The Rise of the Remote Work Lifestyle and Its Impact to Travel

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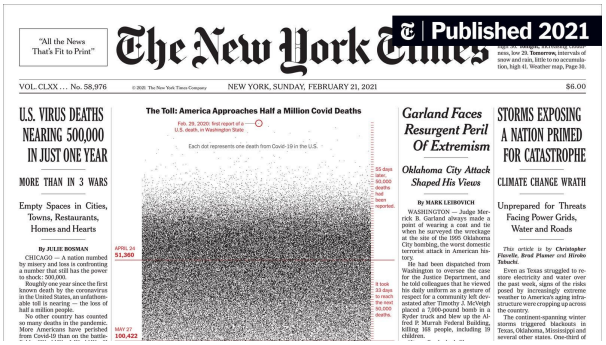
DATASCI 200 Section 4, Spring 2024

Good evening everyone,

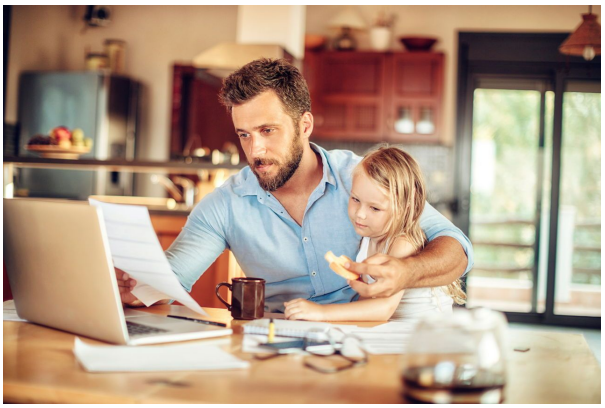
My name is Kent, and together with my colleagues Kenneth and Jason, we're excited to present our findings on the rise of the remote work lifestyle and its impact on travel. We've analyzed data on both remote work and travel to provide you with insightful plots and figures. So without further ado, let's get started.

Background



As we all recalled, COVID-19 pandemic impacted the daily lives of millions of people. Most of us ended up staying home because of the strict social distancing rules. Places like offices, schools, and gyms all went online, and we just didn't go out as much. There was this study back in May 2020, with about 1200 participants that highlighted that during the pandemic, travel distances shortened, and the frequency of trips decreased. The study emphasized that during the COVID-19 pandemic, factors affecting travel decisions, like time, comfort, and cost under normal circumstances, became less important. Instead, concerns related to infection, such as wearing masks and social distancing, became more important than traditional factors.

Background



Not only did we travel less because of the pandemic, but the way we work turned upside down too. Another survey (performed during the pandemic) done with 50,000 people showed us that about half the people who used to go into work were now doing their jobs from home. Over a third stopped commuting because they started working remotely. And it was more common for people with office-type jobs, like managers or professionals, to switch to working from home. Additionally, there was significant variation among states in the proportion of individuals switching to remote work compared to those still commuting

Problem Statement

This project aims to investigate the impact of the COVID-19 pandemic and the rise of the work-from-home (WFH) lifestyle on people's daily lives. Specifically, we seek to understand changes in travel behavior before, during, and after the pandemic using datasets measuring travel distances from home

The significant rise in remote job opportunities, combined with the emergence of the COVID-19 pandemic, has greatly impacted people's lives, including their travel behavior both during and after the pandemic.

This project aims to investigate the impact of the COVID-19 pandemic and the rise of the work-from-home (WFH) lifestyle on people's daily lives. Specifically, we seek to understand changes in travel behavior before, during, and after the pandemic using datasets measuring travel distances from home. Additionally, we aim to explore variations in WFH job opportunities across different states within the US and determine if these variations correlate with changes in travel habits.

Questions

How have people's tendency to travel changed with (1) the COVID-19 Pandemic and (2) the new work-from-home lifestyle?

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- Which states are more likely to have work-from-home job postings? Does the number of postings in a given state have any impact on people's travel habits?
- Did COVID-19 change the way we travel compared to the pre-pandemic era?

