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Change in consumer sensitivity to electricity prices in response to retail deregulation: A panel empirical analysis of the residential demand for electricity in the United States

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ABSTRACT

About ten years have passed since the deregulation of the U.S. retail electricity market, and it is now generally accepted that the available data is adequate to quantitatively assess and compare conditions before and after deregulation. This study, therefore, estimates the changes in price elasticity in the residential electricity market to examine the changes, if any, in household sensitivity (as a result of retail electricity market deregulation policies) to residential electricity rates. Specifically, six types of panel data are prepared, based on three cross-sections—all states (except for Alaska and Hawaii) and the District of Columbia, deregulated states, and non-deregulated states—and two time series—the period before deregulation and the period after deregulation. The panel empirical analysis techniques are used to determine whether or not the variables are stationary, and to estimate price elasticity. We find that there is no substantial difference in the price elasticity between deregulated and non-deregulated states for both periods—before deregulation and after deregulation. Thus, it can be said that the deregulation of the retail electricity market has not made consumers more sensitive to electricity rates and that retail deregulation policies are not the cause of price elasticity differences between deregulated and non-deregulated states.

1. Introduction

In 1882, when Thomas Edison started his Pearl Street Station in New York City, he gave birth to the electric utility industry in the U.S., the country that is now the world's largest producer and consumer of energy. Approximately 120 years later, in 2007, residential customers comprised 87% of all U.S. electric utility customers and consumed 37% of the electricity sold. Between 1990 and 2007, the total volume of electricity sold grew at an average of 1.9% a year, with annual growth rates of 2.4% for the residential sector, 0.4% for the industrial sector, and 3.5% for the commercial sector. Residential customers, therefore, increased their share of electricity sales from 34% to 37% over this period.

Companies involved in the generation, transmission, and distribution parts of the electric power business broadly include both utilities and non-utilities. Traditionally, utilities have been defined as companies involved in any one or in all three parts of the business, and they could be classified as investor owned, federally owned, publicly owned, or cooperatively owned. More recently, a new class of utilities, made up of power marketers trading electricity on deregulated wholesale markets or supplying power in deregulated retail markets, has emerged. Traditional utilities are, on the whole, vertically integrated—they are involved in the generation, transmission, and distribution of electricity—and operate under monopoly franchises that have been granted by local governments and that cover certain geographic areas. In exchange for these monopoly franchises, utilities have had to accept regulation by state and federal authorities. In recent years, however, there has developed a new set of market rules and regulations, under which a part of the U.S. electric utility industry, responding to regulatory loosening, has evolved competitive markets and has abandoned the vertically integrated monopoly franchise business structure. Non-utilities, in contrast, are companies that generate electricity for their own consumption, for sale to utilities or other parties, or for both, and are generally referred to as "independent power producers."

Constitutionally, the U.S. federal government has regulatory authority over electric utility business that crosses state lines. This authority is exercised through the Federal Energy Regulatory Commission. Electric utility business confined to a single state is regulated at the state level through bodies such as public utility

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commissions. Before electric power systems took on their current interstate structure and were not confined to individual states, the dividing line between interstate and intrastate business was clear. As power systems have increasingly crossed state lines, however, that distinction has become more difficult to make. Transmission is now regarded as falling under federal regulation, while distribution is regulated by the states.

Federal law has deregulated the power generation market and has opened access to transmission lines, but the deregulation of retail markets has been left to the states. Seeking to lower utility rates and to diversify services through competition among electric power suppliers, in the mid-1990s, states with high electricity rates, mostly in the US Northeast, began to pass legislation aimed at introducing competition to retail electricity markets. At one point, 24 states and the District of Columbia had passed such laws, each one providing for their own unique regulatory processes and scope. Some states, such as Massachusetts, made it possible for all electricity consumers to choose an electricity supplier as of a certain point in time, while other states took a different approach by gradually expanding, in stages, the scope of regulation. Oregon and other states took a third approach by deregulating only that part of the market which was occupied by large commercial consumers and by retaining regulation for residential consumers. Circumstances, though, changed with the 2000–2001 electric power crisis in California. This event prodded some states, such as Oklahoma, to indefinitely postpone deregulation plans already set for implementation, and prompted Arkansas and others to drop pending deregulation legislation altogether. As of December 2008, 16 states (Arizona, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Texas, and Virginia) and the District of Colombia were in the process of deregulating retail electricity markets. Deregulation processes in most of these areas began prior to 2001. Nevada and Oregon have deregulated electricity markets only for large commercial customers.

