Design Document

Visualizing the 2008 Financial Crisis

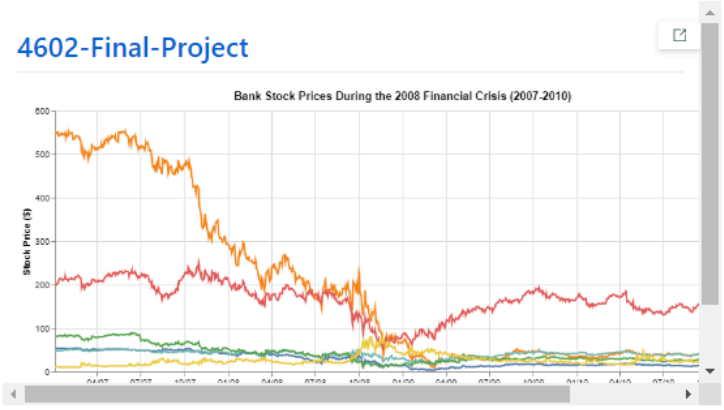
Summary:

Our vision for this project was to create a dashboard that could teach the average person a bit about the financial crisis of 2008, and the effects it had on the U.S economy. To accomplish this, we retrieved and analyzed economic data from the FRED (Federal Reserve [of] Economic Data
), and used that data to construct 4 visualizations in order to help visualize the effects. With several interactive visualizations that allow the user to explore the data over time on their own. While the 2008 crisis had many moving parts and a cascade of downstream effects, we decided to focus on the simpler concepts that people were more likely to recognize and relate to.

Visualizing the Economic Impact of the 2008 Financial Crisis

Michael Baur, Jacob Kossman, Colm Nkposong, Jackson Giemza
April 23, 2024

The 2008 financial crisis stands as one of the most significant economic upheavals of modern times, sending shockwaves through global markets and reshaping the financial landscape for years to come. Stemming from a complex interplay of factors including subprime mortgage lending, regulatory failures, and the proliferation of complex derivative instruments, this crisis revealed fundamental flaws within the financial system. In this project, we aimed to visualize the intricate web of events and trends that culminated in the collapse of major financial institutions, the onset of a deep recession, and the widespread socio-economic ramifications that reverberated across the globe.



4602-Final-Project

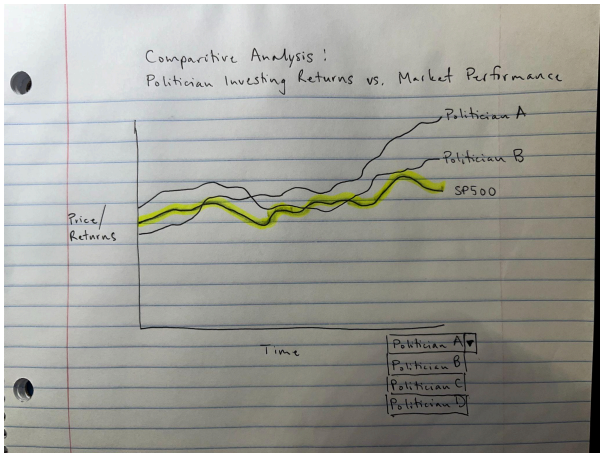
Initial Brainstorming:

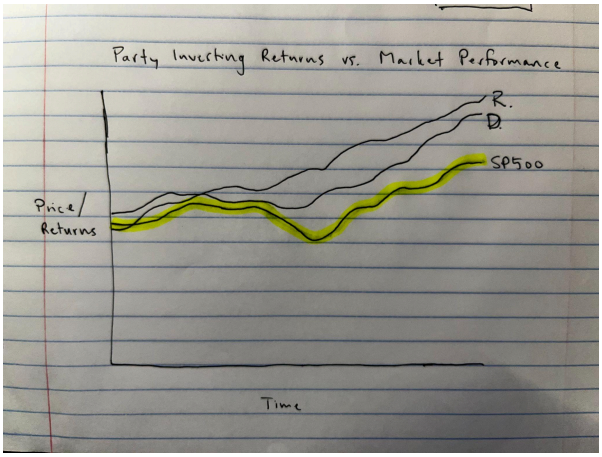
Our group's theme was finance, and at first, we were a little paralyzed about the broadness of our theme, with “finance” being a broad umbrella and having a plethora of unique subsets and topics to explore. After the initial meeting, we all began brainstorming topics that we explore in the finance industry. We narrowed it down to one idea that intrigued us all, analyzing insider trading committed by U.S politicians, like members of Congress, and their family members. However, we ran into a roadblock pretty early on after we discovered data on the topic was limited and difficult to access, forcing us to pivot to a new topic, visualizing the 2008 financial crisis. The crisis was caused by a combination of subprime mortgage lending and the rise of derivative trading on mortgage-backed securities. We decided that we wanted to look at and visualize the

effects on economic instruments such as bank stocks, unemployment rates, interest rates, consumer spending, and GDP changes throughout the recession and afterward.

