RETAIL CHOICE IN ELECTRICITY: WHAT HAVE WE LEARNED IN 20 YEARS?

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Electric Markets Research Foundation

Christensen Associates Energy Consulting conducted this study for the Electric Markets Research Foundation (EMRF). EMRF was established in 2012 as a mechanism to fund credible expert research on the experience in the United States with alternative electric utility market structures – those broadly characterized as the traditional regulated model where utilities have an obligation to serve all customers in a defined service area and in return receive the opportunity to earn a fair return on investments, and the centralized market model where generation is bid in to a central market to set prices and customers generally have a choice of electric supplier.

During the first few years of restructured markets, numerous studies were done looking at how these two types of electric markets were operating and the results were mixed. But since those early studies, limited research has been done regarding how centralized markets and traditionally regulated utilities have fared. The Electric Markets Research Foundation has been formed to fund studies by academics and other experts on electric market issues of critical importance.

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CA Energy Consulting is a wholly owned subsidiary of Laurits R. Christensen Associates, Inc., whose multi-disciplinary team of economists, engineers, and market research specialists has been serving the electric power industry (as well as other industries) since 1976. CA Energy Consulting's focus on energy markets covers a broad range of technical and regulatory policy issues concerning wholesale and retail electricity market restructuring, market design, power supply, asset evaluation, transmission pricing, market power, retail and wholesale rate design, and customer response to price signals.

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EXECUTIVE SUMMARY

Electric power industry restructuring in the United States in the 1990s was motivated by the expectation that substantial benefits were available through increased competition at the wholesale level – that is, in power sales among generators and utilities for resale to ultimate retail consumers. These expected benefits were of two types. First, competition in generation services would induce technological and management improvements in power production that would reduce generation costs and improve generators' performance. Second, the breaking down of barriers to trade among utilities and other wholesale market participants would foster competitive power trading that would substitute relatively cheap for relatively expensive generation.

In contrast to the very real expected benefits of wholesale restructuring, the potential gains from retail choice were speculative at best. By the time that restructuring occurred in the late 1990s, there was already a substantial body of evidence, from innovative retail electricity programs dating back to the 1970s, that customers' short-term response to electricity prices was small and that customers' willingness to be curtailed, even when they had promised to be available for curtailment, was even smaller. Nonetheless, through a confluence of hopes from disparate interest groups, particularly from industrial customers seeking lower electricity prices and terms of service better tailored to their needs, retail choice was adopted alongside wholesale restructuring in nearly half the states. Nearly two decades later, there is little evidence that retail choice has yielded any significant benefits.

Current Status of Retail Choice

"Retail choice" refers to customers' ability to choose the entity that provides them with electrical energy through the traditional power network. Australia, Korea, New Zealand, Turkey, and eight of the twenty-seven member states of the European Union (EU) appear to have real retail choice options. Fourteen U.S. states and the District of Columbia presently have retail choice, and eight states have suspended or rescinded retail choice. Because many states allow limited retail choice, however, the dividing line among states is somewhat ambiguous.

In U.S. jurisdictions with retail choice, roughly half of commercial and industrial load has switched to competitive suppliers, while under a tenth of residential load has done so. Because the gross benefits of switching suppliers are roughly proportional to a customer's size, larger customers are better able to overcome the transaction costs of switching than are smaller customers.

Retail Choice Outcomes

Retail choice appears to have the following impacts on innovative service offerings:

- Retail choice is extending the market penetration of dynamic pricing programs that reflect power system conditions. All other things equal, this improves the efficiency of use of power system resources, lowers the average costs of producing power, and tends to improve resource adequacy.
- Retail choice promotes renewable resources. To the extent that this raises the market penetration of intermittent resources such as wind and solar, it may raise resource adequacy issues because of the non-dispatchability of such resources.
- Retail choice has a mixed record in promoting demand response.
- Retail choice has not generally promoted smart metering.

The evidence indicates that retail choice has the following impacts on consumer prices:

- Retail choice states, from the beginning of retail choice up to the present, have had retail prices persistently higher than those in other states, with the price gap varying over time with changes in fuel prices and other factors. The overall trend has been toward a lower price gap, though that is at least partly due to the happenstance of natural gas prices being low at the present time.
- Retail electricity prices in retail choice states vary more immediately with current fuel prices and other market factors than do retail prices in other states, and are therefore less stable than retail prices in other states.
- Retail electricity prices in retail choice states vary by location in a manner that mimics locational variations in wholesale electricity market prices.
- Neither price regulation nor the opening of retail markets seems to have had significant impact on average residential prices in the EU. The EU experience gives no clear signal about how retail choice affects retail electricity prices.
- The numerous statistical studies of the relationship of electricity prices to restructuring have reached contradictory conclusions about the price impacts of retail choice.

Implementation of retail choice has created some costs:

- Retail choice exacerbates the resource adequacy problem by materially adding to the financial uncertainties faced by investors in generating resources because it adds to uncertainties in the revenues that a generator will receive for its services. With retail choice, investors have sales contracts with durations that are only small fractions of the lives of their investments, which means that their revenues depend upon uncertain future market conditions. This uncertainty makes investment in new generation less attractive and makes long-term fuel contracting less attractive for existing generators, which may impinge upon resource adequacy and certainly raises the required returns on investment capital. This increase in required returns must ultimately be paid by consumers in the form of higher prices.

- The risk of retail supplier bankruptcies under retail choice is greater than under traditional regulation, which may increase the costs borne by consumers.
- Retail choice requires that billing procedures be adapted so that appropriate shares of customer payments go to the utility (for non-competitive services) and to third-party retail suppliers (for competitive services).
- Retail choice requires metering that is compatible with new retail service offerings.
- Under retail choice, retail suppliers incur marketing costs that must be recovered from customers.
- To facilitate the competition in generation services that is necessary for retail choice, there must be functional unbundling of utilities' generation function from its distribution and transmission functions. In most retail choice states, government encouraged or required utilities to divest generation assets or move them to separate affiliates, which, due to bad timing, ultimately cost customers tens of billions of dollars.

There is also evidence of the following additional impacts of retail choice:

- Some retail energy suppliers cherry pick customers. Some of the most attractive customers, namely industrial and large commercial customers, take advantage of lower prices in either the retail choice market or the regulated market, which may result in other customers bearing disproportionate shares of utilities' generation costs.
- There does not seem to be a clear relationship between retail choice and customer satisfaction. Results for U.S. residential customers are mixed. The EU experience suggests that retail choice, when well implemented, improves customer satisfaction.
- Retail choice decisions require business savvy that many consumers lack. Less educated or low-income consumers are more likely than other consumers to make poor retail supplier choices.

<u>Directions for Future Policy</u>

Policymakers should measure the success of retail choice according to the extent to which it reduces customers' bills relative to what they would have been for service from the incumbent utility, and according to the extent to which it creates service options of real value to consumers. Success should not be measured according to switching rates; and encouraging greater switching should not be a goal of public policy. In particular, smaller electricity consumers recognize that the transaction costs of switching are high relative to the prospective benefits of lower bills and better customer service, and can therefore rationally remain with their incumbent utilities.

Regulators in all states should encourage utilities to unbundle the pricing of generation services from that of other services, particularly distribution services, and charge consumers for non-competitive services when they choose an alternative generation supplier. Consumers should be able to clearly compare the prices of the generation services offered by competing suppliers, without the distraction of the prices of non-competitive services. Utilities should be able to

recover the costs of non-competitive services regardless of the customer's choice of competing energy supplies whether obtained through the power system or outside of the power system.

Subsequent to unbundling of generation services from other services, regulators in retail choice states should encourage utilities to offer real-time pricing to all customers willing to pay the costs of the associated metering and billing. All customers can then have access to the wholesale market if they are willing to pay for such access.

To limit cherry-picking in retail choice states, customers who choose an alternative retail energy supplier should be ineligible to return to a conventional utility tariff. Instead, customers who want to return to the incumbent utility should be required to accept its real-time pricing rate or some other market-based rate.

Regulation in retail choice states needs to vigilantly protect consumers against retail energy suppliers' default and fraud.

RETAIL CHOICE IN ELECTRICITY: WHAT HAVE WE LEARNED IN 20 YEARS?

1. INTRODUCTION

1.1. Background

Traditionally, electric power was provided to U.S. consumers by vertically integrated utilities that owned generation, had exclusive retail franchises, and traded wholesale power through bilateral contracts. Beginning in the late 1990s, a new "restructured" market model was introduced under which regional transmission organizations (RTOs) or independent system operators (ISOs) operate centralized competitive wholesale markets in certain regions of the U.S. While about a third of the U.S. population continues to obtain electric power service based on traditional institutional arrangements, about two-thirds of the population now obtains electricity through restructured wholesale markets.

Although retail customers must obtain their power through transmission and distribution facilities that are owned and operated by regulated monopolies, it is technically feasible for them to obtain generation services (like electrical energy) and customer services (like special billing plans) through suppliers other than their traditional utilities. The prices and terms of transmission and distribution services thus continue to be determined through regulatory processes; but in states wherein retail choice is available, the prices and terms of generation and customer services can be set through market processes.

Retail choice – by which customers are allowed to choose their suppliers of generation and customer services – is available primarily in states located within regions served by the centralized wholesale markets, but they are also allowed such choice in a few states operating under traditional wholesale market structures.[1] In most states offering retail choice, competition at the retail level may therefore be regarded as an extension of the new competition at the wholesale level. Electricity markets with and without retail choice are thus distinguished, in part, by the nature of the corresponding competition at the wholesale level: retail choice states usually participate in restructured wholesale markets; while states without retail choice fall into both traditional and restructured wholesale markets.[2]

[1] For example, under the traditional market structure in Georgia, new commercial and industrial customers with loads of 900 kW or higher are eligible for one-time electricity supplier choice. In Oregon, commercial and industrial customers that use at least 30 kW per month are eligible for electricity supplier choice.

[2] Borenstein and Bushnell [2015b, p. 4] note that "competitive generation is central to the retailer being able to offer better procurement options, different generation sources, or alternative billing mechanisms, which the retailer would likely want to balance with the wholesale contracts it has with producers."

1.2. Purpose of This Report

This report examines "retail choice," which we define as competition in the supply of the generation and customer components of retail electricity service *received through power systems*. It looks at the reasons why retail choice has been adopted in many jurisdictions, how it has evolved over the past few decades, the challenges in its implementation, and how it has affected power supply reliability and costs. This examination relies, in part, upon a comparison of U.S. electricity markets that have retail choice with U.S. electricity markets that do not have such competition, recognizing that such a comparison is complicated by the many factors that distinguish electricity markets with and without retail choice. These factors include weather, access to and costs of fuel, labor market and other input market conditions, and the characteristics of state laws and regulations. Moreover, each of these factors encompasses a range of conditions. For example, most states have laws or regulations that subsidize distributed resources directly through tax credits or indirectly through net metering rules that pay retail electricity prices for customers' self-generated electrical energy; but the states vary substantially in both the levels of the tax credits and the conditions that define net metering rules. It is thus a complex matter to determine the extent to which the reliability and cost differences among states are due to retail choice rather than to other factors.

This report also takes a limited look at retail competition in general. "Retail competition" not only includes retail choice, but also includes electricity or electricity substitutes available to consumers *through sources other than the power system*. These alternatives include self-generation such as solar panels, energy efficiency measures such as more efficient motors and better insulation, and other energy sources such as natural gas for heating. Some forms of retail competition are occurring in almost all states regardless of the status of retail choice. Such competition has been stimulated by a variety of factors including falling natural gas prices, renewable portfolio standards, net metering policies, and tax and other incentives to electricity customers to adopt renewable energy technologies like rooftop solar.

1.3. Organization of This Report

The first sections of this report are descriptive. Section 2 summarizes the current status of retail choice, with an emphasis on the U.S. and an overview of some other nations' policies and retail market structures. Section 3 describes the major technological and institutional factors that have driven the movement toward retail choice. Section 4 briefly reviews the history of how those technological and institutional factors have in fact induced states to adopt or choose not to adopt a retail choice policy. Section 5 identifies the technical and institutional factors that must be addressed by those jurisdictions that adopt retail choice.

Section 6 looks at what reliability agency reports, government agency reports and data, industry organization reports, and industry and academic literature tell us about the impacts of retail choice on customer service, power system costs, electricity market efficiency, retail electricity prices, power system resource adequacy, the division of financial risks among stakeholders, particular demographic groups, and electricity sector regulation. Section 7 interprets the analyses and data of Section 6, drawing inferences about how the actual net

benefits of retail choice compare to the promised benefits, and offers suggestions for future public policy.

2. CURRENT STATUS OF RETAIL CHOICE

This section provides a brief overview of the status of retail choice in the U.S. and elsewhere.

2.1. Status in the U.S.

Retail competition comes in two forms. First, customers can choose the entity that provides them with electrical energy through the traditional power network, which we call "retail choice." Second, customers can procure part or all of their electrical energy through energy alternatives available to consumers through sources other than the power system. In this section, after looking at the status of retail choice, we look at one prominent energy alternative, namely self-generated solar power through rooftop photovoltaics.

2.1.1. Retail Choice

Nearly half the states have allowed competitive suppliers to supply electrical energy and other services to retail electricity consumers through the power network, though several of them have suspended or rescinded this form of retail competition. Figure 1 shows the present state-by-state status of retail choice. The fifteen green jurisdictions have retail choice, the eight red states have suspended or rescinded retail choice, and the white states never pursued retail choice. Four of the states that suspended or rescinded retail choice (California, Nevada, Oregon, and Virginia) still allow large industrial customers and some commercial customers to choose their suppliers.

Figure 1
Status of Retail Choice[3,4]

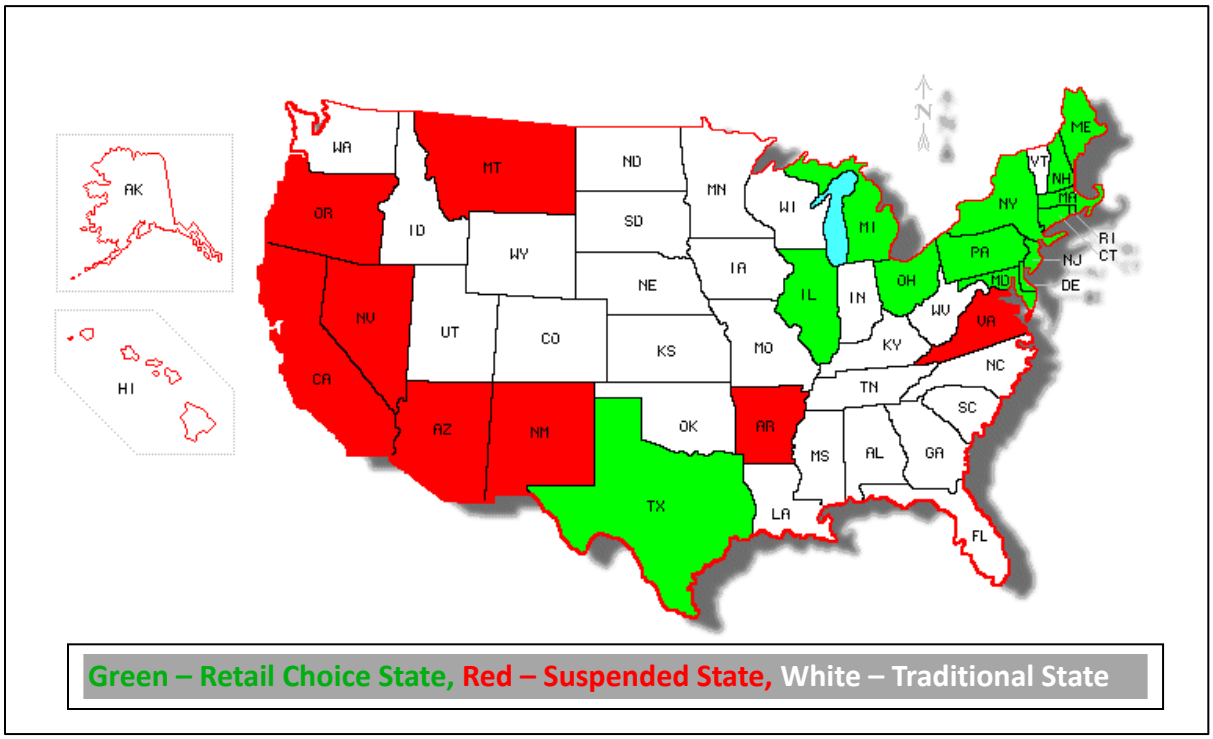


Figure 2 shows the extent to which retail customers have switched to competitive suppliers in sixteen states and the District of Columbia as of 2014. Shares are relative to total MWh sales for each class in each state. Of the seventeen jurisdictions shown in the figure, retail energy suppliers sold a majority of industrial load in eleven states and a majority of commercial load in eight states. As simple unweighted averages, 58% of industrial load, 44% of commercial load, and 7% of residential load in the seventeen jurisdictions have switched to competitive suppliers. The District had the highest switching rates for industrial customers (100%) and commercial customers (85%). While Texas had the highest switching rate (about 60%) for residential customers because the state requires retail choice program participation by all customers served by investor-owned utilities in the footprint of the Electric Reliability Council of Texas, Connecticut has the highest switching rate for residential customers (29%) among the

[3] Figure 1 is based on a composite of information from Belmont Electricity Supply Study Committee [2004, p. 19], http://www.eia.gov/electricity/policies/restructuring/restructure_elect.html, and U.S. Energy Information Administration [2003, p. 3].

[4] The division among states is not entirely unambiguous. Georgia, which is denoted as lacking retail choice, nonetheless allows retail choice for customers with more than 900 kW of load. Michigan, which is denoted as having retail choice, caps allowable sales by non-utility suppliers at 10% of each utility's previous year's sales. Arizona, Oregon, and Virginia, which are denoted as having suspended retail choice, nonetheless permit retail choice for certain large electricity customers; and Virginia allows retail choice for residential customers seeking 100% renewable energy if the local utility does not provide that option.

states that lack such a mandate. Overall, 16% of the total electrical energy sold in the U.S. in 2014 was sold by competitive retail energy suppliers.

Figure 2
Competitive Retail Energy Suppliers' Retail Sales as Shares of Total MWh Sales, 2014[5]

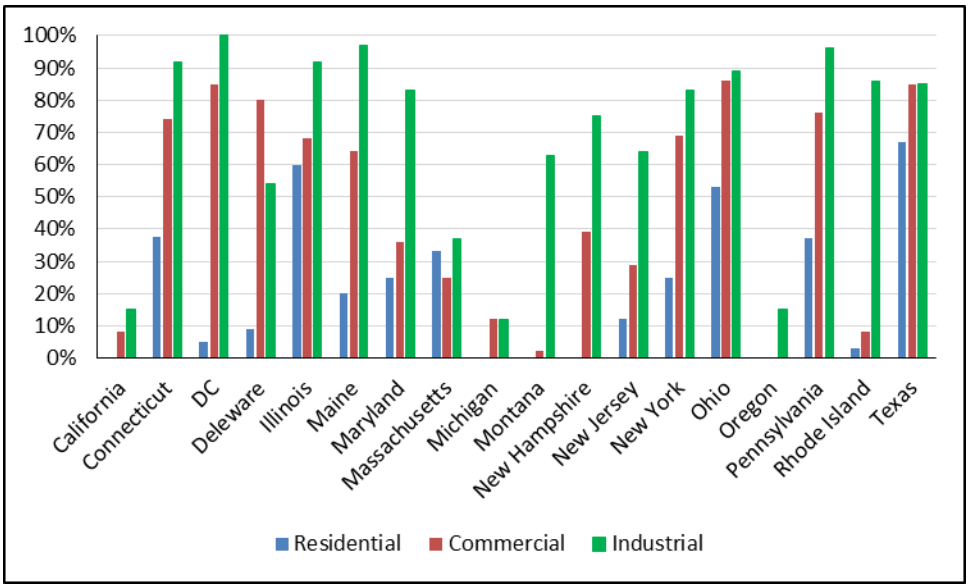


Figure 3 shows the extent to which residential customers have switched to competitive suppliers, though in this figure switching shares are measured according to *numbers of eligible customers* rather than according to *MWh sales*. For the fourteen jurisdictions shown in the figure, 44% of 37.8 million eligible customers took service from competitive suppliers in 2014. Only Illinois, Ohio, and Texas had majorities of residential customers taking service from competitive suppliers. Excluding Texas, which skews the results because all its eligible customers are required to shop, a more modest but still impressive 33% of eligible customers switched.

For all fourteen jurisdictions shown in the figure, the aggregate number of customers taking competitive supply fell 1.2% between 2013 and 2014, with half the states showing gains in numbers of switching customers and half showing losses. Of the fourteen jurisdictions, eleven rely primarily upon direct transactions between consumers and suppliers, while three rely primarily upon municipal aggregators.

[5] Sales shares are based on the most recently available state migration statistics obtained from state public utility commission websites for calendar years close to 2014. Data for Montana are based on U.S. Energy Information Administration [2012].

