%	2.6%	0.118	0.095	-0.023
Other services (except Public Administration)	3.5%	2.0%	0.118	0.080	-0.038
Total	**100**	**100**	**2.558**	**2.559**	**0.001**

Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimates.

Herfindahl-Hirschman Index (HHI)

An alternative measure of diversification is the Herfindahl-Hirschman index (HHI), which ranges from 0 (a very large number of equally sized firms) representing a highly diversified economy to 1 (a single firm with 100% market share) highly specialized economy where market shares are expressed as fractions. Hawai'i's total jobs HHI reflects employment became more diversified from 2001-2024, improving in diversification by 10.8%, as shown in Figure 12. This pattern aligns with the pattern based on the Entropy index for total jobs. Hawai'i's real GDP HHI has not changed over the same period. The real GDP HHI pattern is closely similar to the entropy trend for real GDP, with increased specialization during the COVID-19 period (2019-2021) and no significant change during the full period (2001 to 2024).

Figure 12. Herfindahl-Hirschman Index for Total Jobs and Real GDP for Hawai‘i, 2001-2024



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars) & Lightcast. READ estimates.
Data unavailable for real GDP 2003-2004.

2.2 Peer-State Analysis (Hachman Index and Location Quotient)

In this section, we estimate Hawai‘i’s Hachman similarity index and Location Quotient (LQ) using a peer-state composite—the average of five states with comparable gross domestic product (GDP): Idaho, New Hampshire, Maine, West Virginia, and Delaware—as the reference economy. Henceforth, we refer to this peer-state composite as the reference economy. For each year and 2-digit NAICS industry, the employment (QCEW) and real-GDP shares were found for both Hawai‘i and the reference economy. Then (i) the Hachman index to assess how closely Hawai‘i’s overall industry mix matches the reference economy benchmark was computed and (ii) utilized the location quotients (LQ) to identify industries where Hawai‘i’s share was above or below the reference economy. This approach provides both an economy-wide similarity measure and industry-level diagnostics relative to a size-appropriate reference.

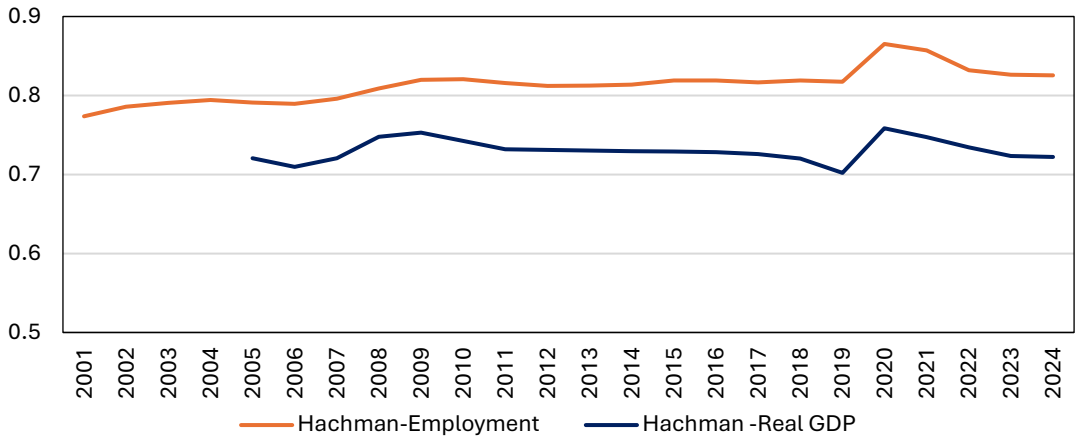
Hachman Index Peer-State Analysis

The Hachman index measures how similar a region’s industry mix is to a chosen reference economy. Values near 1 indicate a structure very similar to the reference; values near 0 indicate a very different structure. While useful as an economy-wide summary, the Hachman index does not capture industry-specific detail or dynamics over time.

Hawai‘i’s Hachman Similarity Index for employment consistently exceeds that of real GDP, indicating that the state’s job mix is more similar to the reference economy than its value-added mix during the period of 2001 to 2024. Put simply, Hawai‘i resembles the reference economy in how workers are distributed across industries, and less so in how output is generated. Both the employment and real-GDP Hachman series rise around 2020

(COVID-19), suggesting that Hawai‘i’s sectoral structure temporarily aligned more closely with the reference economy during the pandemic.