Data Sources

U.S. Department of Transportation
Bureau of Transportation Statistics

Trips from Home Data

```
RangeIndex: 6007914 entries, 0 to 6007913
Data columns (total 22 columns):
 #   Column                          Dtype
---  ------                          -----
 0   Level                           object
 1   Date                            object
 2   State FIPS                      float64
 3   State Postal Code               object
 4   County FIPS                     float64
 5   County Name                     object
 6   Population Staying at Home      float64
 7   Population Not Staying at Home  float64
 8   Number of Trips                 float64
 9   Number of Trips <1              float64
 10  Number of Trips 1-3             float64
 11  Number of Trips 3-5             float64
 12  Number of Trips 5-10            float64
 13  Number of Trips 10-25           float64
 14  Number of Trips 25-50           float64
 15  Number of Trips 50-100          float64
 16  Number of Trips 100-250         float64
 17  Number of Trips 250-500         float64
 18  Number of Trips >=500           float64
 19  Row ID                          object
 20  Week                            int64
 21  Month                           int64
dtypes: float64(15), int64(2), object(5)
memory usage: 1008.4+ MB
```

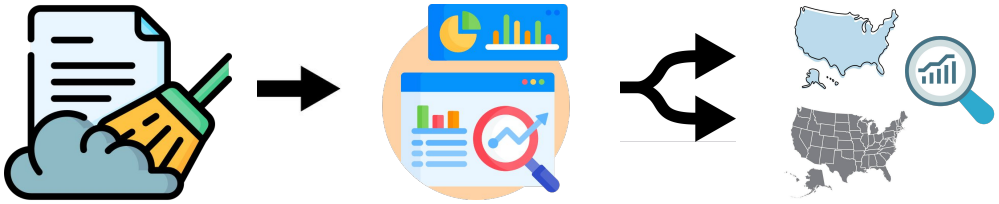
NBER | NATIONAL BUREAU of ECONOMIC RESEARCH

Work from Home Data

```
RangeIndex: 2907 entries, 0 to 2906
Data columns (total 10 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   year         2907 non-null   int64
 1   month        2907 non-null   object
 2   year_month   2907 non-null   float64
 3   state        2907 non-null   object
 4   region       2907 non-null   object
 5   division     2907 non-null   object
 6   state_code   2907 non-null   object
 7   percent      2907 non-null   float64
 8   n            2907 non-null   int64
 9   measurement  2907 non-null   object
dtypes: float64(2), int64(2), object(6)
memory usage: 227.2+ KB
```

Our data sources are from the DOT and the NBER to get the number of trips from home and the work from home data respectively. Both of these datasets are tracked for the national and state level from 2019 until 2023. The Trips dataset is taken from anonymous mobile device data and considers a trip as a movement that is longer than 10 minutes away from home. It buckets these trips into different distance categories that represent the number of miles away from home. The work from home data set on the otherhand tracks the percent of remote job postings. We will look at both the national and state level and use the year_month and state code to relate the two.

Methodology and Assumptions



Data Cleaning & Prep | Data Analysis | National & State Level Insights

Key Assumptions

- *Average population across the entire time period was used for per capita calculations.*
- *COVID period is defined as April 1st, 2020 until February 1st, 2021 (with justification provided in later sections).*
- *Trips data is sampled using a multi-level weighting method to reduce bias and be representative of the entire population for the state or nation (Titlow, 2020).*

Data Cleaning & Preparation

We began our analysis by exploring each dataset individually, to conduct sanity checks and clean the data accordingly. This process included the following steps:

- Examining the column structure and data types
- Standardizing column names by making lowercase, replacing spaces with underscores
- Splitting the Trips and WFH datasets into state level and national level subsets
- Assessing value counts for each column and evaluating presence of null values
- Aligning date column format and level of aggregation between the two datasets
- Removing columns not needed for analysis

