STAT 413/613 Final Project - Vignette

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Contents

Use Case

Our app analyzes how COVID-19 positive cases impacted the U.S. economy, focusing on indicators such as consumer spending, open small business, and employment. The aim of the app is to discover how the number of positive COVID-19 cases influenced consumer spending across industries, as well as revealing how COVID-19 positive cases impacted small businesses or changes in employment.

Our target audience for this app is for federal and state level policy advisers and analysts. By incorporating a variety of data sources and joining them together to display in an interactive dashboard, our goal is to allow those policy advisers to quickly interpret how COVID-19 has impacted various aspects of the economy on a state by state level. With our app, the user can answer questions such as:

- For consumer spending, which industries on average declined the most during the past year? Which industries had the steepest drop? Which industry was affected the least?
- Does there appear to be a relationship between the stimulus checks and consumer spending?
- How did stimulus check help small businesses, consumer spending and employment, and how effective was it?
- Is there a correlation between percent changes in COVID-19 cases and small businesses' open/revenue?

Required Packages

- library(tidyverse)
  - For tidyverse packages and functions
- library(shiny)
  - For the Shiny app
- library(dashboardthemes)
  - For aesthetics on the Shiny app
- library(leaflet)
  - For an interactive map in the Shiny app
- library(ggcorrplot)
  - For plotting the correlation matrix

Data Source and Structure

The primary data sources are from Opportunity Insights' Economic Tracker, a public database which compiled data from various sources on consumer spending, open small businesses, employment. We then build upon these with additional relevant datasets to supplement for exploratory data analysis and statistical analysis.

- **Consumer Spending**
  - Original Source: Affinity Solutions

  Consumer spending is measured via aggregated and anonymized data on credit & debit card spending collected by Affinity, which is a company that aggregates that information - the company captures nearly 10% of credit and debit card spending in the US.

  The data seasonally adjusted credit & debit card spending relative to January 2020 and is daily (presented as a 7-day moving average). The data is broken down by industries (merchant codes used by Affinity Solutions) and income based on consumer zip code (the transactions are linked to zip codes where the consumer lives and those zip codes are classified into income categories based on median household income from the American Community Survey)

  Number of Observations: 21713

  Date range: January 22, 2020 to April 4, 2021

  Industries:

  - Accommodation, Food Service
  - Arts, Entertainment, Recreation
  - All Merchant Category
  - General Merchant, Apparel, Accessories
  - Grocery
  - Healthcare, Social Assistant
  - Transportation, Warehousing
  - Retail with Grocery
  - Retail without Grocery

Income:

- High Median Income (median household income >$78,000)
- Middle Median Income (median household income $46,000-78,000)
- Low Median Income (median household income <$46,000)

- **Small Business Open**
  - Original Source: Womply

Small businesses that are open are defined by those having financial transaction activity. This data originates from Womply, a company that aggregates data from credit card processors.

The number of small businesses open is defined by having had at least one transactions in the last 3 days and is daily (presented as a 7-day moving average). The data is broken down by industry (as defined by NAICS supersector) and and income is based on business zip code (the transactions are linked to zip codes where the business is located and those zip codes are classified into income categories based on median household income from the American Community Survey).

Number of Observations: 22434

Date range: January 22, 2020 to April 14, 2021

Industries:

- Education, Health Services Revenue
- Education, Health Services Open
- Leisure, Hospitality Revenue
- Leisure, Hospitality Open
- Professional, Business Services Revenue
- Professional, Business Services Open
- Retail, Transportation Revenue
- Retail, Transportation Open
- All Revenue
- All Open

Income:

- High Income (median household income >$78,000)
- Middle Income (median household income $46,000-78,000)
- Low Income (median household income <$46,000)

- **Employment**
  - Original Source: Paychex, Intuit, Earnin, Kronos

The employment data is combined via several data sources. Employment measures the changes in employment rates based on payroll data from Paychex and Intuit, worker-level data on employment and earnings from Earnin, and timesheet data from Kronos.

The data counts the number of active employees and is daily (presented as a 7-day moving average). The data is broken down by industries and wage levels.

