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Testing the effectiveness of deregulation in the electric utility industry: A market-based approach

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TESTING THE EFFECTIVENESS OF DEREGULATION IN THE ELECTRIC UTILITY INDUSTRY: A MARKET-BASED APPROACH

by

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ABSTRACT

In this paper, I investigate one stated purpose of deregulation in the electric utility industry – to make utility operations more responsive to news releases, a proxy for market forces. My premise is that utilities providing electricity to highly deregulated states will be more responsive to market forces than those providing electricity to non-deregulated states. I employ intraday data from April to June 2001, the year after deregulation, and from 1994, the year before deregulation. I also employ the Brown-Forsythe-Modified Levene (BFL) test to determine the volatility differences between days with released news and days without released news. The results of BFL F tests for the year 2001 indicate that utilities headquartered in and serving states that have undergone substantial deregulation respond to news releases more strongly than those utilities headquartered in and serving states that are still regulated. The BFL F tests for utilities in 1994 confirm the premise that regulated utilities are less responsive to news releases. Finally, I conduct regression tests for utilities, the results of which support the findings from BFL tests – that all utilities serving highly deregulated states show pronounced responses to macroeconomic news releases. It appears that deregulation in the electric utility industry does, in fact, make utility operations more responsive to market forces and that deregulation is effective for states that implement a customer-choice model.

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Finally, but certainly not least, I want to express my gratitude to my husband, Shin-Shiu Chen, and my two wonderful daughters, Christina and Tiffany Chen, for their unwavering support and encouragement.

I wish to dedicate this dissertation to my father, Hsueh-Kang Wang, who believed in me and supported me in my study in the United States and who died three years ago.

CHAPTER 1

INTRODUCTION

This paper presents an empirical study of the effectiveness of deregulation in the electric utility industry, based on utilities' responses to two types of information: idiosyncratic news and macroeconomic news. The choice of this topic is motivated by a comparative examination of each state's restructuring plan relative to California's energy crisis and rolling blackout during the winter of 2000-2001, and Pennsylvania's successful deregulation plan that lowers retail rates, produces a reliable power supply, and improves services and choices of cleaner energy products. The deregulation of the electric utility industry is designed to reduce government intervention, to let the interaction of the supply and demand determine wholesale power price, and to encourage competition in retail markets so that customers may choose their power suppliers based on options of low rates or high-quality services. However, the success of deregulation depends mostly on each individual state's restructuring plans because these states' restructuring plans directly affect shareholders, managers, customers, and regulators. With open competition in the electric utility industry, money lost by imprudent investments can no longer be recovered. To serve stockholders more efficiently, then, management must seek cost control, on one hand, and, on the other hand, innovative ways to provide customers lower rates as well as multiple choices of services. Because stock prices respond quickly and sharply and sometimes ruthlessly to any related news, shareholders face greater risks with uncertain cash flow caused by open competition.

The contribution of the study is listed as follows: (1) the success of deregulation depends largely on each state's restructuring plan; therefore, this study provides state and federal legislatures with empirical evidence of the effectiveness of deregulation; (2) the finding of the study will influence the way state and federal legislatures enact utility laws; (3) this study provides empirical evidence of successful deregulation models; therefore, a further study of the restructuring policies of successful deregulation models could be done to improve the competition of the electric utility industry in all states; (4) this study provides methods that may be applied to other deregulated industries. To measure the success of the deregulation process of each state, I examine utilities' responses to market forces, comparing utilities providing electricity to highly deregulated states with those providing electricity to regulated states in 2001. In order to develop a more accurate and robust base of reference, I also examine the responses of the specified utilities to market forces for the year 1994 (the year preceding deregulation). My study shows that deregulation in the electric utility industry does, in fact, make utility operations more responsive to market forces and that deregulation is indeed effective for states that implement a customer-choice model. Both BFL F tests and regression tests provide substantial empirical evidence that utilities respond more vigorously to market forces in a deregulated environment and that deregulation is indeed effective in states that implement a customer-choice model.

On December 4, 2000, newspapers carried the astonishing news that California was experiencing a severe energy crisis. In fact, the state issued a Stage Two emergency, which meant that the electrical power reserve had fallen below 5 percent or was expected to fall to that critical level within two hours. At that point, suppliers were allowed to cut power to customers who had signed up for a voluntary emergency interruption program (VIP) in exchange for a 15-20 percent rate reduction. In the days and weeks that followed, California's power crisis continued to worsen. On December 7, an unprecedented Stage Three emergency was declared for approximately two hours, beginning at 5:15 p.m. A Stage Three emergency is called when the power reserve falls below 1.5 percent, a level that may trigger a "rolling" blackout, which shuts off a large area for a period of time, usually an hour, to relieve the burden to the transmission grid. Indeed, the California energy crisis grew even worse after powerful storms hit the state January 9 to 11, 2001. On the night of January 11, 2001, the California Independent System Operator (Cal-ISO), a non-profit corporation, declared a Stage Three emergency for only the second time in the state's history, and blackouts were narrowly averted when the federally owned Bonneville Power Administration in the Pacific Northwest sent 1,000 megawatts to parts of California. Still the crisis continued to deepen. On January 16, 2001, electrical power to some businesses was shut off during so-called voluntary interruptible periods, and rolling blackouts began on January 17, 2001, at 11:30 a.m., when Cal-ISO ordered the utilities in Northern California to reduce their load by 500 megawatts. By California law, it is the utilities' responsibility to provide outage plans, to be approved by the California Public Utilities Commission (PUC). The power loss caused chaos in California. For more than thirty days during the winter of 2001, the state remained in a Stage Three emergency, and throughout the spring and summer of 2001 continued to urge conservation of electric power and to declare Stages One and Two emergencies as demand increased.[1]

In April 1994, the California PUC proposed a radical restructuring plan called the "blue book" and issued an initial order for "direct access" for retail customers, which would allow customers to choose their electricity suppliers. The law, enacted in September 1996, set up a statewide plan for the transition from the traditional monopolistic electric industry to a competitive one. Low-cost private generators were able to enter the market because the large power monopolies were required to divest their generation plants and to purchase power through a power clearinghouse called Power Exchange, which, in turn, determined power prices according to supply and demand in the spot market. Customers received an immediate 10 percent rate reduction, financed by bonds to be repaid by customer fees over a ten-year period. To stabilize electric rates, the law froze rates at the 1996 level to be extended until the year 2002 or until utilities recovered their stranded cost. And to help utilities recover their stranded cost more quickly, customers were charged another fee called the Competition Transition Charge to be extended until the year 2002. The final order for implementing free-market competition for all consumers in California was issued in April 1998. As of year 2002, the transmission segment of the electric utility industry in California is still regulated, and

[1] News reports are compiled from daily news provided by the on-line resource of CNN. The site http://www.cnn.com/SPECIALS/2001/power.crisis/stories.html provides links to important daily news related to the California crisis from Dec. 6 to March 19, 2001. To compile this section I also used material from "The California Crisis – California Timeline", a source that provides news for major events related to deregulation in California form 1995 to May 2001, and available for download at http://www.pbs.org/wgbh/pages/frontline/shows/blackout/california/timeline.html

the state's investor-owned utilities have been ordered to turn over their transmission lines to the Cal-ISO, thereby assuring the reliability of transmissions.[2]