Figure 3
Residential Customers Taking Competitive Electric Service as Shares of Eligible Customers, 2014[6]

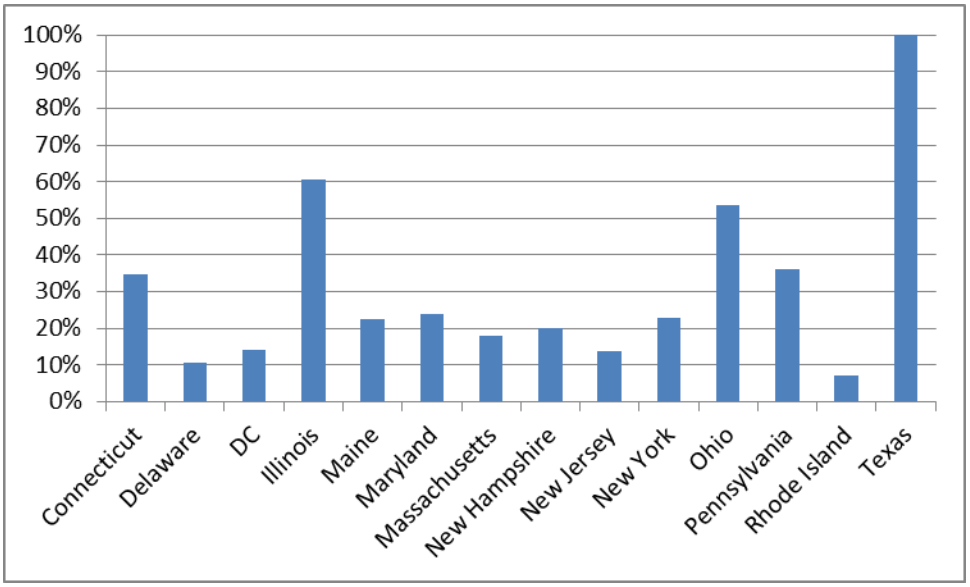


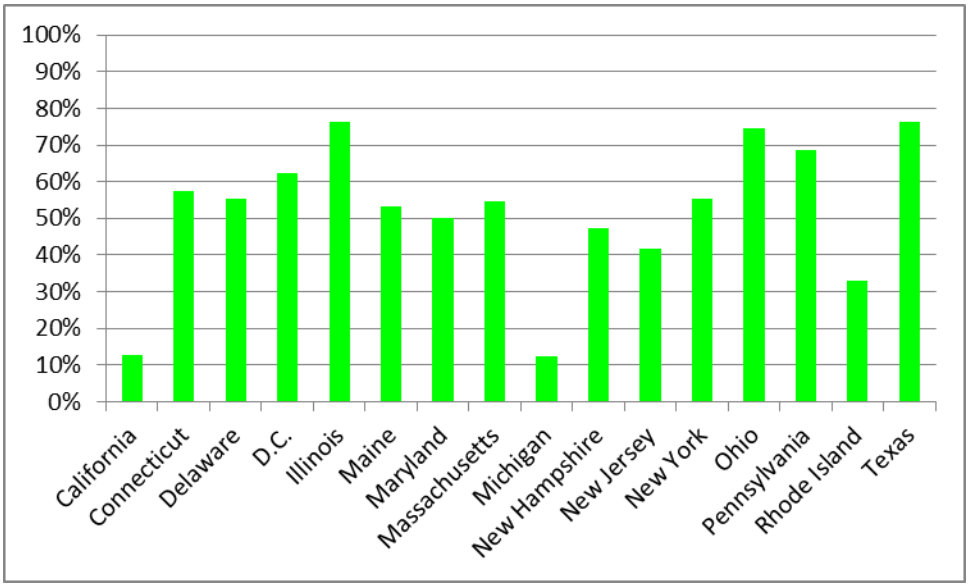
Figure 4 shows the extent to which commercial and industrial customers have switched to competitive suppliers, where the percentages, somewhat strangely, are "Percent of total jurisdictional sales, including the residential sector."[7] In this figure, switching includes only those loads that customers have chosen to take from entities other than the incumbent utility. The simple average switching rate is 52%, with Illinois, Ohio, and Texas again taking the lead. California and Michigan place limits on the extent of switching, which partly explains their relatively low percentages.

Customer size is the main reason that residential customers have adopted retail choice at much lower rates than commercial and industrial customers. The gross benefits of switching suppliers are roughly proportional to a customer's size. For a business, these benefits can be large enough to warrant spending staff time investigating electricity supplier options, and even large enough to justify having some staff dedicated to managing energy consumption decisions. For a residential consumer, by contrast, the gross benefits warrant only minimal consideration of options. Furthermore, businesses have abilities to manage information and financial risks in ways that are generally unavailable to residential consumers; so risk aversion will quite rationally induce residential consumers to stick with their low-risk incumbent supplier to a greater extent than it will so affect businesses.

[6] Distributed Energy Financial Group [2015, Table ES-1].

[7] Distributed Energy Financial Group [2015, Table ES-3].

Figure 4
Percent of Eligible Commercial & Industrial Loads Taking Competitive Electric Service from Non-Incumbent Providers, 2014[8]



To some extent, competition has been discouraged by the ways in which some states have required utilities to offer provider-of-last resort (POLR) service. This requirement has been intended to protect consumers by assuring that they can obtain electricity from incumbent utilities at reasonable prices. In addition to protecting consumers, however, state-mandated ceilings on POLR service prices also interfere with the establishment of retail prices that accurately reflect power system costs and reduce the profitability of offering competing retail electricity services.[9]

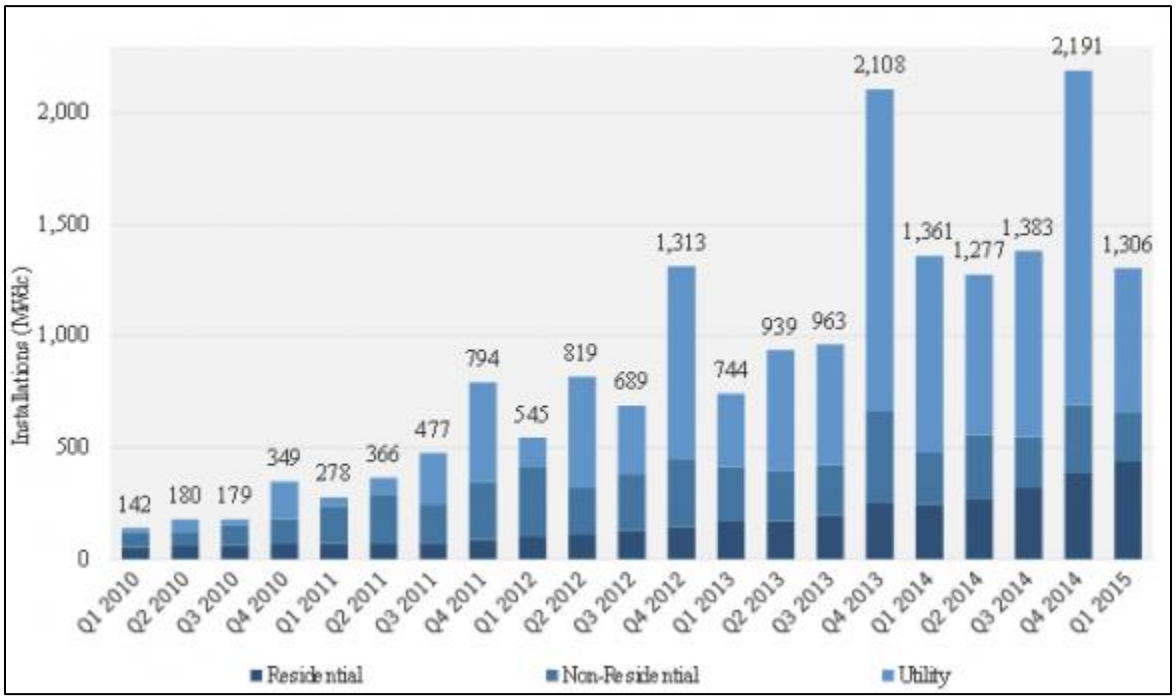
2.1.2. Retail Competition Through Rooftop Photovoltaics

Residential rooftop solar has successfully competed for a growing share of residential electricity consumption in recent years. Figure 5 shows that photovoltaic installations in general have skyrocketed in the U.S. over the past few years, in terms of both numbers and MW. Utility installations have been the majority of these installations, but residential and non-residential installations have increased rapidly as well.

[8] Distributed Energy Financial Group [2015, Table ES-3].

[9] Electric Energy Market Competition Task Force [2006, p. 6].

Figure 5
U.S. Photovoltaic Installations, Q1 2010-Q1 2015[10]



The growth in residential installations has been fueled by third-party financing of rooftop solar, which has accounted for 72% of such installations in some jurisdictions in 2014.[11] There are two types of such financing.[12] Under both types of financing, the developer builds the solar facility on the customer's property, covers specified costs (e.g., design, permitting, installation, and maintenance), and owns the facility for a period of up to twenty years. The customer's payments to the developer, however, depend upon the type of financing.

- *Under a power purchase agreement*, there is no up-front cost to the customer, and the customer pays specified prices for energy consumed from the solar facility.
- *Under a traditional lease agreement*, there may or may not be an up-front cost to the customer, and the customer pays a monthly fee that is independent of energy consumed.

Under either type of financing, there will be some agreement regarding the customer taking over ownership after some period of time, perhaps for a buyout payment. The developer not

[10] Munsell [2015b].

[11] Munsell [2015a]. This source indicates that, in 2014, the leading companies in the U.S. residential solar installation market were SolarCity (34%), Vivint Solar (12%), and Sunrun (10%).

[12] Solar Energy Industries Association and U.S. Energy Information Administration [2013].

only receives revenue from the customers, but also receives substantial tax benefits as owner of the installation.

At least twenty-six states and the District of Columbia allow power purchase agreements, while seven states prohibit it.[13] Similar numbers allow and prohibit traditional lease agreements.[14]

The economics of residential solar installations primarily depend upon three factors. First and foremost, they depend upon tax incentives. The federal investment tax credit is critical, as it accounts for 40% to 50% of developers' net profit on residential solar installations. State incentives are also critical: of the ten jurisdictions with the highest rates of return on residential solar, only one (California) remains in the top ten without its state incentives. Second, the economics of residential solar depend upon retail electricity prices. When tax incentives are removed, the jurisdictions with the ten highest rates of return have residential electricity rates that average 42% higher than those of the second ten jurisdictions, even though their solar output is virtually identical. Third, residential solar economics depends upon the availability and characteristics of state net metering programs. Net metering policies, which are presently in place in forty-one states plus the District of Columbia,[15] have customers pay utilities for the electricity they consume net of the electricity that they produce. Net metering in effect pays customers not only for the electrical energy that they provide but also delivery and customer services that they do not provide, but instead use. The consequence is that the delivery and customer service costs of residential customers with solar power are heavily subsidized by customers without solar power. Somewhat ironically, solar irradiance – that is, how much the sun shines in a particular place – is a lesser factor in determining the profitability of investment in residential photovoltaic installations, even though it is a critical factor in determining how much electricity is actually produced.[16] The consequences of these tax and regulatory subsidies are inefficiently high investment in costly solar facilities and distortion of retail electricity prices.

2.2. Status Elsewhere

Liberalization of electricity markets began with Australia, Chile, and the United Kingdom in the 1980s, and reached the European Union (EU) in the 1990s.[17] As shown in Table 1, New Zealand was the first country to achieve full opening of its retail markets in which consumers have the right to choose their retailer suppliers. Nonetheless, the table shows that full retail market openings have occurred primarily in EU countries, with a smattering of other developed

[13] Database of State Incentives for Renewables & Efficiency [2016a].

[14] https://solarpowerrocks.com/solar-lease-map/.

[15] Database of State Incentives for Renewables & Efficiency [2016b].

[16] UBS [2015].

[17] In the EU, market liberalization has been implemented through three directives, the first of which, adopted in 1996, mandated open access to transmission and distribution networks, allowed customers to change suppliers, and promoted independent regulatory agencies. See European Commission [2012].

countries participating. In the U.S., only Maine (in 2000) and Texas (in 2002) have achieved comparable market liberalizations.

Table 1
Years of Full Retail Market Opening[18]

Country	Year	Country	Year
Australia	2002	Italy	2002
Austria	2001	Korea	2001
Belgium	2007	Netherlands	2001
Czech Republic	2006	New Zealand	1994
Denmark	2003	Norway	1997
Finland	1998	Poland	2007
France	2007	Portugal	2006
Germany	1998	Spain	2003
Greece	2007	Sweden	1996
Hungary	2000	Turkey	2003
Ireland	2000	United Kingdom	1999

Retail electricity market liberalization is different in different places. In several countries listed in Table 1, the transition to liberalized electricity sectors was preceded by state ownership of power systems and then followed by their privatization, with significant implications for the differing ways in which retail choice has been implemented. Furthermore, the extent and terms of retail choice often vary among the jurisdictions within a country.[19]

Table 2 summarizes the extent of competition in each of the member states of the EU in terms of the numbers of "main suppliers" with market shares of at least 5%, the market shares of those suppliers, and the market share of the largest supplier in 2010. The table divides EU member states into categories that reflect inferred values for the Herfindahl-Hirschman Index (HHI) of market concentration.[20] Only four member states have unconcentrated markets, and another four have moderately concentrated markets. These eight countries arguably have real retail choice options. Another seven member states have highly concentrated markets, which means that retail choice is limited at best. The last twelve countries basically have monopolies, meaning that retail choice is not offered or is offered in name only.

According to one source:

[18] Cook [2011, pp. 22-23].

[19] See, for example, London Economics [2012, p. 33].

[20] The table follows the U.S. Department of Justice and Federal Trade Commission Horizontal Merger Guidelines § 5.2 (2010) in using an HHI value of 1,000 to separate "unconcentrated" from "moderately concentrated" markets; but it uses the relatively high HHI value of 2,500 to separate "moderately concentrated" from "highly concentrated" markets.

> …the moderately concentrated electricity retail markets of Denmark, Finland, Germany, Great Britain, Italy, the Netherlands and Norway perform relatively well, judged on the basis of key competition performance indicators (e.g. choice of suppliers and offers; switching rates; entry-exit activity; consumers' experiences; mark-up etc.)… Retail competition performance indicators show no or weak signs of competition in MSs [member states] with highly concentrated markets at the national level: in electricity in Bulgaria, Cyprus, Hungary, Latvia, Lithuania, Malta and Romania… According to a data sample based on offers in the capital cities, the electricity and gas markets of Germany, Great Britain, Denmark and the Netherlands are the relative best performers in relation to the number of offers and suppliers providing diversified products for electricity and gas consumers, such as the type of energy pricing, green offers, additional free services and/or dual fuel offers.[21]

The numbers of retailers in each country – and consequently, market concentration – vary over time. For example, large drops in numbers of retailers have been experienced in Denmark (from 113 retailers to 49) and Spain (from 375 to 162), both drops occurring mainly when retail markets were opened to residential customers.[22] Apparently, industry consolidation was induced by the relatively high costs of reaching large numbers of small customers. On the other hand, increases in numbers of retailers have occurred in other countries, like Germany, Italy, and the United Kingdom. More generally, in many countries (including some of those just named), numbers of retailers have risen and fallen over time.

Although the large numbers of retailers in some EU states suggests that retail markets are fragmented, Table 2 shows that all EU markets are, in fact, dominated by no more than eight main suppliers. Apparently, there is a large fringe of small suppliers in many EU states; and although the numbers of these small suppliers vary considerably over time, the numbers of main suppliers are fairly stable.

Customer switching behavior in the EU seems to be related to the degree of competition. In the United Kingdom, the retail energy market (both electric and gas) has an impressively high annual switching rate of 18%, with almost all consumers being aware of the right to change energy suppliers.[23] On the other hand, countries with weak competition have little product and price differentiation and therefore little inducement for consumers to seek new suppliers. The continuation of retail price regulation further discourages competition and switching.[24]

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[21] Agency for the Cooperation of Energy Regulators and Council of European Energy Regulators [2014, p. 9]. ACER/CEER's characterization of Italy as "moderately concentrated" is belied by its largest supplier having 85% of the market.

[22] Rathke [2015].

[23] Karan and Kazdagli [2011, p. 16].

[24] Agency for the Cooperation of Energy Regulators and Council of European Energy Regulators [2014, pp. 6-7].

Table 2
Competition in Retail Electricity Service in the European Union, 2010[25]

Member State	# of Main Suppliers	Mkt Share of Main Suppliers	Mkt Share of Largest Supplier
Unconcentrated Markets:			
Austria	8	69%	17%
Finland	4	45%	17%
Germany	3	25%	14%
Sweden	3	45%	19%
Moderately Concentrated:			
Denmark	3	59%	46%
Netherlands	4	79%	32%
Slovenia	5	99%	36%
United Kingdom	6	85%	24%
Highly Concentrated:			
Belgium	4	89%	61%
Czech Republic	3	87%	52%
Hungary	4	99%	45%
Ireland	3	98%	60%
Luxembourg	2	85%	68%
Slovakia	4	98%	35%
Spain	3	92%	41%
National or Regional Monopolies (RM):			
Bulgaria	3	100%	RM
Cypress	1	100%	100%
Estonia	1	94%	94%
France	1	92%	92%
Greece	1	100%	100%
Italy	1	85%	85%
Latvia	1	99%	99%
Lithuania	2	94%	RM
Malta	1	100%	100%
Poland	6	88%	RM
Portugal	1	93%	93%
Romania	4	100%	RM

[25] ECME Consortium [2010].

Although the EU mandated retail choice as a means of breaking up monopolies and improving the efficiency of the electricity sector, the various member states have chosen different methods for implementing retail choice, yielding a diversity of outcomes. The result is that only eight of the EU's twenty-seven member states have real retail choice options. It is notable that these eight countries tend to be wealthier EU members, and that the twelve countries that have maintained monopolies tend to be poorer EU members. Breaking up old monopolies thus appears to be a luxury that is easier for the wealthy to afford.

3. DRIVERS OF RETAIL CHOICE

At the height of the restructuring movement in the 1990s in the U.S., industrial electricity consumers led the charge for retail choice, primarily in the hope that it would provide them with opportunities to get lower electricity prices, secondarily in the hope that they could negotiate terms of service that would better be tailored to their needs. In this effort, industrial customers were supported by entities, most notoriously Enron but also including many utilities, that hoped to profit by selling into or trading in newly deregulated wholesale and retail electricity markets.

For example, John Anderson, executive director of the Electricity Consumers Resource Council, an industrial electric consumers' lobbying group, expected lower prices for his members:

> We think competition in any industry brings about not only lower prices but also increased innovation and technological stimulation.[26]

Steve Burton, President of the Electric Power Supply Association and of Sithe Energies, an independent power producer (IPP), foresaw lower prices and more services:

> Consumers will have choice as well as lower prices… They will be able to choose the type of service they want, how they want it delivered, and there will be a wider range of services.[27]

Another group of IPPs also foresaw low prices and innovation:

> Consumers will benefit. According to the US Energy Information Administration, the average price of electricity is projected to decline by one percent a year between 1996 and 2020 as the result of competition among electricity suppliers. As retail competition becomes more widespread and more customers throughout the country are allowed to choose their power suppliers, these suppliers can be expected to work harder and smarter to keep prices down, attract and retain customers, and provide better service. More than 70 percent of consumers surveyed by the Americans for Affordable Electricity, a coalition that supports giving customers the power to choose their electricity supplier, said they would prefer to have a choice when buying electricity.[28]

[26] Jost [1997].

[27] Jost [1997].

[28] Competitive Power Supply Industry [2000, p. 10].

The Chairman of the nation's largest power trading firm was able to put a number on the benefits that consumers would enjoy:

> Enron's chairman, Kenneth L. Lay, says that consumers could save $60 billion-$80 billion per year if the electric power market were completely opened to competition.[29]

The extent to which these hopes were realized is the topic of Section 6 of this report. The present section focuses on the benefits of retail choice that were expected by the advocates of retail choice as restructuring was initiated. We divide these benefits into three categories: reducing retail electricity prices; offering customers a wider range of choices in service conditions; and promoting alternative resource technologies.

3.1. Reducing Retail Electricity Prices

The movement toward retail choice was partly driven by the hope that competition would result in retail electricity prices that are lower than they would otherwise be. Indeed, as later described in Section 4, the states with retail choice are generally those that had relatively high retail prices in the late 1990s, when restructuring activity was at its peak. The hope for lower prices was partly based upon the expectation that competition would drive improvements in the efficiency of electricity production and delivery, but was also driven by consumer groups hoping to capture economic rents from utility shareholders.

3.1.1. Price Reductions Due to Efficiency Improvements

In theory, retail choice can potentially lead to efficiency improvements in the provision of generation services and in retail electricity prices themselves.

With respect to improving generation services, competition in the provision of retail services may enhance the competitive positions of non-utility generators by expanding the market opportunities for these generators' services.[30] Such opportunities might increase the market shares of those generation firms that are most efficient, ultimately resulting in lower costs of providing electricity to final customers. These potential benefits of retail choice are different and much smaller than the benefits of wholesale competition, which has led to significant improvements in the commitment and dispatch of generation and transmission resources in regions with balkanized resource ownership. Nonetheless, retail choice may provide benefits that complement those of wholesale competition.

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[29] Jost [1997].

[30] Borenstein and Bushnell [2015b, p. 4] note that "a merchant generator would be in a very weak position if there were only one retail electricity provider to which it could sell its output. A monopoly retail provider (a distribution utility) could still engage in competitive procurement, but that creates a narrower spectrum for competitive generation and it means that the monopoly retailer is the single determinant of the range of products that might be procured for retail. For instance, the monopoly retailer might not pursue low-carbon sources even if there are many retail customers who would be willing to pay a premium for greener energy. Thus, retail competition potentially makes competitive generation more viable."

With respect to improvements in electricity prices, retail choice may drive retail prices toward the market's marginal costs. Utilities' retail electricity prices have traditionally been determined according to the average costs of the generation, transmission, distribution, and customer services that are required to produce electricity and deliver it to customers. These average cost-based cost-of-service rates partly depend upon the quality of utility management and partly upon the legacy of past cost commitments, such as decisions to build particular types of power plants or to commit to particular long-term fuel supplies. In a market setting, by contrast, the retail prices of electricity services subject to competition, particularly generation services like electrical energy, may move closer to the market's marginal costs of these services. These marginal costs are the costs of obtaining new supplies of these services, given current technologies and input prices, and are not dependent upon legacy costs. Retail prices based upon marginal costs could encourage customers to consume more power when power supplies are relatively abundant and to consume less power when power supplies are relatively scarce. This better match between retail prices and wholesale market conditions may improve resource adequacy through peak load reduction and may reduce the average costs of providing power to consumers, which could ultimately result in lower retail prices.

Utilities have long recognized the benefits of retail prices that reflect marginal costs. Consequently, they have offered time-of-use rates since the 1970s, real-time pricing rates since the 1980s, and other dynamic pricing programs in more recent years. Retail choice may potentially further this movement toward more efficient retail pricing.