Figure 13. Hachman Index of Employment and Real GDP for Hawai‘i, 2001-2024



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars) & Bureau of Labor Statistics, QCEW. READ estimates. Data unavailable for real GDP 2001-2004.

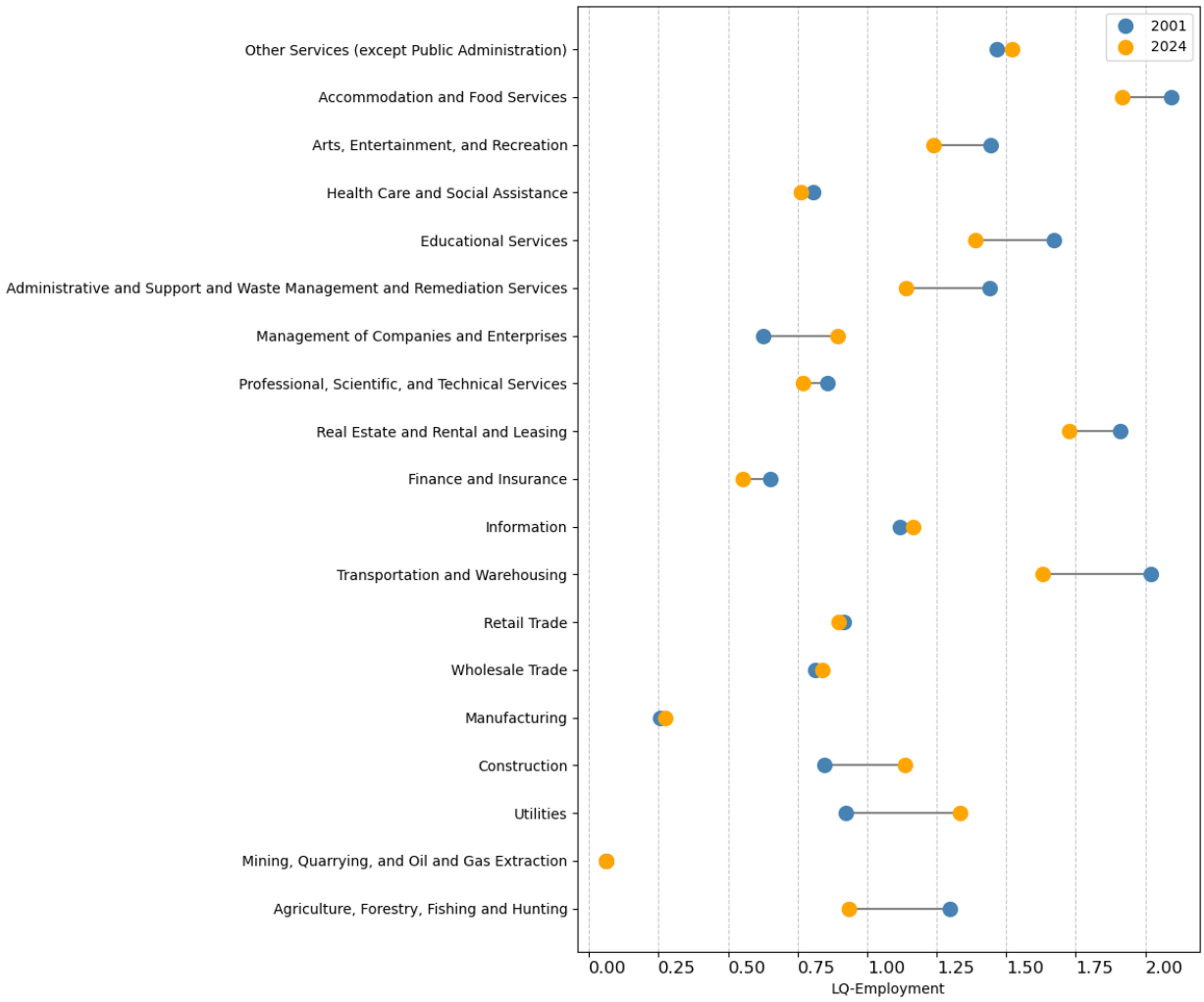
Location Quotient Peer-State Analysis

The location quotient (LQ) compares the regional share of economic activity to the corresponding share for a reference economy. An LQ of one indicates that the share of an industry in the regional economy and the reference economy is the same, while an LQ value of greater (or smaller) than one indicates that the regional economy has a greater (or smaller) share of that industry in its economy than the reference economy.