The deregulation of the electric utility industry has not been successful in California. Escalating energy costs have driven up the wholesale prices, and when demand has been high, power suppliers have been allowed to charge any price they want. Moreover, high profits by active generators have reduced the incentive for building new generation plants. Yet because of price caps, utilities are not allowed to pass on to customers the increasing cost of energy. In fact, two of the state's largest utilities were forced into bankruptcy. Further exacerbating the crisis, utilities in other states have been unwilling to supply power to California because of their fear of not being paid. Moreover, shareholders' investments have fallen sharply because of falling credit ratings and the financial instability of the utilities. In an effort to prop up the electric power investments, the California Public Utility Commission approved a rate increase of 40 percent, effective May 2001, for customers of the two largest investor-owned utilities. The government also allowed utilities to sign long-term contracts with suppliers to reduce their risk in the wholesale market, but with the financial crisis the utilities face, suppliers hesitate to offer the long-term contracts. Although deregulation was designed to increase the competition in generation and distribution segments, the outcome in California failed. In fact, the California Public Utility Commission was forced to suspend retail access in

[2] This section is compiled from "Status of State Electric Industry Restructuring Activity as of September 2002", and is available for download at http://www.eia.doe.gov/cneaf/electricity/chg_str/california.html

October 2001[3] and to submit a new plan—the ISO's Market Design 2002 proposal—to the Federal Energy Regulatory Commission.[4]

In contrast to California's failed attempt at deregulation, Pennsylvania established a successful model for deregulation in the electric utility industry. The Electricity Generation Customer Choice and Competition Act, HB 1509, was passed in December 1996.[5] Under that law, utilities were not required to divest their generation plants but to submit their own locally adapted restructuring plans by September 1997. For example, the Pennsylvania Public Utility Commission approved PECO Energy Company's restructuring plan in May 1998:

> Under this plan, PECO customers will receive an 8 percent rate reduction next year, 6 percent in 2000, with 20 percent savings expected for those willing to shop for power. PECO will be allowed to recover $5.26 billion in stranded costs over a period of 12 years. Two-thirds of customers will be phased in to retail competition by January 1999 and all customers by January 2000.[6]

The success of Pennsylvania's deregulation plan may be inferred from the following comments by John Hanger, former Pennsylvania Commissioner and currently CEO and President of PennFuture:

> In 1996, Pennsylvania's electricity rates were about 10-15% above the national average. Today they are 4% below the national average. Pennsylvania's consumers have saved $2.84 billion since passage of its electricity competition statute in December 1996. 80,000 customers are buying cleaner or renewable energy products who never got these products from monopolies. . . . No customer is paying more than what they were paying on Jan. 1, 1997. . . . 8,000 megawatts of new plant construction

[3] See the "Status of State Electric Industry Restructuring Activity as of September 2002," pp.6. Available for download at www.eia.doe.gov/cneaf/electricity/chg_str/california.html

[4] See the "Status of State Electric Industry Restructuring Activity as of September 2002," pp.1. Available for download at www.eia.doe.gov/cneaf/electricity/chg_str/california.html

[5] See the "Status of State Electric Industry Restructuring Activity as of September 2002," pp.2. Available for download at www.eia.doe.gov/cneaf/electricity/chg_str/pennsylvania.html

[6] See the "Status of State Electric Industry Restructuring Activity as of September 2002," pp.3. Available for download at www.eia.doe.gov/cneaf/electricity/chg_str/pennsylvania.html

> will come on line in 2001 and 2002. . . . More than 50% of all customers who have switched in the country have switched in Pennsylvania . . . .[7]

Nationally there is no time frame for restructuring electric utilities; each state sets its own schedule. As expected, some states have moved quickly, whereas others have been more cautious. For instance, the report provided by the Louisiana Public Service Commission (PSC) in May 1999 recommended that no action be taken toward retail competition because of the lower-than-average electric rates and the relatively few generators in the state. However, the Louisiana PSC did issue a draft of a restructuring plan, effective January 2003, that would allow large industrial customers to choose their suppliers. But Louisiana has not yet called for utilities to divest their generation plants. The Louisiana PSC has requested another study to be due in 2005 to determine whether direct access will benefit all customers.[8]

For almost a century, the electric utility industry has been regulated by the government, at state and federal levels. The evolvement of the electric utility industry and the development of authority held by both state and federal governments over the industry are quite interesting. The opening of Thomas Edison's generating station on September 4, 1882, in New York City initiated the modern electric power industry.[9] The New York City gas and electric carbon-arc commercial and street lighting system served fifty-nine customers in a one-square-mile radius. By the end of the 1880s, many cities had small stations serving a small area. Then in 1896, using the hydraulic power from

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[7] See the Retail Energy Deregulation (RED) Index, 2nd edition, July 2001, from the Center for the Advancement of Energy Markets, pp. 33.

[8] This section is compiled from "Status of State Electric Industry Restructuring Activity as of September 2002", and is available for download at http://www.eia.doe.gov/cneaf/electricity/chg_str/louisiana.html

[9] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, pp. 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

Niagara Falls with a multiple-phase generator designed by Nikola Tesla, George Westinghouse built the Niagara power station to transmit a massive amount of power to Buffalo, New York, over twenty miles away.[10] Soon, private utilities sprang up rapidly, and competition was strong. The next big change came early in the twentieth century, when private electric utilities merged into large utility holding companies to offer more economical rates in large-scale operations by serving large cities and by reducing risks with diversification of investments in a variety of geographical areas.[11] "By 1930, 90 percent of all operating utilities were controlled by nineteen utility holding companies."[12]

The uncontrolled expansion of service areas by these utility holding companies prompted state regulations in the early 1900s. "Georgia, New York, and Wisconsin established State public service commissions in 1907, followed quickly by more than 20 other States. Basic State powers included the authority to franchise the utilities to regulate their rates, financing, and service, and to establish utility accounting systems."[13] However, the state regulations had no power over interstate commerce, a fact that resulted in abuses by utility holding companies. A "pyramiding process" allowed these holding companies to increase their control over the bottom level of the operating utilities. First, the holding companies often issued bond and preferred stock to finance

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[10] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, pp. 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

[11] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.3. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

[12] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.6. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

[13] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, pp. 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

the acquisition of the operating utilities, which in turn caused many operating utilities to fail. Second, the holding companies charged "exorbitant service fees to their subsidiary companies" and "these excessive fees (e.g., construction charges) were then capitalized into the accounts of the holding company, which in turn inflated the operating utility's book value and caused the rates charged to the customers to increase."[14] Last, because of the excess benefits generated by the pyramid structure of holding companies, the sale of the operating utilities to other holding companies inflated prices well above their market value. As a result, the Public Utility Holding Company Act (PUHCA) was passed in 1935. Under this bill, all utility holding companies were required to register with the Security and Exchange Commission (SEC) and to come under the supervision of the SEC. This bill also required each utility holding company that operated interstate commerce to be integrated into an efficient system, preferably confined to a single state so that it could be regulated by that state's public service commission. By the end of 1950, all utility holding companies were integrated or simplified into smaller organizations.[15]

The growing demand for electricity from 1945 through 1970 was met by a combination of the expansion of privately owned utilities and federally owned power plants, development of commercial nuclear power plants, and, most significantly, improved technology that provided greater efficiency and reliability in generation and transmission.