Regardless of whether retail choice makes prices more efficient, it is likely to change the relative prices paid by different customer groups. As just noted, retail choice may move prices away from a cost-of-service basis toward short-run marginal costs. But it may also change the relative bargaining power of different customer groups. Under regulation, utilities' retail electricity prices have traditionally reflected not only their average costs of service but also the relative political power of different groups of electricity consumers. Under retail choice, prices will be influenced by the relative economic power of different customer groups, with relatively mobile customers or relatively large customers able to negotiate price discounts that are not available to less mobile or smaller customers.

3.1.2. Price Reductions Due to Capture of Economic Rents

Sometimes the marginal costs of generation services are lower than utilities' average costs, and sometimes they are higher. Marginal costs are higher than average costs during periods of high inflation, when the capital costs, fuel costs, and other operating costs of generators are higher than expected. Marginal costs are lower than average costs during periods of low inflation or when technological advances are greater than expected.

During years when marginal costs are lower than average costs, there is political pressure to open electricity markets to competition so that consumers can obtain lower-priced electricity. At such times, retail choice allows non-utility suppliers to attract customers away from utilities. During years when marginal costs are higher than average costs, by contrast, there is little or no

political pressure to open electricity markets to competition, as customers prefer utilities' prices to those that would be available from the market.[31]

3.2. Wider Customer Choice in Service Conditions

In principle, competition can result in customers having a wider range of retail electricity products than is traditionally available, and can result in lower retail prices. Retail products can be differentiated along several dimensions, including the following:

- *Energy source*. The consumer can choose to buy electricity produced by renewable resources rather than by fossil or nuclear fuel.
- *Firmness of service*. Service can be guaranteed under all conditions (aside from transmission and distribution deliverability problems) or only some conditions. If the provider can curtail service, curtailments may or may not be limited by wholesale electricity market conditions, or by limitations on the required notice, frequency, and duration of interruptions.
- *Variability of price over time*. Price can be identical (fixed) in all time periods, or can vary by season, by peak or off-peak periods, or by hour.
- *Duration of price guarantee*. Price can be guaranteed for specific time periods, such as one year or five years.
- *Degree of price guarantee*. Price can be guaranteed for all wholesale electricity market conditions or for only some market conditions.
- *Flexibility of allowable consumption of electricity*. Price can be guaranteed for all or part of a customer's consumption. For consumption in excess of a subscribed quantity, price can be set according to wholesale electricity market conditions or to some formula.
- *Billing and payment arrangements*. Customers may be offered choices about the timing and frequency of billings. Customers may be offered flexible payment plans that do not require prompt payment of each month's bills, but spread payments over time.
- *Bundling of electricity and complementary products*. Customers may be offered special deals for energy efficiency services (i.e., home inspection or insulation) and for electricity-consuming equipment purchases or maintenance.
- *Additional incentives*. Customers may be offered "free" goodies like airline miles.

Utilities have long differentiated their retail products along many of the foregoing dimensions. Retail choice may potentially further such product differentiation.

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[31] Consistent with the text, Borenstein and Bushnell [2015b, p. 1] say "the greatest political motivation for restructuring [in the 1990s] was rent shifting, not efficiency improvements, and… this explanation is supported by observed waxing and waning of political enthusiasm for electricity reform." Borenstein and Bushnell [2015b, p. 2] say "Average cost is the basis for price setting under regulation, while marginal cost is the basis for pricing in a competitive market. During periods in which these two costs have diverged, consumer and political sentiment has tilted toward whichever regime (regulation or markets) offered the lowest prices at that time."

3.3. Promoting Alternative Resource Technologies

Retail choice allows competition in the promotion of "green power" that is generated by environmentally benign resources, of energy efficiency and management systems for homes and businesses, and of self-generation. Such resources may reduce the costs of electricity production, may facilitate a transition toward less-polluting renewable energy, and, when placed at some locations within a distribution system, may improve the reliability of local power systems.

Retail choice may be particularly compatible with the development of market-driven investment in distributed energy resources (DER). Although much of the substantial growth in DER over recent years has been due to tax subsidies, net metering subsidies, and renewable portfolio mandates, retail choice could foster market-driven growth in DER. First, retail choice can allow retail energy suppliers to offer DER as part of their portfolio of services. Second, retail choice can foster the unbundling of transmission and distribution wires service cost recovery from generation and customer service cost recovery, which could mitigate some of the inefficient cross-subsidies inherent in present retail electricity prices.

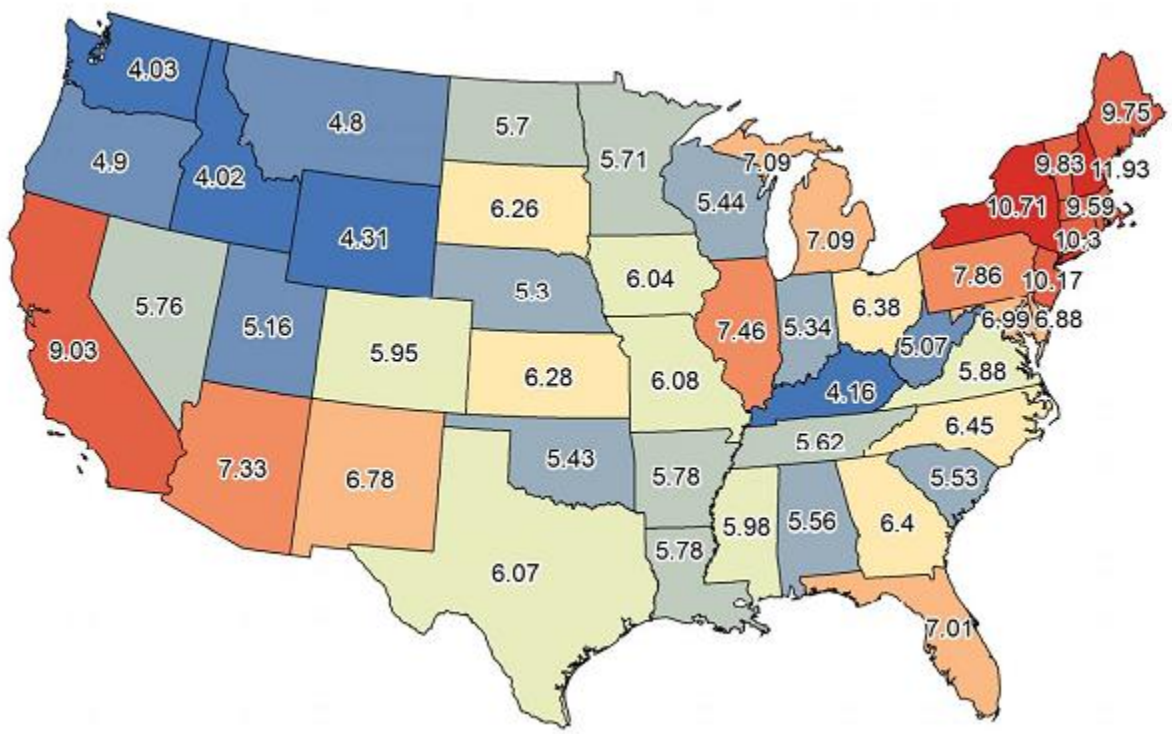
Thus, at least in theory, there are potential benefits to be gained from retail choice. But there are real questions about whether or not retail choice has lived up to its expectations, which is the subject of this study.

4. HISTORY OF RETAIL CHOICE IN THE U.S.

During the 1980s and 1990s, a confluence of factors undermined confidence in utility planning and cost-of-service regulation. These factors – including massive cost overruns on utilities' nuclear plant investments, falling costs of gas-fired generation technologies, and certain efficiency improvements fostered by IPPs – led to high retail electricity prices in several states and fostered the passage of the Energy Policy Act of 1992 at the federal level. This Act, together with supporting actions by the Federal Energy Regulatory Commission (FERC), opened wholesale electricity markets to competition and thus paved the way for competition at the retail level as well.

Figure 6 shows state-by-state average retail prices in 1998. Bluer states had lower prices, while redder states had higher prices. Comparing this map to the map of retail choice states shown in Figure 1, it is apparent that the states with retail choice are generally those that had relatively high retail prices when restructuring activity was at its peak. High retail prices, coupled with the hope that retail choice would help drive these prices down, were clearly a major reason for opening electricity markets to competition in most states wherein such an opening occurred.

Figure 6
Average Retail Prices by State, 1998 (cents per kWh)[32]



In the years 1996 through 2001, twenty-two states and the District of Columbia directed regulated utilities to prepare to open their retail markets through either legislative or regulatory action. These moves toward retail choice began in 1996, coincident with FERC's issuance of Order No. 888, which promoted non-discriminatory access to transmission facilities and thus promoted competition at the wholesale level.[33] The movement toward retail choice came to a sudden halt in 2001, when the Western power crisis made it clear that there were fundamental problems with the manner in which electricity sector restructuring had been implemented in some regions. The suspensions were also motivated by the bankruptcies of several merchant generating and trading companies; shrinking retail supply options; fraudulent trading, price reporting, and accounting practices by merchant firms; unanticipated high wholesale market price volatility; and rising retail electricity prices. Not coincidentally, the years 2000 and 2001 saw the first average real retail electricity price increases in the U.S. in fifteen years.

Table 3 lists the jurisdictions in which legislative or regulatory action promoted retail choice. The "Year Initiated" columns show the years in which such legislative or regulatory action began the retail market opening in each of twenty-three jurisdictions. The "Year Suspended"

[32] Borenstein and Bushnell [2015a], slide 5.

[33] U.S. Federal Energy Regulatory Commission [1996].

columns show the years in which eight states suspended or rescinded retail choice, though four of these states (California, Nevada, Oregon, and Virginia) still allow large industrial customers to shop. The table shows that the year 2001 was the sharp dividing line between actions initiating retail choice and actions suspending retail choice.

Table 3
Timing of State Retail Choice Initiation and Suspension[34]

Jurisdiction	Year Initiated/Year of Access for Residential Customers	Year Suspended or Legislation Repealed
Arkansas	1999/2003	2003
Arizona	1998/1998	2004
California	1996/1998	2001
Connecticut	1998/2000	
District of Columbia	2000/2001	
Delaware	1999/2000	
Illinois	1997/2002	
Massachusetts	1997/1998	
Maryland	1999/2000	
Maine	1997/2000	
Michigan	1999/2002	
Montana	1997	2002/2003

Jurisdiction	Year Initiated/Year of Access for Residential Customers	Year Suspended or Legislation Repealed
New Hampshire	1996/2001	
New Jersey	1997/1999	
New Mexico	1999/2007	2003
New York	1996/2001	
Nevada	1997	2001
Ohio	1999/2001	
Oregon	1999	2002
Pennsylvania	1996/1999	
Rhode Island	1996/1997	
Texas	1999/2001	
Virginia	1999/2004	2007

Realizing that transaction costs would be lowest for sales to large industrial electricity consumers, most states opting for retail choice implemented a phased approach to market opening – with the largest customers becoming eligible first – and required incumbent utilities to offer default (standard offer) service and POLR service for those customers who did not want to shop or whose retail energy supplier went bankrupt. To protect consumers from financially weak suppliers, most states required retail energy suppliers to obtain licenses for which they must offer evidence of financial soundness. A few states also required surety bonds or letters of credit from suppliers.

[34] Table 3 is based upon a composite of information from Belmont Electricity Supply Study Committee [2004, p. 19], http://www.eia.gov/electricity/policies/restructuring/restructure_elect.html, and U.S. Energy Information Administration [2003, p. 3].

5. CHALLENGES IN IMPLEMENTING RETAIL CHOICE

There are both technical and institutional challenges to implementing retail choice. This section describes these challenges and the ways that states have striven to meet them.

5.1. Restructuring of Utility Organizations

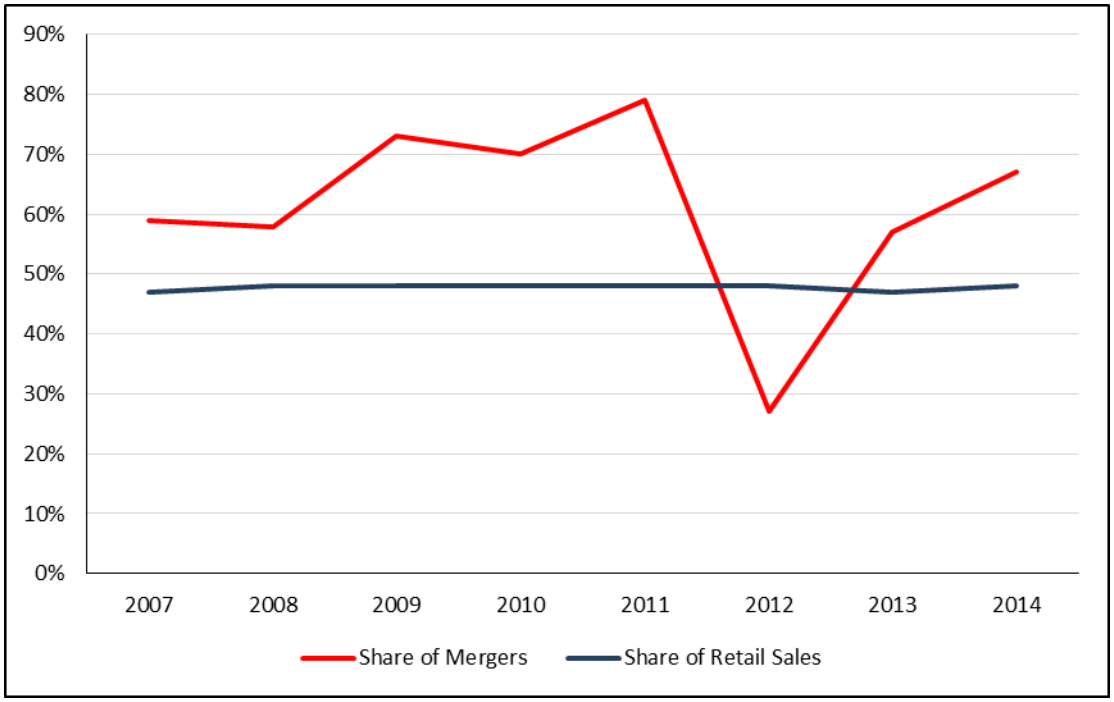
Retail choice in generation services requires that there be competition in generation services. Under the normal circumstance that a state's electricity service is provided by vertically integrated utilities, retail choice requires functional unbundling of utilities' generation function (and perhaps customer service function) from its distribution and transmission functions. Virtually all states that implemented retail choice required vertically integrated utilities to undertake such separation. Depending upon the state, separations have been accomplished through various combinations of functional unbundling of generation and customer services, spinning off generation assets to affiliates, and divestiture of generation assets.

In combination with wholesale market restructurings, retail choice has also induced revisions of longstanding reserve pooling arrangements and may have added to merger incentives. Although wholesale market restructurings were sufficient to induce mergers to gain scale economies in generation, retail choice provides additional merger incentives both to gain scale economies in retail marketing and maintain market share and (perhaps) market power.

During the years 2007 through 2014, 49% of retail choice states had utilities undergo consolidation via merger, while such consolidation occurred in only 10% of the non-retail choice states.[35] More specifically, the red line in Figure 7 shows that, from 2007 through 2014, merger activity in retail choice states ranged from a low of 27% of all electric industry mergers (2012) to a high of 79% of all electric industry mergers (2011), and averaged 61%. The dashed blue line shows that retail choice states have accounted for about 48% of sales during this whole period, so mergers have occurred to a disproportionate extent in retail choice states. While consolidation of the electric utility industry has been underway for several decades, it would seem that the restructuring of retail markets has recently been one of the drivers of that consolidation.

[35] Sonenshine [2015].

Figure 7
Shares of Electric Industry Mergers and Sales in Retail Choice States, 2007-2014[36]



5.2. Adaptation of Utility Power Operations

Retail choice must be accompanied by integration, into power system operations, of the resources that provide energy to customers. RTOs accomplish such integration on behalf of utilities that are located within RTO footprints. Utilities that are not located within RTO footprints must adapt their planning and operations to accommodate third-party resources.

5.3. Adaptation of Utility Administrative Operations

Retail choice requires that billing procedures be adapted so that appropriate shares of customer payments go to the utility (for non-competitive services) and to third-party retail suppliers (for competitive services). This can be accomplished either through separate billings by utilities and third-party retail suppliers or through the utility acting as billing agent on behalf of both itself and third-party retail suppliers.

Retail choice also requires metering that is compatible with new retail service offerings. For some utilities, the needed metering may already be in place to meet the utilities' own needs. For other utilities, it may be necessary to install meters with finer time differentiation (e.g., hourly), with peak demand metering, and/or with two-way flow measurement (e.g., for self-generation).

[36] Sonenshine [2015] and U.S. Energy Information Administration [Form EIA-861].

5.4. Institutional Challenges

Each of the states that adopted open access retail markets faced some common policy challenges, which can be summarized as falling into the following categories:

- *Timing of retail choice*. Some states granted retail choice to all customer classes at the same time; but a few granted retail choice to larger customers before smaller customers, which allowed potential suppliers to ramp up their competitive efforts. In some states, retail choice for residential and commercial customers was delayed several years until the end of state-mandated controls on utilities' retail rates.
- *Retail rate controls*. Nearly all retail choice states improved the initial appeal of retail choice by mandating reductions in utilities' prices for captive retail customers; and many of these states also imposed rate freezes for a few years or placed caps on retail prices. Although these rate controls gave consumers immediate rate relief or insulated them from volatile wholesale market prices, they had the adverse effects of stifling potential competitors' ability to compete, impairing utility finances, and damaging market processes by imposing a substantial barrier between the supply and demand sides of the market.
- *Provider of last resort service*. All retail choice states require that utilities or their affiliates provide POLR service (also known as "default service") to customers who do not choose to be served by retail energy suppliers. Such requirements assure that electricity service continues to be available to all consumers, and can also support price reduction and income redistribution goals. In states that require POLR service to be supported by power procured through competitive auctions, POLR service also supports the strengthening of market competition. Because of customer inertia, however, over 90% of residential customers and roughly half of commercial and industrial customers in retail choice states continue to take standard offer or POLR service.[37]
- *Generation asset divestiture and stranded cost treatment*. Some states mandated divestiture of utility generation assets, while others encouraged or otherwise allowed utilities to make their own decisions. The divested assets were primarily coal-fired, gas-fired, and nuclear plants. The new owners were IPPs or utility affiliates. Table 4 shows the extent and timing of divestiture in each of the divesting states, distinguishing states according to whether they have retail choice. The table shows that generation plants were sold only during the period 1998 through 2001, and that divestitures came to a sudden halt in the aftermath of the Western power crisis of 2000-2001.[38] The table indicates that divestiture was significant in all regions of the contiguous U.S. except the Southeastern and Plains states.

[37] See Figure 2 and the accompanying text for details.

[38] Generation assets have been sold by utilities since 2000, but these transactions were not the direct consequence of orders or compromises reached in the process of retail choice reform.

Table 4
States Divesting Generation Assets[39]

State	Number of Plants	Percent Divested	Year of Divestiture
States With Retail Choice or Suspended Retail Choice			
California	29	44%	1998
Connecticut	13	80%	2000
District of Columbia	2	100%	2001
Delaware	7	100%	2001
Illinois	37	58%	2000
Massachusetts	34	100%	1998
Maryland	19	70%	2001
Maine	3	100%	1999
Montana	14	95%	2000
Nevada	10	52%	2000
New Hampshire	3	100%	2006
New Jersey	27	50%	2000
New York	32	54%	1999
Ohio	2	8%	2000
Pennsylvania	60	40%	1999/2000
Rhode Island	1	100%	1998
Texas	3	3%	2001
Virginia	3	5%	2001
States Without Retail Choice			
Indiana	2	5%	1998
Kentucky	5	20%	1998
Vermont	5	55%	2001
Washington	2	NA	2000
West Virginia	1	10%	2000

- *Stranded cost treatment*. "Stranded costs" are the amounts by which the book values of utility generation assets exceed their market values. Restructuring occurred at a time when stranded costs were high precisely because customers wanted access to then-cheap market-priced power. In virtually every state that allowed retail choice, this customer desire was frustrated by the imposition of charges that allowed utilities to recover their stranded costs from all customers, regardless of their supplier. The stranded cost charges generally offset any savings that customers might have gained by

[39] Data on Number of Plants and Year of Divestiture are from Bushnell and Wolfram [2004, Table 1, p. 32]. Percent Divested is computed on the basis of information from Bushnell and Wolfram [2004], Electric Power Supply Association [2002], and U.S. Energy Information Administration [Form EIA-860].

switching to competitive suppliers. Such charges were justified by utilities' need to recover stranded costs in order to maintain financial solvency. This need was often expressed as regulators' obligation to honor the "regulatory compact" of allowing cost recovery of utility investments previously deemed prudent by regulators.

- *Market rules for utility affiliates*. In states where incumbent utilities transferred their generation assets to unregulated affiliates, codes of conduct have been developed to assure that the incumbents do not give unfair advantages to their affiliates. Such advantages can include asymmetric information-sharing that would undermine competition and harm competitors, and cross-subsidization that would funnel monies from the regulated utility to its unregulated affiliate, thus raising regulated prices and harming captive retail customers
- *Protection for low-Income Customers*. Although states have longstanding policies to protect low-income electricity customers, several states implemented new protections for and allocated new funds to such customers in anticipation of new needs created by retail choice.

6. RETAIL CHOICE OUTCOMES

Measuring the success of retail choice programs is difficult because retail choice is only one of many factors that affect power systems and power markets. To assess retail choice in spite of these difficulties, the literature uses three basic methods:[40]

- Direct comparison of traditional versus retail choice markets, either across states (with and without retail choice) or across time (before and after the start of retail choice);
- Estimation of the effects of variations in regulation across states and time; and
- Estimation based upon underlying behavioral relationships.

