PRIVATE ENTERPRISE RESEARCH CENTER
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PERCSPECTIVES ON POLICY

ENERGY AND THE ECONOMY

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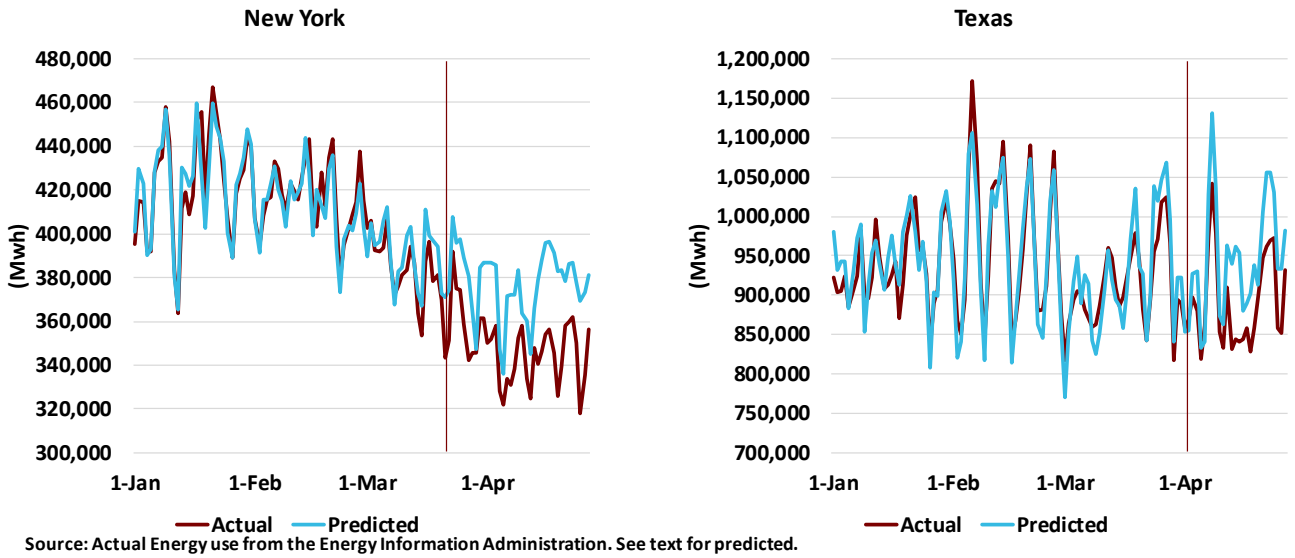
The economy is reeling as we begin slowly relaxing the mitigation measures aimed at controlling the spread of the coronavirus. The economic indicators tell a grim story. Weekly unemployment claims for the last six weeks exceed 30 million, equal to 20% of the February labor force. The stock market dropped 34% by March 23 from its all-time high and is now down 16.1%. Oil prices have plummeted, and incredibly, oil futures have been in the red. Unfortunately, some of what we usually regard as our most timely measures of economic activity, such as the monthly unemployment rate, are only available with a lag, a lag that has become unacceptable in these times of unprecedented fast-moving changes in the economy. For instance, we have an estimate of the national unemployment rate in March of 4.5%, a full one percentage point higher than February's 3.5%, but still a much-too-low measure of what actually is the (surely much higher) current unemployment rate. (April's rate will be released on Friday, May 8.)

More timely data on economic activity is at a premium. One source of extremely timely data is energy use. Energy is an input into the production of many kinds of economic activity. Energy use is not only tied to the weather as we heat and cool our homes; it is also tied to economic output as firms power their production facilities and establishments open for business and provide services.

To investigate how energy use has changed in the last six weeks, we estimate the degree to which energy demand has diverged from expected demand. We use energy demand data from the Energy Information Administration (EIA) from January 2017 to the present. The EIA's energy demand data is available for five individual states and for eight regional groupings containing the remaining states. To control for weather conditions, we use daily state level heating and cooling degree days from the National Oceanic and Atmospheric Administration (NOAA). We control for the days of the week and holidays,

FIGURE 1. ACTUAL AND PREDICTED ENERGY USE IN NEW YORK AND TEXAS



Source: Actual Energy use from the Energy Information Administration. See text for predicted.

because energy use falls during those times. We control for weeks, years, and a time trend, as a state or region may have energy use rising, or falling, over time and during the year. Our estimates are made separately for each state and region.

The time period over which we estimate how these variables explain energy demand is January 1, 2017 to March 15, 2020. This period provides the baseline effects of each of these variables on energy demand. We then predict expected demand for the period March 15 to April 27 based on the estimated baseline effects of each variable.