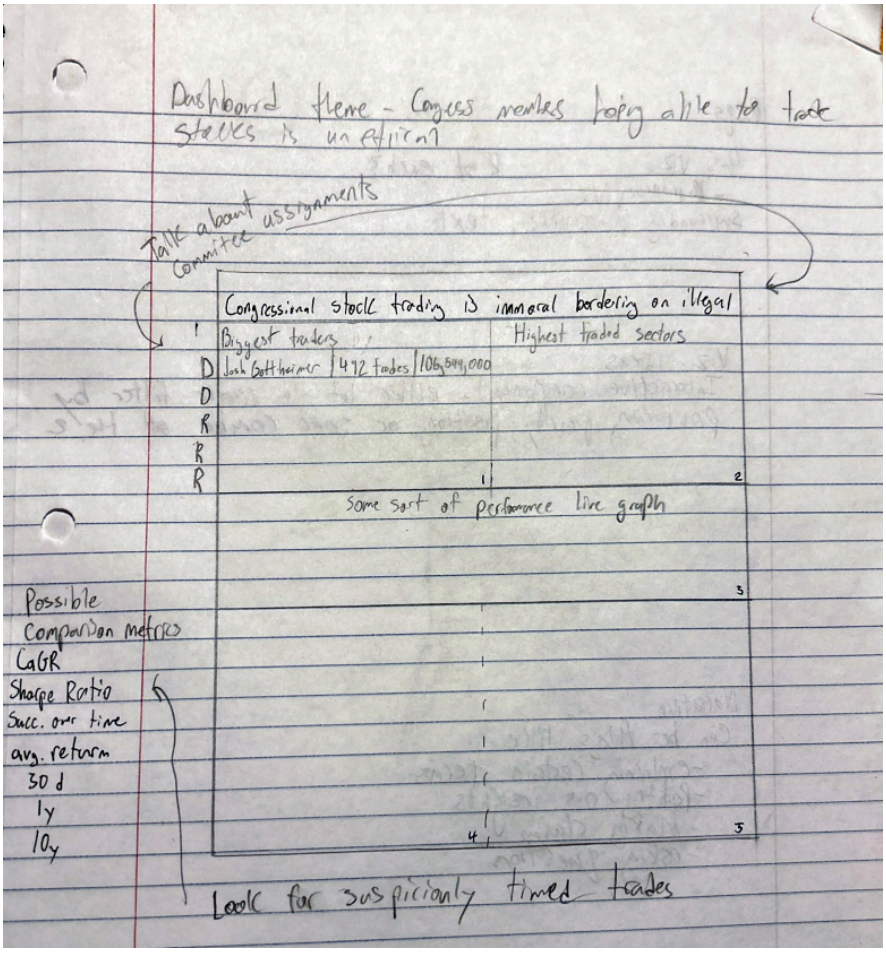
Initial Sketches:

When we were first researching our topic, we thought that an API from a finance trading data site named Quiver Quantitative would be super helpful. They had a ton of visualizations and tables containing information on different politicians and their trading volumes, risk ratios, average returns, and a couple of other statistics we would either need or would be super useful for our dashboard. We were even able to get in touch with Quiver and they granted us free access





to their site & API and some of our first dashboard sketches were based on the data we *thought* we could access.



Our first dashboard sketch

Back to the drawing board:

However, upon downloading the actual files we realized that we only had access to a fraction of the data they had actually displayed. The data we could actually access was really only surface level, so we were forced to pivot to a new topic, the 2008 financial crisis. This was a topic that also held a lot of interest to us because we were all just children at the time who couldn't quite comprehend what was happening. One thing we did know was that the financial crisis had reverberated across many different facets of countless financial markets, consumer spending habits, and more. We figured this topic would provide both ample amounts of online data and the opportunity to visually characterize and highlight these consequences.

Mapping:

Three main questions:

What is the data? (And data types)

U.S Percentage Change in Unemployment rate YoY - Time (Y-M-D) + Unemployment (Float)
Unemployment rate by State - State (Categorical Text) + Time (Year) + Unemployment (Float)
Percentage Change in Real GDP YoY - Time (Year) + GDP change (Float)
10 year & 30 year Treasury rates: Time (Year) + 10/30 Year Interest Rate (Floats)
Bank stock prices: Time (mm/yy) + float

What is the question?

What were the effects of the 2008 financial crisis and how did those effects emerge?

