Week 8: Process Book & Project Proposal

Authors: Sophie Sun, Verena Lin, and Eric Lin

Consumer Spending Telltales

Abstract

The lipstick index was inspired by a rise of cosmetic sales in the midst of the economic recession of the 2000s. Since then, economists have found characteristics in consumer spending that may predict future economic trends. Our motivation in pursuing this project is to illuminate consumer spending patterns that may predict the state of the economy. By analyzing certain product sales and overall industry health, we hope to evaluate whether these consumer spending trends can predict the financial market and the economic cycle (primarily via the national GDP). Our goals include mapping consumer behavior with future economic states, as well as proposing the implications that spending may have on policy making. We plan on using consumer expenditure surveys, as well as US Bureau of Labor Statistics datasets in order to map consumer patterns to periods of economic recessions and growth.

Week 9: Team Agreement & Detailed Project Plan

Team Agreement

1. Preparation
    a. We will read the assignment, come up with at least two broad ideas, and be prepared to listen to others' ideas prior to meetings
2. Communication
    a. We will communicate primarily through our text group chat and expect responses within three hours, with the exception of the 10:00 pm to 7:00 am hours (local hours)
    b. We will remind or bump members who aren't responding
    c. We will keep the rest of the team in the loop for when we are "going dark," or not responding due to other assignments or other life events
    d. We will get to the root of the problem and depending on circumstances, redistribute work if certain situations or surprises arise
3. Responsibility
    a. We will structure our work by brainstorming and discussing ideas together

while fleshing out the top ideas individually. We will then reconvene during our weekly meetings and discuss these ideas more in detail
    b. We will assign weekly individual to-dos
    c. We will assign a point person for each milestone - this point person will make final edits and submit the assignment for the milestone by the deadline
    d. We will organize each project milestone as follows:
        i. The team brainstorms and works on the milestone together in Google Docs after class or on the agreed upon date.
        ii. Individual to-dos should be completed by the set deadline established during the meetings
4. Logistics
    a. We will meet every 3:00 pm EST to discuss the milestone and lecture assignment. We will meet via this recurring Zoom link
5. Team Dynamic
    a. We will assume best intentions, and if conflicts arise, we will be respectful of the concern that is voiced and attempt to solve the conflict. If the team cannot solve the conflict, we will bring it up to our TF
    b. We will be open to expressing these concerns, and the team will proactively address the conflict immediately
    c. We will ensure that everyone has the opportunity to speak their ideas and voice their opinions by noticing who has spoken and who has not - for those who have not, we will ask them about their thoughts before moving on

We will use all of the above to fulfill the following goals:

1. Continue to learn about data visualization
2. Explore different types of data visualization by incorporating at least one advanced visualization
3. Make new friends
4. Have a good time!

Signatures: Sophie Sun, Verena Lin, Eric Lin
Date: 10/28/2020

Detailed Project Plan

Basic Information:

Project Title: Consumer Spending Telltales
Names: Sophie Sun, Verena Lin, and Eric Lin
Email Addresses: sophiesun@college.harvard.edu, tlin@college.harvard.edu, eric_lin@college.harvard.edu
Team Name: Sunny Lins

Background and Motivation:

Our project is inspired by economic indicators like the leading lipstick index, hot waitress index, and skirt length (hemline) theory. They all serve to correlate consumption patterns with the economic cycle. For example, the leading lipstick indicator proposed by Estee Lauder's chairman Leonard Lauder predicts that sales of less expensive indulgences like lipstick increase when consumers feel less confident about the economic future. Similarly, George Taylor of Wharton Business School proposed that skirt hemlines are higher when the economy is performing better. Through data visualization, we seek to present correlations similar to the one described by the lipstick index. We will start off by confirming or invalidating the lipstick index. Afterward, we will investigate whether such patterns can be observed through the consumption of other goods.