Figure 1 illustrates actual and the predicted energy use in New York and Texas for the period from January 1, 2020 to April 27, 2020. New York's actual energy use dropped below the predicted in mid-March. This predated New York's state-wide stay at home order that was issued on March 22. In contrast, actual and predicted energy demand in Texas does not exhibit the same degree of divergence. Some of the actual peak demand days are lower than predicted in the latter part of March and into April, and the differences for the last three weeks of data is more evident. The stay-at-home order in Texas was issued on April 2. The overall differences between actual and predicted use in Texas is delayed relative to New York and is due in part to the different timing of the stay-at-home orders.

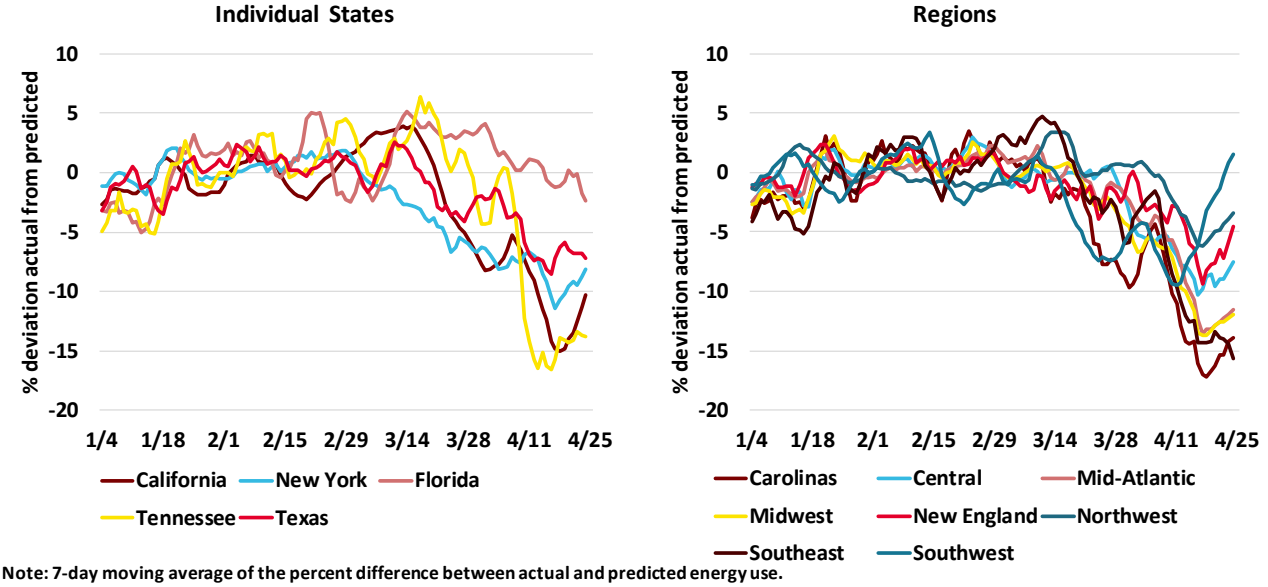
These types of patterns of declining energy use relative to predicted are seen across the country, and the timing of the divergence is related to the timing and strictness of the states' stay at home orders.

Figure 2 depicts the percentage divergence of actual demand from predicted energy demand for states and regions. From the previous figure, this is the ratio of (actual – predicted demand)/(predicted demand) multiplied by 100. The left-hand panel depicts the percentage divergence by the individual states and the right-hand panel depicts the result for the regions. A seven-day moving average of the percentage differences is used to smooth the data.

Among the individual states, New York had the earliest significant percentage declines of actual energy demand relative to predicted demand. By the end of April, actual energy demand in Tennessee was 14% below predicted and California was 10% below. Energy use in New York was 8.1% lower than expected and Texas was 7.2% lower than expected by the end of the data. Florida's energy use was actually higher than expected for much or the prediction period after March 15. Florida's stay-at-home order was issued April 3. At the end of April, energy demand in Florida was 2.3% lower than expected.

