

An Econometric Assessment of Electricity Demand in the United States Using Utility-specific Panel Data and the Impact of Retail Competition on Prices

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Executive Summary

The electricity sector has undergone fundamental changes in the past half century including major technological advances in generation supply and the development and growth of wholesale and retail competition. In this paper I use utility-specific panel data covering 72 electricity distribution companies from 1972 to 2009 to econometrically estimate structural demand and reduced-form price models for residential, commercial and industrial customers. The use of utility-specific panel data covering a diverse set of electricity distribution companies throughout the United States and for close to a 40-year period is a significant contribution to the economics literature on electricity demand and pricing and permits for the estimation of econometric models that control for important unobservable utility-specific factors. Another contribution to the literature on electricity pricing in this paper is that I control for utility-specific total factor productivity (“TFP”), the absence of which would result in biased and inconsistent parameter estimates in the reduced-form electricity pricing models.

I find that the own price elasticity of demand varies between -0.40 to -0.61 for residential customers, between -0.33 to -0.77 for commercial customers and is approximately -0.60 for industrial customers. While static models work well for residential demand dynamic models are more appropriate for the larger customer classes who require more time to adjust consumption. I find that the income elasticity of demand varies between 0.34 to 0.41 (for residential demand), 0.43 to 0.79 (for commercial demand) and 1.3 to 4.6 (for industrial demand). These findings on

the own-price elasticity of demand for the different customer classes add to the literature on the topic and can be used as inputs into different types of electricity and energy studies such as tariff and demand response studies.

Regarding the reduced-form price equations I find consistently that TFP is a significant determinant of electricity prices with a 1% increase in TFP resulting in electricity price declines ranging between 0.05% to 0.30%, depending on the model used and the customer class analyzed. I find that retail competition has provided benefits to consumers. For residential customers I find that based upon the econometric evidence the mean total impact of competition during the period 1998-2009 was approximately -4.2% (simple average of the results from different models: -4.1%, -2.02%, -2.40%, -5.3% and -7.2%) but the effect was declining over the period and eventually turning positive in 2007. For commercial customers I find that based upon the econometric evidence the mean total impact of competition during the period 1998-2009 was approximately -8.45% (simple average of: -9.6%, -6.27%, -5.6%, -9.8% and -11.0%) with the impact being fairly constant during the period. For industrial customers I find that based upon the econometric evidence the mean total impact of competition during the period 1998-2009 was approximately -11.62% (simple average of -14.98%, -9.83%, -8.50%, -11.35% and -13.42%) with the effect generally increasing over time. These results thus indicate that continued market liberalization of retail electricity markets in the United States is expected to lead to increased consumer benefits with greater benefits expected for the larger customer classes.