[14] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.5. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

[15] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.12. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

> These productivity gains had a more substantive effect on customers, who watched the price of electricity decline. Adjusted to 1992 terms, a residential customer in 1892 paid more than 4 dollars for each kilowatt-hour, . . . But by 1907, the price had dropped by more than half, to $1.56 per kWh. As utilities pursued incremental technological advances, prices fell to 55 cents in 1927 and 19 cents in 1947. . . . the price of electricity dropped to 13 cents per kWh in 19[5]3 and 9 cents in 1967.[16]

For almost a century now – since the beginning of electric power regulation – every electric utility system has been regulated by both federal and state governments when it operates three functional segments – generation, transmission, and distribution – as a monopolistic market. But a 1944 Supreme Court ruling allowed Hope Natural Gas (Federal Power Commission vs. Hope Natural Gas Company) to cover the original or replacement cost, plus a reasonable rate of return;[17] thereby a regulation policy was established which gave customers the lowest rates possible as well as allowing utilities a reasonable rate of return.

During the 1970s, the electric utility power industry faced major challenges. Increasing oil prices, caused by the oil embargo and energy crisis in 1972, drove the power cost up. Then capital costs increased because of growing inflation, and, finally, the demand for nuclear power plummeted because of environmental concerns prompted by the incident at the Three Mile Island nuclear plant near Harrisburg, Pennsylvania.[18] To meet these challenges, several steps were taken. In order to reduce dependency on

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[16] See the "Post World War II "Golden Years," Available for download at http://americanhistory.si.edu/csr/powering/hirsh2/frmain.htm

[17] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, pp. 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

[18] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, pp. 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

foreign oil, to promote alternative energy sources, and to increase competition among generation plants, Congress passed the Public Utility Regulatory Policy Act (PURPC) of 1978 that would encourage a new class of producers, called Independent Power Producers (IPPs) or Qualifying Facilities (QFs), to join the commercial power production market. These unregulated IPPs generated power for their own use, plus a surplus to sell, or they co-generated a usable energy as a byproduct of generation. For instance, the paper industry often produces wood waste as a byproduct of the manufacturing process, which, in turn, can become a so-called renewable fuel to generate electricity.[19] With the Federal Energy Regulatory Commission's approval, IPPs were allowed to sell their energy to utilities at the marginal cost (avoided cost) that utilities would have incurred in producing that power.[20] These avoided costs were usually set up in favor of producers to encourage more unregulated producers to enter the wholesale market. With this favorable support, IPPs produced about 9 percent of all electricity in the U. S. during 1991.[21]

A long debate over the PUHCA reform movement began in the 1980s.[22] Those who advocated reform emphasized that the Act put limits on diversification that, in effect, weakened the holding companies' competition and growth. Further, the advocates maintain, the Law also prevented IPPs from purchasing operating utilities because that

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[19] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

[20] See the report from the *Value Line Investment Survey* dated February 24, 1995, Vol. 50, Pt. 4, pp. 1732

[21] See the "The Changing Structure of the Electric Power Industry: An Update," Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, U.S. Department of Energy, September 1996, pp. 105-115. Available for download at www.eia.doe.gov/cneaf/electricity/page/electric_kid/append_a.html

[22] Detailed debate over the PUHCA reform can be found in the article of "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, Office of the Administrator, U.S. Department of Energy, Jan. 1993, pp.23-27.

would put them under the regulation of the PUHCA; thus, IPPs would be forced to divest all businesses unrelated to utilities.[23] Those who opposed the reform of the PUHCA contended that repealing of the Act would promote monopoly control in the industry and the diversification would only increase difficulties for governments in monitoring the businesses. Moreover, the diversification would also increase the risk, not only to shareholders but also to ratepayers. Two Public Laws, 99-186 and 99-648, passed in 1985 and 1986 respectively, provided limited diversification for utilities, IPPs, or any other nonutilities. Public Law 99-186 allowed utility holding companies to purchase coal-generation facilities in any geographical area; whereas Public Law 99-648 allowed nonutility holding companies to own one gas utility subsidiary.[24] With the increasing number of mergers and acquisitions, most of the utility holding companies operated two types of businesses: regulated and unregulated.

The process of the PUHCA reform was accelerated when President Bush issued an order on July 26, 1989, directing the Department of Energy to develop a comprehensive National Energy Strategy. The main focus of the National Energy Strategy was to allow generators to freely compete in wholesale markets across the United States.[25] After a long debate in the House, the PUHCA reform was passed by Congress in 1992 as the Energy Policy Act. This Act is the most comprehensive piece of legislation in energy history and impacts all producers, utilities, and customers

[23] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.25. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

[24] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.29. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

[25] See the "Public Utility Holding Company Act of 1935: 1935-1992," Energy Information Administration, U.S. Department of Energy, Jan. 1993, pp.57. Principal author of the report is Dr. Calvin A. Kent, Administrator of the Energy Information Administration.

nationwide as well as federal and state governments. Producers are allowed to petition the Federal Energy Regulatory Commission for access to transmission grids owned by private utilities, and utilities that provide the services are allowed to charge fees to recover their cost. In this Act, a new class of generators, Exempt Wholesale Generators (EWGs), is defined as "any person determined by the Federal Energy Regulatory Commission (FERC) to be engaged directly . . . at wholesale [market exclusively]."[26] These EWGs are not subject to regulation under the PUHCA, but serve to increase the competition in the wholesale market and to expedite the deregulation of the generation segment of the electric utility industry.

In July 1996, Congressman Dan Schaefer introduced a bill to further deregulate the distribution segment in the electric utility industry. Under his proposal, each state was required to submit a restructuring plan allowing customers to choose their power suppliers by December 15, 2000.[27] While the FERC set guidelines for wholesale market rules and transmission accessibility, Schaefer's bill gave states freedom to implement retail access.[28]

Since deregulation legislation, many states, like California, Rhode Island, Pennsylvania, New Hampshire, and New York, have responded quickly and have either proposed or implemented restructuring plans for the transition in the electric utility industry from a monopolistic model to a customer-choice model. Because of the independence of the restructuring plans implemented in each state, the progress of the deregulation in the retail market in each state is also different. As of September 2002, the District of Columbia, Illinois, Maine, Maryland, Massachusetts, New Jersey, New York,

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[26] See the Energy Policy Act, Section 711 of subtitle A for details.
[27] See the report from the *Value Line Investment Survey* dated August 23, 1996, Vol. 51, Pt. 7, pp. 1729
[28] See the report from the *Value Line Investment Survey* dated October 11, 1996, Vol. 52, Pt. 1, pp. 701

Ohio, Pennsylvania, Rhode Island, and Texas have opened full retail access to all customers. Some states opened retail access only to commercial and industrial customers – Nevada and Oregon. One state – Oklahoma – has delayed implementation indefinitely. California has suspended retail access, and Louisiana is still studying options for partial deregulation.[29]

At the beginning of the twentieth century, policy makers believed that the vertical integrated structure of the electric utility industry provided large-scale economies; thereby offering customers lower electric rates. Later in the century, electric utilities were further protected, guaranteed a cost recovery under the cost-of-service regulation. Because of imprudent investments and increased power costs during the 1970s, electric rates spiked, and pressure by customers to lower electric rates brought about the need for deregulation. The history of the electric utility industry reveals the interesting fact that both regulation and deregulation were requested by the same groups, customers and electric utilities; therefore, it is very important to know whether the implementation of governmental policies serves the purpose that policy makers intend. My conjecture is that with regulation as a protection cap for the utility industry, market becomes less efficient and more sluggish to the response of news releases. Furthermore, in a highly deregulated market, information will be incorporated in prices rapidly and response to new information will be strong. Because the success of deregulation in the electric utility industry depends on the response of utilities to market forces, I test the effectiveness of deregulation in the utility industry, using the utilities' responses to macroeconomic news, the best measures of market forces, and the idiosyncratic news. Ross (1989) maintains

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[29] See the "Status of State Electric Industry Restructuring Activity, Timeline as of September 2002," Available for download at www.eia.doe.gov/cneaf/electricity/chg_str/retail_access_timeline.html

that the arrival of information has a direct impact on the volatility of stock prices in an arbitrage-free environment. So in order to observe stock return responses to news releases, I employ second-by-second intraday stock returns to test the volatility differences between days with news releases and days without news releases. Thus, the value of this study is twofold: to provide methods for testing the effectiveness of deregulation that may be applied to any deregulated industry and to provide empirical evidence of the effectiveness of various states' restructuring plans. Further study of the implementation of the successful models will help policy makers expedite restructuring plans in the electric utility industry in all states.