Location Quotient for Employment

Construction, Management of Companies and Utilities industries in Hawai‘i increased their relative employment share during years 2001-2024, as shown in Figure 14. The rest of the industries experienced a decline or minimal increase in their LQ values, suggesting a contraction in their employment share compared to those sectors in the reference economy.

Figure 14. Location Quotient for Employment Share in Hawai‘i, 2001 and 2024



Source: Bureau of Labor Statistics. QCEW, READ estimates.

In 2024, Hawai‘i had 9 of 19 industries with LQ greater than one relative to the reference economy. Accommodation & Food Services in Hawai‘i employs 90% more workers locally than the reference economy (down 8.5% since 2001), Transportation and Warehousing employs 63% more (down 19%), and Arts, Entertainment & Recreation employs 23% more (down 14%). This indicates that tourism remains a pillar, even as its relative intensity has eased since 2001.

Other industries with an LQ greater than one includes Utilities, Construction, Real Estate and Rental and Leasing, and Education Services. Utilities industry employs 33% more (up 44%), reflecting the island’s infrastructure and the energy transition—an essential backbone rather than export strength; Construction employs 13% more (up 34%); Real Estate and Rental and Leasing employs 79% more (down 9%); and Educational Services

employs 39% more (down 5%). Overall, Hawai‘i continues to rely on tourism-related industries alongside rising infrastructure needs for its local population.

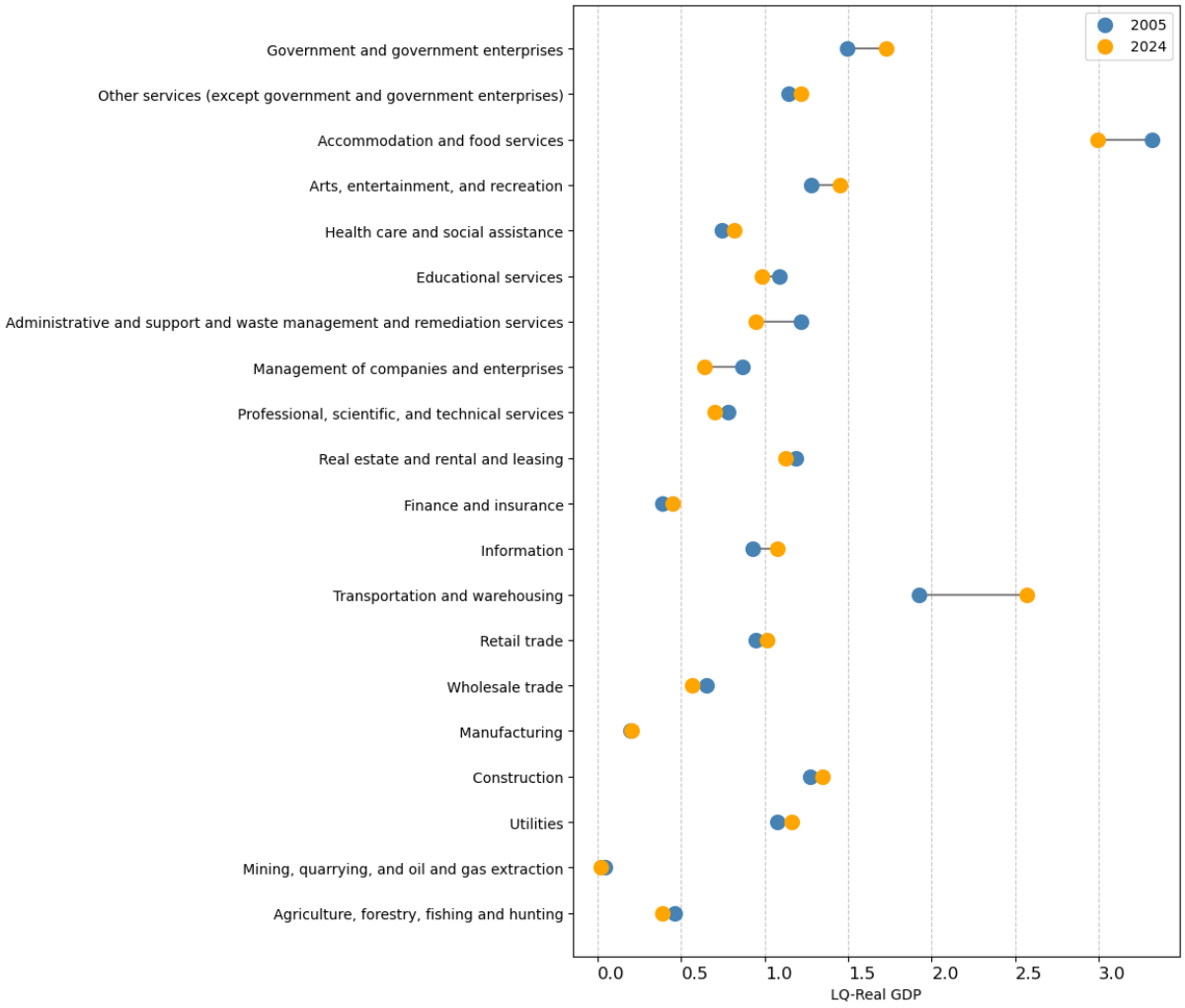
On the other hand, in 2024, 10 of 19 industries had an LQ smaller than one, meaning their local employment shares were smaller than in the reference economy. Notably, this includes Manufacturing, Mining, Finance and Insurance, Professional, Scientific, and Technical Services, and Health Care and Social Assistance.