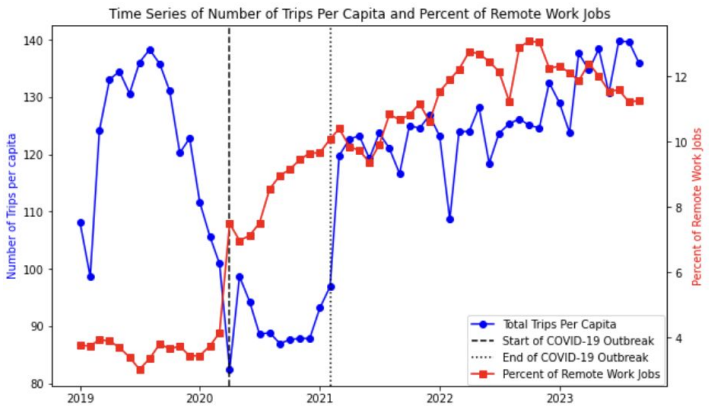
Data Analysis Approach

Once our datasets were prepped and merged, we could begin our analysis. Our high level methodology can be found below:

1. Examine national trends in trips per capita vs. percent of remote work jobs.
2. Compare states based on number of trips per capita and percent of remote work jobs.

1. Compare regional trends in trips per capita between the different time periods surrounding of COVID-19 (before, during, and after).
2. Examine the relationship between trips per capita and percent of remote job postings, and how that changed over time, at both the national and state level.

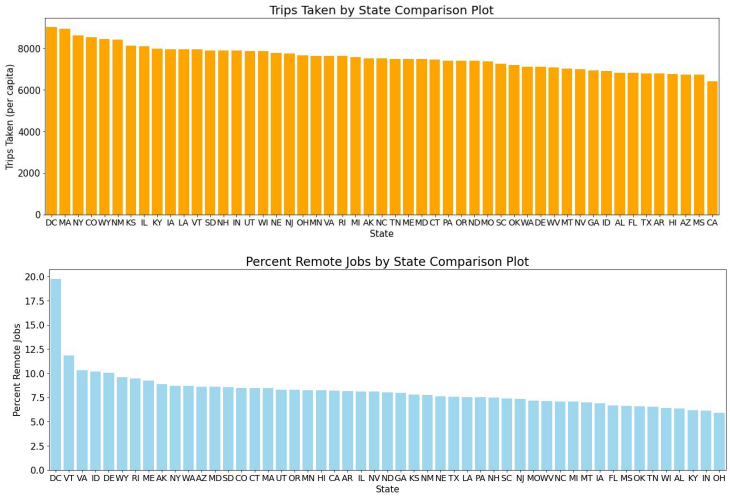
National Level Trends



We began our analysis by plotting the number of trips per capita as a time series against the percent of remote work jobs, at the national level. One of the key questions in our analysis is whether the number of postings in a given state have any impact on people's travel habits, and we wanted to determine if there was a correlation between the two variables at a national level. By plotting this over time, we could identify whether inflection points occurred at key dates related to the COVID-19 pandemic.

From the above chart it is clear that total trips per capita declined at the start of the COVID-19 outbreak, while the percent of remote work jobs saw a sharp increase. Remote work jobs climbed steadily throughout the COVID-19 outbreak, while total trips per capita remained low, until the end of the period as states lifted their lockdown restrictions. In the period following COVID-19, the number of trips per capita rebounded as people got back to their normal lives, although it did not reach pre-pandemic levels until the end of 2023. Interestingly, remote jobs continued to rise at the same rate as during the pandemic for nearly 2 years, eventually peaking toward the end of 2023 and declining slightly since then.