CHAPTER 2

LITERATURE REVIEW

There are three prevailing theories of economic regulation: Public Interest theory, Capture theory, and Buffering theory. The Public Interest theory holds that traditional regulation corrects market failures on behalf of consumers. The Capture theory contends that regulation is captured by regulated industries to protect their interests at the expense of consumers. The Buffering theory refers to a wealth redistribution among participatory groups in which a successful regulator adjusts regulated prices to benefit both producers and consumers.

Not many empirical studies support the Public Interest theory, because their findings show that regulation has only minor and slow effects in lowering prices and in alleviating price discrimination for consumers. Similarly, few empirical studies give support to the Capture theory, which maintains that industrial groups profit from charging higher prices and exercising price discrimination. Contrary to the weak support for the Public Interest theory and the Capture theory, many studies support the Buffering theory by providing evidence that regulation reduces firm-specific risks as well as systematic risk, thereby increasing shareholders' wealth, and, at the same time, offering lower prices to consumers. However, in a deregulated environment, firms are no longer "buffered" by regulation, but, in fact, are more sensitive to economic forces and idiosyncratic news.

A number of empirical studies examine the following concerns: (1) factors that affect security price adjustment, (2) the speed of price adjustment to idiosyncratic news and macroeconomic news, measures of economic forces, and (3) volatility persistence. However, no articles examine the differences among responses to macroeconomic news and idiosyncratic news before and after deregulation. Furthermore, no articles probe the effectiveness of deregulation by comparing responses to macroeconomic news and idiosyncratic news between highly deregulated firms and regulated firms in any industry. According to the Buffering theory, the responses to economic forces and idiosyncratic news are stronger and the volatility persistence is weaker in a deregulated environment than in a regulated environment. It follows, therefore, that the responses to economic forces and idiosyncratic news are stronger and the volatility persistence is weaker in a highly deregulated environment.

2.1: An Overview of Theories of Economic Regulation

"Economic regulation" refers broadly to any government intervention, at either state or federal level, in the economic sphere (Posner 1974); but within this broad category of economic control, there are more narrowly defined areas to be analyzed: the forms of government intervention, the beneficiaries of regulation, and the effectiveness of regulation (Stigler 1971). There are basically three prevailing theories of economic regulation: Public Interest theory, Capture theory, and Buffering theory.

2.1.1: Public Interest Theory (Consumer Protection Theory)

The development of the Public Interest theory is based on two assumptions: (1) that the economic market is inefficient and inequitable without regulation; and (2) that government regulation is costless (Posner 1974). The Public Interest theory advocates traditional regulation, according to its proponents, and serves to correct market failure on behalf of consumers. One example of market failure occurs when goods or services needed by a majority of customers in a specific area are controlled by a single company. That company, having monopolistic power, can then exploit customers by charging exorbitant prices or by refusing to provide goods or services to unprofitable areas. Therefore, according to the Public theory, the demand for regulation serves to protect customers from exploitation or abandonment by monopolistic companies. Another example of market failure is an externality, which occurs when an industry impacts others either negatively or positively and is not penalized or compensated. The use of taxes for industries with negative externality, the use of subsidies for industries with positive externality, and the use of property rights to promote technological inventions are examples of regulation for the benefit of the pubic interest.

2.1.2: Capture Theory (Producer Protection Theory)

In contrast to regulation for protecting consumers' interest, the Capture theory requires that regulated industries or producers seek regulation to protect their own interests. This theory assumes that producers have influence on the structure and process of regulation; thus, regulation is "captured" by producers to gain benefits from regulation.

Stigler (1971) proposes a refined version of the Capture theory. He maintains that regulation is the product of political decision-making, which is different from market decision-making. Market decision-making occurs frequently and involves only those who are directly affected, whereas political decision-making involves all voters, interested or uninterested. The price of the political decision-making includes costs of lobbying, contributions to political parties, and costs of disseminating information to individuals who have little or no concern with the issues. Thus, "producer protection," as this process is called, benefits a small group of industries holding large financial resources, because only the smaller, more concentrated industries with a large per capita stake have enough resources to invest in campaigns for legislation (Peltzman 1976). Therefore, Stigler argues, the demand for regulation does not correct market failure for customers' sake, but does, in fact, serve to transfer wealth from a large number of diffused group (customers) to a compact and more influential group, i.e., participatory industrial group, through regulatory processes in the form of cash subsidies, price control, and entry restriction.

2.1.3: Buffering Theory (Political Support Theory)

Instead of protecting only one compact industrial unit, the so-called Buffering theory refers to regulation support from a combination of industry and consumers, "[t]he former obtaining some monopoly profits from regulation, the latter obtaining lower prices (or better service) than they would in an unregulated market—all at the expense of unorganized, mostly consumer, groups" (Posner 1974). This Buffering theory, developed by Peltzman (1976), adapts Stigler's Capture theory in a formal model to demonstrate

Peltzman's own theory that economic regulation is not merely a wealth transfer from customers to a producer group, as suggested by Stigler, but a wealth redistribution through a political process among interested groups.[30] There are three interpretations of Peltzman's model: (1) that total wealth is distributed among interested groups: producers and customers; (2) that regulation reduces firm-specific risk, and possibly systematic risk as well; and (3) that the price discrimination problems existing in monopolistic and competitive markets are attenuated through "cross-subsidization."

In response to changes in demand and costs, Peltzman shows in his model how a successful "buffering" regulator adjusts the regulated prices to benefit both producers and customers. Thus, the total wealth that a regulator can distribute changes when economic factors change. For example, a change in marginal costs, in productivity, or in demand affects the total profit that the regulator can distribute. Because of this, a "buffering" regulator makes appropriate adjustments so that customers absorb some of producers' losses and, in return, producers share gains with their customers. For example, an increase in the marginal cost of production reduces the total profit, which, in turn, prompts the regulator to increase the price charged to customers, thereby buffering producers' losses. On the other hand, an increased demand in production prompts the regulator to reduce prices. Thus, the higher profits generated by increased demand will be shared by customers.

Moreover, the structure of regulated prices provides a cushion, or buffer, for producers against the impact of sudden changes in demand and costs, thereby reducing

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[30] See Sam Peltzman, "Toward a More General Theory of Regulation," *The Journal of Law and Economics*, April 1976, pp. 211-240 for the details of the mathematical model.

the volatility of stock prices and the risk of the regulated firms. If the changes are economy-wide, regulation should even reduce systematic risk.