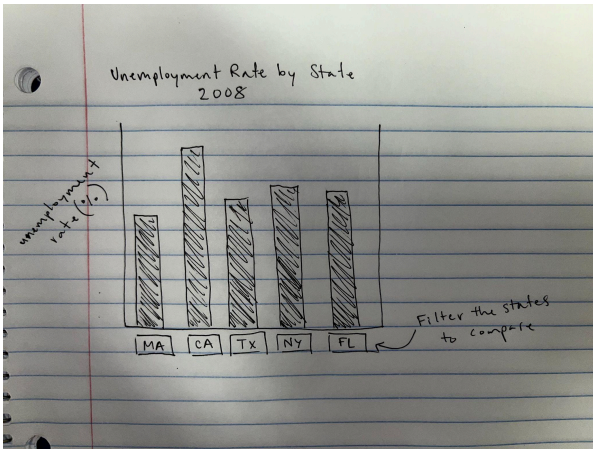
Who is the audience?

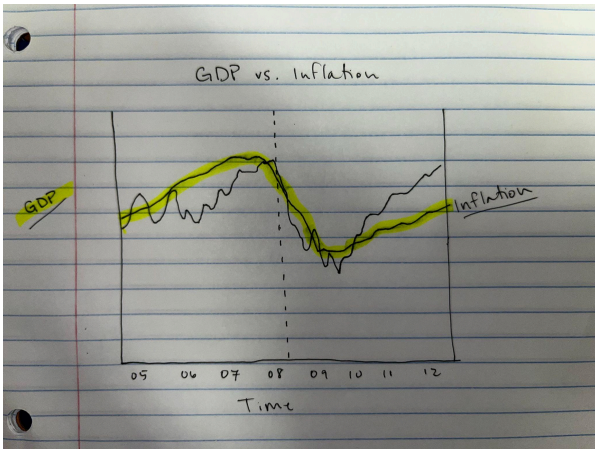
The average person - Our target audience is essentially anyone who wants to learn more about this foundational economic event – students who were too young to recognize the impact at the time, or even adults who want to visually explore the topic.

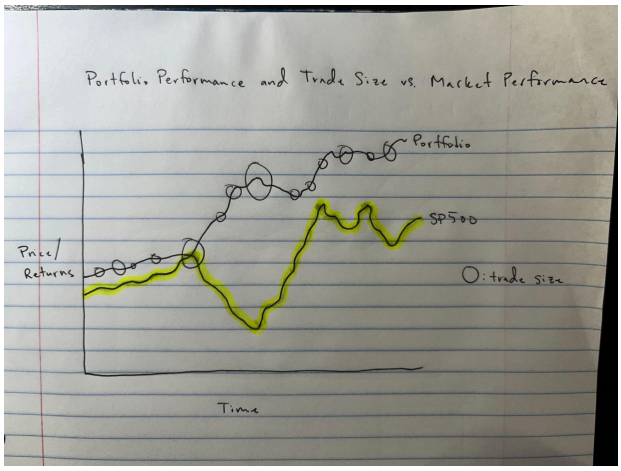
How might we use the data?

- Visualizing the extent of the crisis
- Contrasting economic statistics before and after the crisis
- Contrasting various levels of impact the crisis had on different parts of the economy

Sketching:





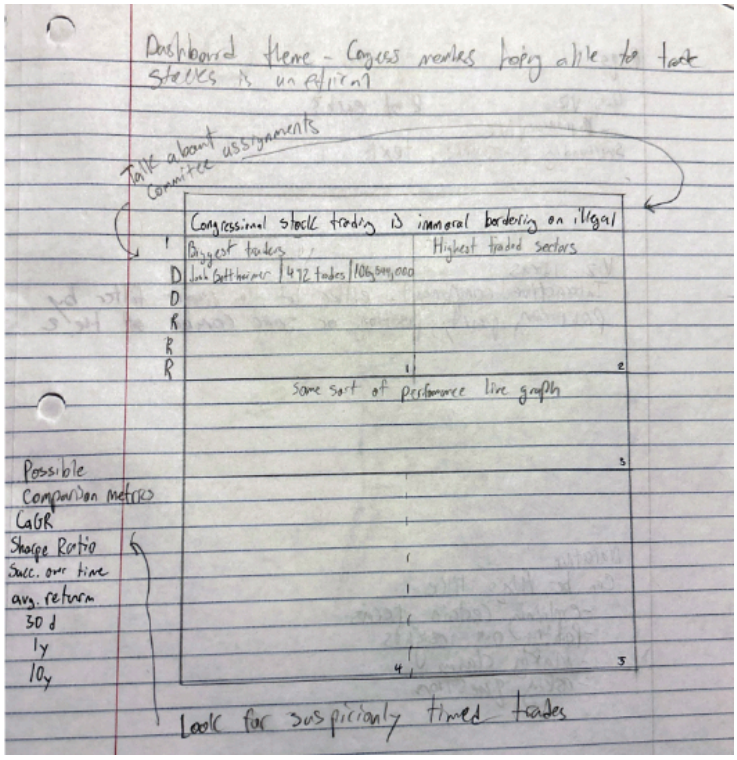


With our pivot finalized, we moved into data exploration and research. We quickly realized that we had the opposite problem from our initial topic, an overabundance of data. Because of this, it was very important for us to think about the bigger picture during this portion of our project: a story detailing the overarching economic impacts of the financial crisis in the U.S. To accomplish this, we looked at different economic metrics that we could visualize to represent the impact on the general population as well as the U.S. economy as a whole, focusing on ones that suffered historic lows during this period.