Related Work:

The lipstick index was initially proposed by Estee Lauder's Leonard Lauder. He did so based on his observations of lipstick sales. Recent research motivated by the ongoing pandemic has discounted the lipstick index -- pointing instead to products like face mask and moisturizer. There has been no official research confirming or invalidating any of these observational conclusions, so we seek to do so through this project.

Interestingly, fashion photographer Bill Cunningham wrote in his book *Fashion Climbing* that "timing is one of the most important ingredients of design. It's exactly like the Wall Street stock market." The comparison he draws between the runway and the stock market reflects our motivation for this project.

Some other related work and aesthetic visualizations include these income visualizations and consumer visualizations.

Audience and Questions:

We hope to inform economists and policymakers with our visualizations. By displaying consumer spending on certain products, as well as their expenses, and correlating them with times of economic recessions and booms, we will be able to illustrate what consumer behaviors look like during certain economic cycles. Therefore, the primary questions we will attempt to answer with our data story include the following:

1. What types of products are most strongly correlated with future economic recessions?
2. What types of products are negatively correlated with future economic recessions?
3. What types of products are positively correlated with future economic recessions?
4. Does consumer behavior differ among people of different income brackets?
5. How long in advance do spikes or dips in these purchases occur before an economic recession?
6. How did consumer behavior change during COVID? Was there a shift towards certain sectors of the economy?
7. What sectors of the economy are performing well and which are still lagging behind?

Our overarching goal from this project is to evaluate how consumer spending behavior can foreshadow economic recessions.

Data:

We will use data collected by the US Bureau of Labor Statistics to find and show patterns within consumer expenditure. We are choosing this source because it is extremely reliable and consistent (collected year after year). It is commonly used for economic visualizations published in the New York Times (such as this Voronoi diagram) and other credible sources.
We will also consider utilizing other sources from government agencies or economic institutions. Here is our full list:

- US BEA (Monthly expenditures; includes 2020!)
- US Bureau of Labor Statistics (Consumer Expenditure Survey)
- UK consumer expenditure
- US Census Bureau Expenses and Expenditures
- Collection of data sources, including the World Bank
- List of other potential sources

Data Cleanup:

Each of the economic datasets have up to 100k+ features and variables. As such, one core challenge we face is to navigate the dataset in a way where we can narrow down and focus on certain variables without losing the entire picture. Since these are government datasets published routinely every year / quarter, we do anticipate to spend some time cleaning the data but trust in their overall reliability.

Week 10: Data, Sketches, Decide & Storyboard

Meeting with Yalong

- Paper to read about visualizations and storytelling: http://vis.stanford.edu/files/2010-Narrative-InfoVis.pdf
- Example of excellent storytelling: http://www.r2d3.us/visual-intro-to-machine-learning-part-1/ http://mbtaviz.github.io/
- Examples of visualization with temporal data:
    - https://www.cs.middlebury.edu/~candrews/showcase/infovis_techniques_s16/themeriver/themeriver.html
    - https://vcg.informatik.uni-rostock.de/~ct/timeviz/timeviz.html

Data

The dataset we are planning to use for our project can be found at this Google drive link here. This dataset was found on the US Census website that breaks down consumer spending by month - it has done so since 1992. We took the adjusted sales data (which "reflect corrections to data," a fuller explanation can be found here) for 32 categories including the total retail and food services sales, motor vehicle and parts data, furniture and home furnishings stores, food and beverage stores, grocery stores, health and personal care stores, clothing stores, department stores, and more, all broken down by month. This dataset includes consumer spending data starting in January 2007 and ending in August 2020.

We also want to explore GDP trends. Here is a dataset for GDP per state. The data is broken down into a separate csv file per state from 2005 to 2020. We then merge the csv's together into a nationwide dataset over the past 15 years. There is also quarterly data by state of consumer expenditures (similar to the above paragraph). The data is segmented into different sectors of the economy and both absolute and relative (percentage of the total U.S.) values are given.

Sketches

See below, under Storytelling.