Furthermore, a "buffering" regulator will suppress some economic forces in order to attenuate the problem of price discrimination among customers. One example of an economic force that a regulator may suppress is cost disparity; high-cost customers are subsidized by the low-cost customers. This phenomenon appears in many industries; e.g., utility customers in rural areas subsidized by those in urban areas and airline services in unprofitable small cities subsidized by large cities. Consequently, regulated firms are less sensitive to economic forces than unregulated firms.

2.2: Empirical Study Relating to Regulated Theories

2.2.1: Public Interest Theory

If regulation does, in fact, protect consumers, one should find a consistency of increased wealth of consumers directly related to the implementation of regulations in different industries, such as drug, electricity, water, natural gas, airline, cable, and transportation. However, empirical studies do not support this Public Interest theory. For instance, the 1962 Kefauver-Harris Amendments to the Food, Drug, and Cosmetics Act were designed to give the Food and Drug Administration authority to regulate new drugs for safety and effectiveness before they enter the market (Peltzman 1973). But in a cost-benefit analysis for 1970, Peltzman found that the cost of implementing the amendment far exceeded the benefit. Peltzman maintains that "[t]he net effect of the amendments on consumers is comparable to their being taxed something between 5 and 10 percent on their $5 billion annual drug purchases."

Moreover, findings from various studies show little effect of regulation on monopolistic industries like electricity and natural gas, both of which are considered natural monopolies because of their extensive economic power. Therefore, regulation is designed to diminish its economic power for customers' benefit in terms of price, availability, and service quality (Jordan 1972).[31] However, empirical studies suggest that regulation has little effect on price and price discrimination. Electric utilities are a good example. Stigler and Friedland (1962) conclude that "[t]he regulation of electric utilities by state commissions from 1907 through 1937 had no measurable impact on the level of electric utility rates, on the charging of discriminatory prices, and on the market values of utility stocks." Likewise, studies of electric utility rates on commercial, industrial, and residential customers by Jackson (1969) and Moore (1970) indicate that regulation has little effect on electric utility rates. Although the earliest state regulations started in 1907 in Georgia, New York, and Wisconsin to lower electric utility rates, commercial and industrial consumers began to benefit from lower electric utility rates during the years of 1940-1950. The least powerful group, residential customers, who were supposed to benefit the most, had waited until 1960 to realize lower rates (Jackson 1969).

Although regulation of monopolistic industries was intended to lower prices and reduce price discrimination for public consumption while limiting producers' economic power, all research findings show minor and slow effects of regulation in lowering prices and reducing price discrimination. Posner (1972, 1974) suggests two reasons to explain the minor and slow effects of regulation in lowering prices and reducing price discrimination: (1) agencies or commissions, usually at the state level, are given authority

[31] See Jordan (1972) for detailed discussion about prior market structure and the effects of government regulations in monopolistic, oligopolistic and competitive industries.

to regulate rates, but it is "mission impossible" to figure out the costs of regulated firms; (2) with the increasing complexity of economy, the costs of effectively supervising agencies by legislation rise over time.

Upadhyaya et al. (1997) examine the stated purpose of the Public Interest theory and the failure to produce benefits laid out by Posner: lowering prices and reducing price discrimination in public consumption while limiting producers' economic power. Upadhyaya et al. show that the regulation is ineffective in reducing the price of the electricity for 1922 and 1927. However, the study does find a negative relationship between utility prices and regulation for the year 1932, indicating that regulation is "somewhat successful in lowering the price of electricity." MacAvoy (1971) supports Posner's conclusion that customers suffered a shortage of natural gas due to the reallocation of reserves to unregulated industrial users in the 1960s as a result of inequitable price ceilings set by Federal Power Commission. All these studies provide some evidence that the intention of regulation is for consumers' benefit, but has little effect in reducing prices because of ineffectiveness.

2.2.2: Capture Theory

Stigler (1971) examines the Capture theory by studying the weight limits on trucks and occupational licensing and finds that weight limits on trucks supports the Capture theory whereas occupational licensing does not. Stigler examines three possible factors that might have an influence on the regulations of weight limits on trucks for all states in 1932 and 1933: (1) the number of trucks per 1000 farmers, (2) the length of the average railroad haul, and (3) the percentage of well-preserved highways in each state.

These three factors represent three participatory groups: (1) farmers who own trucks for transportation of goods, (2) railroads that transport farm products, and (3) the public that is most concerned about the damage from heavy trucks. The results show that these three factors have impact on regulations of the weight limits on trucks for all states in 1932 and 1933 and "the larger the truck population in farming, the less competitive the trucks [are] to railroads, and the better the highway system." However, the effects of occupational licensing do not support the Capture theory. By contrast, Upadhyaya et al. (1997) support the Capture theory and suggest that while regulation may initiate lower price and reduce price discrimination for consumers' benefit, in the long run the industry becomes more influential in regulation, which, in turn, causes the price of electricity to increase.

Some empirical studies support the Capture theory by providing evidence that producers exploit price regulation to get higher profits. Peltzman (1971) finds evidence that privately owned utilities are more likely to manipulate price control for their own gain than are government-run utilities. And Jordan (1972), in his study of the effectiveness of the Civil Aeronautics Board and the Interstate Commerce Commission regulations, concludes that regulation has not effectively attenuated price discrimination in interstate airlines, or in railroad, or in motor carriers, but in each instance "[r]egulatory actions and procedures have allowed the carriers . . . to reach agreements regarding prices and to enforce adherence to these agreements." In fact, there have been significant increases in price levels for all these. All these studies evidence that producers have influence on the structure and process of regulation; thus, regulation is captured by producers to gain benefits from regulation.

2.2.3: Buffering Theory

The Buffering theory proposed by Peltzman (1976) maintains that total wealth is distributed among participatory groups, regulation reduces firm-specific risk and possibly systematic risk as well, and the price discrimination problem is attenuated through cross-subsidization. Whereas many researchers' findings support the Buffering theory, others argue that regulatory lag causes price stickiness that, in turn, increases firm-specific risk and decreases shareholder wealth because of the fluctuation of profit streams.[32] Recent empirical studies in the utility industry focus on two factors that determine stock returns: (1) the relationship between regulation and systematic risk and firm-specific risk, and (2) the relationship between regulation and cost of capital.

Using the relationship between daily returns and the natural log of ratios of profit-maximizing price to actual price in nine states for years 1969 and 1974 to test whether regulation increases systematic risk for 1974, when fuel prices rose dramatically, Meyer and Leland (1980) show that because of regulated price, rising costs associated with the energy crisis did not result in higher systematic risk. Employing the same method of analysis, Norton (1985) reexamines the effect of regulation on systematic risk for the period 1969-74 using monthly data and the average of the 1969 and 1974 ratios of profit-maximizing price to actual price. Norton supports Meyer and Leland's finding that regulation lowers systematic risk during the period of rising costs as a result of wealth redistribution.

Norton (1985) further examines the relationship between the intensity of regulation, classified as unregulated, weakly regulated, and strongly regulated, and systematic risk in the utility industry, where the intensity of regulation is determined by

[32] See Joskow and MacAvoy (1975), Spann (1976), Chandrasekaran and Dukes (1981), Archer (1981).

three factors: (1) the power of the respective commissions, (2) the size of commission staff, and (3) the budget size. He concludes that the higher the intensity of regulation, the lower the systematic risk. Contrary to other research findings, Norton shows that leverage (total debt/assets), capital intensity (net plant/total assets), diversification (total revenue/electric operating revenues), and manufacturing intensity (manufacturing employees/total employees) are not significant in determining systematic risk when the intensity of regulation is taken into account for systematic risk.