State Level Comparison

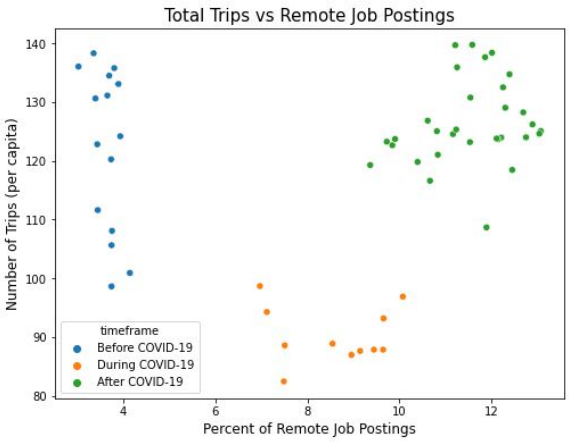


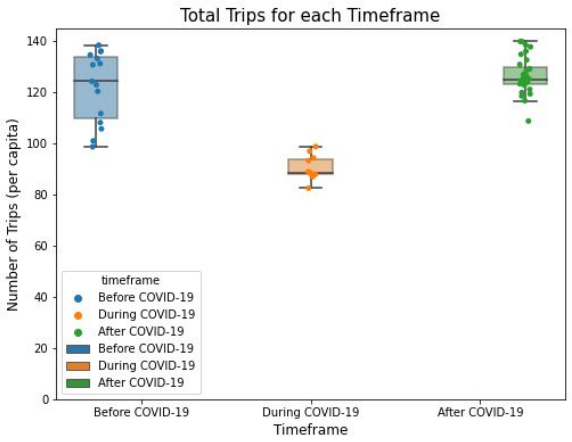
We continued our analysis by next examining a comparison of trips taken by state. Due to the differences in populations between states, we chose to evaluate this on a per capita basis, since that would be a more accurate reflection of an individual's travel habits. By rank ordering the states as shown below, we were able to clearly compare each state against one another. We identified the top states as DC, MA, and NY, and the bottom states as CA, MS and AZ for trips taken per capita.

We then compared the states based on percent of remote jobs, in order to determine which states were most and least likely to offer remote work. Since the percent of remote jobs for each state varied over time, we took the average across the entire date ranges for this comparison. In subsequent sections we will examine the time series behavior for certain states, but an average will suffice for this initial comparison.

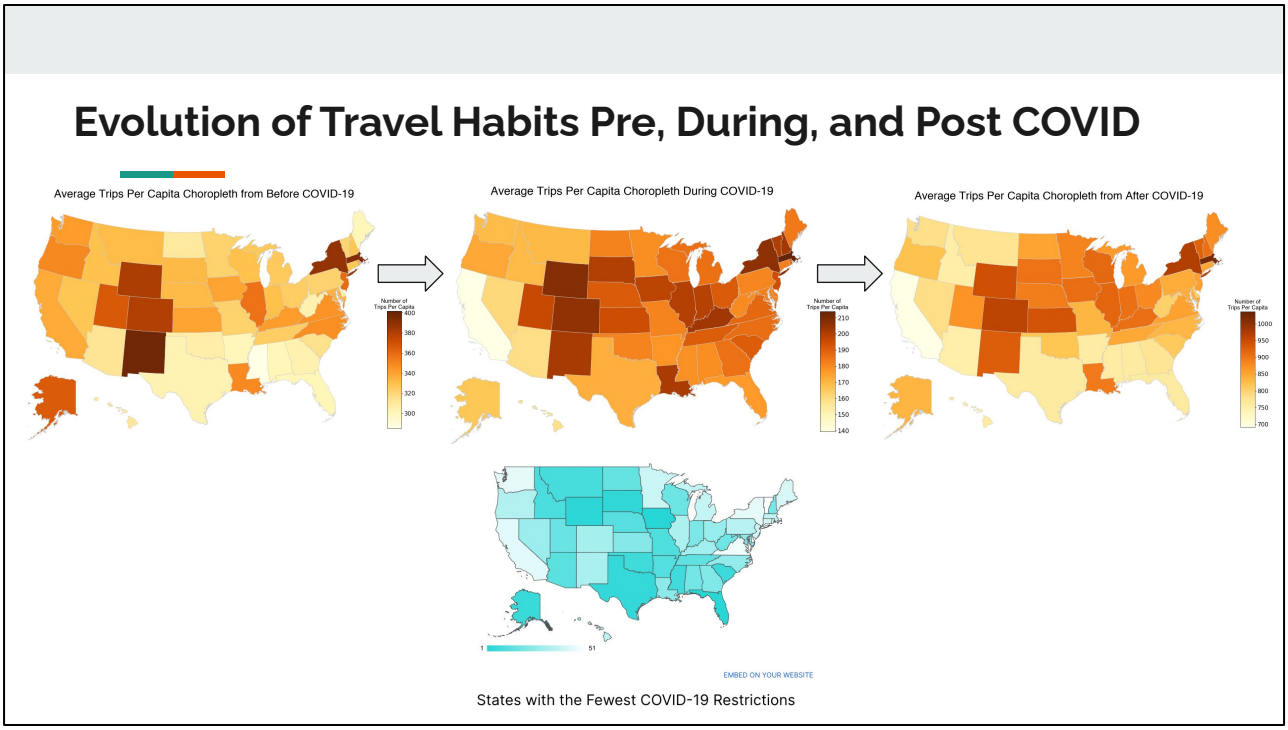
From the above chart, we can see that the top states are DC, VT, and VA, while the bottom states are OH, IN, and KY for percent of remote jobs. DC in particular is a significant outlier compared to the rest of the states, in addition to being the top state in trips per capita. Based on these comparisons, we have a better understanding of which states might be interesting to examine in further detail. In particular, the top states for each chart will be analyzed in more detail in the sections that follow.

