Effect of COVID-19 on the State of Texas

Dane Kutz Smith, Denisse Ogata, Harsh Chapadia, Linh Vitullo, Jorge Vargas, Kristen Farabaugh

Project Overview and Hypothesis

- **Background:** The COVID-19 pandemic began in the US in March 2020 and marked a pivotal point in history. A “shelter in place” mandate was enacted, forcing “non-essential” workers to work from home. As a result of this, many companies have changed the way they think about in office work. Specifically, companies deemed “non-essential” (e.g Tech, Staffing, Financial Services) have become more accepting of hybrid and fully remote employees.

- **Hypothesis:** As a result of this shift in the world of work, the COVID-19 spurred a migration from high cost of living cities (HCOL) to medium/low cost of living cities. If the migration from HCOL cities (e.g, San Francisco, New York City, Atlanta) to medium/low cost of cities (in this case, located in the state of Texas) is material, we expect to see an increase in the the following metrics (comparing a pre vs post COVID-19 world):
    - Population
    - CPI (Consumer Price Index)
    - Home Values
    - Rent Index

Data Exploration and Clean Up Process

Step 1: Metric Alignment

- Define a list of core metrics to explore to test the hypothesis
- Define how the metrics will be pulled (API, excel file)
- Define ideal level of granularity for metrics

Step 2: Research & Iterate

- Explore public, free data sources (including APIs, Kaggle, and various websites) to determine feasibility of pulling defined list of metrics
- Create a SOT list of data sources & pull sample data to understand level of granularity available

Step 3: Clean & Merge

- Clean each independent data source to account for nulls, get rid of unnecessary columns, do calculations, etc.
- Once each data source is cleaned and at the right level of granularity, merge the data together into one table for each of analysis

Data Sources, Metrics and Definitions

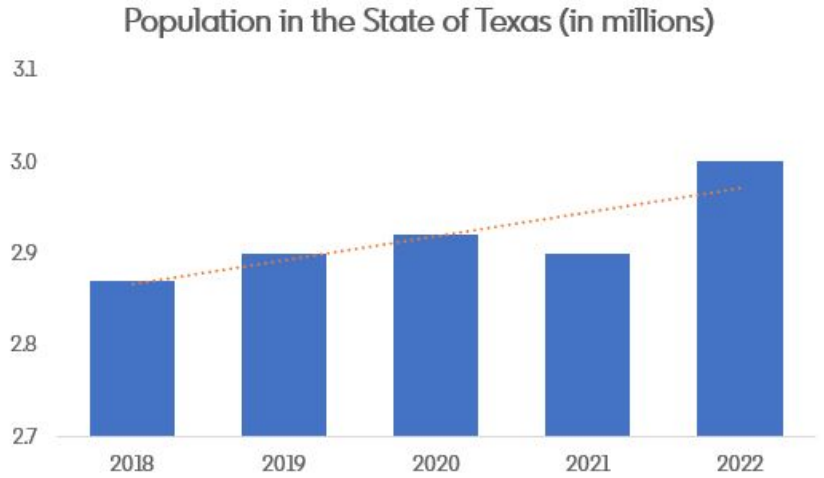
- **Bureau of Labor Statistics API**
  - # of Job Openings: job openings in the state of Texas for all non-farm industries with companies of all sizes
  - Labor Force: pool of individuals age sixteen years or older who are able 1) able to work and 2) employed or seeking employment
  - Employment # (and Employment Rate): smoothed measure of the typical observed market rate rent across a given region
  - Unemployment # (and Unemployment Rate): # of individuals aged sixteen years or older who are able 1) able to work and 2) seeking employment
  - CPI: measure of the average change overtime in the prices paid by urban consumers for a market basket of consumer goods and services

- **Census API**
  - Population: number of individuals residing in the state of Texas

- **Zillow API**
  - Home Value Index: measure of the typical home value and market changes across a given region and housing type
  - Rent Index: smoothed measure of the typical observed market rate rent across a given region