Based upon the literature, this section summarizes the impacts of retail choice on several key characteristics of electric power markets. These characteristics are customer service, power system costs, electricity market efficiency, retail electricity prices, resource adequacy, financial risk allocation among stakeholders, demographic group welfare, and regulation.

6.1. Impacts on Customer Service

Retail choice has been promoted, in part, because of the prospect that competitive retail service providers may offer new and innovative services that will improve customer service. On the other hand, because non-utility providers of retail service are more lightly regulated than utilities, retail choice also raises consumer risks that have been largely absent for regulated utilities.

[40] See Kwoka [2006] for a more complete description of these methods.

6.1.1. Retail Innovation

A promised benefit of opening retail markets to competition was that it would encourage innovation and experimentation in both pricing of and types of services offered to retail customers. To assess this hope, we look at how much experimentation and innovation has taken place in the retail choice states relative to the traditional states and those states that suspended retail choice. We divide innovations into four categories: dynamic pricing programs; demand response programs; smart metering; and green pricing programs. In each case, we attempt to determine whether the evidence indicates that retail choice has made a difference. What we find is that retail choice induces relatively high participation in dynamic pricing programs, that it has a mixed record in promoting demand response, that it has not generally promoted smart metering, and that it does promote green pricing.

Dynamic Pricing Programs

In the U.S., conventional retail electricity tariffs have "flat pricing" by which the price of electricity is the same all year long, or at least the same within each season. Dynamic pricing programs, by contrast, have prices that change over time. The most prevalent forms of dynamic pricing are the following:

- Time-of-use (TOU) pricing programs have prices that vary by time period, but are constant within each period. Prices may differ by peak, off-peak, and shoulder periods within each week, and by season. TOU prices are set at least months in advance, and so reflect expected power system conditions rather than actual conditions. TOU programs induce customers to shift load from hours that are *expected* to have relatively high electricity production costs to hours that are *expected* to have relatively low costs.
- Real-time pricing (RTP) programs have prices that change every hour. Day-ahead RTP prices are set a day in advance while same-day prices are set almost contemporaneously with the hour to which they apply. In both cases, prices reflect expected or measured electricity production costs at the time they are set, which in RTO markets have an explicit hourly wholesale price benchmark. RTP programs induce customers to shift load from hours that *actually* have relatively high electricity production costs to hours that *actually* have relatively low costs.
- Critical peak pricing (CPP) programs have the prices of either TOU or flat pricing programs in most hours, but have high RTP-based prices in a limited number of extreme peak hours. The high RTP-based prices are not announced until shortly before they take effect. CPP programs induce customers to shift load away from the hours with the highest electricity production costs.
- Peak time rebates (PTR) are the mirror image of CPP. Like CPP, they have TOU or flat prices in most hours, and high RTP-based prices in a limited number of extreme peak hours. But instead of customers *paying* the high price for consumption in extreme peak hours as with CPP, customers receive the high prices for their consumption reductions in extreme peak hours under PTR. Like CPP, PTR programs induce customers to shift load from the hours with the highest electricity production costs.

TOU pricing is the most common form of dynamic pricing, while PTR is the least common.

Table 5 summarizes the numbers of retail electricity customers participating in dynamic pricing programs by state type (traditional, retail choice, and suspended) and by customer segment (residential, commercial, and industrial). The retail choice states have significantly greater numbers of customers in all segments participating in dynamic pricing programs than either the traditional states or the suspended states. This is significant because retail choice states account for less than half of all retail load and a similar share of customers; so retail choice states clearly have much higher participation rates than traditional states.

Table 5
Numbers of Customers Participating in Dynamic Pricing Programs, by Customer Segment, 2014[41]

State Type	Residential	Commercial	Industrial	Total
Traditional	1,078,298	243,599	27,531	1,349,428
Retail Choice	3,308,180	1,159,483	62,258	4,529,921
Suspended	968,599	43,895	4,472	1,016,966

Demand Response Programs

Table 6 summarizes recent demand response program outcomes for each of the state types and customer segments. The second column shows the numbers of customers enrolled in demand response programs. The third column shows outcomes measured in energy savings, which is a better measure than annual peak load reductions because many demand response programs seek goals other than or in addition to peak load reductions. The third column shows annual energy savings as a percentage of total annual energy consumption.

For the residential class, retail choice states have lower participation than traditional states in terms of both numbers of customers and energy saved. For the commercial class, retail choice states have higher participation in terms of both customers and energy savings. For the industrial class, retail choice states and traditional states have similar numbers of customers; but retail choice states lag behind traditional states in energy savings. On the whole, the evidence does not support the hypothesis that retail choice improves demand response outcomes.

[41] U.S. Energy Information Administration [Form EIA-861, Dynamic_Pricing2013.xls and Dynamic_Pricing2014.xls].

Table 6
Demand Response Program Outcomes, 2014[42]

State Type	Residential			Commercial			Industrial		
	Custs (000s)	Annual Savings (GWh)	Annual Savings (%)	Custs (000s)	Annual Savings (GWh)	Annual Savings (%)	Custs (000s)	Annual Savings (GWh)	Annual Savings (%)
Traditional	4,246	135	0.02%	102	57	0.01%	22	78	0.02%
Retail Choice	3,141	38	0.01%	478	222	0.03%	24	12	0.00%
Suspended	1,008	707	0.51%	24	183	0.14%	11	2	0.00%

Smart Metering

Expansion of product offerings– particularly including dynamic pricing and demand response programs – depends upon the adoption and implementation of "smart metering" technologies that enable communications among the customer, the retail energy supplier, and the power system operator. The feasibility of offering new products therefore depends, in part, upon the available smart metering infrastructure.

Twenty-five states have smart metering programs, some of which are pilots and others of which mandate universal residential coverage. These policies have been driven by the goal of replacing aging infrastructure with cutting-edge metering technologies that can implement dynamic pricing for both loads and distributed energy resources. Dynamic pricing of loads can improve the efficient utilization of power system resources, while dynamic pricing of distributed energy resources can help promote environmentally friendly power generation.[43]

As shown in Figure 8, about 50 million smart meters had been deployed in the U.S. as of July 2014. These cover 43% of American residences. Thirty utilities have achieved complete smart meter coverage of their customers.

[42] U.S. Energy Information Administration [Form EIA-861, Demand_Response2014.xls].

[43] Joskow and Wolfram [2012, pp. 5-6.]

Figure 8
Smart Meter Installation in the United States, 2007 to 2014[44]

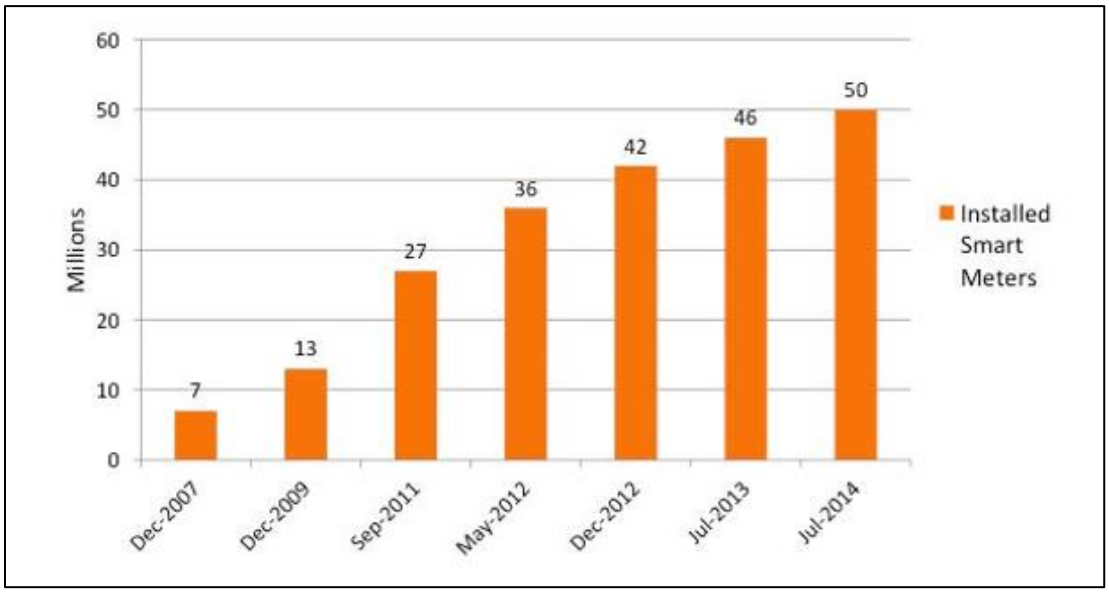


Table 7 shows the penetration of smart meters for each of the three groups of states over the period 2006 to 2014. Penetration is expressed as the share of smart meters in the total number of meters for the states in each group. The penetration of smart meters has grown rapidly everywhere, but more quickly in the traditional states and the suspended states than in the retail choice states. This result seems rather anomalous because metering is usually the responsibility of the distribution utility: if a state has chosen retail choice as a matter of policy, it should logically be inclined to promote smart metering as a matter of policy. Apparently, this logic is not supported by the evidence.

Table 7
Penetration of Smart Meters as a Percent of Total Meters[45]

State Type	2006	2008	2013	2014
Traditional	0.8%	4.6%	45.0%	43.6%
Retail Choice	0.3%	3.9%	24.0%	22.2%
Suspended	0.7%	2.7%	37.8%	36.7%

[44] Institute for Electric Innovation [2014, p. 1].

[45] U.S. Federal Energy Regulatory Commission [2006, Table III-2, p. 30], U.S. Federal Energy Regulatory Commission [2008, Table II-3, p. 12]. For 2013 and 2014, U.S. Energy Information Administration [Form 861, Advanced Meters_2013.xls and Advanced Meters_2014.xls].

Green Pricing

Green pricing programs offer customers the option of buying power from environmentally friendly generation resources, usually at a price premium relative to conventional generation resources.

Table 8 summarizes the number of green pricing program customers over the period 2010 to 2012, which has the most recent data available from Energy Information Administration (EIA). It is clear that the retail choice states have outperformed traditional states in terms of numbers of participants in green pricing programs and in participation rates. Furthermore, over the period shown, green pricing participation more than doubled in retail choice states while barely budging in traditional states. The significant differences between the traditional and retail choice states are due to more aggressive green pricing policies adopted by regulators and legislators in the retail choice states and to the vigorous competitive promotion of green pricing in the retail choice states.

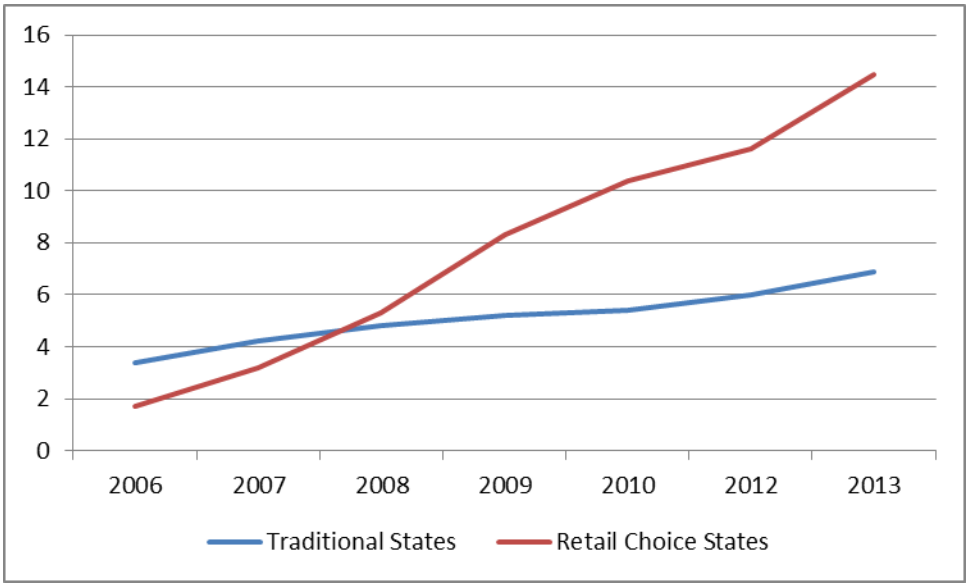
Table 8
Green Pricing Customers by State Type[46]

State Type	2010	2011	2012
Traditional	322,411	312,618	322,183
Retail Choice	730,698	800,246	1,768,571
Suspended	163,473	163,172	175,208

Figure 9 summarizes the estimated annual sales of green energy (in MWh) by market sector over the period from 2006 to 2013. While the retail choice states apparently lagged behind the traditional states at the beginning of the period, the subsequent growth in the retail choice states led them to have approximately twice the volume of green sales as in traditional states by 2013.

[46] U.S. Energy Information Administration [Form 861, Green_Pricing2010.xls, Green_Pricing2011.xls, and Green_Pricing2012.xls].

Figure 9
Estimated Annual Green Sales by State Type (Millions of MWh), 2006-2013[47]



6.1.2. Customer Satisfaction Surveys

Customer satisfaction is an important determinant of customer switching behavior, customer receptivity to proposed service changes and program innovations, and customer acceptance of rate increases. In traditional market settings, utilities with high customer satisfaction ratings may benefit from goodwill in ways that ease regulatory proceedings.

J.D. Power conducts annual electricity customer satisfaction surveys that measure satisfaction among residential customers of retail electric providers in retail choice states. Its most recent surveys have the following key findings:[48]

- Of the customers who switched providers in 2013,
    - 6% switched from another retail electric provider, with 64% of those doing so in response to a better price;
    - 11% enrolled for the first time with a retail provider; and
    - 24% renewed with their existing retail electric provider.
- In 2013, retail choice customers were more satisfied with price than customers of local electric utilities in the retail choice states.

[47] National Renewable Energy Laboratory [2014, Table 2, p. 7]. For consistency with the designations in this report, the labels for market sector have been changed from "utility green pricing" and "competitive markets" in the original to "traditional states" and "retail choice states" in this presentation.

[48] J.D. Power [2010, 2013, 2014, 2015].

- Customer satisfaction is strongly tied to price perception, which is partly shaped by the level of price volatility experienced by customers on variable price plans.
- In retail choice states, price satisfaction is higher among customers on a fixed price contract than among those on a variable pricing plan.
- Residential customers do not switch from the local utility to an alternative retail provider because:
    - The savings from switching are not large enough to justify the move. Over one fourth of surveyed customers indicate that they would switch to a retail provider if they could save $20 on their monthly bill.
    - Customers are satisfied with service provided by the incumbent utility.
    - Customers' lack of knowledge about how to switch.
    - Customers' fear that service quality would decline.
- Satisfaction with alternative retail energy suppliers is lower under an aggregation program than when the customer chooses a provider themselves.
- In 2015, 57% of highly satisfied retail customers indicated they "definitely will" renew their contract, and 62% indicated they "definitely will" recommend their retail electric provider to other customers. In contrast, 21% of dissatisfied customers said they "definitely will" renew, and 3% indicated they "definitely will" recommend their provider to others.
- Residential electric customers' satisfaction with the overall price of service increases substantially as customers become more familiar with available energy efficiency programs.[49]

Another source of information about electricity customer satisfaction comes from the American Customer Satisfaction Index (ACSI). The ACSI measures the satisfaction of U.S. household consumers with the quality of products and services offered by both foreign and domestic firms with significant share in U.S. markets. The ACSI for the electric industry, investor-owned electric utilities in particular, has been conducted for about twenty years.[50] Customer satisfaction benchmarks are updated annually based on interviews with hundreds of residential customers about recent experiences with their service provider. Key metrics include customer expectations, customer perceptions about the value and quality of their actual experiences, customer complaints, and customer retention. The ACSI captures customer opinions about

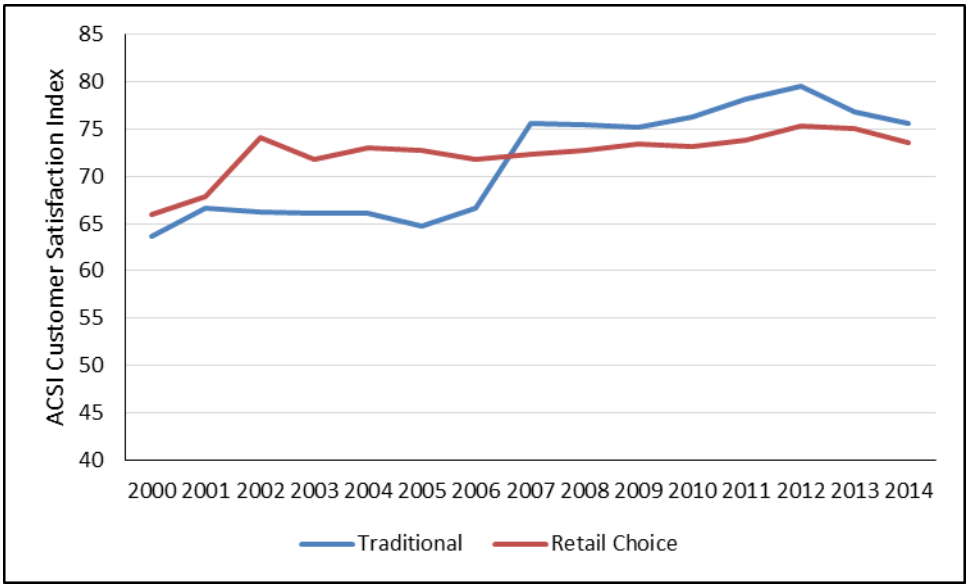
[49] Customers who understand that they have access to tools to help them manage their overall bills would logically be more satisfied than customers who don't know how or where to find help. In a time of increased upward pressure on utility rates, giving people assistance in managing bills through energy efficiency should be an important motivation to regulators and utilities.

[50] In 2011, the ACSI expanded its coverage of power suppliers to include both municipal and cooperative energy utilities.

critical elements of the residential customer experience, including the supplier's ability to provide reliable electric service and ability to restore electric service following a power outage.

Figure 10 summarizes the averages of the ACSI values for investor-owned electric utilities serving customers in traditional and retail choice states over the period 2000 to 2014. The satisfaction ratings in the retail choice states rose in the first couple of years, and have held fairly steady since. The average of ACSI scores for traditional states were below those of the retail choice states until 2007, when they suddenly jumped and thereby exceeded the latter until 2012, since which time the average rates have been statistically indistinguishable. The reason for the early rise in satisfaction in the retail choice states is probably that customers became comfortable with retail choice as it became familiar; but the reason for the 2007 jump in satisfaction in the traditional is not clear.

Figure 10
Average ACSI Scores for Traditional and Retail Choice States IOUs, 2000 - 2014[51]



Zarakas *et al* [2013] conducted a statistical regression analysis of the J.D. Power satisfaction scores for electric utilities to attempt to explain the differences in scores across utilities. The analysis found that customer satisfaction significantly depends upon the following factors:

- Service interruptions reduce satisfaction.
- Higher population density in the utility service area increases satisfaction.
- Higher retail price reduces satisfaction.

[51] American Customer Satisfaction Index [2015]. Utilities or holding companies included in traditional state average are Dominion Resources, Southern Company, Entergy, NextEra Energy, Xcel Energy, Berkshire Hathaway, Duke Energy, and Small IOUs. Utilities or holding companies included in retail choice state average are Sempra, FirstEnergy, PPL, Ameren, Edison International, CMS Energy, DTE Energy, American Electric Power, Pepco, Public Service Electric & Gas, Exelon, Consolidated Edison, and Eversource Energy.

- Customer location in the Northeastern U.S. reduces satisfaction.[52]

The analysis looked for but did not find that satisfaction significantly depends upon spending on distribution systems or on customer service.

The experience of the EU indicates that retail choice is correlated with better service quality and higher customer satisfaction. This can be seen in Table 9, which shows the rankings of EU member states for the quality of the electricity service and consumer satisfaction. In this table, 1 is the best ranking and 27 is the worst, and countries are divided into groups according to their market concentrations as explained earlier in this report for Table 2. Table 9 highlights in yellow those quality of service and consumer satisfaction rankings that are in the top third of the class, and highlights in pink those rankings that are in the bottom third of the class. Almost half the top rankings are in the unconcentrated markets with the most retail choice. Although the worst rankings are generally held by the countries with monopolies, those countries also have nearly half of the top rankings.

In summary, there does not seem to be a clear relationship between retail choice and customer satisfaction. The ACSI results for U.S. residential customers are mixed. The EU experience suggests that retail choice, when well implemented, improves customer satisfaction. What is clear is that customers like prices that are low and stable, and they like service that is reliable.

[52] Zarakas *et al* [2013, p. 53] note that this "suggests an unfortunate locational distinction for Northeastern utilities. … It's possible that this geographic effect reflects cultural pre-dispositions; it also might be the result of cross correlations with storm-related service interruptions."

Table 9
Quality of Electricity Service and Consumer Satisfaction in the European Union, 2010[53]

Member State	Quality of Service	Consumer Satisfaction
Unconcentrated Markets:		
Austria	1	2
Finland	4	8
Germany	5	8
Sweden	7	13
Moderately Concentrated:		
Denmark	16	18
Netherlands	15	6
Slovenia	10	19
United Kingdom	12	11
Highly Concentrated:		
Belgium	17	12
Czech Republic	19	15
Hungary	13	20
Ireland	2	1
Luxembourg	11	5
Slovakia	21	10
Spain	24	22
National or Regional Monopolies:		
Bulgaria	27	27
Cypress	3	7
Estonia	6	16
France	14	4
Greece	25	25
Italy	20	21
Latvia	9	9
Lithuania	8	24
Malta	26	26
Poland	23	14
Portugal	22	23
Romania	18	17

[53] ECME Consortium [2010].