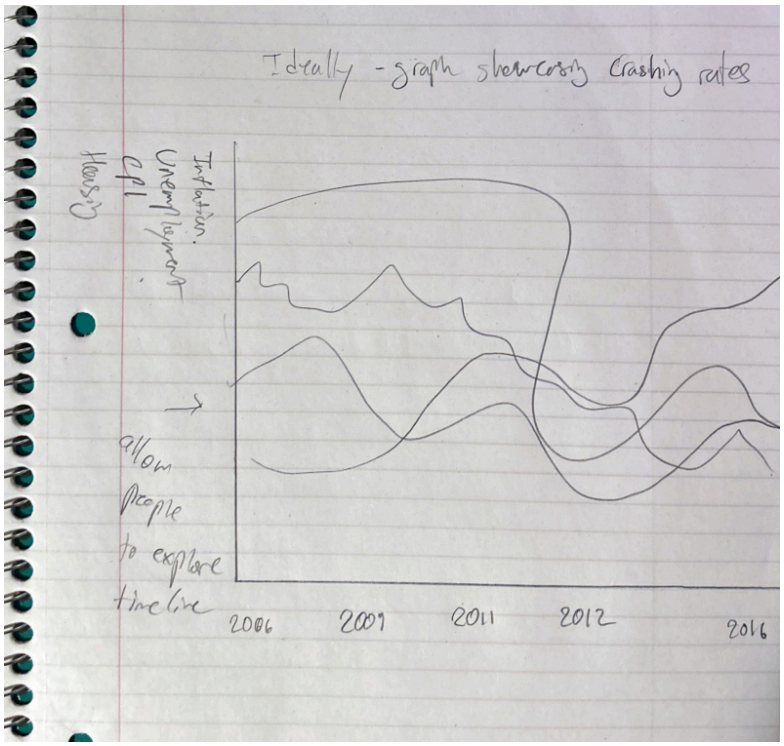
From Individual Designs to a Cohesive Story:

Before each one of us jumped into individually designing our visualizations, we mapped out the story that we wanted to tell. By doing this, we all had a clear understanding of what data to pursue and what types of visualizations we wanted to show. The data and variables we used are all interconnected either directly or indirectly. The specific metrics we analyzed were considered as a team and we concluded they would tell the best cohesive story of the economic event.

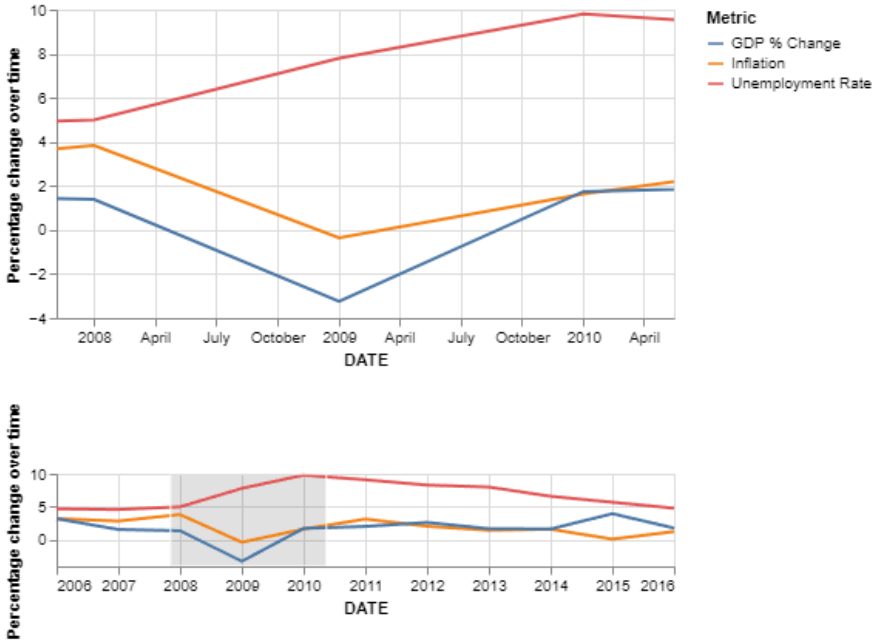
Prototyping:



Colm's Prototype:


Ideally - graph showcasing crashing rates
Housing
Inflation
Unemployment
GDP
→
allow
people
to explore
timeline
2006
2009
2011
2012
2016