COVID-19's Impact on Travel and Remote Work



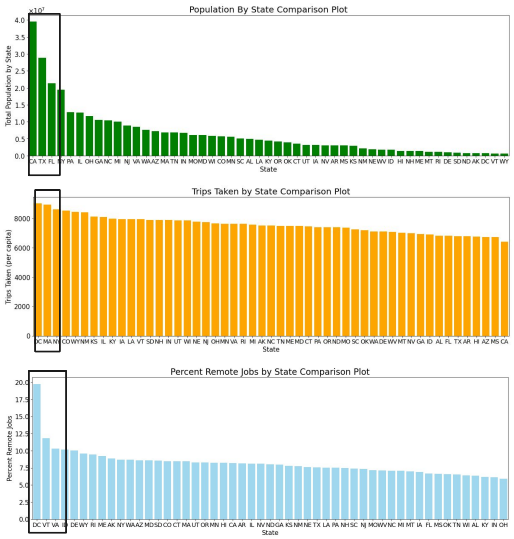


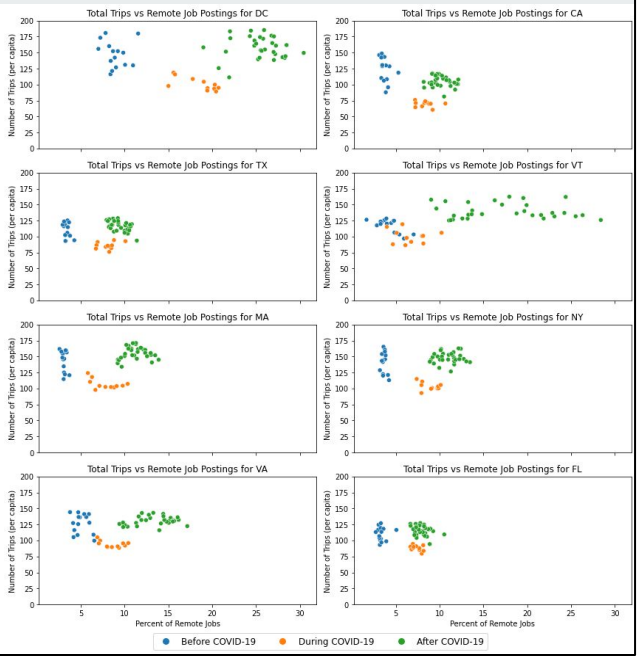
Moving further into COVID-19's impact on Travel and Remote Work, the plot on the left shows a scatterplot of the percent of remote job postings on the x-axis vs the number of trips per capita on the y-axis, to see if there are any relationships between them. Each point is a specific month and we can see that there are three distinct groups of data that we realized is sequential in time. This allowed us to define when COVID-19 impacted travel and remote work the most, which ended up being the period between April 2020 and February 2021. The plot on the right displays the number of trips over time and we see that during the pandemic, there was a distinct step change in the number of trips; however, after COVID and with far more remote work job postings, the number of trips actually returned back to pre-pandemic levels, where the median for both before and after is nearly the same.



To see the evolution of travel habits, the top 3 plots show a heat map of the relative change in travel habits between states before, during, and after covid (defined in the last slide). We can see that areas around the west coast, like California, decreased in the number of trips compared to other states and actually continued to have fewer trips than other states. The Southern portion, on the contrary, actually had significantly more trips per capita during COVID, when compared to other states. The blue heatmap below was taken from a WalletHub Article that shows the rankings of the states with the fewest restrictions during the pandemic, where the darkest color means that the state has the least number of restrictions while the lightest color indicates that the state had the most restrictions. We believe that this might explain our observations of why states like California dropped in the number of trips but the southern states increased during COVID-19, where the fewer restrictions there are, the more a state is willing to travel, bar some exceptions.