6.1.3. Fraudulent Advertising

Retail choice can create opportunities for less scrupulous retail energy suppliers to misrepresent the terms and prices of the services they offer, thereby enabling them to persuade customers to switch from the incumbent local utility provider. In the worst cases, fraudulent behavior has included the following:[54]

- falsely promising bill savings;
- vaguely describing the basis for determining retail electricity prices;
- levying charges that differ from written pricing disclosures;
- switching customers from their utility providers without the customers' consent;
- providing inadequate training to marketing agents;
- inadequately supervising marketing agents;
- requiring marketing agents to pay for their training;
- misrepresenting the identity of the marketing agent;
- distributing promotional materials that display the corporate logo of the incumbent utility;
- misrepresenting the nature of the utility's default service;
- using high-pressure sales tactics on low-income, elderly, and non-English speaking customers; and
- going out of business and thereby stranding customers, thus requiring the incumbent utility to provide POLR service.

Most retail energy suppliers have been legitimate. Nonetheless, all retail choice states have attempted to regulate suppliers' behavior by requiring retail energy suppliers to register and demonstrate financial soundness, and by specifying customers' rights and protections against fraudulent energy supplier behavior. Still, state resources to enforce the rules are limited. As Paula Carmody, the people's counsel for the state of Maryland, has complained, "An agency like mine is so tied up with regulated utility cases, rate cases, merger cases, we don't have the resources to consistently go in to monitor what's going on in the marketplace."[55]

Fraudulent business behavior is not unique to the retail electric industry. Smaller electricity customers, having been served historically by their incumbent utilities, will not initially be familiar with the challenges of finding reliable electricity providers and understanding contract terms, and may therefore be easy prey for scoundrels at the outset of retail choice. As retail choice matures, customers will become more alert to the possibilities of fraud; but the

[54] These examples are from Alexander [2015, pp. 5-6] concerning Blue Pilot Energy in Maryland, Newsham [2014] concerning Viridian Energy in Connecticut, and Meneimer [2014] concerning Viridian Energy and North American Power Company in Maryland.

[55] Meneimer [2014].

complexity of retail electricity sales terms may require significant continuing consumer protections.

6.1.4. Market Entry, Market Exit, and Bankruptcies

Ideally, competitive markets have low barriers to entry and exit. Given the substantial numbers of suppliers who have entered and exited the retail electricity market, it would appear that the barriers to entry and exit are not high in retail choice markets.

For retail energy suppliers, the threat of bankruptcy arises from mismatches between their costs of procuring power and the prices at which they sell power. For RTP programs that have sales prices that rise and fall with wholesale market prices, the supplier faces little risk. To offer customers fixed-price products, however, the supplier needs generating assets or long-term contracts that have relatively fixed costs.

Bankruptcies and significant financial stresses have plagued suppliers primarily when they have had fixed-price sales obligations and insufficient long-term purchase rights, and when wholesale electricity spot market prices suddenly jumped. Such events occurred, for example, during the California electricity crisis of 2001 and the polar vortex of the winter of 2014. In this latter event, Dominion Resources left the retail electricity business voluntarily while smaller players succumbed by defaulting on their obligations.[56]

Because retail energy suppliers in retail choice states face much larger financial uncertainties than do traditionally regulated utilities, the risk of retail supplier bankruptcies under retail choice are indisputably greater than under traditional regulation.

6.2. Impacts on Power System Costs

Retail choice can have direct and indirect impacts on power system costs.

The direct impacts come through whatever changes in load profiles are induced by retail choice. Table 5 (above) shows that retail choice is extending the market penetration of retail pricing programs that reflect power system conditions, thus shifting loads from peak to off-peak periods and lowering the average costs of producing power. The amount of this benefit will depend upon the extent to which retail choice is inducing load shifts.

The indirect impacts come through retail choice helping enable wholesale market restructuring. As indicated above by Table 4, retail choice played a large role in facilitating states' decisions to require or encourage utilities to divest their generation assets. These policy errors ultimately cost customers tens of billions of dollars.[57] In addition to these one-time cost impacts, wholesale market restructuring, abetted by retail choice, arguably has the following impacts:

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[56] Kuckro [2014].

[57] Most notoriously, generation asset divestitures played a decisive role in creating the Western power crisis of 2000-2001, which all by itself cost electricity consumers many billions of dollars. The States of Maryland and New Jersey had similar regrets a decade later, as they tried to regain control of their resource planning processes from PJM and the wholesale market. The states' loss of control over resource planning processes has contributed to

- It can reduce generation costs by encouraging entities to engage in cost-reducing power trades.
- It can induce improvements in generation technologies and management costs by giving stronger incentives to cut costs and increase production.
- It makes the recovery of generation investment costs more uncertain, and can thereby raise required returns on capital invested in generation relative to the returns needed in markets in which capital recovery is "guaranteed" by cost-of-service regulation.
- It can induce generation firms to be more aggressive in seeking lower fuel prices. On the other hand, because competitive generation firms lack the long-term electricity sales obligations of traditional utilities, wholesale market restructuring can also induce generation firms to seek shorter-term fuel contracts than are sought by traditional utilities. Shorter-term contracts likely make fuel costs more unstable and may make fuel supply more uncertain, but do not necessarily increase or reduce expected fuel costs in the long run.
- Wholesale market restructuring would likely have the impacts on generators' non-fuel operating costs that are similar to those on their fuel costs, namely more aggressive cost-cutting and shorter-term contracting.

Retail choice would contribute the foregoing impacts of wholesale market restructuring if retail choice somehow resulted in generators receiving different prices or different electricity sales contract durations than they would receive in the absence of retail restructuring.

6.3. Impacts on Market Efficiency

The efficiency benefits of retail choice depend upon retail service providers doing things that incumbent utilities are either unable or unwilling to do. As expressed by Paul Joskow at the outset of the retail choice movement, there are only a few such things.

> The physical attributes of electricity supply make many of the traditional "convenience services" provided by retailers in other industries irrelevant in electricity… [T]hese attributes provide a low-cost way for electricity consumers to buy directly in the wholesale market. In this way, retail consumers can receive the commodity price related benefits of competitive generation markets without incurring large increases in advertising, promotion and customer service costs. Electric distribution companies… can easily provide a Basic Electricity Service (BES) that makes it possible for all consumers to buy commodity electricity in competitive wholesale electricity markets at the spot market price. The availability of BES is especially important for residential and small commercial

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resource adequacy problems; but the more general result of the loss of control has been increases in the cost of maintaining adequate resources, as explained in the text. These resource adequacy and cost issues are due to wholesale restructuring, and can be attributed to retail choice only to the extent that retail choice motivated and enabled wholesale restructuring.

> customers for whom few new retail value-added services are evident. BES also provides an excellent competitive benchmark against which consumers can compare the value added associated with competitive supply offers from competing Electricity Service Providers (ESPs), helps to protect residential and small commercial customers from exploitation by ESPs, and mitigates wasteful expenditures on marketing and promotion by rent-seeking ESPs that will increase prices. The availability of BES helps to channel ESP competitive efforts toward providing value added services such as real time metering and control, energy management contracts, risk hedging and forward contracting, green power and other services… The success of retail competition should be judged by the new value added services it brings to the system, not by the number of customers who switch to ESPs…[58]

In other words, retail choice creates efficiency benefits only to the extent that alternative retail energy suppliers do a better job than utilities do at making wholesale electricity prices available to their customers or at offering value-added services. Specifically, retail choice creates efficiency benefits only if alternative retail energy suppliers do a better job than utilities at some of the following:

- If alternative retail energy providers expanded dynamic pricing programs, retail choice could improve customer response to power system conditions and thereby help improve the efficiency of use of power system resources. Table 5 indicates that this has, in fact, occurred to some extent.
- If alternative retail energy providers offered menus of products that offer different degrees of price guarantee, they could cater to customers' different tolerances for financial risk. Such diversity of price guarantee can improve the efficiency of meeting the risk preferences of different customers.
- If alternative retail energy providers were better than utilities at negotiating terms for the supply of power in securing forward contracts, they could do a better job of holding down costs and managing risks.
- If alternative retail energy providers induced entry of new generation into the market or invested in generation capacity of their own, they could help resource adequacy and might help mitigate wholesale market power.
- If alternative retail energy providers paid for the smart meters that support time-varying rates, they could better help induce consumers to shift consumption toward lower-cost hours and thereby improve the efficiency of the generation mix.
- If alternative retail energy providers offered attractive curtailable service rates, such rates might induce customers to accept relatively low-cost service curtailments that would avoid the need for costly generation investment.

[58] Joskow [2000, p. 1].

Aside from the evidence that competitive retailers are inducing greater participation in dynamic rate programs, we are not aware of evidence that the foregoing activities to improve wholesale market efficiency have been significantly affected by retail choice.

6.4. Impacts on Retail Prices

Retail prices depend upon myriad factors, of which retail choice is merely one. A rigorous analysis of the impacts of retail choice on retail prices requires statistical analysis that separates the effects of retail choice from the other factors.

This section begins with an overview of retail price histories relevant to retail choice in both the U.S. and the EU. It then summarizes the findings of many studies that have attempted to quantify the determinants of retail price, including retail choice.

6.4.1. Overview of Retail Price Histories in the U.S.

Although a casual analysis of retail prices over time and across regions cannot provide a definitive conclusion about the impacts of states' retail policy decisions or of RTO markets on retail prices, the historical path of retail prices *does* illustrate the general impact of retail choice in states that have adopted it compared to those that have not. In comparing these paths for states with and without retail choice, it is important to recognize that retail prices in RTO markets depend upon current fuel prices: because natural gas is the fuel that is most commonly at the margin, the RTOs' retail prices commonly reflect the current price of natural gas. Figure 11 shows that natural gas prices rose gradually through the 1990s, quadrupled between 1999 and 2005, and then fell by more than half following the financial crash of 2008. As will be seen, retail electricity prices in retail choice states partially mimic this pattern.

Figure 11
Real Annual Henry Hub Natural Gas Spot Prices, 1991-2014 (2015 dollars)[59]

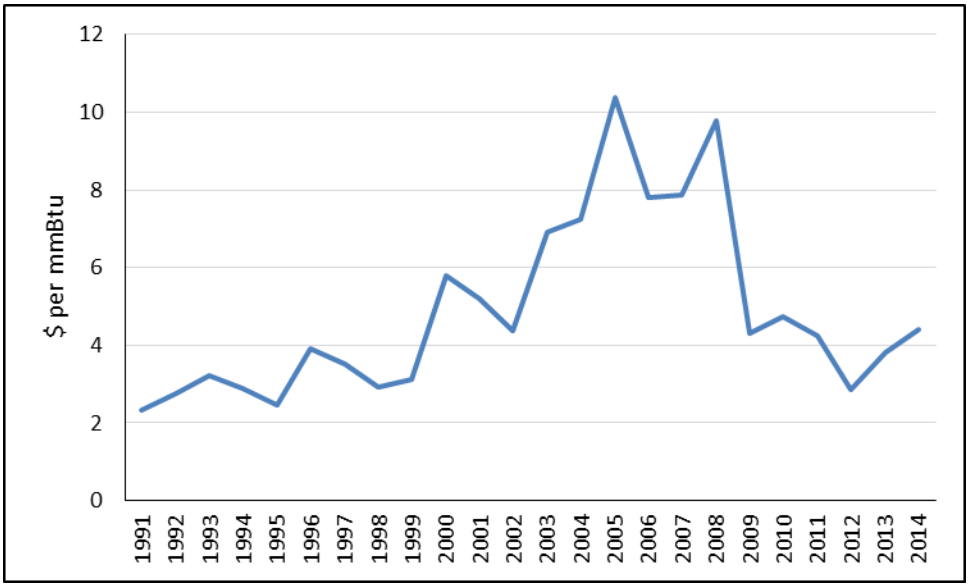


Figure 12, Figure 13, and Figure 14 show the paths of weighted average real revenue per kWh for residential, commercial, and industrial class customers, respectively, for the period 1990 to 2014 for the three groups of states. Weighted average real revenue is a close proxy for load-weighted average real retail prices, so the figures (and this discussion) refer to the results as "prices." The figures show that the real price gap between the retail choice states and the traditional states began to close in the late 1990s, when gas prices were still low and decisions were made to adopt retail choice. Following adoption of retail choice, however, the retail electricity price gap widened over the period 2000 to 2008 with rising fuel prices. During this period, regulated retail electricity prices, which depend upon an average of historical generation investment costs and contracted fuel costs, only rose slowly with spot fuel prices. As stated by Borenstein:

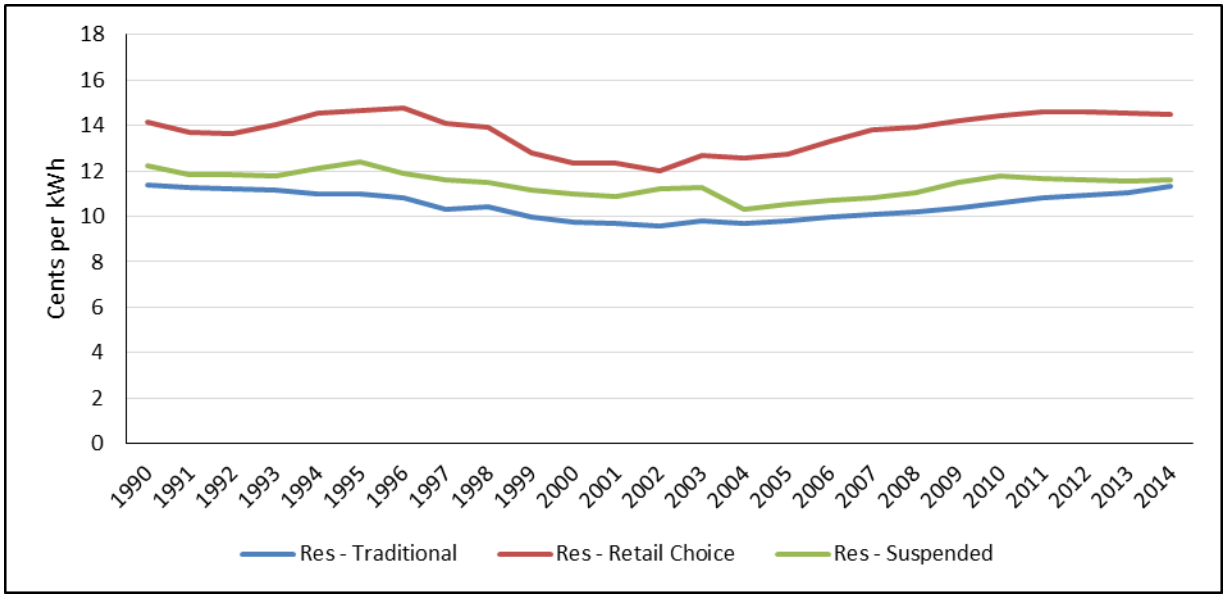
> Because gas generation comprises a minority share in most electricity markets, under average-cost based regulation it did not dominate rate making. Prices for deregulated generation, however, are driven by the marginal producer, which is much more commonly gas generation. Thus to a degree that was not appreciated at the time, restructuring of generation greatly increased the exposure of electricity rates to natural gas costs, even if a fairly small share of electricity was sourced from gas-fired plants. As natural gas prices nearly tripled during the first half of the 2000s, the impact on retail rates and the rents created

[59] Reuters [U.S. Henry Hub] for period 1991 to 1996, and U.S. Energy Information Administration [Henry Hub] for 1997 to 2014.

for infra-marginal generation were far greater than they would have been under regulation.[60]

Since 2008, the price gap has slightly narrowed along with the decline in fuel prices. It therefore appears that the states that embraced retail choice – nearly all of which were contained within RTO regions[61] – have only recently witnessed any significant reduction in the retail price gap relative to the other states.

Figure 12
Weighted Average Real Prices for Residential Customers, 1990 to 2014 (2015 dollars)[62]



[60] Borenstein, p. 14.

[61] Arizona, New Mexico, and Oregon adopted retail choice without being in RTOs. All of them have since suspended or rescinded retail choice.

[62] Data for this figure and for all other figures and tables in this section were obtained from U.S. Energy Information Administration [Form 861, 1990 to 2014].

Figure 13
Weighted Average Real Prices for Commercial Customers, 1990 to 2014 (2015 dollars)

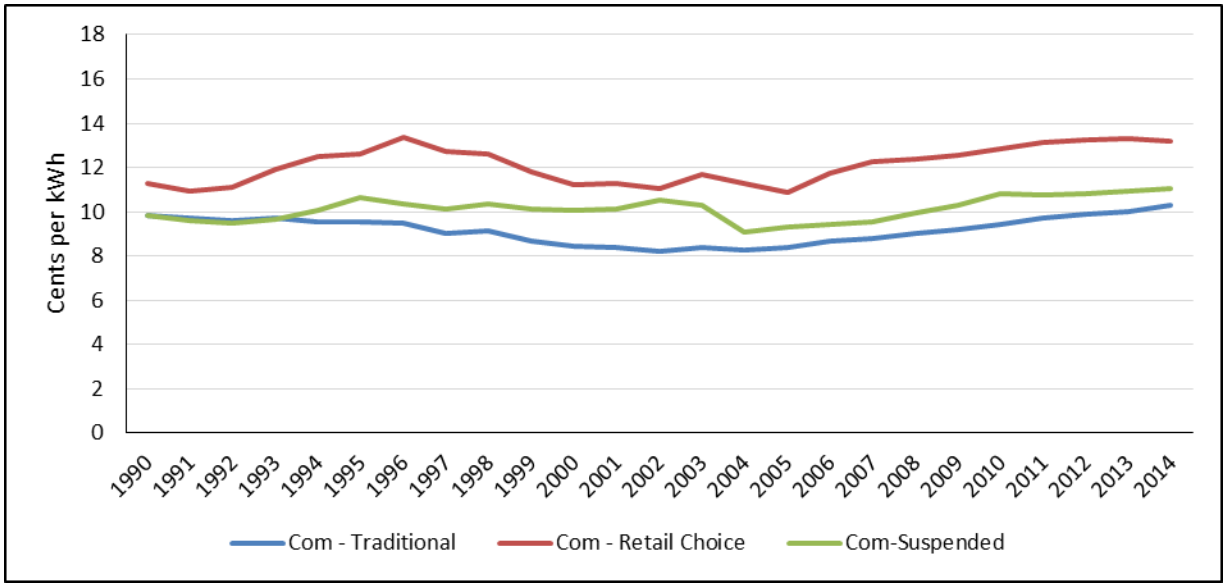


Figure 14
Weighted Average Real Prices for Industrial Customers, 1990 to 2014 (2015 dollars)

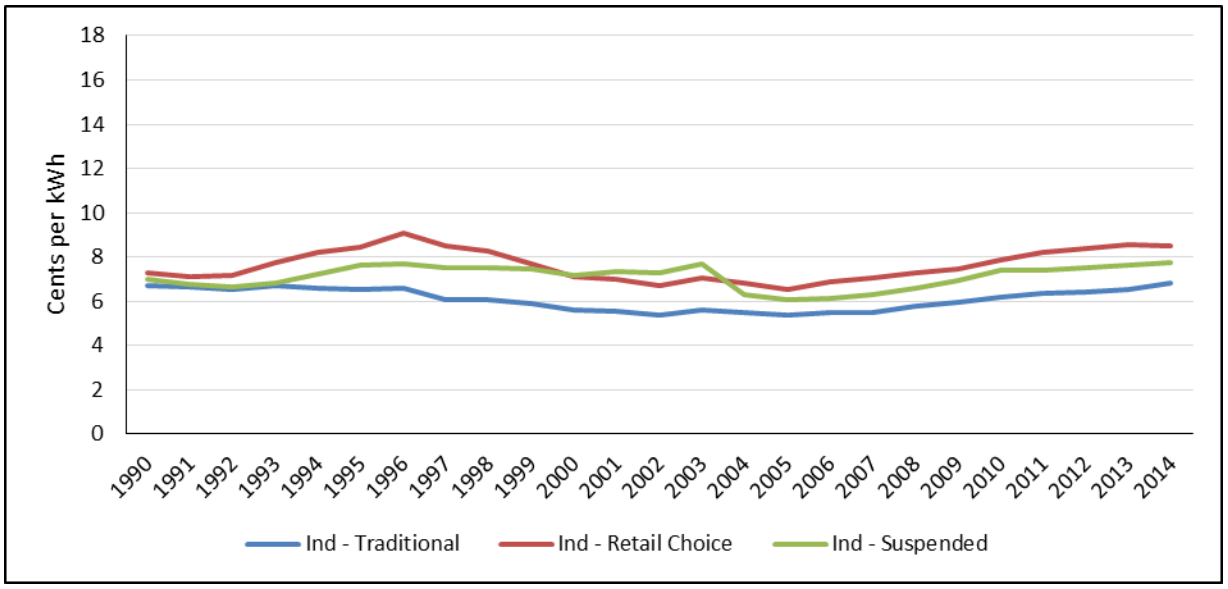
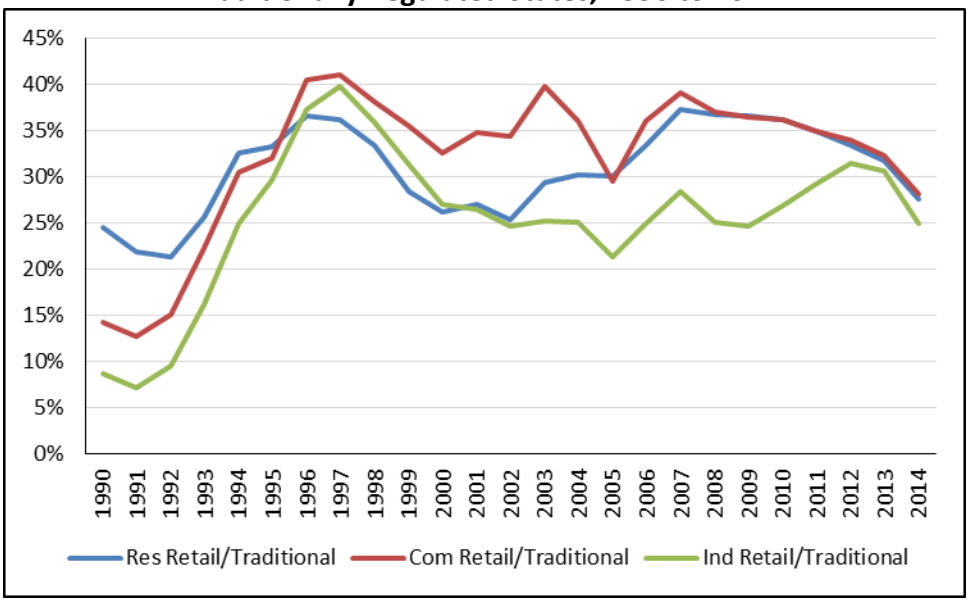


Figure 15 illustrates gains that might be attributable to retail choice. For each of the residential, commercial, and industrial classes, the figure shows the percentage amount by which load-weighted average revenue per kWh in the retail choice states exceeded those of traditionally regulated states over the period 1990 to 2014. Several characteristics of the percentage price gap are remarkable. First, average revenues in the retail choice states have persistently been

higher than those in the traditionally regulated states, by averages of 31% for the residential class, 32% for the commercial class, and 25% for the industrial class. Second, the percentage gaps have fluctuated widely, from 21% to 37% for the residential class, from 13% to 41% for the commercial class, and from 7% to 40% for the industrial class. Third, the peaks and troughs have been somewhat similar for all three classes, tending to peak when natural gas prices are high and to trough when they are low.