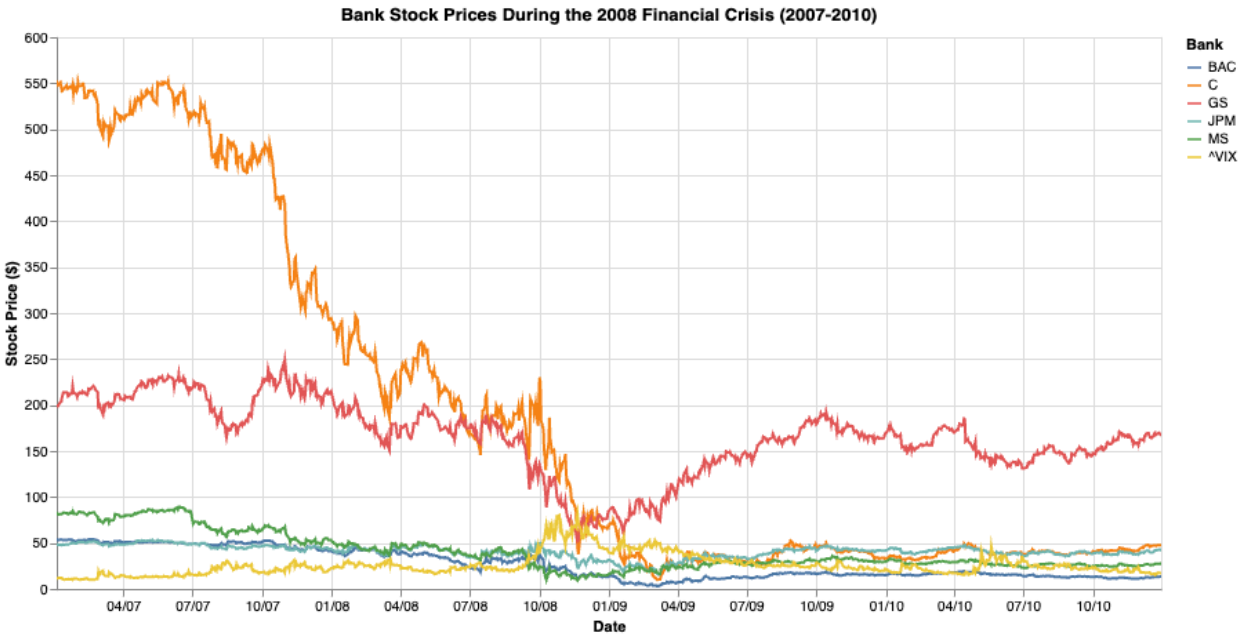

Inflation, GDP % Change, UNRATE
10
8
6
4
2
0
−2
2006
2007
2008
2009
2010
2011



Since we ended switching topics, I wasn't able to use much of the feedback on my earlier sketches and prototypes. But I tried to incorporate some of what I had heard earlier, someone suggested adding an interactive way to explore trends, so I wanted to create a visualization that allows you explore the different variables over a long period of time. I think I would probably change something next time to highlight that a bit more. I think people were trying to explore using the top graph and got confused. I also included another chart that was less interactive, but would tell you the exact rates at the time your mouse was hovering over, I thought it looked cool, but next time I would try and combine my two visualizations into one.

Visualizations:

Bank Stocks



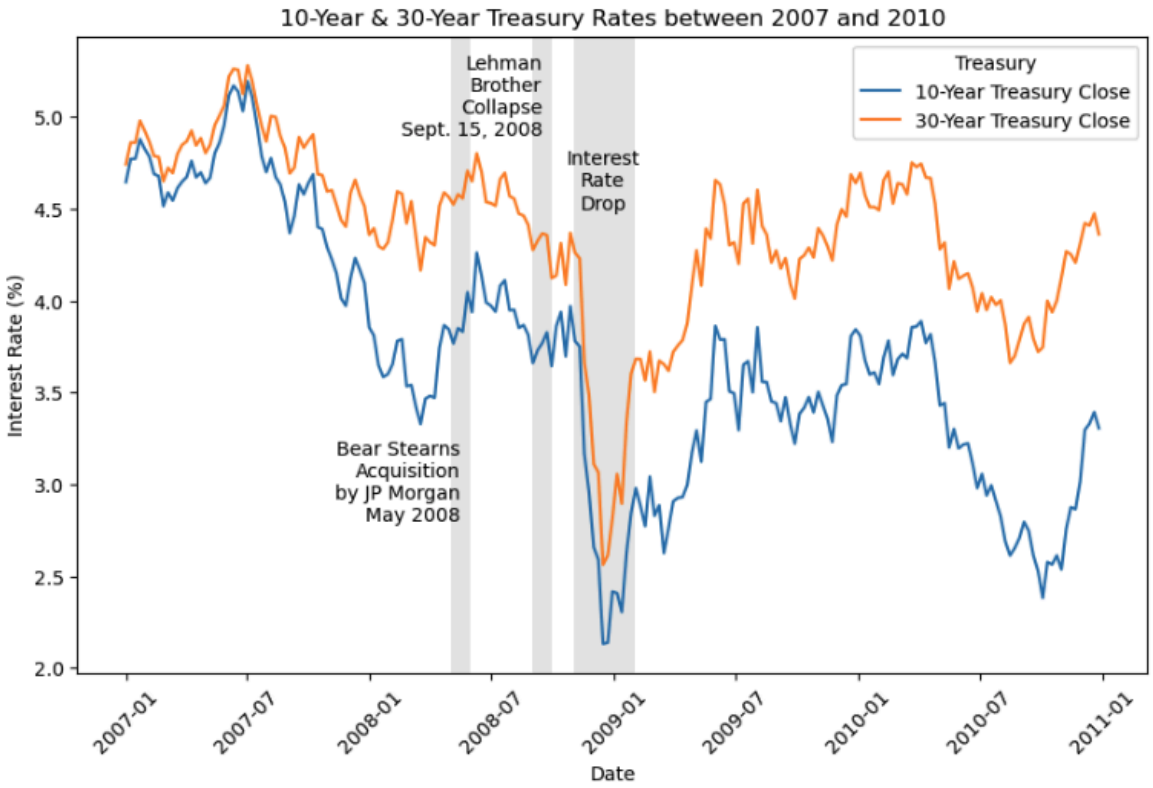
As seen in the visualization above, the VIX spiked in late 2008, the bottom of bank stocks. Showing this on the same graph gives the user additional, yet crucial information about market performance during this time.