Fig. 1 traces an index of electricity rates for all 50 states and the District of Columbia, which are broadly divided into those that do have deregulated retail electricity markets and those that do not. The value "1" represents residential electricity rates in 1990. In states that adopted deregulation, discounts and price-cap regulations caused residential electricity rates to initially decline when deregulation was introduced (1998–2002). In 2002, however, rates began to rise in nearly all of these states, and rates in states that did not adopt deregulation reflected the same upward trend. This increase is thought to have resulted from a sudden rise in natural gas prices, which led to higher wholesale prices for electricity. When states began to remove price-caps in 2004, rates in deregulated states began to increase at a more precipitous pace, converging on market levels.

Immediately after deregulation, large commercial electricity consumers changed their electric power suppliers fairly regularly. Residential markets, on the other hand, did not. There was very little entry of new alternative suppliers, and the tendency among consumers was to stay with the existing supplier. Now, however, with approximately 10 years having passed since the deregulation of retail electricity markets began, a new movement has taken hold. Using Massachusetts to illustrate, when price-cap regulations in that state came to an end in February 2005, only 3% of its residential electricity consumers were buying electricity from an alternative supplier, and alternative suppliers accounted for only 3% of electricity sales. By March 2008, though, both these figures had risen to 11%. Changes such as these are seen as having resulted from the end of the price-caps that had made it advantageous to purchase electricity from existing suppliers at rates fixed below market levels.

It is now generally accepted that enough time has passed to gather data on conditions before and after deregulation and to quantitatively assess the changes.

Much research has been done on electric utility deregulation. This work has spanned a broad range of perspectives, categories, countries or regions, and approaches. Several of these studies have focused on developments in recent years. Goto and Sueyoshi (2009) examine the cost structure of Japanese electricity distribution and find evidence of improved productivity growth after deregulation. Hyman (2009) argues that the semi-competitive electric industry model in the U.S. and U.K. has led to the more efficient operation of electric companies than the pre-regulatory model did, but has failed to deliver significantly greater benefits to the consumer. He suggests that financial modelers and policymakers should address these issues. Yucekaya et al. (2009) present two algorithms to determine the bid prices and quantities under the rules of a competitive power market in which power companies sell electricity at high prices to maximize profit. Barmack et al. (2008) argue that the econometric

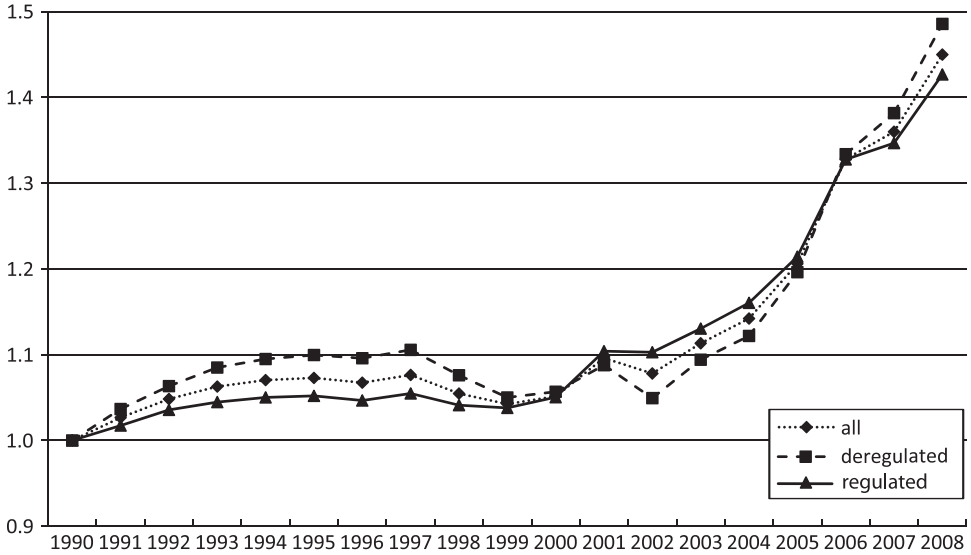

Fig. 1. Transition of the real overall unit price of residential electricity.