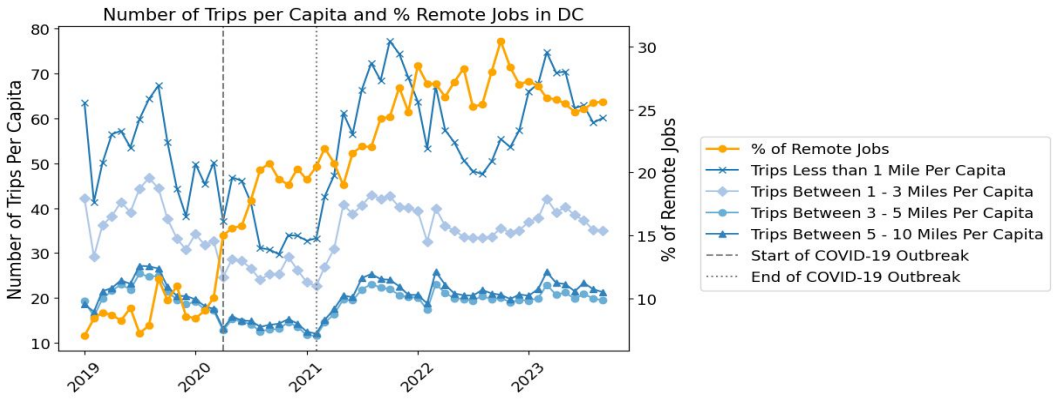
State Relationships





We then looked at the top 3 states in each of the following categories: population size, number of trips taken, and percent of remote work jobs and plotted the same scatterplot as the national one. To note, there are only 8 plots because DC was in the top three for both number of trips per capita and percent of remote jobs. From the plots we can see that states like Vermont exploded in the percent of remote work after COVID-19; however, the overall trend amongst all states is nearly the same. COVID altered our travel habits and significantly increased the number of work from home jobs, but the number of trips nearly always returned back to the same same y as the pre-pandemic era. This suggests that remote work itself did not impact our travel habits in nearly all states, but more so that COVID did.

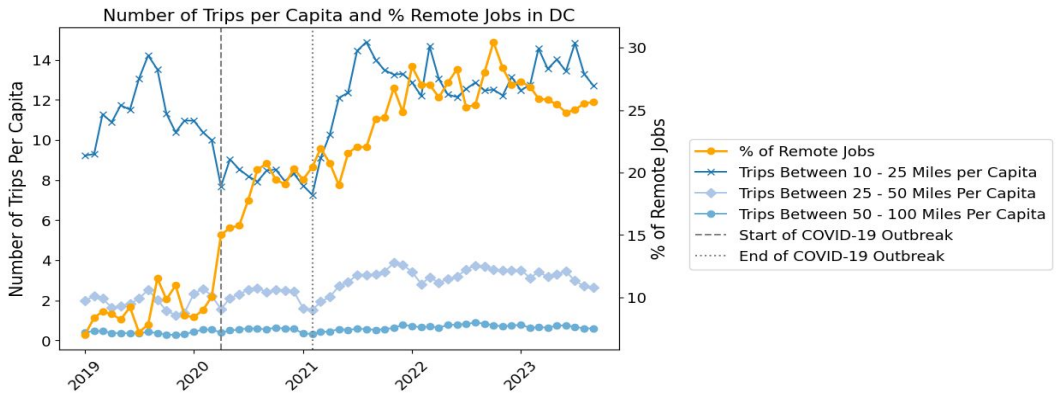
State Review: DC - Short Travel Distance:



As previously mentioned, Washington, D.C., stood out as the region with both the highest trips taken per capita and the highest percentage of remote jobs in the country. An analysis was conducted using three distinct plots, each representing various travel distances categorized as short, medium, and long.

