

Experiment

The purpose of this experiment is to assess the correlation between Hawaii's real GDP and three explanatory variables using quarterly data from Q1 2008 through Q2 2025.

Dependent Variable / Response Variable

Real Gross Domestic Product (GDP): All Industry Total in the State of Hawaii (HIRQGSP)

- [Source]
 - U.S. Bureau of Economic Analysis. (2025, October 26). Real gross domestic product: All industry total in Hawaii (Series HIRQGSP) [Data set]. FRED, Federal Reserve Bank of St. Louis. <https://fred.stlouisfed.org/series/HIRQGSP>
- [Units]
 - Millions of Chained 2017 U.S. Dollars, Seasonally Adjusted Annual Rate
- [Frequency] Quarters
- [Notes]
 - *Description:*
 - A quarterly time-series of the State of Hawai'i's Gross Domestic Economy (U.S. Bureau of Economic Analysis, 2025).
 - *Additional Information:*
 - Based on economic theory, real (inflation-adjusted) dollars better reflect the purchasing power of Hawaii's consumers relative to the price of the same quantity of goods.
 - Seasonally-adjusted should help give a cleaner signal of underlying trends and shocks by removing seasonal patterns (e.g., summer/winter tourist visiting cycles due to school system's summer and winter breaks)

Independent Variables / Explanatory Variables

1. Global Price of Brent Crude (POILBREUSDQ)

- [Source]
 - International Monetary Fund. (2025, October 27). Global price of Brent crude (Series POILBREUSDQ) [Data set]. FRED, Federal Reserve Bank of St. Louis. <https://fred.stlouisfed.org/series/POILBREUSDQ>
 - Federal Reserve Bank at St. Louis. (2020, May 20==). WTI vs. Brent oil prices: When and why do they diverge?. FRED, Federal Reserve Bank at St. Louis. <https://fredblog.stlouisfed.org/2020/05/wti-vs-brent-oil-prices-when-and-why-do-they-diverge/>
 - Hofschneider, A. (2022, March 13). War In Ukraine Helps Drive Up The Cost Of Living In The Pacific. Honolulu Civil Beat. <https://www.civilbeat.org/2022/03/war-in-ukraine-helps-drive-up-the-cost-of-living-in-the-pacific/>
- [Units]
 - Nominal U.S. Dollars per Barrel, Not Seasonally Adjusted
- [Frequency] Quarters

- [Notes]
 - *Description:*
 - A quarterly time-series of the global Brent Crude price (IMF 2025). Hawaii's energy-cost proxy will be the Brent spot price, which reflects crude produced in the North Sea rather than the U.S. West Texas Intermediate (WTI), according to FRED (2020).
 - *Additional Information:*
 - Historically, Hawaii imported ~30 % of its oil from Russian sources (Hofschneider 2022). After the 2022 Ukraine-Russia war, the supply mix shifted away from Russia.
 - Brent better captures Hawaii's reliance on imported petroleum because it tracks worldwide oil price movements and, since 2014, has moved closely with WTI while typically trading at a modest premium (FRED, 2020).
 - That premium is justified for Hawaii considering the additional transportation cost of shipping crude to the isolated islands makes a globally-referenced benchmark more appropriate than the domestic U.S. WTI crude oil price.

2. Total Real Visitor Expenditures in the State of Hawaii

- [Source]
 - University of Hawaii Economic Research Organization. (2025). Total Real Visitor Expenditures [Data set]. UHERO.
<https://data.uhero.hawaii.edu/#/series?id=164724&sa=true&geo=HI&freq=Q&start=2005-01-01>
- [Units]
 - Nominal Values deflated using Interpolated Honolulu CPI, Seasonally Adjusted by UHERO
- [Notes]
 - *Description:*
 - A quarterly time-series evaluating real total visitor expenditures in the State of Hawaii, seasonally adjusted to smooth cycles
 - *Additional Information:*
 - 2020: Quarters 2, 3, and 4 are missing the Level, Year-over-Year % Change, and Year-to-Date % Change values, likely because of COVID-19 reporting disruptions. **I will treat these missing entries with 0.01 for the log-log analysis which can not work with zeros or negative values.**
 - 2021: Quarters 2, 3, and 4 lack the Year-over-Year % Change and Year-to-Date % Change, since the corresponding data from the same quarters of the previous year are also unavailable.