We also made this visualization interactive with a drop-down menu to highlight one equity at a time. Since JP Morgan, Bank of America, and Morgan Stanley stocks prices trade at similar prices, letting the user highlight one at a time allows better accessibility and better conveys the data and story. Additionally, the ability to pan and zoom in/out was added for similar reasons.

Distinct colors were used to separate the lines so the user could distinguish against the different variables being portrayed.

Treasury Rates

Bond and debt markets were also significantly impacted by the 2008 crisis. We decided to delve into 10-year and 30-year treasury rates to explore the effect.



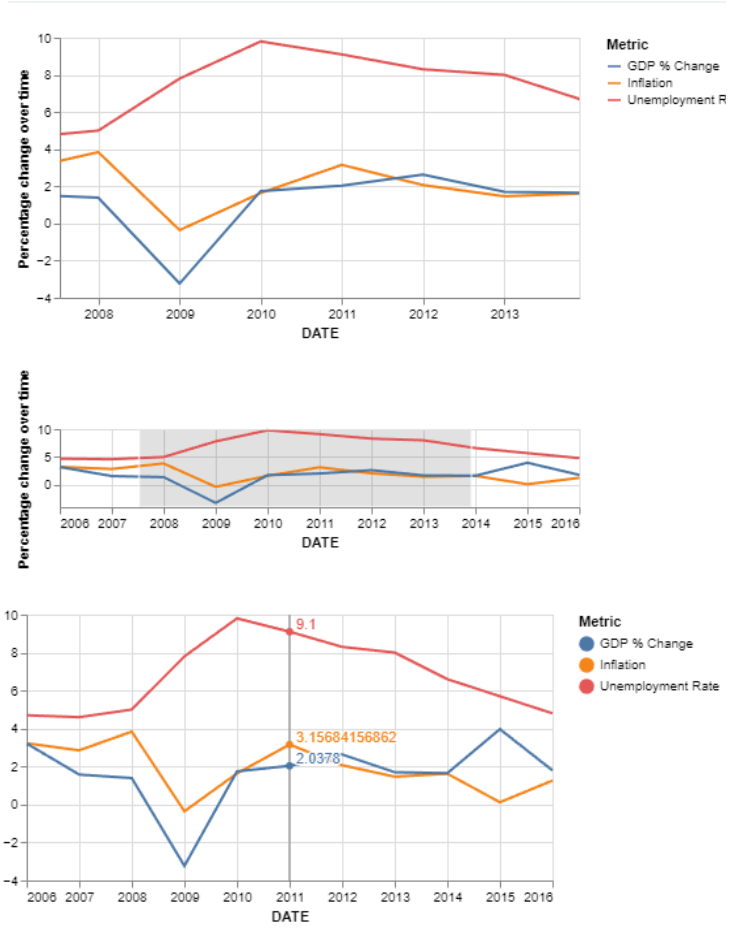
Examining 10-year and 30-year Treasury yields is crucial in understanding the 2008 financial crisis because their movements reflect investor sentiment regarding economic stability. The federal reserve will often cut rates during a recession with the attempt to jumpstart spending and the overall economy.

As seen in the graph above, treasury yields considerably dropped during late 2008 reflecting the crisis.

