STRONG PRICE SIGNALS: RESIDENTIAL ELECTRICITY DEMAND WHEN THE PRICE IS ZERO

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Overview

Understanding how energy users respond to energy prices is a key piece of information for governments considering the adoption of carbon pricing or taking measures to improve energy security, and for the infrastructure and procurement decisions of utilities. Recent research suggests that the price elasticity of residential electricity demand is very low, perhaps because of inattention or insufficient salience if price changes are modest. We focus on the Republic of Georgia, where in normal times the tariffs follow a rather unusual increasing block rate scheme. We take advantage of government policies introduced during the pandemic to see *if* people respond to massive price changes—and how quickly they do so. In April 2020, during lockdowns to mitigate the spread of Covid-19, the government announced that electricity would be free to residential customers in April and May, 2020, as long as usage did not exceed 200 kWh/month. In August 2020, the government announced that the policy would be in force again in November and December 2020, and January and February 2021.

We ask three research questions. First, did people respond to the free electricity policy? Second, assuming that they did, did the policy lead to a reduction or an increase in electricity consumption? Third, what is the price elasticity of residential electricity demand in the Republic of Georgia, in normal times *and* during the free electricity months?

Methods

We use a 10% sample from the entire residential customer base in the capital, Tbilisi, merged with weather and tariff information, from January 2012 to October 2021. This produces a panel dataset with a substantial longitudinal component, Our first order of business is to examine whether consumption rose or fell during the free electricity months, controlling for weather and the tariff period. Next we estimate the price elasticity of demand during periods with regular pricing. Our regressions instrument for price because in a block pricing scheme the price and the quantity consumed are mechanically positively correlated. Finally, we examine the histograms of consumption during the free electricity months. As shown in figure 1 below, which refers to January 2021, consumption exhibits a “hole” just before 200 kWh, then a “vertical wall” at 200 kWh, and again a “hole” just above 200 kWh. This is evidence of “notching,” suggesting that individual consumers were trying to limit consumption to below 200 kWh to avail themselves of free electricity. Bunching vanishes quickly as soon as the free electricity policy is lifted. We deploy bunching methods (Bertanha et al., 2021, 2022) to estimate the price elasticity of demand when the tariff is zero 0 for consumption levels below or equal to 200.

Results

We find that consumers did respond to the policy. Depending on the month, electricity consumption declines by 1-8% during the free electricity months. During the winter months, the policy reduces CO_2 emissions at a cost of about $467-848 per ton. The price elasticity of demand is around -0.2 for periods with regular tariffs. The demand appears to be much more inelastic during the free electricity months. But our models—regular or based on arc elasticity—struggle to arrive at a negative and significant price elasticity when the periods with the free electricity policy are included. Using bunching methods, we estimate the price elasticity in the neighborhood of 200 kWh to be -0.02 to -0.05 during the free electricity months. This confirms evidence from the income reporting literature that notching and bunching behavior may be pronounced—and yet the underlying elasticity is very small. The bunching estimator suggests that

Conclusions

Consumers did respond to the pricing policy, showing that, even at locales where the price of electricity is low, tariff structures that impose strong penalties to heavy-volume consumers, or offer substantial discounts to low-volume consumers, can be effective and can be deployed to moderate demand when needed—during droughts which impact hydroelectricity generation, conflicts which are expected to affect energy imports, and when it is necessary to reduce GHG emissions associated with fossil fuel generation.

References

Bertanha, Marinho, Andrew H. McCallum, and Nathan Seegert (2021), "Better Bunching, Nicer Notching," Finance and Economics Discussion Series paper 0002, Washington, DC: Board of Governors of the Federal Reserve System.

Bertanha, Marinho, Andrew H. McCallum, Alexis Payne, and Nathan Seegert (2022), "Bunching estimation of elasticities using Stata," Stata Journal, 22(3), 597-624, doi:10.1177/1536867X221124534.

Figure 1.