3. U.S. Federal Government's Total Obligations in the State of Hawaii

- [Source]

- USAspending.gov. (2025). Usaspending.gov.
<https://www.usaspending.gov/search?hash=060db270b74528212670ede24407439d>
- Hawaii Defense Economy. (2023). Hawaii Defense Economy. Hawaii Defense Economy. <https://defenseeconomy.hawaii.gov/>
- Leib, M. (2025, October 27). With SNAP cuts looming, some suggest handing out nonperishables to trick-or-treaters. ABC News.
<https://abcnews.go.com/GMA/Living/snap-cuts-looming-suggest-handing-nonperishables-trick-treaters/story?id=126906304>
- [Units]
 - Doesn't explicitly state, hence **I assume it is reported in nominal (current) U.S. dollars.**
 - **I will use the Consumer Price Index (CPI)** for All Urban Consumers: All Items in Urban Hawaii (CBSA) - Semiannual Data provided by the U.S BLS. Despite being chained to 1982 U.S. dollars = 100 as base and the real GDP of Hawaii is chained to \$2017 U.S. dollar, the **regression result wouldn't change as logs remove constant scaling.** Given only semiannual data is available since 2008, I will have to use **moving averages of 2 quarters**, which is basically $(Q_1 + Q_2)/2$.
 - *Source:*
 - U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in Urban Hawaii (CBSA) [CUUSA426SAoS], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CUUSA426SAoS>, October 28, 2025.
- [Notes]
 - *Description:*
 - The sum of all quarterly federal spending commitments / obligations to recipients in the State of Hawaii. It includes defense, non-defense, contracts, grants, direct payments, and loans (USAspending.gov, 2025).
 - *Additional Information:*
 - I originally intended to capture quarterly defense spending because the sector was the second-largest component of Hawaii's economy in 2023, accounting for 8.9 % of GDP or roughly \$6,081 per resident (Hawaii Defense Economy, 2023). However, the data are reported only at the fiscal-year level and are primarily available in PDF files. This makes it cumbersome to extract data for all 20 years from 2005 to 2025.
 - Total federal obligations may provide a broader proxy for Hawaii's economy, encompassing programs such as Medicaid and SNAP/EBT benefits. I find it especially relevant given recent cuts to SNAP under the current administration's stance and federal shutdown (Leib, 2025), which could impact the State's future economic conditions.

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Hypothesis:

Equation

$$\log(\text{Hawaii's Real GDP}) = \beta_0 - \beta_1 \log(\text{Price of Brent Crude}) + \beta_2 \log(\text{Total Visitor Expenditures}) + \beta_3 \log(\text{Total Federal Obligations})$$

Initial Thought before Analysis

1. *Price of Brent Crude Oil* has a statistically significant, negative % correlation on the State of Hawaii's real GDP, $H_0 < 0$
 - a. Reasoning:
 - i. According to the U.S. EIA, 90% of the State of Hawaii's energy consumption is petroleum (2025). Among which, the transportation sector accounts for 58% of energy consumption in the form of jet fuel and motor gasoline (EIA, 2025). Jet fuel and motor gasoline are the refined finished product of crude oil and are categorized as petroleum.
 - b. Source:
 - i. U.S. Energy Information Administration. (2025, May 15). *Hawaii - State Energy Profile Analysis - U.S. Energy Information Administration (EIA)*. [www.eia.gov](https://www.eia.gov/state/analysis.php?sid=HI). <https://www.eia.gov/state/analysis.php?sid=HI>
2. *Total Real Visitor Expenditures* has a statistically significant, positive % correlation on the State of Hawaii's real GDP, $H_0 > 0$
 - a. Reasoning:
 - i. UHERO forecasts the State of Hawaii faces a mild recession as the number of tourists decline, thereby suggesting a correlation between GDP and visitor spending (UH News, 2025).
 - b. Source(s):
 - i. News, U. (2025, September 26). *Hawai'i faces mild recession as tourism falls, inflation rises in new UHERO forecast | University of Hawai'i System News*. University of Hawai'i System News. <https://www.hawaii.edu/news/2025/09/26/uhero-third-quarter-forecast-2025/>
3. *Total Federal Obligations* has a statistically significant, positive % correlation on the State of Hawaii's real GDP, $H_0 > 0$
 - a. Reasoning:
 - i. The defense sector is the second-largest component of Hawaii's economy in 2023, accounting for 8.9 % of GDP or roughly \$6,081 per resident (Hawaii Defense Economy, 2023). The defense sector is mostly funded by the Federal Government. Hence, total federal obligations should have a positive impact on Hawaii's Real GDP.
 - b. Source:
 - i. Hawaii Defense Economy. (2023). *Hawaii Defense Economy*. Hawaii Defense Economy. <https://defenseeconomy.hawaii.gov/>