Additional design choices on the visualization includes annotations and highlighting. These gray shaded areas represent key events in the economic crisis timeline. We further chose to denote them using annotations. We chose the Lehman Brothers collapse and the Bear Stearns acquisition by JP Morgan as primary events to point out directly before the significant rate cuts.

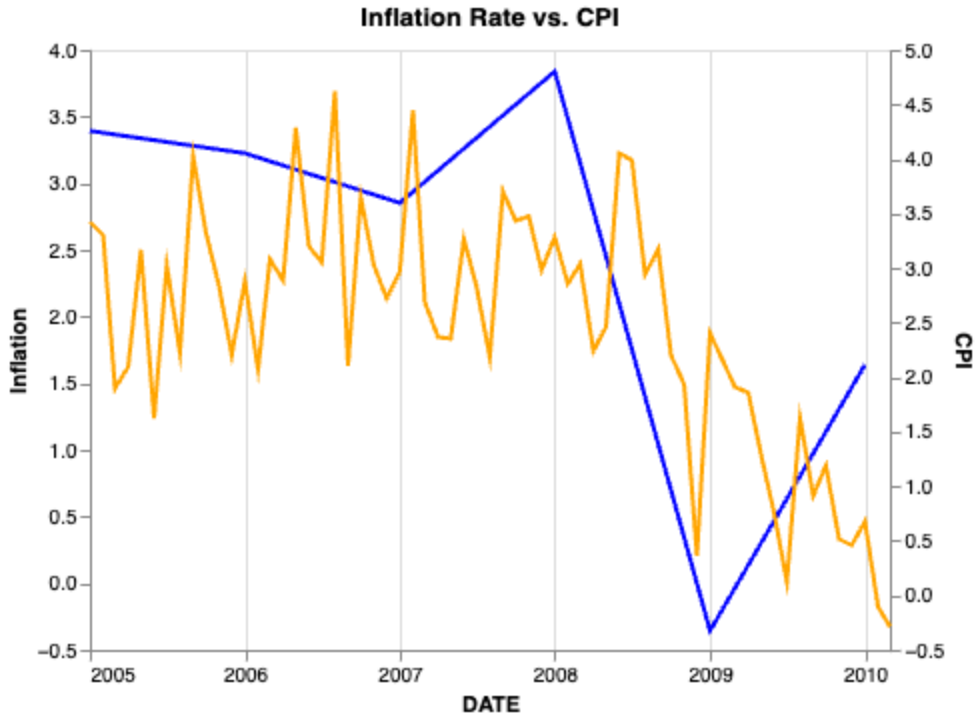
In the initial sketches and prototypes, we had these annotations on the bank stocks visualization but ultimately decided they fit better on this one. When they were on the other graph, it looked too ‘busy’ and clouded the more important story. Treasury yields are often used as key economic indicators so we concluded that these events better fit on this visualization.

Inflation, Unemployment, & % Change in GDP:



In our initial project pitch, someone mentioned that we needed to use clear and easily understandable terms that people without a financial background would understand. So we wanted to highlight and look at some statistics people are used to hearing about more often, either from news or peers. Inflation was one metric I thought would be cool to look at because it's one that many people have heard of before, and affects people even when they don't realize it. It also has cascading effects on consumer supply and demand, company pricing, and more. Unemployment rate was another one I thought would be important to highlight, one of the most common parts of the crisis that I personally heard about were people losing or fearing losing their jobs. We wanted to see if that trend carried over to the actual data, which it absolutely did, with a historically high unemployment rate. GDP was another economic indicator that, while less widely known, is important nonetheless, it is an indicator of U.S economic output, and the slump in the dataset highlighted the damage inflicted by the crisis.