Figure 15
Amounts by Which Average Revenues in Retail Choice States Exceeded Those in Traditionally Regulated States, 1990 to 2014



The drop in the price gap since 2008 has been driven by the very different ways that the two groups of states have been influenced by the recent recession. Although retail prices have been relatively flat or falling slightly in the retail choice states since 2008, they have been rising in traditional states and therefore significantly narrowing the price gap. This is attributable to two factors. First, customers in retail choice states have benefited from the recession-induced reductions in electricity demand and fuel prices and from the technology-induced reduction in natural gas prices, all of which have lowered wholesale market clearing prices and been partially passed on to end-use customers in those states. The drop in the price gap for industrial customers since 2012 has been larger than those for residential and commercial customers because industrial customers have higher participation rates in retail choice programs than do residential and commercial customers, and so are more directly exposed to changes in wholesale electricity market prices. Second, customers in the traditional states are experiencing the impacts of a spate of recent cost-of-service rate cases that are allowing regulated utilities to catch up with cost increases after many years without rate cases.

Table 10 presents the percentage changes in weighted average prices, in both nominal and real terms, from 1990 to 2014 by class for the three state groups. Retail choice states had the best

price outcomes for all three customer classes, though this outcome is at least partly due to the happenstance of the timing of the recent fall in natural gas prices. States that suspended retail choice had better price outcomes than traditional states for the commercial and industrial classes, but a worse outcome for the residential class. The relatively mediocre performance of the traditional states may be partly due to their lack of retail choice, but is very likely due more to their having lower prices than the other states to begin with (as well as lower prices at the end of the period).

Table 10
Percentage Changes in Weighted Average Retail Prices, 1990-2014

State Group	Residential		Commercial		Industrial	
	Nominal	Real	Nominal	Real	Nominal	Real
Traditional	63%	0%	56%	-4%	60%	-2%
Retail Choice	59%	-2%	39%	-15%	39%	-14%
Traditional - Suspended	72%	6%	45%	-11%	47%	-10%

A recent national survey of electric customer average monthly bills conducted by Lincoln Electric System highlights the continuing price gap between retail choice states and traditional states.[63] This survey compares average monthly bills for rates in effect on January 1, 2015 for 106 U.S. cities. As shown in the rows of Table 11, the survey distinguishes between two usage levels for the residential class, four usage levels for the commercial class, and six usage levels for the industrial class. The table shows average monthly bills for the year.

The demand and monthly energy levels in the table are category boundaries selected by Lincoln Electric System. The Traditional State and Choice State columns show average monthly bills that we derived from the survey findings. These columns indicate that the price gap in 2015 between retail choice states and traditional states is significant for all customer classes and sizes, ranging from 37% for small residential customers up to 70% for large industrial customers. There is a very strong relationship between the price gap and customer size: the gap gets bigger as customers get bigger. This may be due to the fact that smaller customers in retail choice states, including large majorities of residential customers, are still being served by the incumbent local utility, which somewhat insulates them from the changes in wholesale market prices.

[63] Lincoln Electric System [2015].

Table 11
Typical Bills per the LES Survey Results, 2015[64]

	Demand Level (kW)	Average Monthly Energy (kWh)	Traditional State ($/Month)	Choice State ($/Month)	Price Gap ($/Month)	Percent Difference
Residential		500	64	88	24	37%
		1,000	118	169	51	43%
Commercial	40	10,000	1,138	1,593	455	40%
	40	14,000	1,441	2,021	581	40%
	500	150,000	15,304	23,119	7,815	51%
	500	180,000	17,062	26,399	9,337	55%
Industrial	75	15,000	1,856	2,542	685	37%
	75	30,000	2,851	4,130	1,278	45%
	75	50,000	4,051	6,159	2,108	52%
	1,000	200,000	23,821	34,989	11,168	47%
	1,000	400,000	35,368	56,284	20,916	59%
	1,000	650,000	48,586	82,779	34,193	70%

6.4.2. Prices in the EU's Electricity Markets

As discussed earlier, the EU has mandated retail choice in all its member states, with mixed outcomes for the extent of competition within each country. This mixture notwithstanding, Figure 16 shows average real retail electricity prices in 27 EU countries for medium-size customers in the residential and industrial classes over the period 2005 through 2015, including taxes for the residential class but excluding taxes for the industrial class.[65] Real average prices for medium-size residential customers rose 29% over this period, while real average prices for medium-size industrial customers rose 10%.

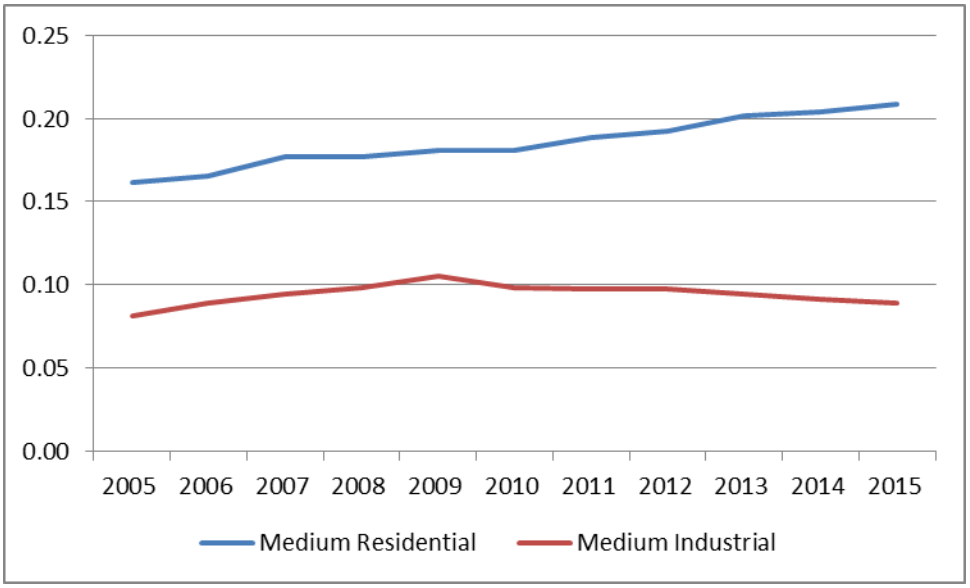
Figure 16 is remarkable in showing that real industrial prices peaked in 2009, at the time of the financial crisis, and have come down 15% since that time. Real residential prices, by contrast, have had a steady upward march, regardless of the financial crisis. This is very different from the U.S. experience, wherein falling fuel prices drove down the prices of retail choice customers of all classes. A large part of this difference is due to EU member states' non-contestable charges such as taxes, transmission and distribution charges, and charges for recovery of the costs of subsidized renewable resources. These non-contestable charges constitute more than

[64] Based upon Lincoln Electric System [2015]. 37 of the 106 cities in the survey were in retail choice states, with 31 of those served by investor-owned utilities. 85 of the 106 cities were served by investor-owned utilities.

[65] Medium-size residential customers are defined as consuming between 2,500 and 5,000 kWh per year. Medium-size industrial customers are defined as consuming between 500 and 2,000 MWh per year.

half the electricity bills in some countries. In Austria, Germany, Ireland and Slovenia in 2013, increases in renewable energy subsidies almost completely offset the drop in wholesale electricity prices. The large non-contestable charges have thus significantly undermined retail choice in the EU.[66]

Figure 16
Average Real Electricity Prices for Residential and Industrial Electricity Customers in 27 EU Countries, 2005-2015 (2015 € per kWh)[67]



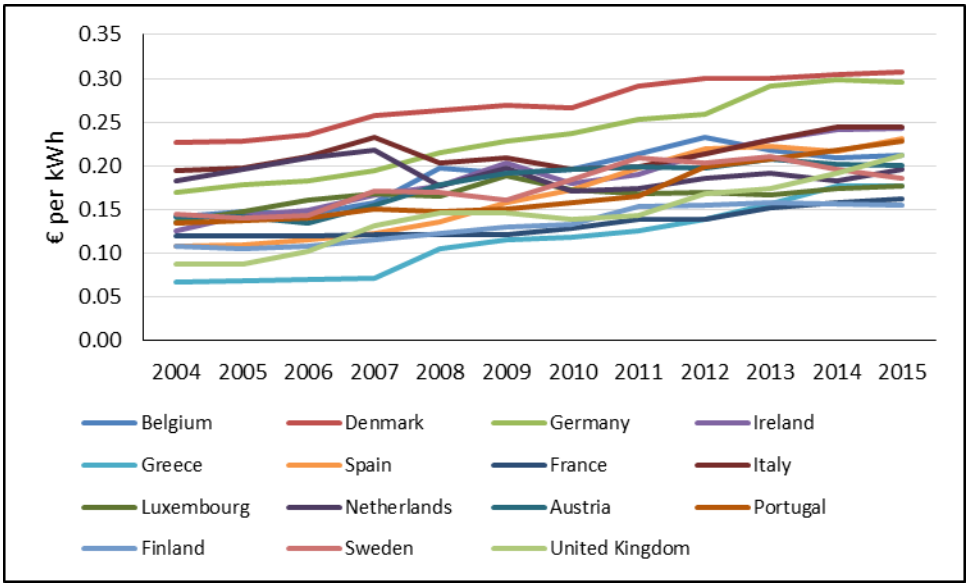
Residential price levels and trends have varied considerably among the EU-15 countries, as illustrated by Figure 17.[68] Over the 2004 through 2015 period, the Netherlands experienced the lowest increase in residential prices (7%), followed by Italy (26%), Sweden (29%), and Luxembourg (30%). At the other end of the spectrum, nominal residential prices more than doubled over this span of time in Spain (114%), the United Kingdom (142%), and Greece (163%). Nonetheless, Greece, Finland, and the United Kingdom have maintained the lowest residential prices over the period. These very different experiences indicate that retail choice is not the only factor influencing price.

[66] Agency for the Cooperation of Energy Regulators and Council of European Energy Regulators [2014, pp. 8-9].

[67] EUROSTAT [Electricity prices]. Prices are deflated by the EU's harmonized index of consumer prices as reported by Eurostat, http://appsso.eurostat.ec.europa.eu/nui/show.do.

[68] The EU-15 countries – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom – are those that were members of the EU before May 2004.

Figure 17
EU-15 Nominal Residential Electricity Prices 2004-2015[69]

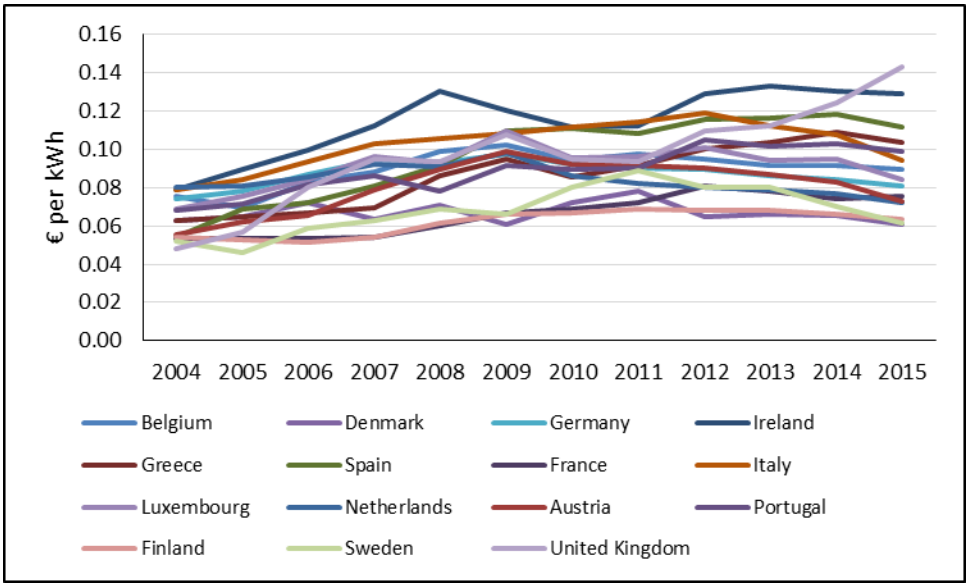


As illustrated by Figure 18, countries in the EU-15 with price decreases for industrial customers over the 2004 through 2015 period were the Netherlands (-11%) and Denmark (-3%). Industrial prices saw the greatest increases in the United Kingdom (200%), Spain (107%), and Greece (65%). Ireland has had the highest industrial prices over almost the entire period, with Sweden and Finland having the lowest prices. Again, this diversity shows that electricity prices are influenced by many factors, of which retail choice is only one.

Neither price regulation nor the opening of retail markets seems to have had significant impact on average residential prices. Two of the EU-15 countries – Finland and Portugal – saw price drops of about 10% in the three years immediately following market opening. In seven countries – Austria, Denmark, France, Germany, Luxembourg, Sweden and the United Kingdom – average prices rose less than 10% in the three years following market opening. Five countries had relatively large price increases after market opening: Belgium (22% after one year), Ireland (30% after three years), the Netherlands (36% after three years), Spain (37% after three years), and Greece (60% after two years). These price changes were due to multiple causes – in Ireland and Spain, for example, prices were already rising significantly before market opening – but it is apparent that retail choice alone was not sufficient to cause prices to drop. As illustrated by Figure 17 and Figure 18, prices for customers in the EU-15 countries continue to rise, with industrial customers experiencing a much flatter price trajectory in recent years.

[69] EUROSTAT [Electricity prices].

Figure 18
EU-15 Industrial Electricity Prices 2004 - 2015[70]



The EU experience gives no clear signal about how retail choice affects retail electricity prices. The difficulty is that prices are determined by a multiplicity of factors, and in some member states have been particularly driven by non-contestable charges such as taxes and renewable resource subsidies.

6.4.3. Review of Statistical Studies

Numerous studies have conducted statistical analyses of the relationship of electricity prices to restructuring and other factors likely to influence price. These studies have reached contradictory conclusions about the price impacts of retail choice, with the differences driven by differences in methodology and data series and by the fact that retail prices are determined by a complex mix of factors. Studies that particularly focused on retail choice have reached the following conclusions:

- Retail choice has reduced retail prices.[71]
- Restructuring and retail choice have improved generating plant efficiencies.[72]

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[70] EUROSTAT [Electricity prices].

[71] Andrews [2010] compared average retail prices in retail choice states versus traditional states over 1967-2007. Joskow [2006] statistically identified the determinants of industrial and residential rates by state for 1970-2003. Ros [2015] compared residential, commercial, and industrial prices in retail choice states versus traditional states over 1980s through late 2000s. Su [2014] compared residential, commercial, and industrial real average prices in retail choice vs. traditional states over 1990-2011.

[72] Craig and Savage [2009] compared heat rates of plants in retail choice states versus traditional states over 1996-2006.

- Retail choice has reduced retail prices in states with high participation rates and raised retail prices in states with low participation rates.[73]
- Retail choice has increased retail prices.[74]

Studies that focused on restructuring, without special consideration of retail choice, reached the following conclusions:

- Restructuring has provided substantial consumer benefits and/or significantly lower consumer prices.[75]
- Consumers in PJM have enjoyed savings due to restructuring.[76]
- Restructuring has not significantly affected customers' prices.[77]
- Restructuring has increased wholesale prices.[78]

Plainly, the studies have not reached consensus. Most of the reason for lack of consensus is that retail prices depend upon many factors, of which retail choice is only one; and statistical methods are unable to isolate the impacts of retail choice with precision. As stated by one analyst:

> …suppliers of full requirements retail service add to the wholesale [electricity] price additional costs and risks not directly related to the costs of energy. These may include capacity; ancillary services; transmission and RTO service charges; congestion charges; risk management costs; risks from fluctuating fuel prices; the risk that load will change; the risk that customers will migrate between suppliers; the risk of regulatory or

[73] Swadley and Mine Yücel [2011] statistically identified the determinants of retail choice states' prices over 1990-2010.

[74] Blumsack *et al* [2008] compared price-cost margins in retail choice states and traditional states over 1994-2005. Zarnikau and Whitworth [2006] and Zarnikau *et al* [2007] respectively analyzed residential and commercial retail prices in Texas as a function of Electric Reliability Council of Texas generation prices plus other bill components over the period 2000-2006, when rising gas prices fueled the results.

[75] Global Energy Decisions [2005] compared actual prices to simulated prices based on constructed costs under regulation for the Eastern Interconnection in 1999-2003. Harvey *et al* [2007] compared residential prices in RTO versus traditional markets in the southeast U.S.

[76] Center for the Advancement of Energy Markets [2003] compared PJM states to three non-restructured states, comparing 2002 to 1997. Energy Security Analysis [2005] simulated power flows and resulting costs within expanded PJM for 2005. Synapse Energy Economics [2004] compared actual wholesale generation prices for three PJM utilities to their implied costs under regulation in 1996-1997 as projected forward to 1999-2003.

[77] Apt [2005] compared rates of change in industrial prices before and after restructuring to rates of change without restructuring, by state and region, for 1990-2003. Tabor *et al* [2006] statistically identified the determinants of residential, commercial, and industrial prices, by utility, for 1990-2003.

[78] Lenard and McGonegal [2008] compared average wholesale power revenue in RTO versus non-RTO states for 1991-2006.

legislative changes; counterparty risks, and administrative, marketing, and legal costs to serve retail customers.[79]

Yet another reason for lack of consensus is that the experience with retail choice has occurred over only a limited number of years, so some of the statistical results have been heavily influenced by the happenstance of the events – like sharp fuel price changes or swings in the overall economy – that occurred during the years covered by the analysis. But statistical and data issues notwithstanding, it is apparent that there is no clear relationship between retail choice and retail price outcomes.

6.4.4. Cost-Shifting Among Customers

There is some evidence that retail energy suppliers cherry pick customers. The evidence also suggests that the most attractive customers, industrial and large commercial customers, take advantage of lower prices in either the retail choice market or the regulated market. Michigan is an example of this situation.

From 2001 to 2008, between 3% and 20% of Michigan's utility load participated in retail choice programs. Figure 14 shows that this participation moved in inverse proportion to wholesale energy prices and did so during this period. When wholesale energy prices were low, as it was before 2005 and after 2009, choice participation increased. When wholesale prices were increasing, as it was between 2005 and 2009, choice participation fell.

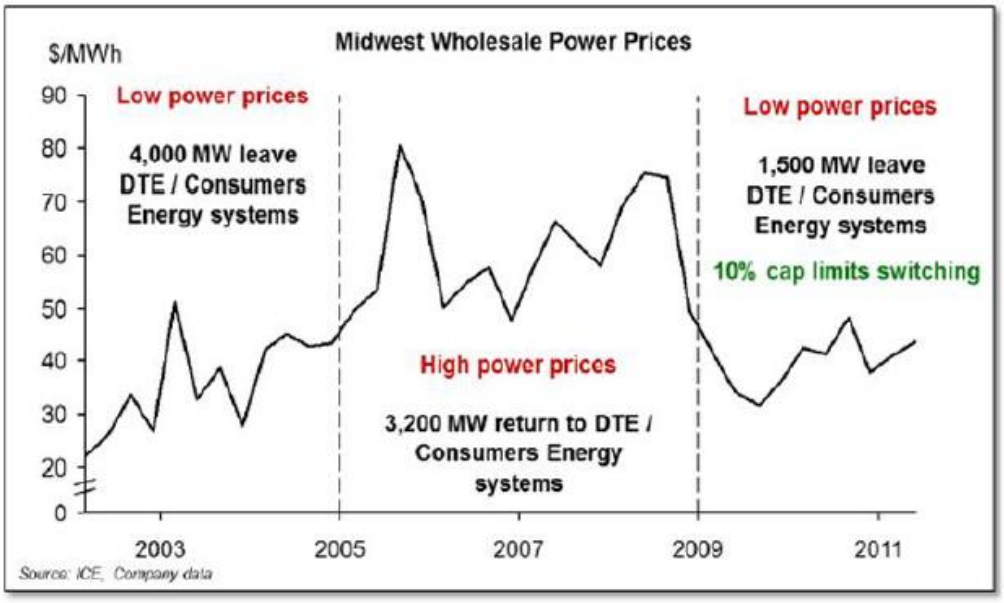
As Quackenbush *et al* note: "The nearly 11% load participation in the choice market today [2013] translates into 0.3% of total customers for DTE and 0.06% for Consumers Energy. The current rate structure essentially transfers fixed costs no longer recoverable from customers participating in choice to all remaining customers, creating a subsidy from more than 99% of customers to less than 1% of customers."[80]

Alternative retail energy suppliers target larger customers first because of the large size of their loads relative to the transaction costs of serving them. Likewise, large electricity customers will seek the lowest available electricity prices. The result of customers being able to shift between the market and utilities that price according to cost of service is rent-shifting: when large electricity customers leave for lower market prices, the utilities' fixed costs of service are borne by their remaining customers; and when large electricity customers return to the utility when market prices are high, the remaining customers share with the big guys the relatively low utility costs. For customers able to shift between the market and utilities, this is a heads-I-win, tails-you-lose proposition, for which the remaining customers are the losers.