Deciding

Rough draft of a general outline for how our final website may look like:

1. GDP comparison of 2008 and 2020
2. Interactive component
3. Transition to online learning — Zoom
    a. In parallel, stock market crash 2008
4. How long it took for recessions to reach lowest point / how sharp was decline
    a. WHO global crisis
    b. Lehman Brothers
5. Consumer expenditure
    a. Compare sectors
6. Narrow down into one sector
7. Conclusion: public policy

Storytelling

Storyboard link here.

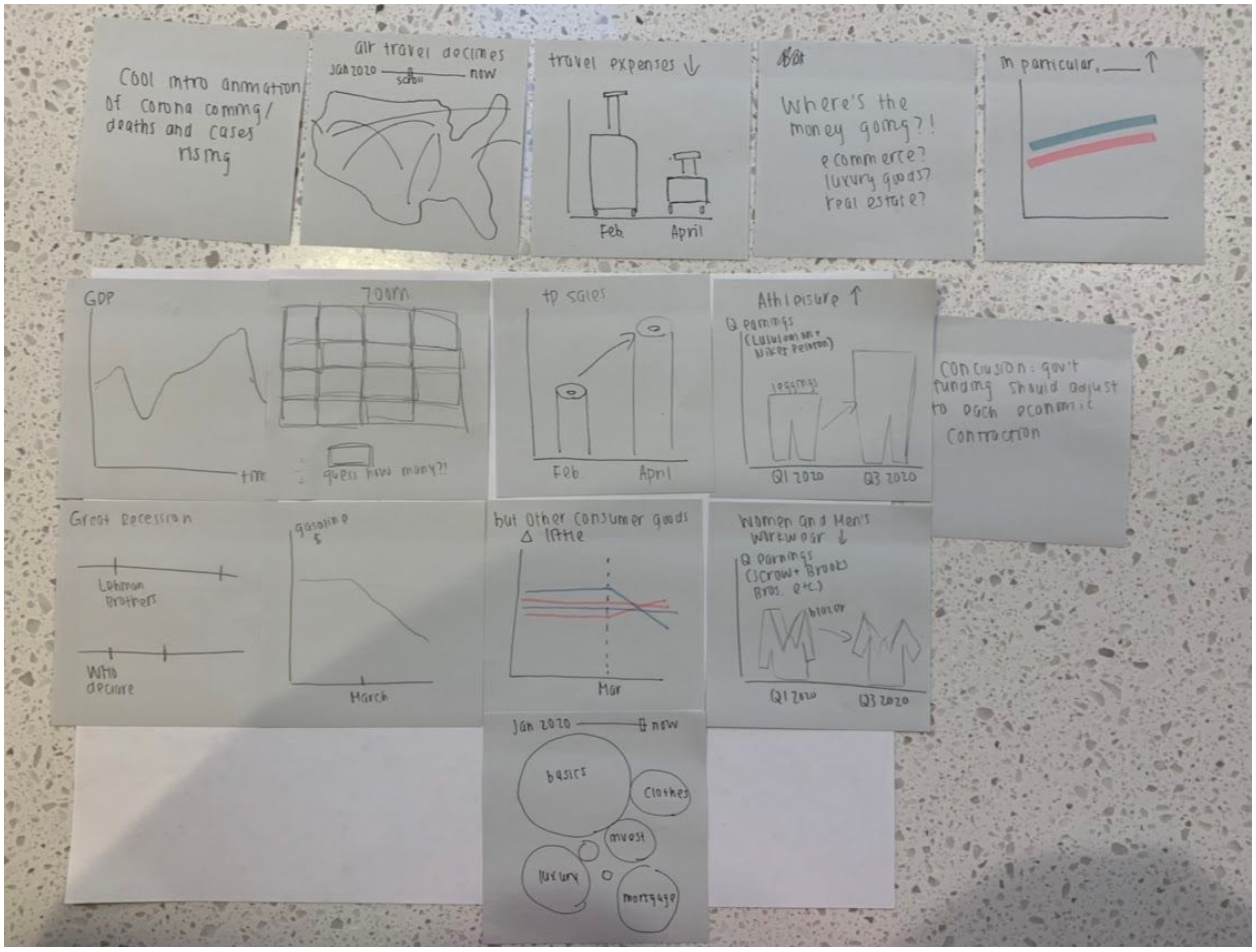
We will first begin by analyzing the data from the recent COVID-19 recession. In doing so, we will be able to capture the audience's attention by displaying the data that is most relevant to their lives now. We will set up a quick background with regards to the fact that consumer behavior changes when the economy in the US changes, specifically when the US faces a recession. We will analyze specific products that consumers purchased using the monthly dataset and exploit trends in the data. The story here is that consumer spending increases and decreases based on 1. The product that they purchase and 2. The state of the economy.