Number of Observations: 19788

Date range: January 22, 2020 to February 12, 2021

Industries:

  - Education, Health Services
  - Leisure, Hospitality
  - Professional, Business Services
  - Retail, Transportation

  Wages:

  - High Income (>$60,000)
  - Middle Income ($27,000-60,000)
  - Low Income (<$27,000)

We use additional data to join with the primary datasets (Consumer Spending, Small Business Open, Employment). Each of the 3 datasets also include data on the following:

- **COVID-19**

  - Original Source: Centers for Disease Control and Prevention

  COVID-19 data consists of the number of cases and deaths daily (presented as a 7-day moving average) by state. The COVID-19 data is joined by the date and statefips. Each observation includes a count of COVID-19 cases and death as new confirmed COVID-19 cases/deaths per 100,000 people, presented as a 7-day moving average.

- **GeoIDs - State**

  - Original Source: Opportunity Insights

  The GeoID data uses 'statefips' as the geographic identifier in which we joined with the primary datasets. The GeoID data provides the state name, 2-letter state abbreviation, and the state population in 2019 from Census Bureau estimates.

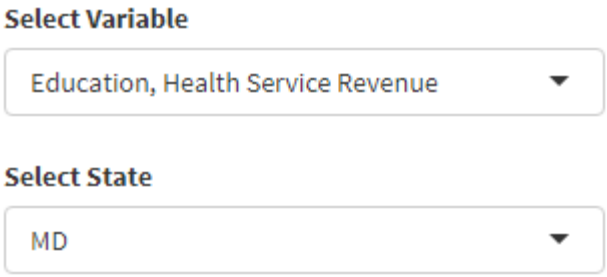
- **State Lockdown**

  The State Lockdown data includes information on how many days in lockdown each state has been under. This data uses 'statefips' as the geographic identifier, and includes the dates when the lockdown started/ended.

Exploratory Data Analysis

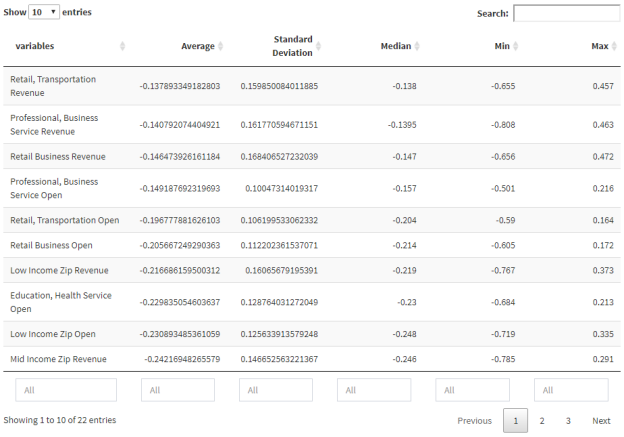
Inputs

- **Descriptive Plot**
  - Select variables on industries and income/wages from Consumer Spending, Small Business Open and Employment data
  - Select state



Outputs

- **Descriptive Statistics**
  - Table that displays the average, standard deviation, median, minimum, and maximum for each variable



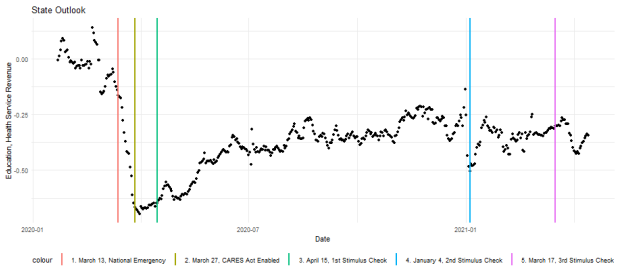
Show 10 entries — Search:

variables	Average	Standard Deviation	Median	Min	Max
Retail, Transportation Revenue	-0.137893349182803	0.159850084011885	-0.138	-0.655	0.457
Professional, Business Service Revenue	-0.140792074404921	0.161770594671151	-0.1395	-0.808	0.463
Retail Business Revenue	-0.146473926161184	0.168406527232039	-0.147	-0.656	0.472
Professional, Business Service Open	-0.149187692319693	0.10047314019317	-0.157	-0.501	0.216
Retail, Transportation Open	-0.196777881626103	0.106199533062332	-0.204	-0.59	0.164
Retail Business Open	-0.205667249290363	0.112202361537071	-0.214	-0.605	0.172
Low Income Zip Revenue	-0.216686159500312	0.16065679195391	-0.219	-0.767	0.373
Education, Health Service Open	-0.229835054603637	0.128764031272049	-0.23	-0.684	0.213
Low Income Zip Open	-0.230893485361059	0.125633913579248	-0.248	-0.719	0.335
Mid Income Zip Revenue	-0.24216948265579	0.146652563221367	-0.246	-0.785	0.291

All | All | All | All | All | All

Showing 1 to 10 of 22 entries — Previous 1 2 3 Next

- **Descriptive Plot**
  - A line graph showing selected variable in the selected state with milestones of national emergency declaration, CARES Act and stimulus checks sent

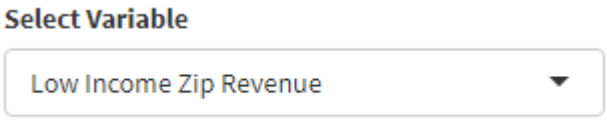


Statistical Analysis

Inputs

- **Density Plot**

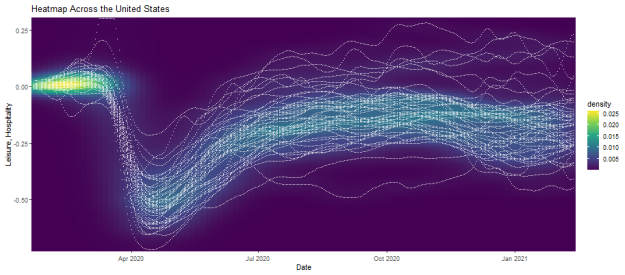
- Select variables on industries and income/wages from Consumer Spending, Small Business Open and Employment data



- **Bivariate Analysis**
  - X and Y variables on industries and income/wages from Consumer Spending, Small Business Open and Employment data

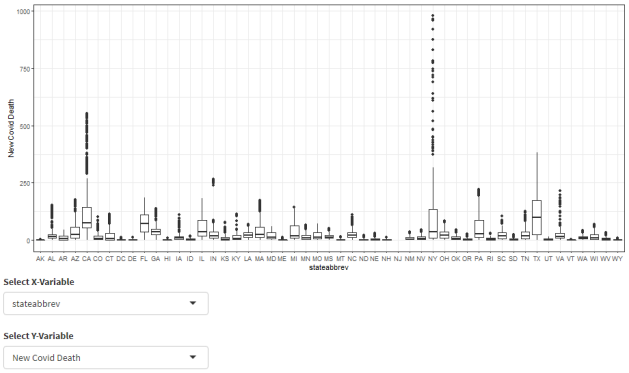
Outputs

- **Density Plot**
  - Displays a density plot of the selected variable.

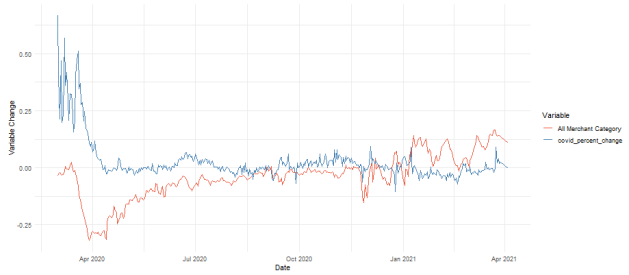


- **Correlation Matrix**
  - Displays the correlation between variables. For Small Business Open, shows two matrix (One for 'open', another for 'revenue;).

- **Bivariate Analysis**
  - If input X variables is continuous, displays scatter plot showing the relationship between selected variables. If input X variable is categorical, displays boxplots showing the relationship between selected variables.



- **Time Series**
  - Line plot between selected variable and the COVID-19 percentage change.



References

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