Joskow (1974), Clarke (1980) and Norton (1988) all document the fact that regulation shifts some of the burden of rising costs from producers to consumers, a fact which supports the Buffering theory. Norton (1988) also examines the impact of OPEC oil supply shock on shareholder wealth for the utility industry and finds an adverse effect on shareholder wealth caused by the 1973 oil supply shock. But contrary to the belief that regulatory lag amplifies the adverse effects, the adverse effects are softened by regulation. Thus, he concludes that "shareholder wealth is endogenous to regulation" and that a "regulation-induced buffering effect" reduces firms' risk and, in turn, increases shareholder wealth.

The first line of studies indicates that regulation provides a cushion for the utility industry against unexpected changes of demand and cost. The impact of rising costs does not trigger higher systematic risk. Since regulation sometimes shifts some of the burden caused by rising costs from producers to consumers, it reduces the variability of stock prices and the risk for the regulated utilities. The higher the intensity of regulation, the lower the systematic risk. According to these studies, regulation results in increasing shareholders' wealth.

Another line of studies deals with the relationship between regulation and the cost of capital. In the past, electric utility rates have been regulated to give customers low rates and to allow utilities to cover the cost of service, plus a fair rate of return (Blacconiere et al. 2000); therefore, regulators normally assume that the cost of capital is a determinant in the regulated rate of return. However, Brennan and Schwartz (1982) show that the expected regulatory policy determines the cost of capital in the utility industry. Archer (1981) studies the relationship between the intensity of regulation and the cost of capital and finds that the higher the intensity of regulation, the slower the response to a utility's request for rate increases and the higher the cost of capital for the requesting utility.

The second line of studies indicates that the cost of capital is endogenous to regulation. The higher the intensity of regulation and the slower the response to a utility's request for rate increases, the higher the cost of capital for the requesting utility. Whereas some regulatory policies reduce the cost of capital, some have adverse impact on the cost of capital. The increased cost of capital reduces the market value of firms and thereby decreases shareholders' wealth.

All the above studies show that since regulatory policies have profound influence on firm-specific risk, systematic risk, and the cost of capital, both expected earnings and earnings' responsiveness to market environment are affected, depending on the intensity of regulation and the effectiveness of regulatory policies. Utilities operating in states with high intensity of regulation show less response to market forces than utilities operating in states with less intensity of regulation.

Conversely, in a deregulation environment, producers are no longer "buffered" from exogenous economic impact; therefore, increasing competition along with uncertainty of expected earnings increases firms' risks as well as systematic risk, which, in turn, decreases shareholders' wealth. Nwaeze (1999) examines the effects of the deregulation act, Energy Policy Act of 1992, on the market value of earnings and asset components for electric utilities. The uncertainty of future earnings causes managers to take precaution when dealing with competition, and findings suggest that managers increase capital spending to alleviate the associated risk and reduce capital intensity for future competition. He also finds that market value of each asset component is sensitive to the market movement and long-term interest rates. Thus, the adverse effect of the Energy Policy Act for the incentive-regulated utilities and for those regulated by a performance-based compensation scheme is less for traditional utilities. Finally, the study shows that overall deregulation of the electric utility industry causes the market value of traditional utilities to drop.

Blacconiere et al. (2000) examine the effect of ongoing deregulation in the electric utility industry on the relation between market value, book value, and earnings for all investor-owned electric utilities for 1988-1996 and suggest that deregulation influences the relevance of financial statement information. They show that book value becomes less important in explaining the value of a firm whereas earnings become more important in explaining the value of a firm. Since each state has a different pace of deregulation, the Blacconiere' study shows that the importance of earnings in explaining market value increases in highly deregulated states.

2.3: An Overview of Information Theory and Its Empirical Studies

The Efficient Market Hypothesis (Fama 1970) says that the market value of an asset reflects all relevant information, which includes the information regarding the expected cash flows, as well as the discount rate that reflects the riskiness of the expected cash flows. Any information about the timing and the magnitudes of expected cash flows and any changes in expected real interest rates, inflation, default risk, and various risk premiums are quickly incorporated into the market price of the asset. Thus, information relevant to the timing and the magnitudes of expected cash flows is idiosyncratic news and macroeconomic news. And because this is true, market efficiency and volatility of security returns have intrigued researchers for over three decades, especially studies that (1) identify the relevance of information and (2) analyze the speed of price adjustment to relevant information and volatility persistence.

The study by Patell and Wolfson (1984) analyzes the speed of price adjustment to idiosyncratic news: earnings and dividend announcements and the volatility persistence of stock returns. They find that it takes only five to ten minutes to adjust security prices in response to earnings and dividend information and that return volatility continues even into the following day.

Many studies examine the impact of macroeconomic news announcements on different markets: (1) interest rate and foreign exchange futures markets (Ederington and Lee 1993), (2) the British Pound, Canadian Dollar, Deutsche Mark, Japanese Yen, and Swiss Franc currency futures markets (Christie-David et al. 2000), (3) the Municipal over Treasury bonds, the Treasury notes over Treasury bonds, and the Treasury bills over Eurodollar futures interest-rate spreads (Aggarwal et al. 2001), (4) the British Long Gilt, the German Government Bond, the Japanese Government Bond, the Italian Government Bond, and the U. S. Treasury Bond futures (Christie-David et al. 2002).

Ederington and Lee (1993) find that the majority of the price adjustments occur within the first minute of trading after a news announcement. But because information is not fully incorporated into prices during the first minute, high volatility remains for at least fifteen minutes after announcement, as more information accrues in the market, and remains slightly elevated for several hours. They also find that the direction of price adjustments after the first minute of trading is independent of the first-minute price adjustment, implying that individual investors form their expectations about the future security prices. Christie-David et al. (2000) also find that the majority of the price adjustments occurs within the first few minutes of trading after a news announcement and that volatilities remain high for fifteen to forty-five minutes, depending on respective markets. In the studies of Aggarwal et al. (2001) and Christie-David et al. (2002), however, the results show that it takes considerable time, varying from fifteen to seventy-five minutes, for the prices to adjust fully to a relevant news announcement.

It has been demonstrated that different markets react differently to macroeconomic news announcements. For instance, Jain (1988) shows that security prices respond to the release of the consumer price index (CPI) and the money supply. Ederington and Lee (1993) find that the employment report, the producer price index (PPI), the CPI, and the durable goods orders had the greatest impact on interest rates in the 1988 to 1991 period. One study also shows that the PPI and the CPI affect Gilt and Bund futures (Christie-David et al. 2002). In another study, Flannery and Protopapadakis (2002) examine the impact of real macroeconomic variables on aggregate equity returns and find that the CPI, the PPI, a Monetary Aggregate, Balance of Trade, Employment Report, and Housing Starts affect the aggregate equity returns.