Location Quotient (LQ) for Real GDP

Similar to Hawai‘i’s LQ for employment, the state’s real GDP share also exhibited shifting industry dynamics relative to the reference economy. Figure 15 shows Hawai‘i’s real GDP LQ during years 2005 and 2024. Over this period, Transportation and Warehousing, Art, Entertainment and Recreation, Information, Utilities and Construction in Hawai‘i increased their relative real GDP share compared to the reference economy. In contrast, industries such as Accommodation and Food Services, Administrative Support and Agriculture experienced a decline in their LQ values over the same period, suggesting a relative contraction in their real GDP share compared to those sectors in the reference economy.

In 2024, Hawai‘i had 10 industries with higher GDP shares (LQ value greater than one) and 10 with lower shares (LQ value less than one) relative to the reference economy. The industries with the highest relative real GDP share (LQ) were Accommodation and Food Services (LQ of 3 – highest LQ overall, a decrease of 9% since 2005), Transportation and Warehousing (LQ of 2.6, an increase of 33% since 2005), Art, Entertainment and Recreation (LQ of 1.45, an increase of 13%), and Construction (LQ of 1.3, an increase of 5% since 2005).

Figure 15. Location Quotient for Real GDP Share in Hawai‘i, 2005 and 2024



Source: Bureau of Economic Analysis, Real GDP (millions of chained 2017 dollars). READ estimates.

Several of Hawai‘i’s industries exhibited real GDP shares less than those of the reference economy and have declined over time. These included Mining (LQ of 0.02, decreasing 5% since 2001), Wholesale Trade (LQ of 0.56, decreasing 13% since 2005), Professional and Scientific Services (LQ of 0.7, decrease of 10% since 2005) and Agriculture, Forestry, Fishing and Hunting (LQ of 0.4, decreasing 16% since 2005).

Hawai‘i’s real-GDP specialization remains strongest in tourism-related and transport-linked activities, with notable gains in Utilities and Construction that reflect infrastructure and energy-transition investment rather than tradable strength.

3. Discussion and Conclusions

This report explored major concepts and measurement tools used to assess diversification, stability, and industrial performance. The analysis applied widely accepted indicators of economic diversification, namely as the Entropy Index, Herfindahl-Hirschman Index (HHI), and Hachman Index, and the Location Quotients (LQ). Utilizing sectoral employment and real GDP data from 2001 to 2024, the study evaluated diversification and concentration patterns across Hawai'i's industrial base.