From there, we will look back into history by analyzing the data from the 2007-2009 US financial crisis. We will analyze general consumer spending behavior and attempt to use the data points from this historical recession to predict and analyze the COVID-19 recession.

The difference between the aforementioned COVID-19 and 2007-2009 financial crises is that we will analyze more specific trends of consumer spending behavior, such as athleisure, when exploring the COVID-19 data on consumer behavior. The story here is that although consumer spending changes according to the state of the economy, the *different* events that caused the current state of the economy leads to differences in consumer spending changes.

This has public policy implications, especially in how the government should react to different economic contractions. Depending on what's driving the contraction, different sectors of the economy are positively vs. negatively impacted. For example, some sectors (i.e. food) were affected in 2008 but not during the pandemic. Thus, in

crafting programs like the Paycheck Protection Program (PPP), the government should focus their funding on suffering industries, rather than make the funding available to all.



Note: top row additional drawings/notes that could come in use depending on data analysis

Week 11: Prototype V1

- Name of students that worked on prototype V1 submission: Sophie Sun, Eric Lin, and Verena Lin.
- Data scraping and cleaning complete: consumer spending dataset, GDP per state dataset, consumer expenditure dataset.
- Storytelling:
    - We will first begin by analyzing the data from the recent COVID-19 recession. In doing so, we will be able to capture the audience's attention by displaying the data that is most relevant to their lives now. We will set up a quick background with regards to the fact that consumer behavior changes when the economy in the US changes, specifically when the US faces a recession. We will analyze specific products that consumers

purchased using the monthly dataset and exploit trends in the data. The story here is that consumer spending increases and decreases based on 1. The product that they purchase and 2. The state of the economy.
    - From there, we will look back into history by analyzing the data from the 2007-2009 US financial crisis. We will analyze general consumer spending behavior and attempt to use the data points from this historical recession to predict and analyze the COVID-19 recession.
    - The difference between the aforementioned COVID-19 and 2007-2009 financial crises is that we will analyze more specific trends of consumer spending behavior, such as athleisure, when exploring the COVID-19 data on consumer behavior. The story here is that although consumer spending changes according to the state of the economy, the *different* events that caused the current state of the economy leads to differences in consumer spending changes.
    - This has public policy implications, especially in how the government should react to different economic contractions. Depending on what's driving the contraction, different sectors of the economy are positively vs. negatively impacted. For example, some sectors (i.e. food) were affected in 2008 but not during the pandemic. Thus, in crafting programs like the Paycheck Protection Program (PPP), the government should focus their funding on suffering industries, rather than make the funding available to all.
- Each of the following can be found in this zip file.
    - At least one D3 visualization already partly implemented, and drafts for 2 more visualizations
    - Rough webpage design and structure has to be done and implemented
    - The first design of an innovative view
    - Interactions (e.g., filtering, brushing, etc.) have to be designed

Feedback from Yalong:

- You need to make sure your data story flows well. For example, at the very beginning, the # of Zoom users seem to appear all of a sudden, and the next thing is also not very related to Zoom. I understand that the number is quite eye-catching, how about moving this part after showing the trend of different sections? Explaining why Tech performs well during the Covid. Maybe a few more similar thing as # of Zoom users will be even stronger. You can also probably show the stock price of Zoom across time?
- For the matrix, think about what purpose it serves. It needs to help your data story.