2.4: Summary

The market value of an asset reflects all available relevant information; that is, information which includes the expected cash flows and the discount rates reflecting the riskiness of these expected cash flows. Since regulation provides a buffer for the utility industry against unexpected changes of demand and cost, the riskiness of a utility's expected cash flows is reduced, a fact which, in turn, increases the market values of utilities. Many empirical studies support the position that regulation reduces systematic risk and firm-specific risk; therefore, yielding evidence that producers are buffered by regulation and that regulated firms are less responsive to exogenous impact. However, the utility industry has been moving toward deregulation in retail market since 1994, when each state took control of its own pace of deregulation (Blacconiere et al. 2000). If the Buffering theory holds, then the stock prices are less sensitive to the arrival of information in a regulated environment. Thus, the response to economic forces and idiosyncratic news in a regulated environment is weaker than that in a deregulated environment. For this reason, those utilities operating in highly deregulated states respond to economic forces and idiosyncratic news more strongly than those operating in less deregulated or regulated states. I am not aware of any article studying the differences of responses to macroeconomic news and idiosyncratic news for firms in any industry that operate in a regulated environment and that later move into a deregulated environment. My conjecture is (1) that the economic forces and idiosyncratic news will have less influence on utilities before deregulation than after deregulation and (2) that the responses to economic forces and idiosyncratic news are weaker in a regulated environment. Since the pace of deregulation in utilities varies among all states, the speed of price adjustment to economic forces and idiosyncratic news and the volatility persistence will be different. My conjecture is that the responses to economic forces and idiosyncratic news are stronger in a highly deregulated environment than those responses in a less deregulated or regulated environment.

CHAPTER 3

DATA AND RESEARCH DESIGN

3.1: Identification of Two Categories of Utilities

Empirical studies indicate that regulation provides a cushion for the utility industry against exogenous economic impact, thereby reducing the variability of stock prices and the risk for the regulated utilities. In other words, firms that operate in a regulated environment are less responsive to economic forces and idiosyncratic news. After the industry has been deregulated, these firms are not "buffered" by the regulation; thus, they become more responsive to economic forces and idiosyncratic news. Some studies also indicate that the higher the intensity of regulation, the lower the systematic risk and firm-specific risk. In other words, highly deregulated firms normally face higher risk because they respond to exogenous factors more quickly and more strongly than less deregulated firms. However, the success of deregulation depends largely on each individual state's restructuring plans because each state establishes its own level and pace of deregulation.

In an effort to provide policy makers with empirical evidence regarding the impact of deregulation and the relative effectiveness of each state's restructuring plan, I have selected the year 2001 as the year after deregulation and the year 1994 as the year before deregulation. Given the fact that each state establishes its own pace of deregulation, I then identify two categories of utilities in order to examine the differences of responses to news releases in 2001:

(i) Utilities providing electricity to states that are considered to be moving successfully toward a competitive retail market.

(ii) Utilities providing electricity to states that have rejected the implementation of customer-choice models.

First, I identify states that are moving toward to a competitive retail market and states that have regressed. My sample is based on the Retail Energy Deregulation (RED) Index, 2nd edition, July 2001, from the Center for the Advancement of Energy Markets. The RED Index ranks states (50 states and the District of Columbia) using 22 attributes that affect the transition from a monopolistic model to a customer-choice model, and measures each state's progress in its development of policies related to retail energy competition. A detailed list of the ranks and the index scores for 50 states and the District of Columbia, along with a list of the attributes used to determine index scores, are included in Appendix I, Exhibit 3-1 and 3-2. The index scores used in ranking the states are as follows:

(1) An index score of 0 indicates that a state maintains the traditional monopolistic model.

(2) An index score of 100 indicates that a state has completely and effectively implemented the customer-choice model.

(3) A negative index score indicates that a state explicitly rejects all restructuring plans in the retail energy market.

In order to test the effectiveness of deregulation, I then non-randomly select my analysis states from the extreme ends of the ranking distribution. I select utilities from states with highest ranking and positive scores (Positive Rank Group) and utilities from states with the lowest ranking and negative score (Negative Rank Group). The Positive Rank Group consists of states that are highly deregulated, and the Negative Rank Group consists of states that have explicitly rejected all restructuring plans. For instance, Pennsylvania is ranked number one among all states with a score of 66, indicating that Pennsylvania is implementing a customer-choice model successfully. Texas comes right after Pennsylvania with a rank two and score of 65. Nebraska, Colorado, Idaho, Alabama, Louisiana, Minnesota, and Mississippi are tied with rank 51 and a score of –8, indicating that these states have rejected implementation of a customer-choice model. Some states are ranked 28 with a score of 0 because these states have not explicitly rejected the idea of restructuring electricity retail markets, yet maintain the traditional monopolistic model.

Second, I identify utilities that provide electricity predominantly to the Positive Rank Group states and the Negative Rank Group states, but not both, using the following criteria:

(1) At least 65% of the revenues of the utility companies come from the retail sales of electricity.[33]

(2) The utilities selected in the Positive Rank Group provide at least 50% of retail sales of electricity to Positive Rank Group states and not more than 5% to the Negative Rank Group states. Similarly, the

[33] Some utility companies operate as holding companies with subsidiaries in other businesses, but the income from such enterprises is secondary to the income from the sale of electricity. For instance, 32% of Otter Tail Corp.'s operating income comes from nonutility subsidiaries.

utilities selected in the Negative Rank Group provide at least 50% of retail sales of electricity to the Negative Rank Group states and not more than 5% to the Positive Rank Group states.

(3) The utilities' stock is publicly traded.

Details of service areas and the percentage of revenues from each service area are obtained from the Value Line Investment Survey, Volume 56, 2001. Using the criteria stated above, I select three utilities to put into the Positive Rank Group and three utilities to put into the Negative Rank Group. This selection procedure is as follows: I first identify all utilities that provide electricity to the highest-ranking state, Pennsylvania. Three are identified as DQE, Inc., GPU, Inc., and PPL Corporation, but I select only DQE, Inc. and PPL Corporation. Even though GPU, Inc., does provide electricity to customers in Pennsylvania, 53% of the revenue comes from the sale of electricity to New Jersey, which holds a ranking of seven. I then move to the next-highest ranking state, Texas, and identify two utilities that meet the criteria: TXU Corp. and El Paso Electric Co. Among these four utilities in the Positive Rank Group, El Paso Electric Co. is the only one that provides electricity to more than one state: 65% of its revenues come from serving Texas, 17% of revenues from serving New Mexico with a positive rank of twenty-four, and 18% of revenues from wholesale electricity. Since El Paso Electric Co. meets the selection criteria and does not provide electricity to any Negative Rank Group state, it is included in the sample. Second, I identify three companies that provide electricity to the states with the lowest rank of fifty-one and with the score –8: Idacorp, Inc., Cleco Corporation, and Otter Tail Corp. Even though 49% of the retail electricity revenues of Otter Tail Corp. comes from serving North Dakota and South Dakota with a positive rank of 28 and a score of 0, these are states that are still implementing the traditional monopolistic model. The inclusion of the Otter Tail Corp. will still provide insights of the effectiveness of deregulation; therefore, all three utilities are placed in the Negative Rank Group. Third, I examine the financial data of these seven utilities from Compact Disclosure and find that the total asset of TXU Corp. is substantially larger compared to the rest of the utilities. To alleviate the bias, probably caused by size, TXU Corp. is excluded from my sample. As a result, I have included three utilities in the Positive Rank Group and three in the Negative Rank Group. Since some companies in 2001 are the result of mergers and acquisitions in the late 90s, I then identify all companies' predecessors, together with their ticker symbols and exchange information through the following three resources: (1) each company's daily news from April 1 to June 30, 1994, from Bloomburg database using the current ticker symbol as the search key; (2) the history of each company, when available, listed on its web site; and (3) Compact-Disclosure, April-June 1994. As a result, I identify changes in ticker symbols, in company names, and in trading exchanges. For instance, El Paso Electric is traded in American Stock Exchange using EE as its ticker symbol in 2001, but was exchanged in DASDAQ using a different ticker symbol (ELPAQ) in 1994. PPL Corporation has a different name, Pennsylvania Power & Light Co., in 1994. The final list of selected utilities for the year 2001, together with states they are headquartered in, state rank, total assets, and debt-to-equity ratio as of the December 2000 (the year preceding the sample period), service areas and corresponding rankings and revenue sources for both groups is included in Table 1a. Table 1b shows the corresponding information for all utilities in 1994.