The Entropy and HH indices show that employment diversification increased gradually from 2001–2024, while real GDP diversification showed no change despite cyclical swings. Both the Entropy and HHI indices show a steady increase in employment diversification with no significant fluctuations during the period. For real GDP, the HHI fluctuated significantly during the mentioned period, notably during COVID-19 (2020–2021), consistent with outsized shocks to tourism and related services. Overall, both measures indicate that Hawai'i's real GDP diversification did not change substantially over the 2001–2024 period

From the peer state analysis using the Hachman Index and location quotient measures, the result suggests that Hawai'i remains less diversified than the reference economies, particularly in terms of output (real GDP). While the state's employment structure has become somewhat similar to that of reference economy—indicating a broader distribution of jobs—its economic output concentrated in a few key, labor-intensive sectors such as tourism and related services. This mismatch between employment and output diversification reflects Hawai'i's continued reliance on tourism-driven, low–value-added activities, with limited expansion into high–value-added, tradable, or producer-service industries. In short, Hawai'i's job base appears relatively diversified, but its production base remains narrowly focused, suggesting limited overall economic diversification.

In summary, Hawai'i's economic diversification increased for employment from 2001–2024, while economic output diversification remained about the same with high concentrations in key industries. Despite some growth in the employment and real GDP shares of the Construction, Utilities, and Transportation industries; Tourism and Government related industries continue to dominate the state's economic base.

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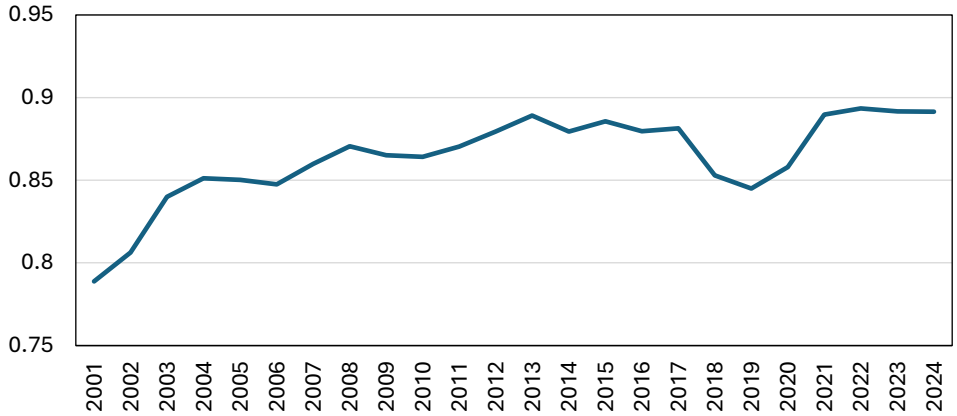
4. Appendices

Appendix A. Peer State Analysis of Island Economies

Hawai‘i’s economy is structurally different from most U.S. states due to its small size, isolation, and island-based nature. Hence we provide the employment-based Hachman Index relative to two peer island economies (Puerto Rico and Virgin Islands) and it is shown in the figure below. Hachman Index for Hawai‘i relative to the island economies composite Index (Puerto Rico and Virgin Islands). The Hachman Index indicates that Hawai‘i’s industrial mix in terms of jobs became increasingly similar to those of Puerto Rico and the U.S. Virgin Islands from 2001 through 2018. Similarity declines in 2019, then rises during the COVID-19 period—when island economies converged—and has since climbed above its pre-COVID level.