Population

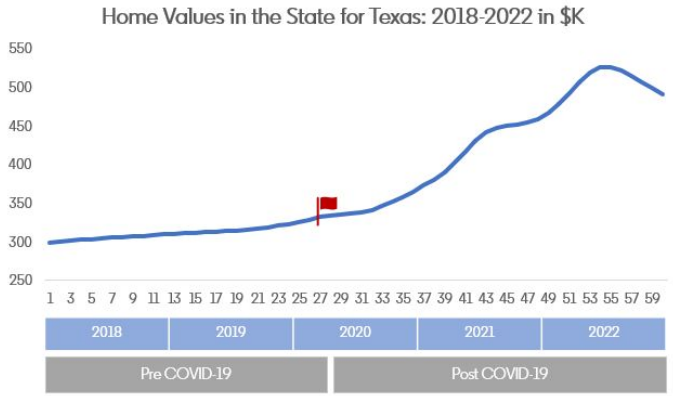
Observation: The population of Texas increased after the pandemic as a result of all three components: net domestic migration (230,961), net international migration (118,614), and natural increase (118,159) (actual numbers from United States Census Bureau). This population shift is a good indicator of the newly adapted work-from-home model, where employers don't require their employees to be in office 100% of the time. Areas in Texas with cheaper housing or better job prospects have attracted emigres from other bigger cities or metropolitan areas of such states as New York, California, etc.

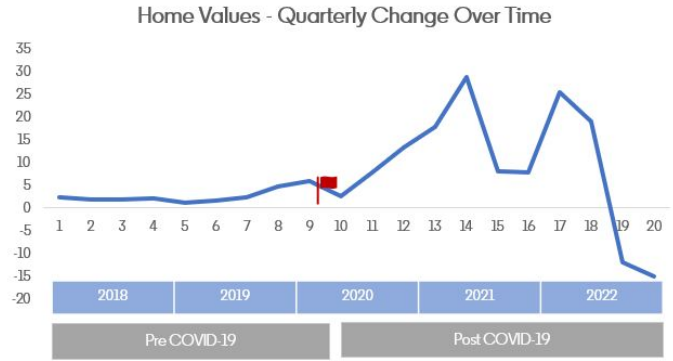


Home Value Index

- A measure of the typical home value and market changes across a given region and housing type. It reflects the typical value for homes in the 35th to 65th percentile range. Available as a smoothed, seasonally adjusted measure and as a raw measure

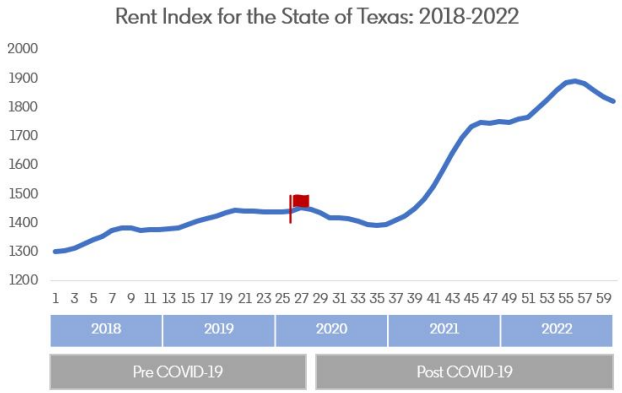
- The Home Value Index shows the impact COVID-19 had on home values. Since the start of the pandemic, the home values increased significantly, as well as the quarterly change over time, increased sharply.

