Differential Impact of COVID-19 on the Energy Consumption of Residential and Business Sectors

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1. Motivations underlying the research

The COVID-19 pandemic upended the world and altered human behavior, changing the patterns of energy consumption in the residential and non-residential sectors. Earlier research on the impact of the pandemic on energy consumption documented two important trends. First, an increase in residential energy consumption as a result of the measures adopted to contain the spread of COVID-19, such as lockdowns, curfews, and stay-at-home orders. Second, a decrease in non-residential energy consumption largely due to closures of non-essential businesses and the overall reduced economic activity brought by the pandemic. Nonetheless, little is known about the heterogeneous impacts of the pandemic on the energy consumption across households from different income levels and across different types of businesses.

There is a growing literature on the effects of the pandemic on energy consumption. Despite this, most of the research conducted so far has focused on the first few months of the pandemic, thus quantifying only the short-run impacts of lockdowns and stay-at-home orders. Moreover, most of the research has focused on quantifying the effect on electricity consumption, and as a result, the evidence regarding the impacts of the pandemic on natural gas consumption is limited.

Unlike previous studies, our analysis benefits from data at the address level over a longer period and provides evidence regarding the heterogeneous impacts on both electricity and natural gas consumption during the pandemic and subsequent reopening periods across the residential and business sectors.

2. A short account of the research performed

In this paper we use address-level data from Gainesville Regional Utilities (GRU), a local utility in Gainesville, Florida, to quantify the impacts of the COVID-19 pandemic on energy demand. Our monthly panel data covers the period that spans from January 2018 to December 2020 and includes the energy consumption of all the single-family homes and business establishments with an active license in GRU's service area. Specifically, we study the effects of the pandemic on the electricity and natural gas consumption of single-family homes across different income levels by sorting the homes according to income quintiles based on the 2019 median household income in the census block group where they are located. In addition, we study the impacts on the electricity and natural gas consumption of businesses, considering whether they were deemed essential or not during the pandemic.

3. Main conclusions and policy implications of the work

The main findings are as follows. Households significantly increased the electricity consumption at the beginning of the pandemic and kept consuming relatively more than previous years until October 2020 when the final business re-opening phase was completed and electricity consumption decreased. Hence, comparing with previous years and controlling for weather conditions, electricity consumption increased 20.4% in March-April 2020 (lockdown), 15.5% in May 2020 (phase 1 of the recovery plan), and 7.3% in June-September 2020 (phase 2), whereas it decreased 7.6% in the last quarter of the year 2020 (phase 3). In the case of natural gas, residential consumption fell during March-April 2020, then increased between May and September 2020 and collapsed in the last quarter of 2020. However, as electricity is the main source of energy used in homes, when both energy sources are jointly considered,

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consumption followed a similar evolution to that of electricity during the pandemic. Moreover, there were differences in the impact that the pandemic had on energy consumption across income quintiles. Although the percentage changes in consumption were relatively homogeneous along the income distribution, the changes in electricity bills affected significantly more the disadvantaged households. Therefore, it is necessary to consider the distributional effect on household energy consumption and expenditure. Spending increases coupled with job losses or income reductions can be destabilizing. The effects of such changes tend to exacerbate preexisting energy poverty and should be considered in analyzing the effects of economic crises like the one experienced during the early stages of the COVID-19 pandemic.

In the case of firms, overall energy consumption fell during the pandemic and, in particular, natural gas consumption significantly decreased during the entire year 2020. However, the distinction between essential and non-essential activities is crucial to understanding the evolution of electricity consumption. Non-essential businesses significantly decreased electricity consumption from May 2020 onward. In contrast, essential businesses increased their consumption from March to September 2020. In the last quarter of 2020, both types of businesses significantly reduced their electricity consumption. Our results suggest that researchers and policymakers need to take into consideration the heterogeneity that exists in initial conditions of companies as well as the differential impacts on essential and non-essential businesses. Most people will agree that economic relief measures for companies should be taken after health and prevention policies, but complementary economic measures can also improve social welfare by preventing initially successful companies from dying out under economic restrictions.

Even though our research focused on one city in Florida, our main findings are applicable to many other cities and could serve as a guide in designing new policies for communities still affected by new COVID-19 waves or future outbreaks.