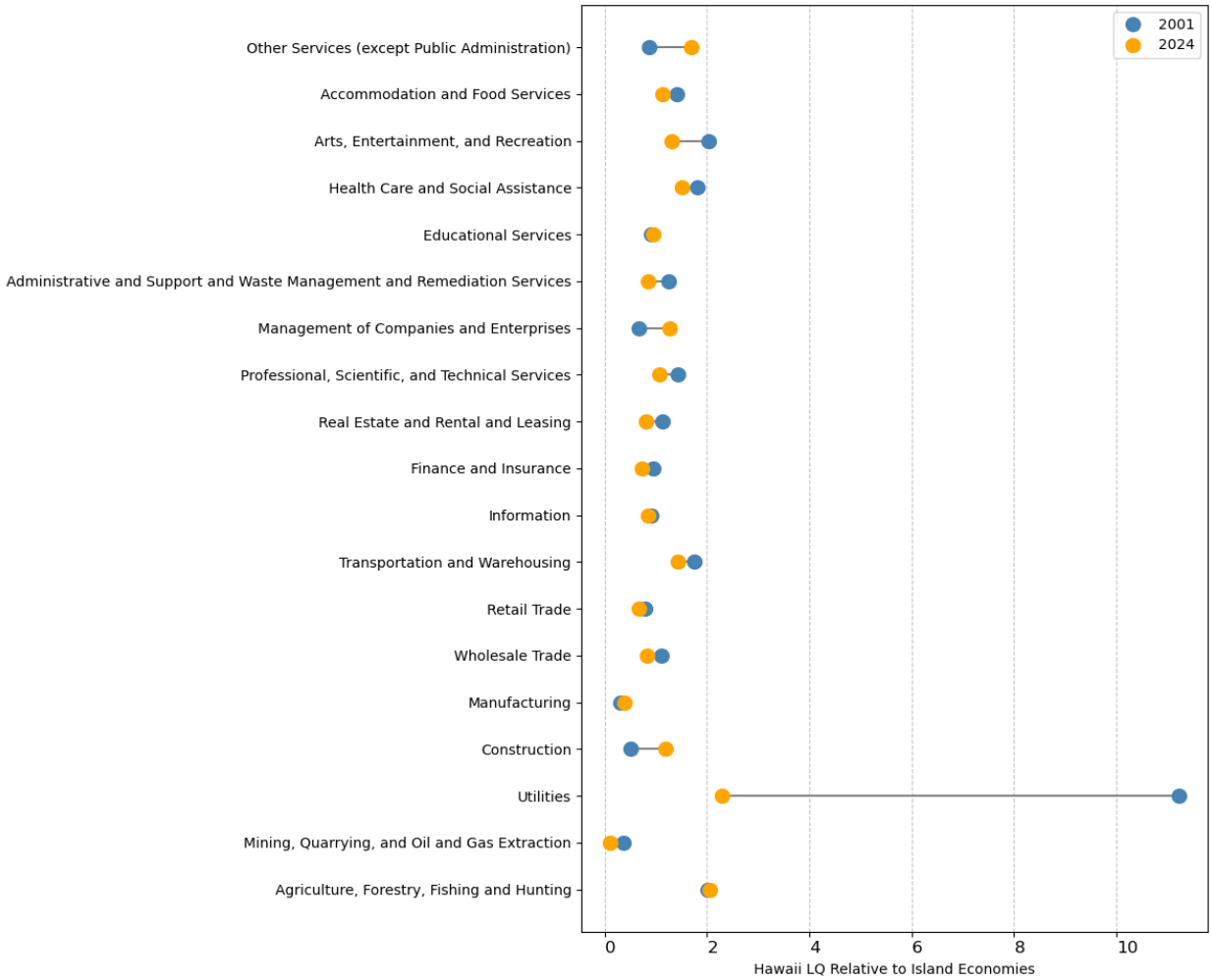
Figure A1. Hawai‘i Hachman Employment Index vs. Island-Peer Composite (Puerto Rico & U.S. Virgin Islands), 2001-2024.



Source: Bureua of Labor Statistics, QCEW.

Hawai‘i remains more specialized than its island peers in all sectors, including tourism-adjacent and tradable-support sectors. Relative to island economies, share of employment in Management of Companies and Enterprise, and Construction increased in Hawai‘i, while share of employment in Utilities, Art, Entertainment and Recreation decreased. Other sectors have not experienced major changes.

Figure A2. Hawai‘i Employment Location Quotients vs. Island-Peer Composite (Puerto Rico & U.S. Virgin Islands), 2001 & 2024



Source: Bureau of Labor Statistics, QCEW.

Appendix B. Methodology

Four different economic theories are summarized below, each of which offers distinct concepts, terminology, and measures related to economic diversity.

Industrial Organization Theory (Absolute Specialization Indices)

According to this theory, a more diversified sector (i.e. less concentrated) is assumed to be more competitive (Scherer, 1980). Scherer argued that concentrated markets allow dominant firms to exert power, raise barriers to entry, and limit rivalry, while fragmented ones disperse influence, ease entry, and force firms to compete. On the other hand, fragmentation encourages diverse strategies and innovations which undermine monopolistic control and sustain competition.