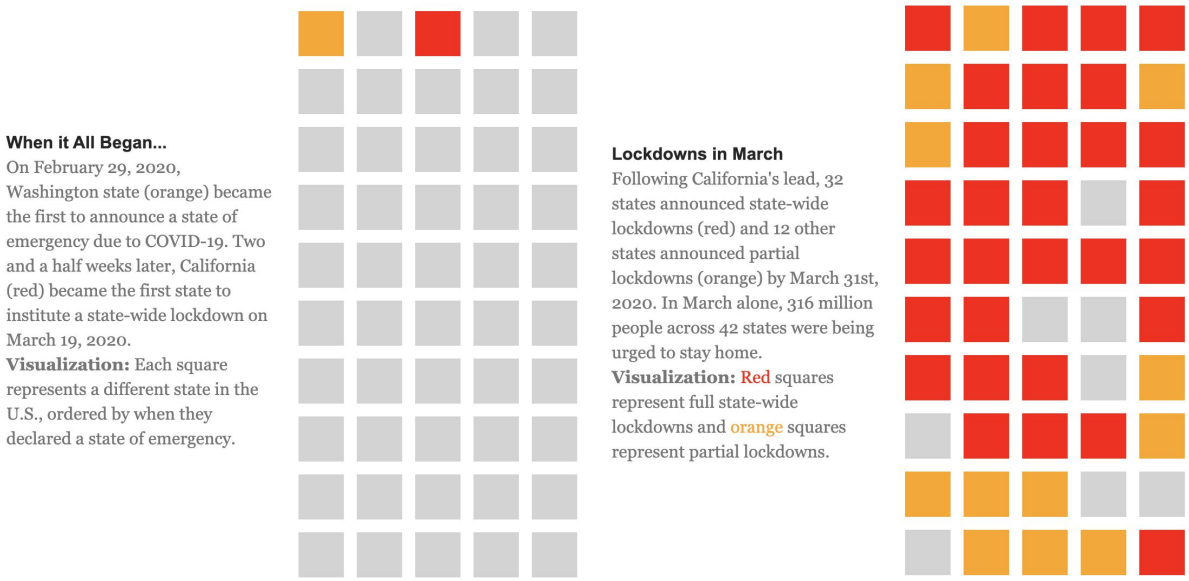
- For the line chart, it can be interesting if you can point out a few important timestamps, e.g., election day, vaccine announced, bankruptcy of Lehman Brothers etc. Give people more context and details.
- Taking actions for local/small business is a nice ending, but you need to set up the context, like, why does the topic suddenly change to small business? Maybe it is because they are affected most? It will be great if you can find data and create visualization to support this.
- The current prototype still overall looks simple, but I believe with the designed map and stuff, you guys can put more things into the v2!

Week 12: Prototype V2

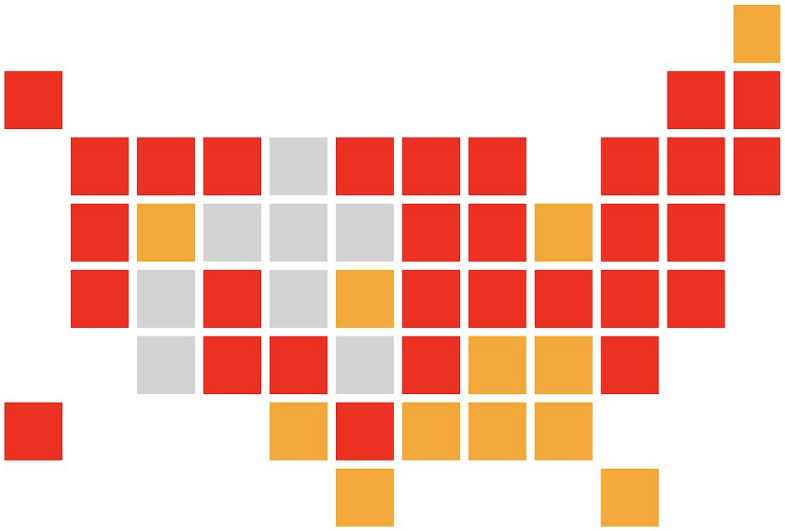
Updates

Please see our V2 code here (also updated on GitHub).

