U.S. COVID Economic Downturn: Effect of State Sales Tax on Employment Recovery

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1 Introduction

On March 11th, WHO declared COVID-19 a global pandemic. Since then, the coronavirus outbreak has disrupted the U.S. economy greatly. We wanted to further explore how the employment rate is changing by analyzing the relationship between state sales tax and employment recovery. More specifically, we are searching for any statistical evidence for the conjecture that high state sales tax has resulted in slow employment recovery.

2 Formal Hypothesis

Our formal hypothesis is that high state sales tax results in slower employment recovery.

3 Data Preperation

3.1 Selecting Data Sources

In order to conduct analysis between sales tax and employment recovery, we first used an external source to obtain the sales tax rate by state [1]. We calculate the average sales tax for each state by using a combined rate of state and local taxes, which is done using a straight average.

3.2 Cleaning the Data

The data cleaning process was fairly simple. First, we noticed that the state employment data provided by The Economic Tracker did not contain state names, but rather state ids while our data set with state tax did [2]. To fix this issue, we used the "geostate" dataset also provided by the Economic Tracker and union joined to obtain the state names for each row. From there, we also noticed that some of the employment rates were filled with ".", which indicated there was no value. To fix this, we considered either imputing the missing values or removing the value from calculations. We opted for the latter because we did not want to falsely predict a missing value. From here, we union joined it with the state tax which gave us our final data set to work with.

4 Data Exploration:

For data exploration, we look at the changes in employment level rate from January to September for the following groups: all workers, low-income workers, middle-income workers, high-income workers, workers in trade, transportation and utilities, workers in professional and business services, workers in education and health services, and workers in leisure and hospitality. We do this for the 5 highest and lowest taxed states to get an idea of how to proceed with our statistical analysis.

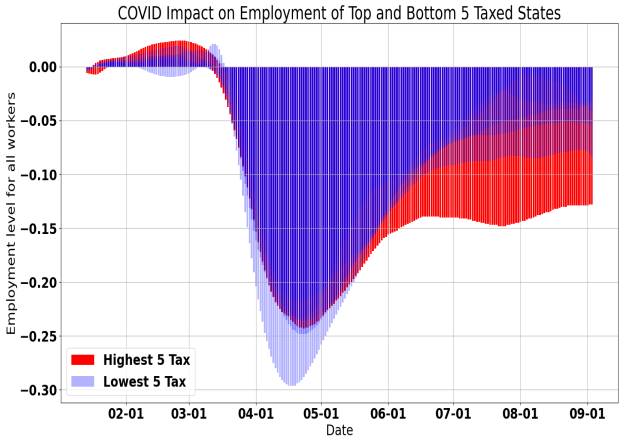

Figure 1. Employment level for all workers in 5 highest and lowest taxed states.

From the plot above we can also see that for employment level for all workers, the top 5 states with highest sales tax have a similar minimum employment level rate between April and May but recover slower than the top 5 states with highest sale tax in September. This plot seems to agree with our hypothesis. We still need to prove this statistically.

One interesting discovery during data exploration was that the graphs for sectors showed high variation in recovery rate compared to Figure 1.

Figure 2 below illustrates that state tax did not seem to have much of an impact on leisure and hospitality workers. The recovery rate for the high and low state taxes look close to identical.

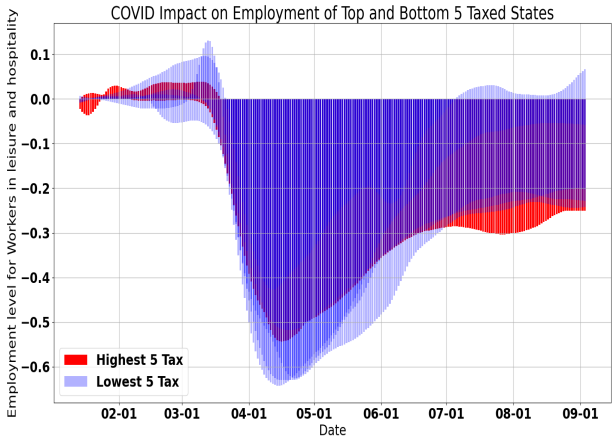

Figure 2. Employment level for leisure and hospitality workers in 5 highest and lowest taxed states.

5 Methodology for Analysis

In order to test if state tax is significant in employment recovery, we selected the top 10 states with highest sale tax as group A and the top 10 states with lowest sale tax as group B. Then we calculated the recovery rate (recent [Sep 03] employment level rate - lowest employment level rate during coronavirus crisis), and used a two-sample t test to compare the mean difference between the recovery rate of group A and that of group B. We implemented this method on employment level for all workers, employment level for low-income workers, employment level for middle-income workers, employment level for high-income workers, employment level for workers in trade, transportation and utilities, employment level for workers in professional and business services, employment level for workers in education and health services, and employment level for workers in leisure and hospitality. We set our null hypothesis as "the mean recovery rate between group A and group B is equal. If P value is less than a significant level of 0.05, we then rejected our null hypothesis, since this is strong evidence showing that the mean recovery rate of group A is smaller than that of group B, indicating that the state sales tax has a significant impact on employment recovery.

After performing t-tests for different employment groups, we obtained the following p-values:

Type of Worker	**P-Value**
All	0.032
Low-Income	0.095
Middle-Income	0.089
High-Income	0.116
Trade, Transportation and Utilities	0.459
Professional and Business Services	0.217
Education and Health services	0.098
Leisure and Hospitality	0.676

6 Conclusion

Based on our t-test on employment level on combined industries, we obtained a p-value of the t test of 0.032. Since the p-value is less than 0.05, we have evidence showing that the mean recovery rate of group A is less than that of group B, indicating that high combined state sales tax is associated with slow employment recovery. Next,We find that the p-values were larger than 0.05 for the following categories: 1) Low-income workers 2) Middle-income workers 3) High-income workers 4) Workers in trade, transportation and utilities 5) Workers in professional and business services 6) Workers in education and health services 7) Workers in leisure and hospitality. For these categories, we fail to reject the null hypothesis. This signifies that high state sales tax was not associated with slow employment recovery for these categories.

In conclusion, high combined state sales tax is associated with slow employment recovery overall. However, the association varies within different categories of industry. We deduce that some industries have higher p-values because there are other external factors that would have affected the change in employment rate more than the state sales tax. For instance, for the leisure/hospitality industry, we can guess that the employment rate was affected more by the decrease in the number of travelers/tourists instead of the state sales tax.

7 Source Code

The project source code is made publicly available and can be found by clicking here.

References

[1] N. H. M. S. Raj Chetty, John Friedman and the Opportunity Insights Team, "The Economic Impacts of COVID-19: Evidence from a New Public Database Built from Private Sector Data," 2020.

[2] J. Cammenga, "State and Local Sales Tax Rates, 2020," in *Tax Foundation*, August 6, 2020.