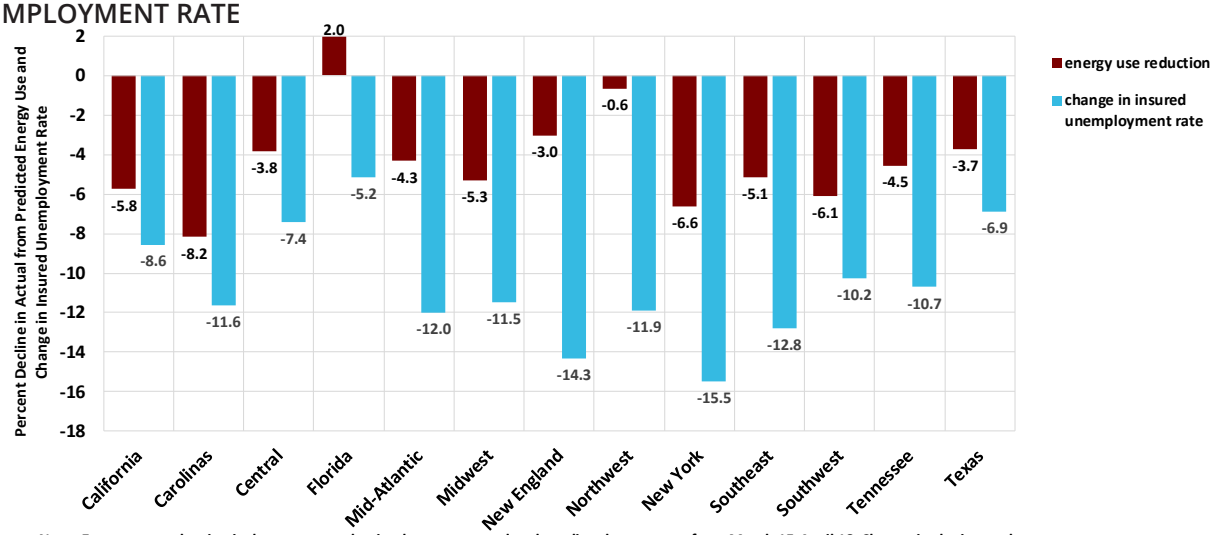
The following regions are depicted in the right-hand panel of Figure 2: The Carolinas, Central, Mid-Atlantic, Midwest, New England, Northwest, Southeast, and Southwest. Some of the EIA regions cover parts of states and some of the regions span far-ranging states. For example, the Midwest region extends from Minnesota in the north to Louisiana in

FIGURE 2. PERCENT DEVIATION BETWEEN ACTUAL AND PREDICTED ENERGY USE IN STATES AND REGIONS



Note: 7-day moving average of the percent difference between actual and predicted energy use.

FIGURE 3. DECLINE IN ACTUAL ENERGY USE RELATIVE TO EXPECTED AND CHANGE IN INSURED UNEMPLOYMENT RATE



Note: Energy use reduction is the percent reduction between actual and predicted energy use from March 15-April 18. Change in the insured unemployment rate is the difference between the rate for the week ending April 18 and the rate for the week ending March 14.

the south. Still, even with the aggregation of heating and cooling degree days to the region level, our regional models explain comparable levels of the variation in energy use as do our state level models.

As the series for the regions illustrate, the timing of the divergence of actual from predicted energy use varies by region. By the end of April, four of the regions' actual demand were more than 10% lower than predicted demand. Also, some of the regions, as with some of the states, while still having actual demand below expected, saw some narrowing of the gap in the last week of the data.

Figure 3 summarizes the results above by presenting the percent deviation between actual and predicted energy use for the period March 15 - April 18 and compares this percent reduction to the insured unemployment rate in the states and regions for the week ending April 18.

First, consider the reduction in actual energy use relative to expected use. The Carolinas, New York, the Southwest, and California had the sharpest drop in actual demand relative to predicted demand over this period. Actual energy demand in Florida for the period from March 15 - April 18 was actually up 2% over expected. The Northwest, New England, and Texas had the next lowest declines for this period.

How closely related are the changes in energy demand to changes in other economic metrics? Here we focus on employment and compare the reduction in energy use to the change in the insured unemployment rate between the week ending March 14 and the week ending April 18. The insured unemployment rate is the number of workers receiving unemployment benefits as a percent of workers who are in insured employment. The difference in this rate between March 14 and April 18 is rough estimate of the percent reduction in employment. New York had the greatest reduction at 15.5%, followed by New England, and the Southeast. Florida and Texas had the smallest reductions of 5.2% and 6.9%. The correlation between the reduction in energy use and the percent reduction in employment is 0.46, a moderate level of correlation.

These results indicate that energy use has dropped markedly relative to expected use since the stay-at-home orders have been in place. These changes in energy use provide an early indication of what traditional economic variables will likely tell us once they become available.

PERC Fellow and Associate Professor Tatevik Sekhposyan provided important input and advice on this project.

[1]The heating and cooling degree days are aggregated to the EIA regions by population-weighting state-level heating and cooling degree days. Heating and cooling degree days identify by how much the average daily temperature in a state diverges from 65 degrees.

Data: The energy demand data is from the Energy Information Administration: https://www.eia.gov/opendata/

States' heating and cooling degree days are from the National Oceanic and Atmospheric Administration. The link for the 2020 data is: ftp://ftp.cpc.ncep.noaa.gov/htdocs/degree_days/weighted/daily_data/2020/

The change in the insured unemployment rate is estimated from the Unemployment Insurance Weekly Claims News Releases, April 2, 2020 and April 30, 2020. https://www.dol.gov/ui/data.pdf

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