[79] Rose [2007, p. 21] examined the relationship of retail prices and wholesale market prices in 2006 in PJM's ComEd zone (i.e., Chicago and northern Illinois region).

[80] Quackenbush and Bakkal [2013, p. 16].

Figure 19
Relationship of Michigan Retail Choice Participation to Wholesale Power Prices[81]



6.5. Impacts on Resource Adequacy[82]

A power system has adequate resources if its supply- and demand-side resources reliably exceed its loads. Although resource adequacy can be measured in an operational timeframe, under which resources' total *available* capacity would need to exceed load by specified operating reserve margins in each hour or dispatch interval, it more generally refers to a planning timeframe, under which resources' total *nameplate* capacity must exceed annual peak load by a specified planning reserve margin. In both timeframes, the reserve margins are set so that the power system can respond, with a high probability of success, to generation and transmission equipment outages, load fluctuations, and other random events.

6.5.1. Investment Risk Impacts of Retail Choice

Resource adequacy requirements are determined by the North American Electric Reliability Corporation, the relevant regional reliability entities, and federal and state requirements. Resource adequacy outcomes are determined overwhelmingly by wholesale market structure, particularly the manner in which resource investors are compensated: in traditionally regulated regions, investors are more or less guaranteed cost recovery, including a return on capital, for investments that regulators deem prudent; while in RTO regions, cost recovery depends upon uncertain market-determined prices for energy, capacity, and ancillary services.

[81] Quackenbush and Bakkal [2013, Figure 2, p. 12].

[82] For a more detailed discussion of some of the issues raised in this section, see Morey *et al* [2014].

Some resource adequacy challenges arise from the ways in which wholesale electricity markets have been structured and planned. With respect to structure, most or all RTO regions have ceilings on allowable prices of or bids for electrical energy and ancillary services. The purposes of these ceilings are to limit the possible exercise of market power by resource owners and to limit price volatility; but another important effect of these ceilings is to limit the profits that resources may legitimately earn at times when reserves are thin. This holding down of energy and ancillary services prices makes resource investments less attractive. With respect to planning, planning reserves are generally set according to a nationwide reliability guideline by which resource-related outages may be expected to occur no more often than one event in ten years. This guideline implies an incremental cost for planning reserves that is at least 30 times what electricity consumers are willing to pay for reliability.[83] The consequence is that a free market mechanism cannot yield planning reserves that meet the standard; so the standard must instead be financed indirectly though administrative mechanisms, like mandatory reserve requirements, that recover their costs through hidden charges on consumption.

The price caps and high nationwide reliability guideline together make it difficult for energy and ancillary service market revenues to cover generators' costs. This can be seen in RTO reports that consistently show that these revenues fall short of covering costs. For example, Table 12 summarizes the findings, by the RTOs or their independent market monitors, regarding the estimated net revenues that would have been earned by a hypothetical new combustion turbine units operating in each of six RTOs in each of the years 2005 through 2014. Net revenues are defined as gross revenues from energy, ancillary services, and capacity markets (where they exist) minus operating expenses like fuel and labor. For a combustion turbine to break even or run a profit, its net revenues must at least equal the turbine's capacity costs. The table shows, in its rightmost column, the capacity costs estimated by the PJM Independent Market Monitor for each year.[84] Comparing the capacity costs of the rightmost column to the RTO-wide net revenues shown in the other columns, it is apparent that, with few exceptions, there is a persistent revenue insufficiency in all the RTO markets. This persistent revenue insufficiency is a hallmark of the "missing money" problem that arises from the wholesale market design flaws already identified.

Retail choice exacerbates the resource adequacy problem by materially adding to the financial uncertainties faced by investors in generating resources. These financial uncertainties arise from uncertainties in the revenues that a generator will receive for its services. In the absence of retail choice, the investor, being a monopoly utility, has a relatively high degree of certainty

[83] Astrape Consulting [2013, p. 1] notes that this reliability target implies customer willingness-to-pay of $300,000 per MWh to avoid curtailment. The $300,000 figure assumes that: a) the carrying cost of new capacity is $90,000 per MW-year; and b) that a typical resource-related firm load shed event lasts three hours. Thus, $300,000 = $90,000 per MW-year / [(3 hours per event) / (1 event per 10 years)]. This absurd result is equivalent to a homeowner with a 3 kW load paying $900 for one hour's worth of power, and is much higher than the $10,000 per MWh that is at the high end of the literature's estimates of consumers' outage costs.

[84] Capacity costs are in nominal dollars levelized over twenty years. Although the cost of new entry (CONE) varies among RTO markets, we use PJM's CONE estimates for simplicity of presentation. Use of the other RTOs' CONE estimates would show similar revenue insufficiency.

about the quantity of service that it will provide to its customers and, under cost-of-service regulation, about the revenues that it will receive for providing that service. With retail choice, investors have sales contracts with durations that are only small fractions of the lives of their investments, which means that their revenues depend upon uncertain future market conditions. This uncertainty makes investment in new generation less attractive and makes long-term fuel contracting less attractive for existing generators, which may impinge upon resource adequacy and certainly raises the required returns on investment capital. This increase in required returns must ultimately be paid by consumers in the form of higher prices.

Table 12
Comparison of Net Revenue for Combustion Turbine Gas Plant ($ per MW-month)[85]

Year	CAISO	ERCOT	ISO NE	MISO	NYISO	PJM	Levelized Cost
2005					1,917	833	6,000
2006					3,167	1,250	6,667
2007	4,333	3,333			4,167	4,083	7,583
2008	5,083	7,583			5,667	4,250	10,333
2009	4,917	3,667			5,250	4,833	10,750
2010	4,417	3,750	2,500	2,250	3,833	7,667	10,917
2011	3,750	9,167	2,333	2,250	3,333	7,167	9,250
2012	4,083	2,083	4,200	2,333	1,750	4,500	9,417
2013	4,200	7,700	6,700	2,500	7,083	4,500	9,144
2014	4,750	3,083	10,800	2,600	6,758	4,300[86]	9,050

Resource adequacy in traditional market states relies on implicit long-term contracts between regulated utilities and their customers in the aggregate. These long-term sales obligations to customers allow regulated utilities to engage in long-term planning processes to secure a generation and contract portfolio that satisfies load and reserve requirements, both now and in the future. In contrast, retail choice markets have relatively few long-term contracting options. Long-term contracting in retail choice states has been hindered by customers' ability to switch

[85] The RTOs assume that combustion turbine units have heat rates between 10,250 and 10,500 MMBtu per MWh. See Brattle Group [2013]; California Independent System Operator [2012, 2013, 2014, 2015]; Patton *et al* [2009, Figures 10 and 11, pp. 36-37; 2013, Figures A-14 and A-15, p. A-22; 2014, Figure A-17 through Figure A-22, pp. A-26 to A-29; 2015, Table A-5, p. A-31]; Potomac Economics [2013a, Figures 63 and 64, pp. 76 & 77; 2013b, Figure 6, p. 10; 2015, Figure 7, p. 12]; and Monitoring Analytics [2009, 2013, Net Revenue Analysis sections]. The MISO figures are averages across zones. The New York figures are averages of values for the Hudson Valley and Capital Zones for 2004-2007, and averages for the Hudson Valley, Capital, and West Zones for 2008-2012, and averages for 2013 for the Capital Zone, Hudson Valley, Long Island, NYC, and West Zone, and capacity weighted averages for 2014 across the Capital Zone, Hudson Valley, Long Island, NYC, and West Zone. 20-year levelized cost figures are from Monitoring Analytics [2009, 2013, 2014, 2015].

[86] PJM's market monitor notes that, due to the high energy prices associated with the polar vortex in January 2014, net revenues would have been sufficient to cover costs in ten of PJM's nineteen zones in 2014.

suppliers, by customers' ability to switch from alternative retail providers to the incumbent utility's standard offer or POLR service whenever the competitive market price rises above the regulated rate, by public policies that protect buyers from service curtailments when there is a power shortage and their own contracted supplies are insufficient to meet their load obligations, and by asymmetries in the positions held by buyers and sellers in retail choice markets.

The asymmetries arise from the fact that consumers and resource owners have radically different timeframes for their engagements in electricity markets. Residential consumers tend to move every several years and generally do not want contracts more than a few years long. Business consumers can be unsure about the longevity of their businesses and generally do not want contracts more than a few years long. Owners of generation, on the other hand, can best hedge their financial risks by selling power under long-term contracts with durations that match the lives of their assets. For generation owners, it is relatively risky to rely on the volatile spot market or short-term contracts for cost recovery. Retail energy suppliers are caught in the middle. If they purchase power and capacity to supply their load under long-term contracts with resource owners while they are unable to enter long-term contracts with retail customers, they face the risk that retail customers may switch to other providers, leaving them unable to recover the costs of their long-term contracts with resource owners. Merchant generators operating in the reformed wholesale markets consequently are unable to readily find either retail providers on the buy side of the market or power marketers on the sell side of the market interested in long-term deals.

6.5.2. Other Impacts of Retail Choice

Retail choice may affect resource adequacy in a few other ways.

First, retail choice might cause significant changes in customers' aggregate loads relative to what they would be without retail choice. For example, retail choice could make customers more accepting of pricing or curtailment terms that significantly reduce peak loads relative to a world without retail choice, thus improving resource adequacy. As shown above in Table 5, retail choice states have higher participation rates in dynamic pricing programs than do states without retail choice; and these higher participation rates may cause enough load shifting to improve resource adequacy by reducing aggregate peak loads.

Second, by allowing customers and generators to deal directly with one another, retail choice might increase the sales options available to generators and raise the net prices they receive, thus encouraging investment.

Third, retail choice may cause consumers to choose to support particular types of generation technologies, thus shifting the generation mix. As shown in Table 8 and Figure 9, retail choice is encouraging customer support toward renewable energy. If the result is a significant shift in generation mix toward intermittent resources such as wind and solar, that would raise resource adequacy issues because of the non-dispatchability of such resources, in particular as the share of intermittent resources in the total generation mix reaches significant levels.

Fourth, by facilitating wholesale market restructuring, retail choice arguably shares some of the credit or blame for the resource adequacy impacts of wholesale market restructuring. On the positive side, these include competition-driven improvements in generators' efficiency and availability. On the negative side, these include greater uncertainties in returns on investments.

6.5.3. Overview of Retail Choice Impacts

Public policy will not allow resource adequacy to be determined by the market, with or without retail choice. Some policies, like wholesale market price caps and other consumer protections, deliberately prevent consumers from seeing prices that reasonably reflect supply and demand conditions. Other policies, like requiring system operators or retail energy suppliers to maintain planning reserves that meet load under almost all conditions, prevent individual customers from choosing lower levels of reliability, and thereby require consumers to pay the costs of maintaining reliability that they may not need.

The consequence is that retail choice is unlikely to materially affect resource adequacy. Instead, retail choice is much more likely to affect the costs of maintaining the level of resource adequacy mandated by public policy and the distribution of these costs among consumers. By making investment returns more uncertain, retail choice raises costs. By promoting dynamic pricing programs, retail choice reduces costs. By promoting investment in intermittent generation resources, retail choice increases costs. By allowing customers to switch between alternative suppliers and incumbent utilities, retail choice can allow some customers to escape some of the costs of maintaining adequate resources.

6.6. Impacts on the Division of Financial Risks Among Stakeholders

Retail choice affects the division of financial risks between electricity producers and consumers. The financial risks are those arising from uncertain future electricity prices and those attending investments in long-lived generation and demand-side resources.

6.6.1. Division of Electricity Price Risk

Under retail choice, retail prices can vary substantially with changes in electricity market supply and demand conditions. This can be seen, for example, in the history of the past decade and a half, during which RTOs' electricity prices have generally swung up and down with the price of natural gas, which has often been the marginal fuel upon which electricity prices have been set. When gas prices have been low, retail choice consumers benefited from low electricity prices while generators suffered low or negative profit margins. When gas prices have been high, retail choice consumers have faced high electricity prices while generators enjoyed healthy profit margins. Consequently, retail choice can cause large variations in producers' profits and lead consumers to see large sudden changes in the prices they pay upon expiration of any limited-term price guarantees.

In principle, producers and retail choice consumers could mitigate electricity price risks through long-term contracts. In practice, however, such long-term contracts are a rarity. Although many retail energy suppliers have induced customers to switch from the incumbent utility to a

competitive supplier by offering fixed rates, these fixed rates are of limited duration. Furthermore, the suppliers offering such fixed rates can and have experienced financial problems, including bankruptcy, that raise questions about the sustainability of some approaches to fixed-rate product offerings.

Traditional regulation minimizes price risks by implicitly imposing long-term contracts upon both producers and consumers. In essence, the generation investments of regulated utilities are dedicated to their customers, who have the right to use those investments at cost (including return on capital). Under traditional regulation, the costs paid by consumers do vary, particularly when large investment costs are incorporated into rate base and when there are large movements in fuel prices. Nonetheless, regulation implicitly hedges costs by fixing a large share of costs at the utility's original cost level. Consequently, the variation in prices seen by consumers is less under traditional regulation than under retail choice; and the variability of producers' profits is also less.

6.6.2. Division of Investment Risks

Investment risks arise from uncertainties in the future prices or values of inputs (like fuel and labor), in the future prices or values of outputs (like electrical energy and ancillary services), in the operational efficiencies and effectiveness of generation facilities, and in law and regulation. Some of these risks (like regulation of electricity market structures) are systematic in that they affect all investments. Some risks (like uranium prices and greenhouse gas limits) affect particular classes of investments. And some risks (like generation operational problems) are idiosyncratic to particular investments.

Traditional cost-of-service regulation more or less guarantees that producers will recover the costs of their prudently incurred resource investments, so that the financial risks of poor investments are largely (but not always) passed on to consumers. Under retail choice, by contrast, producers who make poor investments (due to bad management or bad luck) bear most of the financial risk and consumers bear little or no risk. If the market works well, the risk and attendant costs that producers bear in a retail choice environment will be efficient relative to those achieved in a traditional market setting. Even under retail choice, however, systematic risk increases the costs of all producers, thus reducing investment and raising electricity prices to a level that compensates producers for bearing this risk; so the costs of systematic risk are likely to be indirectly borne by consumers through the prices they pay for power and related services.

Leverage

Related to the division of investment risk is the manner in which utilities have tried to manage this risk with the introduction of retail choice. One of the major means of managing this risk is through the utility's capital structure as characterized by leverage, which is the ratio of the firm's total debt to its total assets. Regulated firms traditionally display a high leverage ratio compared to competitive firms, which means that regulated firms, being relatively low-risk, are willing and able to take on a relatively large amount of debt. One would expect utilities'

leverage to decline with the transition to a competitive retail market as utilities reduce the relative amounts of their debt in the face of higher market risk.

Indeed, this is what has apparently occurred. Controlling for other factors that influence utilities' capital structure decisions, the passage of retail choice legislation appears to reduce utilities' leverage ratios by an average of 22%, a substantial drop that indicates that retail choice substantially increases utilities' risks. All other state policies associated with implementation of retail choice have much smaller effects on leverage. Furthermore, the greater the market risks posed by retail choice, the less debt that a utility will hold. In particular, a 1% increase in the potential customer switching share leads to a 0.02% decrease in the leverage ratio, indicating that utility risk increases as customer switching increases. When an incumbent utility is designated as the default provider, implying lower risk of market share loss, its leverage ratio increases by about 2%.[87]

Return on Equity

The American Public Power Association has summarized several key indicators of the "financial performance of companies that sell significant quantities of unregulated generation in the wholesale electricity market operated by the PJM Interconnection."[88] These indicators are return on equity, net income, and gross margin.

The relatively high returns of the unregulated subsidiaries may be due to several other causes as well. One possibility is that unregulated firms, facing greater financial risk, require higher returns on equity than regulated firms. Another possibility is that retail choice leads to higher retail electricity prices, hence higher returns on equity for unregulated firms. Yet another possibility is that the relative returns of unregulated and regulated firms fluctuate over time, and the two years in the table just happen to be years in which unregulated firms fared better. A great deal more analysis, including a longer time frame, would be required to reach any firm conclusions.

Table 13 summarizes the return on equity (ROE) estimates for the unregulated and regulated subsidiaries of four electric utility holding companies that operate in the PJM RTO wholesale market and that also serve customers in retail choice states in which the regulated subsidiaries operate. For holding companies with multiple regulated subsidiaries, there is a separate row indicating the ROEs for each subsidiary. The estimated ROEs suggest that the holding companies' unregulated generation segments generally earn higher returns from the wholesale market than their regulated subsidiaries engaged in local distribution service. The American Public Power Association attributes the higher returns of the unregulated affiliates to high gross margins (revenue net of fuel and purchased power costs) on electricity sales in the wholesale market due to "the drop in fuel costs… not being fully passed on to consumers."[89]

[87] Sanyal and Bulan [2007].

[88] American Public Power Association [2012, p. 1].

[89] American Public Power Association [2012, p. 4].

The relatively high returns of the unregulated subsidiaries may be due to several other causes as well. One possibility is that unregulated firms, facing greater financial risk, require higher returns on equity than regulated firms. Another possibility is that retail choice leads to higher retail electricity prices, hence higher returns on equity for unregulated firms. Yet another possibility is that the relative returns of unregulated and regulated firms fluctuate over time, and the two years in the table just happen to be years in which unregulated firms fared better. A great deal more analysis, including a longer time frame, would be required to reach any firm conclusions.

Table 13
Estimated Returns on Equity for Selected Electric Industry Companies in PJM RTO[90]

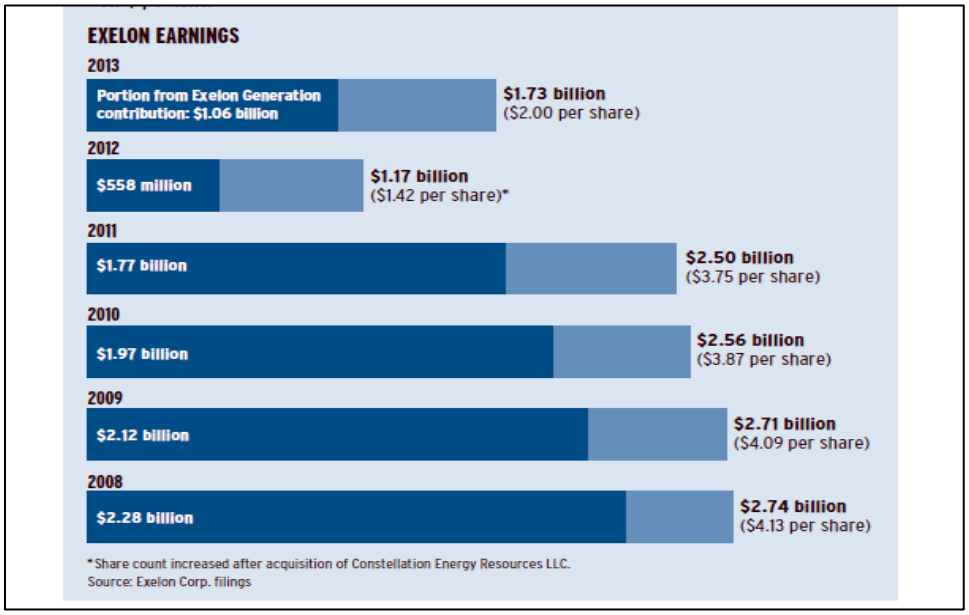
	Unregulated		Regulated	
Holding Company	**2010**	**2011**	**2010**	**2011**
Exelon Corporation	26.9%	23.0%	5.0%	6.0%
			14.0%	13.0%
PPL Corporation	22.0%	15.8%	6.0%	8.0%
PSEG Corporation	21.7%	15.5%	10.0%	11.0%
First Energy Corporation	13.0%	15.1%	6.0%	6.0%
			7.0%	8.0%
			5.0%	8.0%
			17.0%	18.0%
			7.0%	7.0%
			8.0%	9.0%

The separation of generation services from wires service in the majority of retail choice states does appear to have shifted the risk of investment return to generation owners. The fortunes of firms with significant unregulated generation subsidiaries, like Exelon and FirstEnergy, now have their fortunes tied to the vicissitudes of restructured wholesale markets such as PJM's. This can be illustrated by the recent trend in Exelon's earnings over the period 2008 through 2013 as shown in Figure 20. From 2008 to 2012, Exelon Generation's contribution to overall corporate earnings fell by about 75% from $2.28 billion to $0.56 billion as falling natural gas prices caused a fall in PJM's wholesale electricity prices. Exelon Generation in 2008 contributed 83% of Exelon's earning, but by 2012 contributed just 48%. Exelon's fortunes improved in 2013

[90] American Public Power Association [2011, p. 4] and American Public Power Association [2012, p. 7]. Exelon Corporation's unregulated subsidiary is Exelon Generation, and its regulated subsidiaries are Commonwealth Edison and Potomac Electric Power Company. PPL Corporation's unregulated subsidiary is PPL Energy Supply (which has some international operations and gas trading operations) and its regulated subsidiary is PPL Electric Utilities. PSEG Corporation's unregulated subsidiary is PSEG Power and its regulated subsidiary is PSEG. First Energy Corporation's unregulated subsidiary is FE Solutions and its regulated subsidiaries (in the order shown in the table) are Cleveland Electric, Jersey Central Power & Light, Metropolitan Edison, Ohio Edison, Pennsylvania Electric, and Toledo Edison.