Inflation vs. CPI

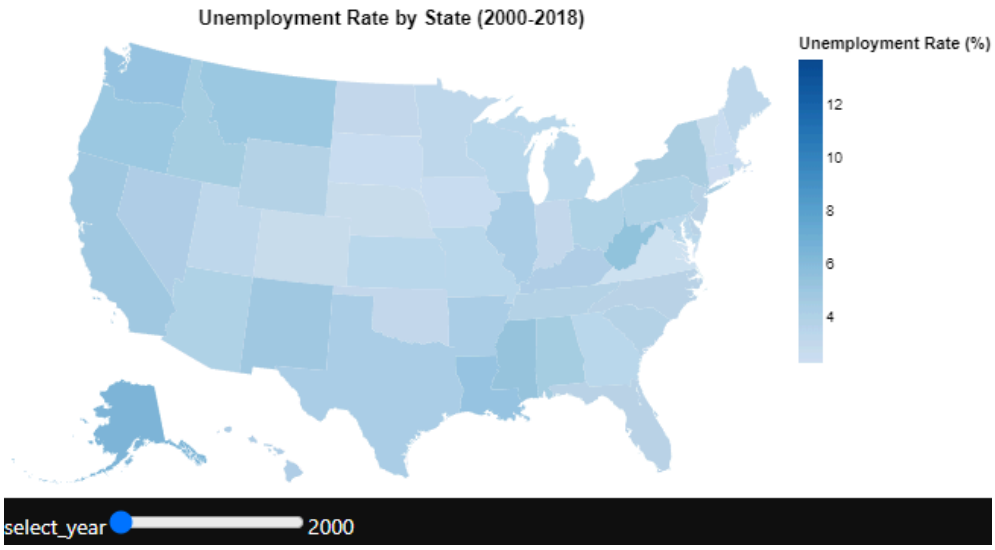


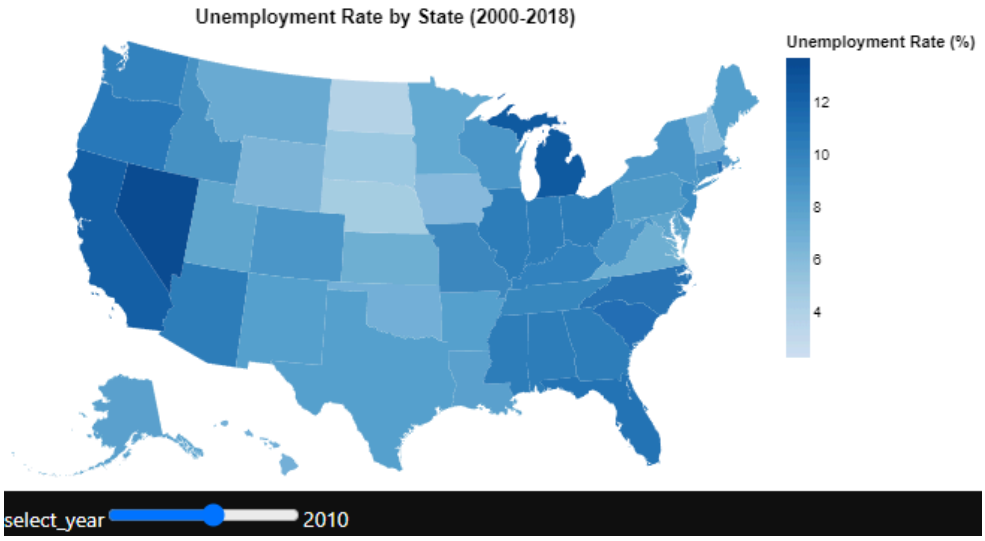
When thinking about economic factors to consider, especially in the context of the 2008 Financial Crisis, two that stuck out were the inflation rate and CPI. Inflation is the rise of general prices of goods and services represented by a percentage. CPI is the percent change in a basket of goods and services over a period of time. It is important to visualize these two concepts in order to understand the effect of the financial crisis on consumers as well as the economy as a whole during this time and how they may have been affected.

It is apparent that during the crisis the inflation rate plummets, eventually reaching a deflation period in early 2010. The CPI level breaches the same negative level at the beginning of 2009. While low inflation rates theoretically means that prices are low, this is not necessarily a sign of a healthy economy. Inflation is actually very important in stabilizing an economy and is a sign that an economy is growing because things are more expensive. A low CPI level, or decreasing CPI, indicates deflation and a weakening economy.

The decreasing CPI level and inflation rate during the financial crisis are strong indicators of the weakened economy. Economically these lead to lower consumer spending, further depleting the economy of its strength.

Unemployment by State over Time:





To visualize the scale of the 2008 financial crisis and the effect it had on the US economy and its citizens we used an interactive choropleth. This visualization allows users to see how unemployment rapidly increased throughout the US leaving no state untouched.

This choropleth utilizes a continuous color scale, with darker shades indicating a higher rate and lighter indicating a lower rate. This gradient allows users to quickly interpret the data without needing to reference the legend too often.

Moreover, the interactive nature of this choropleth extends beyond static depictions, enabling users to compare unemployment rates year by year. Spanning from 2000 to 2018, the contrast of

unemployment rates from before, during and after the crisis becomes very apparent. Through this interaction users can discern patterns and correlations that might elude static representations, allowing for deeper understandings of the crisis unfolding.

Final Takeaways:

After reflecting upon our final prototype and getting feedback from peers, there are things we did well, and things we could still improve. Overall, our story was tight-knit and told an unbiased story of major effects that took place in response to the 2008 financial crisis, however, the use of more annotations to explain certain terms, points, or concepts could have helped a lot. Our graphs accurately and effectively portrayed critical information. However our variety of types of graphs could be improved. We used primarily line graphs with just one choropleth. The addition of bar charts, or other types of visualizations could aid in portraying information in different ways and show even more perspectives. Also, we could have utilized a central color theme to make all of the visualizations appear more cohesive as the user scrolls through our story. One big weakness of our story dashboard is the story telling, there is a story to be read from the data, but we didn't do the best job of making it compelling and easy to understand.