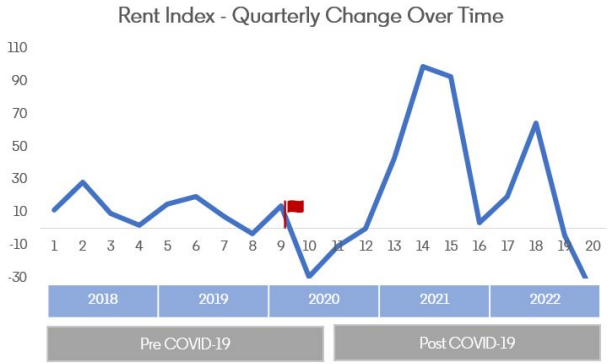




Zillow Rent Index

- A smoothed measure of the typical observed market rate rent across a given region
- ZORI is a repeat-rent index that is weighted to the rental housing stock to ensure representativeness across the entire market, not just those homes currently listed for-rent
- The index is dollar-denominated by computing the mean of listed rents that fall into the 40th to 60th percentile range for all homes and apartments in a given region, which is once again weighted to reflect the rental housing stock
- Although the Rent Index has been slowly increasing since 2018, the Pandemic had a significant impact on how quickly it went up, raising as much as 98 points in 2nd Quarter 2021

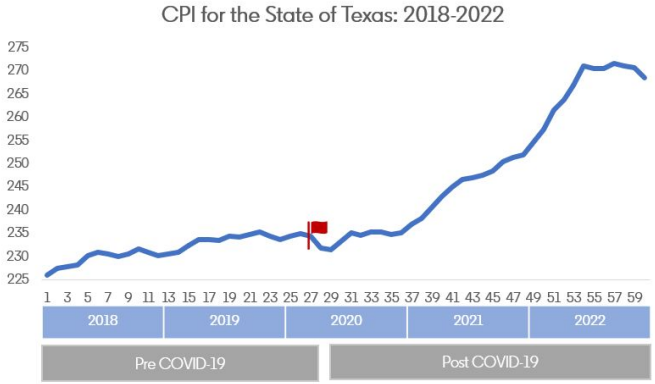


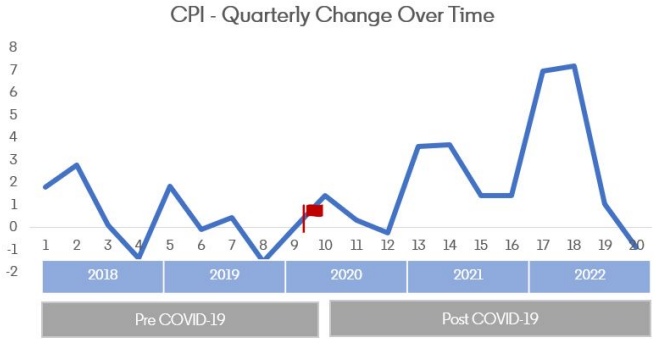


CPI

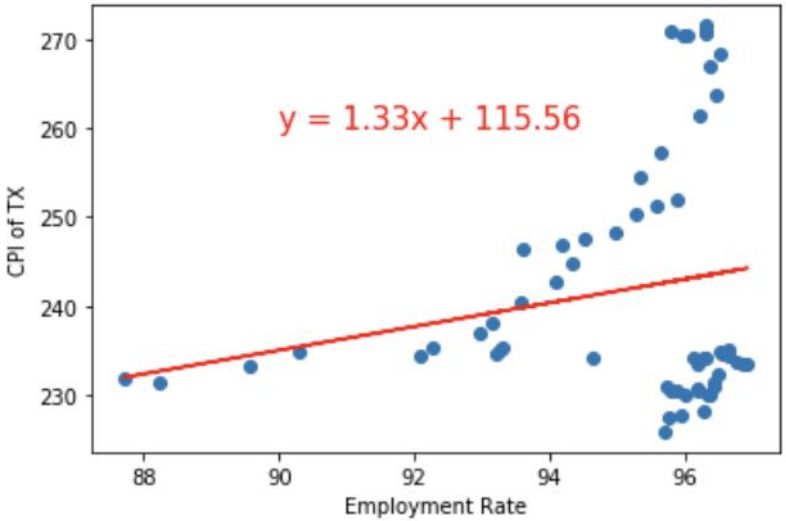
- The Consumer Price Index (CPI) is a measure of the average change overtime in the prices paid by urban consumers for a market basket of consumer goods and services

- The end of COVID-19 lockdowns and the reopening of the world caused significant supply chain disruptions that led to a notable 7% increase in Texas' Consumer Price Index (CPI). The rise in prices was mainly due to shortages of goods and raw materials caused by the pandemic, which resulted in a surge in demand and higher prices, particularly for essential items like groceries and healthcare products