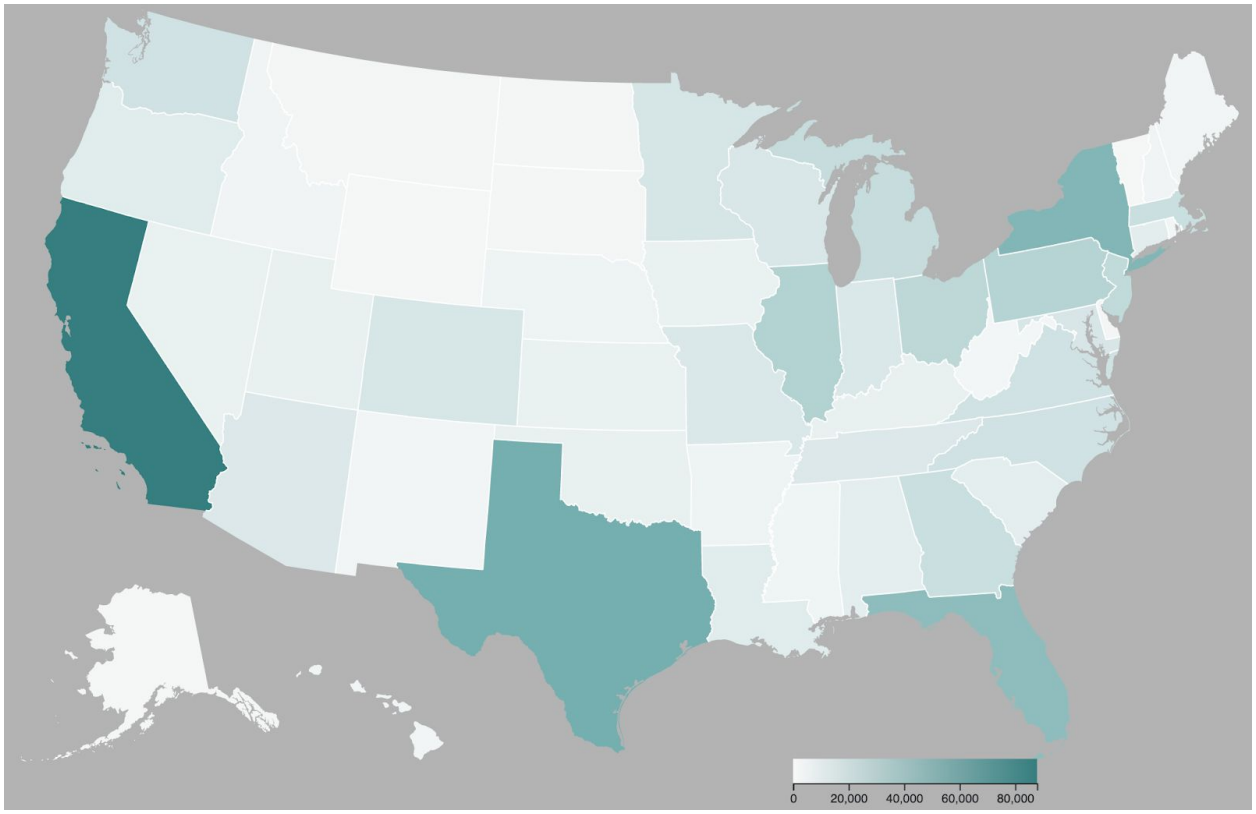
- Created matrix visualizations



A New Normal
In the period of three weeks, virtually the entire U.S. had to adopt to a new normal. One in which hinderd people from working, buying, and traveling.
Visualization: Red squares represent full state-wide lockdowns and orange squares represent partial lockdowns.