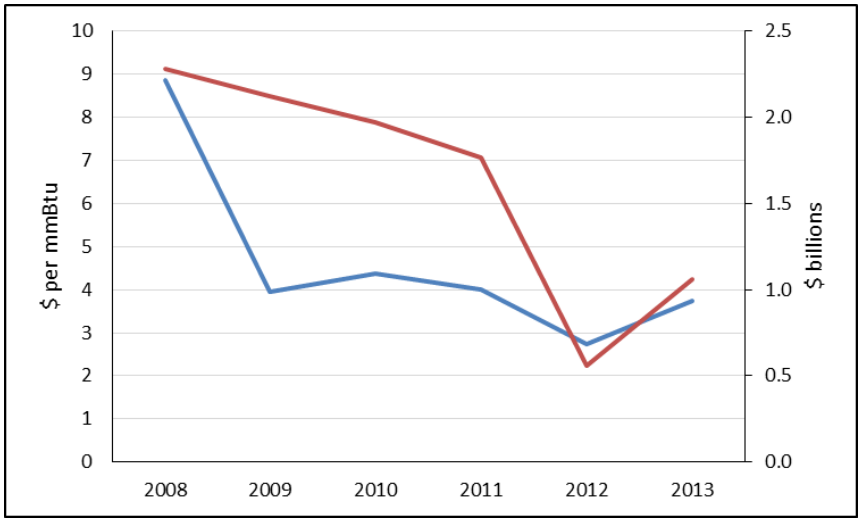
where Exelon Generation contributed 61% of corporate earnings. Because Exelon Generation's revenues primarily come from the sale of energy and capacity from its nuclear plants, its returns on generation investment are highly correlated with fuel costs of competing generation, natural gas in particular. This correlation is somewhat visible in Figure 21. Investors will require a risk premium for investments in the unregulated electricity generation sector, which ultimately affects retail customers' bills.

Figure 20
Exelon Earnings, 2008 to 2013[91]



[91] Daniels [2014].

Figure 21
Relation of Exelon Generation Revenues and Natural Gas Spot Price[92]



An additional indicator that retail market restructuring has shifted risk is the fact that recently there has been a realignment of diversification within the industry. One observer notes that:

> The last few years have seen many asset-level generation deals where IPPs and other financial investors have acquired baseload plants, mostly from diversified utilities, as low natural gas and power prices saw many discounted power plants come to market. Diversified utilities, on the other hand, have focused on optimizing assets and growing their regulated businesses.[93]

Without saying that retail restructuring has shifted risk from customers in a regulated market structure to generation investors in the relatively less regulated wholesale/retail markets, the same observer implies the same by stating that:

> The recent trend of US diversified utilities selling their non-regulated power plants, in order to focus solely on regulated businesses, is re-setting their trading multiples. In 2013, Missouri-based Ameren Corp. sold its merchant coal plants to Dynegy while California-based Edison International sold its non-regulated subsidiary, Edison Mission Energy. Other large caps, including Duke Energy and American Electric Power, have announced sales of Midwest power plants.
>
> Diversified companies, which are significantly levered to generation businesses, are acquiring regulated utilities to de-risk their asset bases. A notable example is PPL Corp. The company's acquisitions of regulated utilities in the US and UK over the last few years have transformed its business mix from 80/20 merchant/regulated to a 20/80 ratio. Also, the company recently announced

[92] Exelon Generation revenues are per Daniels [2014]. Gas prices are per U.S. Energy Information Administration [Henry Hub].

[93] Rennie [2015, p. 8].

plans to spin off merchant assets into a separate IPP, making PPL a purely regulated company. Similarly, Exelon Corp. recently acquired Pepco Holdings, a regulated utility, in a move that will see regulated operations contributing about 60% to 65% of Exelon's total earnings over 2015-16 (up from expectations of 55% to 60% pre-deal).[94]

6.7. Impacts on Particular Demographic Groups

State policymakers and regulators are concerned about the impacts of retail choice on various demographic groups, particularly low-income customers and residential customers in general. Because wholesale prices in RTOs vary by location, there are further concerns that the retail prices available to customers in some locations will be systematically higher than those in other locations. This section discusses the impacts of retail choice along the dimensions of customer income, customer class, and customer location.

6.7.1. Low-Income Customers

According to long-time consumer advocate Barbara Alexander, "there is a growing body of preliminary evidence that many residential customers and particularly low income customers are paying higher prices than they would have paid for default service when they select an alternative supplier."[95] Alexander cites the following examples:

- In New York, a Public Utility Law Project evaluation of 8,709,449 residential customer gas and electric bills for the period August 2010 through July 2012 found that, among the customers who switched to alternative suppliers, 84% of the residential electric bills and 92% of the residential gas bills were higher than would have been charged by the incumbent utility. Over the 24-month period, this raised customers' bills by averages of about $500 for electricity and $260 for natural gas. For this same period, the average bills of low-income customers who switched were raised by about $400 for electricity and $275 for gas. Only 8.5% of low-income electricity customers and 6.6% of low-income natural gas customers realized savings, averaging $40 for electricity and $63 for gas. Over this period, customers served by alternative suppliers were sent 377,736 final termination notices due to nonpayment.
- In Pennsylvania, a study found that about 73% of PPL Electric's low-income customers served by alternative electric suppliers paid more than they would have paid to the incumbent utility. This analysis resulted in the same unfortunate finding — over 70% of the low income customers served by an alternative supplier were paying more than the PPL Electric default service price at the time of the evaluation.

[94] Rennie [2015, p. 10]

[95] Alexander [2013].

- In Illinois, the Citizens Utility Board study found that, since 2003, 94% of the alternative natural gas supplier plans resulted in higher prices for residential customers than they would have paid to the incumbent utility.
- In Ohio, Ohio Partners for Affordable Energy found that Columbia Gas of Ohio indicates that customers purchasing commodity natural gas from unregulated suppliers pay substantially more than the incumbent's default service price for natural gas, which in Ohio reflects wholesale market prices.

Alexander laments policies that push unwary consumers toward alternative suppliers.

> … the stability of default service and the residential customer preference for that service has been viewed as adverse to the development of a "fully" competitive market by some policymakers. Recently, many … state regulatory commissions are seeking to enhance and promote a reliance on retail energy markets and either reduce or eliminate the local utility' obligation to provide default service. Whether as a response to pressure from the alternative suppliers or the theory that default service constitutes a barrier to the creation of a retail energy market, some states have embarked on policies and programs designed to change the nature of default service and "push" residential customers into the arms of the retail suppliers. These regulatory initiatives as well as the increased marketing activities by many alternative suppliers, particularly with respect to door-to-door marketing in large urban areas, have sparked the need for this Report.[96]

Hortacsu *et al* find that retail choice disproportionately benefits well educated, high-income, white, urban customers. They measure the benefits of retail choice according to a metric they call "Percent Achieved," which is the fraction of potential savings that were realized by switching, relative to purchasing from the incumbent. They find the following:

> … households with a higher "Percent achieved" tend to be in neighborhoods with a higher educated population, a lower poverty rate, and a greater fraction of households in an urbanized area. In addition, a higher "Percent achieved" is realized in neighborhoods with *ceteris paribus* fewer senior citizens, more blacks, fewer Hispanics, and fewer houses with electric heating... and find that higher usage households realize a greater "Percent achieved". … We find that homes with higher value and higher electricity usage realize a higher "Percent achieved". To the extent that house value is a proxy of occupant wealth, this suggests that wealth is positively associated with "Percent achieved".[97]

In summary, there is evidence that retail choice decisions require business savvy that many consumers lack, and that less educated or low-income consumers are more likely than other consumers to make poor retail supplier choices.

[96] Alexander [2013, pp. 19-20].

[97] Hortacsu *et al* [2012, pp. 13-14].

6.7.2. Residential Customers

State policymakers have been concerned that residential customers would be particularly prone to miss the benefits of retail choice, partly because competing retail energy suppliers would not solicit small customers and partly because inertia would cause most customers to remain with their incumbent utilities regardless of competitors' efforts. The relatively low switching rates of residential customers, as shown in Figure 2 and Figure 3, for example, support this concern. Furthermore, Hortacsu *et al*, in examining customer inertia issues in the Texas retail choice market, find that the

> …incumbent enjoys an economically very significant 'brand' effect – consumers value the incumbent's brand at nearly $80 per month… The 'search' and 'switching' cost components of decision-making also play important roles… While the percentage of households who actively search in a given month is not large, the search activity shows intuitive seasonal patterns: consumers are most likely to search in summer months, during which electricity bills tend to be high.[98]

We believe that the concern over residential switching rates is misplaced. Residential consumers rightly recognize that the transaction costs of switching are high relative to the prospective benefits of lower bills and better customer service. These transaction costs include those of gathering information, evaluating competing offers, hassling with the communications and paperwork necessary to implement a switch, and risking the uncertainties of doing business with a relatively unknown competitive supplier. Considering these transaction costs, the net benefits of retail choice to residential customers are likely to be small to non-existent. Residential customers rationally forego switching because they intuitively recognize the lack of benefits of doing so.

6.7.3. Customers' Geographic Locations

The cost of electricity varies by location, as is apparent from the significantly different locational prices found within each RTO footprint. Under traditional regulation, retail prices are generally identical at all locations within a utility's service territory because of the notion that it would be unfair for different customers of the same utility to pay different prices merely because of the happenstance of their locations and the power system's configuration. Under retail choice, competing suppliers are forced by locational differences in wholesale electricity prices to charge retail prices that reflect the locational costs of electricity. Consequently, the prices that customers pay under retail choice tend to vary by customers' locations. For example, a study of retail choice in Pennsylvania finds that the retail supply auctions conducted by Pennsylvania utilities consistently reflect the higher wholesale spot prices in eastern Pennsylvania, which is the more densely populated part of the state.[99]

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[98] Hortacsu *et al* [2012, p. 4].

[99] Kleit *et al* [2011].

Whether or not locational differentiation of retail prices is a bad thing depends upon notions of fairness. We accept that the prices of coal, natural gas, and apples, for example, will be lower close to the point of production than it will be elsewhere because of transportation costs; and we accept that the retail electricity prices for lower-cost utilities will be lower than for higher-cost utilities. But the electric power industry has a history of regarding retail price differences within a utility's service territory as inequitable, even if it is more costly to serve customers located far from generation resources than it is to serve customers close to those resources. The traditional uniformity of retail prices within utility service territories has been supported by an implicit system of cross-subsidies among captive utility customers. Retail choice results in retail prices that reflect the locational costs of electricity, and will do so unless retail choice programs are accompanied by similar systems of cross-subsidies. In the context of competition, such a system of cross-subsidies would be more complex and unwieldy than under traditional regulation. The most feasible way to avoid locational differentiation of retail electricity prices is to stick with traditional regulation.

6.8. Impacts on Regulation

Retail choice changes the role of state regulators in two somewhat opposite ways. On the one hand, state regulators have less to say about generation capacity and operating costs than under traditional regulation. This occurs because retail choice moves generation investment and fuel procurement decisions toward the market and away from regulators, especially where wholesale market prices of electricity are determined by RTOs' dispatch of regional generation resources. On the other hand, because of the issues raised in Section 6.1.3, state regulators have a new role with respect to consumer protection than they do under traditional regulation.

7. SUMMARY AND CONCLUSIONS

The Energy Policy Act of 1992 opened the floodgates to wholesale competition by creating a class of Exempt Wholesale Generators who were authorized to compete in wholesale markets. FERC's major response to this Act was Order No. 888 of 1996, which gave wholesale entities non-discriminatory access to transmission networks and thereby fostered competitive wholesale electricity markets. This legislation and regulatory response have together saved the U.S. many billions of dollars per year in generation costs.[100] The creation of RTOs, by more or less automating wholesale trades among participating entities, may have engendered additional savings (which have been at least partly offset by the RTOs' operating costs).

While the wholesale restructuring engendered by the Energy Policy Act of 1992 addressed some real barriers to trade, the dismantling of which has saved the U.S. many billions of dollars per year, the potential gains from retail choice were speculative at best. By the time that retail

[100] These savings began in the 1980s due to the impetus of competition in generation services engendered by the Public Utility Regulatory Policy Act of 1978. This competition provided strong incentives for unregulated generation firms to improve generators' efficiency and availability, which they in fact did. See, for example, the heat rate improvements (that is, increased electricity output per unit of fuel input) cited by Fabrizio *et al* [2007] and Chany *et al* [2012].

choice programs were introduced beginning in the mid-1990s, there was already a substantial body of evidence, from innovative retail electricity programs dating back to the 1970s, that customers' short-term response to electricity prices was small and that customers' willingness to be curtailed, even when they had promised to be available for curtailment, was even smaller.[101] Nonetheless, through a confluence of hopes from disparate interest groups, retail choice was adopted alongside wholesale restructuring. Nearly two decades later, there is little evidence that retail choice has yielded significant benefits beyond those from wholesale competition.

7.1. Expected Benefits and Costs of Retail Choice

At the time of its promotion in the late 1990s, the advocates of retail choice expected that it would produce two major categories of benefits: lower retail electricity prices; and wider range of retail customer service options.

7.1.1. Lower Retail Electricity Prices

There are three basic ways that retail choice might result in lower electricity prices.

First, as a complement to wholesale competition, retail choice might facilitate the development of competition that would drive improvements in the efficiency of electricity production and delivery, particularly through increased innovation and technological stimulation. This could occur because competition in the provision of retail services might enhance the competitive positions of non-utility generators by expanding the market opportunities for these generators' services.

Second, retail choice might promote more efficient retail pricing that would improve the efficiency of customers' use of the power system. This could occur particularly through greater customer participation in dynamic pricing programs. Such participation, while increasing the variability of prices paid by customers, would reduce the average prices paid by customers.

Third, retail choice would enable customers to capture economic rents from utility shareholders. This might have occurred if customers could have escaped responsibility for the costs of power plants that appeared to be expensive in the late 1990s, but turned out to be bargains just a few years later.

On the other hand, as a complement to wholesale competition, retail choice would share some responsibility for the higher costs due to generators' increased financial risks under competition and due to the coordination problems accompanying the unbundling of the generation and transmission functions.

[101] In a notorious episode in January 1994, a generator scheduling error in New York led to rotating blackouts in the mid-Atlantic states that shut down Washington, D.C. In the midst of this crisis, industrial electricity customers who were on curtailable tariffs refused be curtailed, and had their Congressmen go to bat for them (successfully) in pressuring utilities to continue giving them power while supposedly firm customers lost their power.

7.1.2. Wider Range of Retail Customer Service Options

Retail choice held out the promise of offering customers a larger menu of service options than was offered by utilities, and of allowing customers to negotiate terms of service that would better be tailored to their needs. The terms of service could conceivably vary by energy source, firmness of service, variability of price over time, duration of price guarantee, degree of price guarantee, allowed flexibility of the customer's electricity consumption, billing and payment arrangements, and bundling of electricity with other products. Retail choice was supposed to widen the menu of service options because competitive retail service providers would seek new ways to differentiate their products from those of their rivals. Within this range of service options, retail choice promised to facilitate promotion of renewable resources.

On the other hand, because non-utility providers of retail service would be more lightly regulated than utilities, retail choice also raised the prospect of consumer risks – from competitive retail service providers' performance problems, for example – that have been largely absent for regulated utilities.

7.2. Actual Benefits and Costs of Retail Choice

The promised benefits of retail choice were partly real and partly illusory. Those benefits could occur, and did occur, only to the extent that retail choice enhanced competition by broadening the market or that alternative retail energy suppliers could offer retail products that were somehow better than those offered by incumbent utilities.

The benefits and costs of electricity competition arise overwhelmingly from reforms at the wholesale level, not at the retail level. Disentangling the impacts of wholesale and retail reforms is difficult, as these impacts have arisen from a plethora of federal and state policy changes as well as major economic events like financial crises and major movements in national and international commodity markets. We nonetheless summarize the evidence on the actual benefits and costs of retail choice, following the same scheme used above for listing the expectations of the advocates of retail choice.

7.2.1. Lower Retail Electricity Prices

Measuring the price impacts of retail choice programs is difficult because retail choice is only one of many factors that affect power system costs. Statistical studies of the relationship of electricity prices to retail restructuring have reached contradictory conclusions about the price impacts of retail choice. Indeed, the EU experience indicates that the price impacts of retail choice are likely to be swamped by other factors, such as charges to support renewable resources, and that neither price regulation nor the opening of retail markets seems to have had significant impact on average residential electricity prices in the EU. Nonetheless, the evidence supports the following conclusions about price impacts of retail choice:

- Retail electricity prices in retail choice states vary with current fuel prices and other market factors, and are therefore less stable than retail prices in other states.

- Retail electricity prices in retail choice states vary by location in a manner that mimics locational variations in wholesale electricity market prices.
- Retail choice states, from the beginning of retail choice up to the present, have had retail prices persistently higher than those in other states, with the price gap varying over time with changes in fuel prices and other factors. The overall trend has been toward a lower price gap, though that is at least partly due to the happenstance of natural gas prices being low at the present time.
- Retail choice is extending the market penetration of retail pricing programs that reflect power system conditions, thus shifting loads from peak to off-peak periods. All other things equal, this lowers the average costs of producing power and tends to improve resource adequacy.

Implementation of retail choice has involved some new costs:

- Retail choice requires that billing procedures be adapted so that appropriate shares of customer payments go to the utility (for non-competitive services) and to third-party retail suppliers (for competitive services).
- Retail choice requires metering that is compatible with new retail service offerings.
- To facilitate the competition in generation services that is necessary for retail choice, there must be functional unbundling of utilities' generation function from its distribution and transmission functions. In most retail choice states, government encouraged or required utilities to divest generation assets or move them to separate affiliates, which, due to bad timing, ultimately cost customers tens of billions of dollars.

The efficiency benefits of retail choice have been limited by various public policies designed to protect consumers, particularly those that put ceilings on wholesale electricity prices and on standard offer and POLR service prices. While the free market is lauded in theory, it is not allowed to work in practice at those times when supplies are scarce; so systems of implicit subsidies are created to hide high prices from consumers, with adverse impacts on generation investment, customer response, and the profitability of offering competing retail electricity services.

Retail choice, by facilitating competitive wholesale market structures that have increased the uncertainty of generators' returns on capital, may share part of the responsibility for raising the required returns on generation investments.

There is evidence that retail choice decisions require business savvy that many consumers lack, and that less educated or low-income consumers are more likely than other consumers to make poor retail supplier choices. In particular, low-income customers are more likely than other customers to pick alternative energy suppliers who charge more than the incumbent utility.

7.2.2. Wider Range of Retail Customer Service Options

Where retail choice is offered in the U.S., roughly half of commercial and industrial customers and roughly one out of fourteen residential customers have chosen non-utility service

providers. The relatively low switching rate for residential customers is due, in large part, to the transaction costs of switching for these customers being high relative to the expected benefits of switching.

The EU experience indicates that customer switching behavior seems to be related to the degree of competition. It also indicates that where retail choice flourishes, there is reasonable hope for better service quality and higher customer satisfaction.

In the U.S., retail choice has induced relatively high participation in dynamic pricing programs, has a mixed record in promoting demand response programs, and has not generally promoted smart metering relative to traditional states.

Because retail energy suppliers in retail choice states face larger financial uncertainties than do traditionally regulated utilities, the risk of retail supplier bankruptcies under retail choice is greater than under traditional regulation. Bankruptcies and significant financial stresses have plagued retail energy suppliers primarily when they have had fixed-price sales obligations and insufficient long-term purchase rights, and when wholesale electricity spot market prices suddenly jumped.

Retail choice has engendered some fraudulent business behavior that is rare to non-existent among regulated utilities. Nonetheless, the evidence does not indicate that the problems in the electricity supply business are unusual for a retail services industry.

Retail choice has successfully promoted more green pricing participation, in terms of numbers of customers, than is typical for traditional utilities.

7.3. Directions for Future Policy

Policymakers should measure the success of retail choice according to the extent to which it adds value to basic energy and delivery services, particularly including whether it reduces customers' bills relative to what they would have been for service from the incumbent utility. The historical focus on measuring success in terms of the number of customers that have migrated to a competitive retailer or in terms of the share of megawatt hours of energy served by retail suppliers fails to capture the outcomes that matter, namely whether retailers are creating value that exceeds both the customer's switching costs and third-party provider costs. Policies to promote retail choice should refrain from forcing customers to choose an alternative retail provider and from providing any subsidy to retail providers, such as "head room" in standard offer or POLR service prices that is designed to facilitate third-party provider market entry. Smaller electricity consumers recognize that the transaction costs of switching are high relative to the prospective benefits of lower bills and better customer service, and can therefore rationally remain with their incumbent utilities.

In all states, regulators should encourage utilities to fully unbundle the pricing of generation services from that of other services, particularly distribution services. Consumers should be able to clearly compare the prices of the generation services offered by competing suppliers, without the distraction of the prices of non-competitive services. Utilities should be able to recover the costs of non-competitive services regardless of the customer's choice of competing energy supplies whether obtained through the power system or outside of the power system.

Subsequent to full unbundling of generation services from other services, regulators in retail choice states should encourage utilities to offer real-time pricing to all customers willing to pay the costs of the associated metering and billing. All customers can then have access to the wholesale market if they are willing to pay for such access. In addition to offering a real-time rate that is a simple pass-through of wholesale prices, it would be desirable for utilities and other retail energy suppliers to offer other dynamic pricing options (including curtailable service rates) and flexible pricing options with price guarantees that cater to customers' varying levels of tolerance for price risk.

To limit cherry-picking, customers who choose an alternative retail energy supplier should be ineligible to return to a conventional utility tariff. Instead, customers who want to return to the incumbent utility should be required to accept its real-time pricing rate or some other market-based rate.

In retail choice states, regulation needs to vigilantly protect consumers against retail energy suppliers' default and fraud.

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APPENDIX A. ACRONYMS

ACER	Agency for the Cooperation of Energy Regulators
ACSI	American Customer Satisfaction Index
CEER	Council of European Energy Regulators
CPP	critical peak pricing
DER	distributed energy resources
DSR	demand-side response
EU	European Union
FERC	Federal Energy Regulatory Commission
IOU	investor-owned utility
IPP	independent power producer
ISO	Independent System Operator
MW	megawatt
MWh	megawatt-hour
POLR	provider of last resort
PTR	peak time rebates
PV	photovoltaics
ROE	return on equity
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Organization
RTP	real-time pricing
TOU	time of use