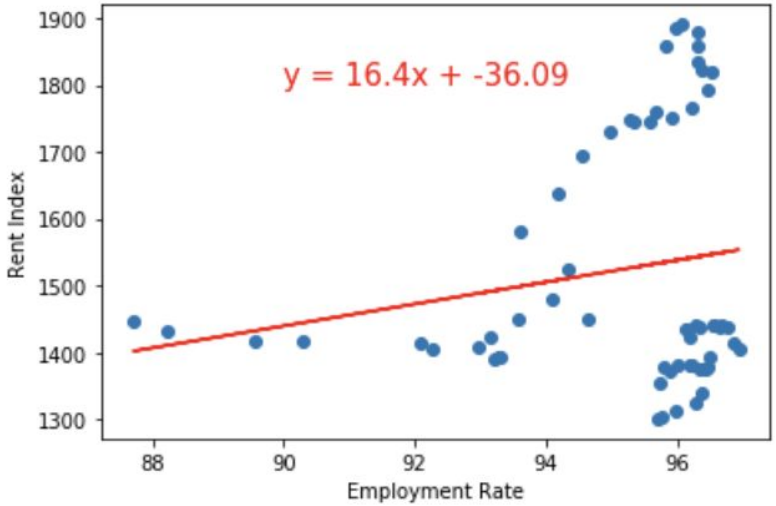


Employment Rate and CPI Regression Model



The regression model with the Employment Rate and CPI yielded the r-squared value of 0.04, which shows the independent variable, the Employment Rate, does not explain the variance of the CPI increasing in Texas, indicating a potential cause could be COVID-19.

Employment Rate and Rent Index Regression Model



The regression model with the Rate Index and Employment rate, yielded the r-squared value of 0.03, indicating that the Employment Rate was not the cause of the variance in higher rent values. Again concluding that the Pandemic had a significant impact on the economy in Texas.

Hypothesis Testing: Home Prices

- Did the COVID-19 pandemic have an impact on the average home price in the state of Texas?

- To test this, we conducted a paired t-test
  - Hypothesis:
    - H0: The mean difference of housing prices in 2018 and 2020 is 0.
    - H1: The mean difference of housing prices in 2018 and 2020 is different from 0.
  - Groups:
    - Group 1: Home values from 2018 to 2020
    - Group 2: Home values from 2020 to 2022

- Since the results of the T-test have a p-value <.05, we reject the null hypothesis. This means the true, average **home value is different for pre and post COVID**. This concludes that **the pandemic had a significant impact on the means of home values** of the state of Texas from 2018 to 2022.

Hypothesis Testing: Job Openings

- Did the COVID-19 pandemic have an impact on the number of job openings in the state of Texas?

- To test this, we conducted a One-Way Anova
  - Hypothesis:
    - H0: The means of 2019, 2020, 2021 numbers of job openings are all equal
    - H1: At least one of the means of 2019, 2020, 2021 numbers of job openings is different from the others.
  - Groups:
    - Group 1: Number of job openings in 2019
    - Group 2: Number of job openings in 2020
    - Group 3: Number of job openings in 2021

- Since the results of the Anova test have a p-value <.05, we reject the null hypothesis. This implies that we have sufficient proof to say **there exists a difference in the mean values** of 2019, 2020, 2021 numbers of **job openings**. We can c**onclude that the pandemic had a significant impact on the mean number of job openings** from 2019 to 2021.

Conclusion

The pandemic had a significant impact on the economy of the state of Texas as a whole, illustrated through a number of negative (upwards) trends have been attributed to the pandemic, including rising housing and rent prices, population growth, and inflation.

We **conclude pre and post-pandemic trends were materially different** and that the **pandemic's disruption was a significant contributor that altered the trajectory of the studied metrics,** which have not completely normalized. This gives us a good understanding of the causal relationship between a medical catastrophe and the economy on the macro scope of view.

Q&A