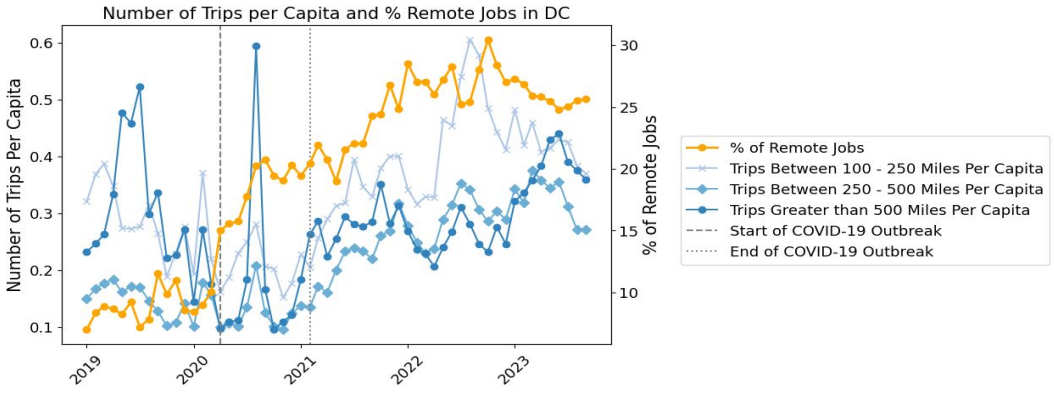
For short trips, we're talking about traveling less than 10 miles. We saw fewer of these when more people started working remotely. When everyone was mostly staying home because of the pandemic, these trips dropped a lot. But as things began to open up again, people got back to moving around more. Even as life started to return to normal, we noticed that the rate of people working from home didn't just keep growing; it eventually leveled off as we moved into the end of 2022.

State Review: DC - Medium Travel Distance:



Looking at medium distances — those between 10 and 100 miles — we noticed something interesting. As more jobs offered the option to work from home, trips that usually cover a commute or a quick out-of-town trip went down. This probably happened because a lot of people didn't need to commute anymore. But after the pandemic started to ease, and offices began opening up again, we saw these numbers go back up, kind of like the short trips. It looks like people started to hit the road again for work-related travel once the option was back on the table.

State Review: DC - Long Travel Distance:



When we checked out longer trips in D.C., the kind that are over 100 miles, we saw some ups and downs. There was a big jump in travel in August 2020. That's when a lot of places started to relax the pandemic rules a bit, so more people were out traveling, taking advantage of the freedom to move around more and maybe even take some trips they'd been putting off. But this increase didn't last. As the number of COVID-19 cases began to rise again, the rules got strict once more, and long-distance travel dropped down again. This was a pattern we saw across the board — when people could, they moved around more, but it always came back down with the virus's ups and downs.

Conclusions

1. COVID-19 had a significant impact on both the number of trips that people take and the percentage of remote job postings, which can be observed on both the state and the national level.
2. There is no relationship between the percentage of WFH jobs and the number of trips that a person takes. This applies to both the national and state level comparisons as well as on the length of the trips taken.

1. We observed that with any given state, there was a distinct downward step change in the number of trips that an individual traveled and a distinct upward step change in the percent of remote jobs during the period of April 2020 until February 2021. This makes sense as the coronavirus effectively locked down the whole world and prevented people from traveling and working. Following the lockdown period, we observed that the number of trips quickly responded with a shift in the number of trips taken for all lengths of trips.

2. The interesting trend is what happened after the COVID-19 era, where the number of remote jobs continued to climb even to this day. This suggests that remote work is here to stay and that COVID allowed corporations to realize the benefits to this new lifestyle. Even with this abundance of remote work opportunities, we showed that this did not change a person's tendency to travel. Nearly all states and the entire nation as a whole showed that after COVID-19, the number of trips returned to pre-pandemic levels, delineating that WFH does not play a factor in our travels.

References

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Rubric

In-Class Presentation (20%)

The final class will include a 10 minute presentation per group with a 5 minute question/answer period. The presentation should include:

- Your overall question
- The steps your group took to analyze the question
- Any assumptions you made in the analysis
- The key is to aim for clarity and telling a story with the data
- Organize your argument clearly
- Guide the listeners through the evidence in the data
- Include any key figures/plots/charts or graphs
- You do not need to show any code but it might be handy to have the code ready in case there are some questions on it