Since Hawai'i economy is small and concentrated with tourism related industries and defense sector, diversification efforts promote a more balanced industry structure, greater resilience to shocks and expansion of emerging/new industries to thrive. A region with a greater number of sectors and/or a more even distribution of economic activity is associated with higher diversity (Malizia and Ke, 1993). Based on this definition, measures of concentration ratios, such as the Ogive and the Entropy indexes, have been used as measures of economic diversity.

Following McLaughlin (1930) and Tress (1938), the Ogive index of economic diversity can be constructed as follows:

$$\text{Ogive Index} = \sum_{i=1}^{N} \frac{(S_i - 1/N)}{1/N}^2$$

where N is the number of sectors in an economy, and S_i is the sectoral share of economic activity for the *i*th sector, usually expressed as the employment share.[1] The more equally a region's economic activity is distributed among its sectors, the greater the diversity (Rodgers, 1957). With N sectors, an equal distribution implies that S_i is equal to 1/N, the ideal share for each sector, and the Ogive index equals zero, meaning perfect diversity. A more unequal distribution of sectoral activity will result in a higher value of the Ogive index. It should be noted that the measure is sensitive to the level of sectoral aggregation (i.e., the chosen number of sectors, N) used to organize the data. However, Grossberg (1982) and Jackson (1984) have shown that, depending on the value of N, a region's economic structure

[1] Because there is no need to inflate or deflate the data as is the case with dollar values, employment has been the most commonly used indicator of economic activity over time. Some studies have also used income and GDP.

can be defined as being either diverse or specialized, both relative to other regions and over time.

Following Smith and Gibson (1988), the Entropy index of economic diversity can be defined as follows:

$$\text{Entropy Index} = \sum_{i=1}^{N} S_i \ln\left(\frac{1}{S_i}\right) = -\sum_{i=1}^{n} S_i \ln(S_i)$$

where N is the number of sectors, S_i is share of economic activity in *i*th industry and ln is natural logarithm. The Entopy index judgment on diversification is that equal distribution of employment across sector is the highest benchmark of diversification.

The Entropy measure compares the existing employment or income distributions among industries in a region to an equiproportional distribution. Higher Entropy index values indicate greater relative diversification, while lower values indicate relatively more specialization. The maximum value of the measure would result in equal distribution of employment among all industries. The minimum value of zero (maximum specialization) would occur if employment were concentrated in one industry. On the other hand, if employment were distributed equally among the N sectors, the Entropy index would reach its maximum value, indicating perfect diversity. Although both Ogive and Entropy indexes yield similar diversity rankings to regions, the Entropy index is the more popular measure of sectoral concentration among the previous studies.

Herfindahl Index

The Herfindahl index, also known as Herfindahl-Hirschman Index (HHI), is a widely used measure of market concentration in the industrial organization literature (Scherer, 1980), but has also been used as a measure of economic diversity (Tauer, 1992). The Herfindahl index indicates the extent to which a particular regional economy is dominated by a few firms and can be expressed as follows:

$$\text{Herfindahl Index} = \sum_{i=1}^{n} S_i^2$$

where S_i is the share of employment in the *i*th industry in fraction term. The Herfindahl (also knowns as Herfindahl-Hirschmann HH) index varies from 0 (when the economy has a large number of industries, with small and equal employment shares – high diversity) to 1 (when one sector accounts for all economy's employment – full specialization). Thus, a decline in the index signifies less concentration in the dominant industry or greater diversification. An increase indicates more concentration in the dominant sector or greater specialization.

Similar to the Entropy index, the Herfindahl index judgment on diversification is that equal distribution of employment across sector is the highest benchmark of diversification.
According to Ogive, Entropy and Herfindahl measures, the more equal distribution of employment among a large number of industries means higher level of economic diversity.