- Updated consumer expenditure graph to be in the timeframe of COVID-19
- Created Interactive (draw your own) graph
- Created PPP federal funding map



Yalong's feedback:

- If scrolling from "Consumer Expenditure" to the previous page, the line chart remains.

- From “A Tale of Two Recessions” to “Consumer Expenditure”, it will work better if you can have staged animation, i.e., first the x axis changes, then the line chart scale and move etc. The current transition is a bit difficult to follow.
- For the line chart, hovering to see what it is is very convenient for the user.
- “It's clear that people in many states have clearly not received enough government loans.” How to get this conclusion from this visualization?
- For using a choropleth map, remember your Week 8’s HW? Absolute values are not good to be presented in a choropleth map.
- The value in the map tooltip is also not easy to understand.
- The ending is a bit unexpected. Feel like you have a lot of other things to tell…
- Overall, the website is super polished. I think you may want to add some extra content/visualization to your visual story. The story as a whole is relatively thin at the moment.

Week 13: Test

Tester 1 Name: Prabha Kramadhati

Tester 1 Email: pkramadhati@g.harvard.edu

General Observations from the think-aloud study:

- Good work but some of the graph axes were a little confusing

What does the tester like about your data story?

- Liked most of the visualizations and the general aesthetic
- Liked the end message and connection between federal funding and lockdowns

What improvements does the tester point out?

- Intro: no comments
- Has trouble knowing which way to scroll so maybe a scroll error
- When it all began: wants letters
- Lockdowns in March: understands the visual better now
- A new normal: likes the map visual. Specify what a gray box means.
- A sharp drop: needs to specify units
- A tale of two recessions: confusing in understanding the graph. Hard to correlate the two axes
- Consumer expenditure: different colors to help differentiate different sectors; have tooltip constantly there like UK

Was the intended key message clear to the tester? Why or why not?

- Federal funding: liked it, but do it per capital, and elaborate more on why federal funding is needed

Did the tester get your next steps or call to action? Why or why not?
- To drive home the key point: potentially add metrics like personal income and deficit, or show percentage decrease for income

- Interactive: how could you track the graph that was drawn and try to match that with the actual graph and show the difference

Robert's comments:
- Drawing the same thing? Ehhhh
- Worth thinking about putting two graphs together - draw TOGETHER and show together

Tester 2 Name: Cyrus Faruque

Tester Email: cyrusfaruque@college.harvard.edu

General Observations from the think-aloud study:
- Likes the scroll a lot
- Small things to fix (like the tooltip)

What does the tester like about your data story?
- Really strong / relevant right now; very insightful information

:

What improvements does the tester point out?
- "Lockdowns in March"
    - Group by color (so almost like a vertical bar chart)
    - Add tooltips and/or labels
- "A New Normal"
    - Add space between Visualizations and Red
    - Typo
    - Consider starting off with this visualization?
- "A Sharp Drop"
    - Fix tooltip
    - Add axes
- "The Recovery So Far"
    - Include the lowest bar to "A Sharp Drop"

- “A Tale of Two Recessions”
    - Label more clearly
    - Fix tooltip to make it easier to hover and see what the lines mean
- “Federal Funding”
    - Make tooltip look less jank
    - Unclear at what the legend is
    - Add commas to numbers in tooltip
    - Use significant figures
    - Reference past map to see the contrast

Was the intended key message clear to the tester? Why or why not?

- Storyline is a bit disjoint - add that just because you don’t have as many cases, your economy takes a big hit
    - Reference back to previous visualizations
    - It should be based on what businesses closed down, not really about the number of cases

Did the tester get your next steps or call to action? Why or why not?

- Really likes call to action

Week 14: Wrap Up & Submission

See submission on Canvas.