

Jiayi Wu '22, Data Science Major Capstone

Background and Research Questions

Personal Consumption Expenditures (PCE) serve as a primary indicator of consumer spending and are integral to assessing the economic vitality. This capstone study explores the relationship of PCE with economic indicators, such as unemployment rates and inflation rates. So for this capstone, I seek to answer:

1. What is the relationship between PCE and other economic indicators?
2. How can these relationships be modeled to predict future trends in PCE?

Data

Data Description

The data used in this study comprises economic data from Q1 2019 to Q4 2023, sourced from Federal Reserve Economic Data (FRED), the Bureau of Economic Analysis (BEA), and the Federal Housing Finance Agency. The final dataset merges several datasets from those sources which include quarterly data from 2019 to 2023 of:

- Percent Change From Preceding Period in Real Personal Consumption Expenditures by Type of Product, which contains 78 individual products and 5 hierarchies (PCE)
- Real Disposable Personal Income (REDISPINC)
- Real Interest Rate (REINTERATE)
- 10-Year Breakeven Inflation Rate (INFLATRATE)
- Consumer Sentiment (CONSENTI)
- Unemployment Rate (UNRATE)
- House Price Index Purchase Only Data
 - Seasonally-Adjusted Purchase-Only Index (1991Q1=100) (SAPOI1991Q1100)
 - Seasonally-Adjusted Purchase-Only Index % Change Over Previous Quarter (SAPOIPERCHG1991Q1100)

Data Cleaning

The dataset, which has a hierarchical structure indicated by leading spaces for product categories and subcategories, was processed using a function. This function classified products into their correct hierarchy levels for mixed-effects modeling. The updated dataset now includes five columns that clearly represent the hierarchical categories and two rows of missing data were removed.

x	Year	PCE	Level1	Level2	Level3
Personal consumption expenditures	Q1	3.2	Goods	Durable goods	Motor vehicles and parts
Goods	Q2	4.1			
Durable goods	Q3	2.6			
Motor vehicles and parts	Q4	-6.4			
Net purchases of used motor vehicles	Q1	-30.2			
Net purchases of used motor vehicles	Q2	0.9	Services	Food services and accommodations	Food services and accommodations
Net purchases of used motor vehicles	Q3	6.8			
Net purchases of used motor vehicles	Q4	5.8			
Net purchases of used motor vehicles	Q1	1.9			
Net purchases of used motor vehicles	Q2	-2.1			
Net purchases of used motor vehicles	Q3	-8.6			
Net purchases of used motor vehicles	Q4	-0.2			
Net purchases of used motor vehicles	Q1	-3.1			
Net purchases of used motor vehicles	Q2	10.5			
Net purchases of used motor vehicles	Q3	9.5			
Net purchases of used motor vehicles	Q4	5.8			
Net purchases of used motor vehicles	Q1	-16.6			
Net purchases of used motor vehicles	Q2	-38.2			
Net purchases of used motor vehicles	Q3	-6.1			
Net purchases of used motor vehicles	Q4	-43.8			
Net purchases of used motor vehicles	Q1	-12.2			
Net purchases of used motor vehicles	Q2	-34.3			
Net purchases of used motor vehicles	Q3	-4.4			
Net purchases of used motor vehicles	Q4	-25.1			
Net purchases of used motor vehicles	Q1	11.6			
Net purchases of used motor vehicles	Q2	4.9			
Net purchases of used motor vehicles	Q3	5.0			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles	Q3	4.9			
Net purchases of used motor vehicles	Q4	-4.1			
Net purchases of used motor vehicles	Q1	-25.1			
Net purchases of used motor vehicles	Q2	11.6			
Net purchases of used motor vehicles					