One limitation of these indices is that they do not tell whether total regional employment is increasing or decreasing. For example, increased diversification may come with a decrease in total employment, which may not be the desired outcome. The ideal would be to have increased diversity with employment gains. Therefore, these indices do not assist in planning which industries should be targeted for recruitment, retention and expansion for enhancing economic diversification for promoting economic growth and stability. The policymaker needs to analyze diversification and its linkages with economic determinants (income, productivity of industry, monetary policy, investment, export/import), non-economic determinants(distance to foreigner market) and structural reforms (trade liberalization, access to capital, population, climate change and migration)(Longmore, et al 2014)(Cadot, et al 2011)

Following McLaughlin (1930) and Tress (1938), it has been hypothesized that the more diverse the economic activity of a region is, the more stable its economic performance. This hypothesis has been widely tested in the literature using the Ogive, Entropy and Herfindahl indexes, but the empirical findings are not robust.

Economic Base Theory (Comparative Indices)

Economic base theory (also called export base theory) views regional economic growth as being driven by exogenous final demands, primarily exports. Industries contributing to exogenous (or external) final demand are termed basic industries and those serving primarily endogenous (or internal) demand are termed non-basic industries. The distinction between a region's basic and non-basic sectors is often illuminated by calculating a location quotient (LQ) as follows:

$$\mathrm{LQ_i} = \frac{\mathrm{Si^{Reg}}}{\mathrm{S_i^{Ref}}}$$

where i = 1, 2, ...N sectors, S_i^{Reg} is the employment share in a region's *i*th industry, $\mathrm{S_i^{Ref}}$ is the corresponding share for the reference economy.[2] Thus, the LQ compares the regional share of economic activity to the corresponding share found at the reference economy level. An LQ of one indicates that the share of an industry in the regional economy and the

[2] Location quotient can also be calculated in terms of both output, income or value added, but it is typically calculated based on employment because the sectoral employment data are often more readily available at the local level.

reference economy is the same; a value of the LQ greater (or smaller) than one means that regional economy has a greater (or smaller) share of that industry in its economy than the reference economy.

Sectors with an LQ greater than 1 are defined as basic (export) sectors and part of their output is assumed to be exported outside the region, while sectors with LQ less than 1 are known as non-basic sectors and their outputs are assumed to be sold within the local economy.

An LQ greater than 1 is one of the most widely used measures of specialization in a given sector and industrial concentration of a regional economy. The summation of sectoral LQs, also referred to as the coefficient of specialization, is used as a measure of regional specialization (Hoover and Giarratani, 1985). Similarly, the reciprocal of the sum of location quotients (LQs) weighted by industry shares gives the Hachman index of economic diversity as follows:

$$\text{Hachman Index} = \frac{1}{\sum_{i=1}^{N}\left[\left(S_i^{Reg}/S_i^{Ref}\right) \times S_i^{Reg}\right]} = \frac{1}{\sum_{i=1}^{N}\left[LQ_i \times S_i^{Reg}\right]}$$

where S_i^{Reg} is a region's share of employment in the ith industry, S_i^{Ref} is the reference share of employment in the ith industry, and N is the number of industries.

The Hachman index is an indicator that measures how closely the region's industry employment distribution compares to that of the U.S. This measure is bounded between 0 and 1, where 1 means the region has exactly the same industrial structure as the reference economy, and 0 means it has a totally different industrial structure.

As discussed before, the core idea of economic base theory states that a region's economic growth depends primarily on export (or basic) industries—those selling goods or services outside the region. These bring in outside income, which then supports local (non-basic) industries (services, retail, etc.). Growth in the basic sector leads to multiplier effects in the rest of the economy because non-basic sectors expand to serve increased local demand. (Andrew et al, 1992). Because direct data on regional exports are often scarce or lagged, analysts use proxies such as location quotients to identify basic industries (industries with a higher-than-average concentration locally are assumed to be exporting a surplus).

There are several limitations associated with the economic base theory. Firstly, it oversimplifies economy into two sectors, basic (export) with LQ greater than one and local

sector with LQ less than one. In reality, many industries serve both local and external markets, so this binary classification is often too rigid. In addition, the theory and indices focus only on exports (the demand injected into the region) and largely ignores the import side and other supply-side factors. Critics note that a region's economy can be equally affected by money flowing out to pay for imports.

The indices associated with economic base theory ignore internal constraints – such as labor force skills, infrastructure, natural resources, or innovation capacity. Such factor limits a region's growth regardless of export demand. By emphasizing external demand alone, the model neglects these crucial inputs and conditions for sustainable development. (Andrew et al 1992).