Table 1a: List of Utilities and Related Details for 2001

Utility Name	Ticker	State Headquartered in	State Rank in 2001	Total Assets (000s) As of Dec '00	Debt to Equity As of Dec '00	Service Area[Rank](% Revenues from Electricity)
DQE, INC.	DQE	PA	1	3,844,245	1.81	Pittsburgh and municipalities in western Pennsylvania[1]
PPL Corporation	PPL	PA	1	12,360,000	2.27	Eastern & central Pennsylvania[1]
El Paso Electric Co.	EE	TX	2	1,660,105	1.88	Western Texas[2](65%), Southern New Mexico[24](17%); wholesale counts 18% of revenues.
Idacorp, Inc.	IDA	ID	51	4,040,000	1.10	Idaho[51](86%) , Oregon[20](4%), Nevada[23](.1%); wholesale counts 9% of revenues.
Cleco Corporation	CNL	LA	51	1,753,320	1.44	Central Louisiana[51]
Otter Tail Corp.	OTTR	MN	51	737,708	0.71	Minnesota[51](51% of retail elec. revenues), North Dakota[28](41% of retail elec. revenues), South Dakota[28](8% of retail elec. revenues); Nonutility subsidiaries accounted for 32% of '00 operating income.

Source of utilities is the Value Line Investment Survey (Volume 56, 2001)
To be included in the sample the following criteria must be met:
(1) At least 65% of the revenues of the utilities come from the retail sale of electricity.
(2) The utilities selected in the Positive Rank Group provide at least 50% of their electricity to the Positive Rank Group states and not more than 5% to the Negative Rank Group states.
The utilities selected in the Negative Rank Group provide at least 50% of their electricity to the Negative Rank Group states and not more than 5% to the Positive Rank Group states.
(3) The utility companies' stock is publicly traded.

Table 1b: List of Utilities and Related Details for 1994

Utility Name	Ticker	State Headquartered in	State Rank in 2001	Total Assets (000s) As of Dec '93	Debt to Equity As of Dec '93	Service Area(% Revenues from Electricity)
DQE	DQE	PA	1	4,574,041	1.07	Pittsburgh and municipalities in western Pennsylvania
Pennsylvania Power & Light Co.	PPL	PA	1	9,454,113	0.91	Eastern & central Pennsylvania
El Paso Electric Co.	ELPAQ	TX	2	1,715,406	-5.42	Texas(64%), New Mexico(19%), FERC(17%)
Idaho Power Co.	IDA	ID	51	2,097,417	0.87	Idaho(87%), Oregon(5%), Nevada(less than 1%); wholesale counts 7% of revenues.
Central Louisiana Electric Co. Inc.	CNL	LA	51	1,161,635	0.96	Central Louisiana
Otter Tail Power Co.	OTTR	MN	51	563,905	0.84	Minnesota, North Dakota, South Dakota; Nonutility subsidiaries accounted for 27% of '93 revenues.

Source of utilities is the Value Line Investment Survey (Volume 49, 1994)

3.2: Data Description for Quotes and Trades

Once utilities are identified, I then gather trades and quotes data for each utility. I obtain intraday transaction data for bid prices, ask prices, bid sizes (bid volumes), ask sizes (ask volumes), trading prices, trading sizes (trading volumes), and time of trading from the Trade and Quote (TAQ) database, New York Stock Exchange, Inc., for the sample period of April to June in 1994. The TAQ database contains a trade file and a quote file for each stock. The selection of the 2001 data allows me to conduct several tests to study the responses to macroeconomic news and idiosyncratic news for the Positive Rank Group utilities and the Negative Rank Group utilities, after deregulation across states. I also conduct the same tests using sample data from April to June 1994 to strengthen my inferences because the 1994 sample conveys information relating the responses to news releases before deregulation. For both groups–the Positive Rank Group and the Negative Rank Group–I then obtain or calculate the following seven variables for each month, day, hour, minute, and second for the sample period from the open of trading at 9:30 a.m. to the close of trading at 4:00 p.m. These are the variables:

1. BAS = bid-ask spread = $\dfrac{ask - bid}{(ask + bid)/2} * 1000$
2. BSZ = bid size (based on 100 share units)
3. OSZ = ask size (based on 100 share units)
4. TSZ = trade size (actual number of shares traded)
5. $NOBS_m$ = the number of transactions traded at minute m.
6. TBT = time between trades in seconds

7. $RTN_s = \ln(\frac{P_s}{P_{s-1}})*100$ where P_s is the trading price traded at date *d*, hour *h*, minute *m*, and second *s* and P_{s-1} is the first price traded preceding the current second.

There are 391 minutes between 9:30 a.m. and 4:00 p.m. (including 9:30 a.m.); thus, an activity occurring in the first minute after trading starts represents a 9:30 a.m. activity, and an activity occurring 391 minutes after trading starts represents a 4:00 p.m. activity.

3.3: Macroeconomic News and Idiosyncratic News

In order to compare the responses to economic forces and idiosyncratic news of the utilities in 2001 that serve the Positive Rank Group with the utilities that serve the Negative Rank Group, and to examine the responses to economic forces and idiosyncratic news in 1994, I secure macroeconomic news and idiosyncratic news from DowJones Newswires database for the period of April 2 to June 29 of 2001 (63 trading days)[34], macroeconomic news from Money Market Service and idiosyncratic news from Bloomburg for the period of April 1 to June 30 of 1994 (62 trading days). Twenty-two major macroeconomic news releases are used as measures of market forces. There are 67 news announcements for twenty-two types of macroeconomic news during the sample period of 2001, whereas there are 68 news announcements for the same types of macroeconomic news during the sample period of 1994. I then separate days that have news releases from days that do not have any news releases, using a two-step filtering procedure.

[34] To avoid the contamination of the electricity crisis occurring in the Western region of the U.S. caused by the shortage of electricity in California during the winter of 2000-2001, I select April-June 2001 after the rolling blackout problems were corrected.

A schematic diagram (Figure 1) illustrates the procedure used to separate transaction data from a trade file of any given utility into the announcement days file (the AD file), the nonannouncement days file (the NAD file), and the special announcement days file (the SAD file). The same procedure also applies to a quote file for any given utility. In the first step of separation, I use macroeconomic news releases as the separation key. All trades that occur on days having at least one macroeconomic news announcement are classified as Macroeconomic Announcement Days (see MACAD in Figure 1). It is possible that these announcement days might include idiosyncratic news. If macroeconomic news is released after the close of trading or on holidays, such as Good Friday and Memorial Day, or on regular trading days closed for special reasons, I assume the impact of this release will be manifested on the next trading day; thus, these (next) days are classified as Macroeconomic Special Announcement Days (MACSAD). All other days are classified as Macroeconomic Nonannouncement Days (MACNAD). With macroeconomic news announcements days in 2001 and 1994, there are 35 Announcement Days, 27 Nonannouncement Days and one Special Announcement Day in 2001; there are 38 Announcement Days, 24 Nonannouncement Days, and no Special Announcement Days in 1994. A list of macroeconomic news forecasts, actual release values, and release times is included in Table 2a for the year 2001 and 2b for the year 1994.

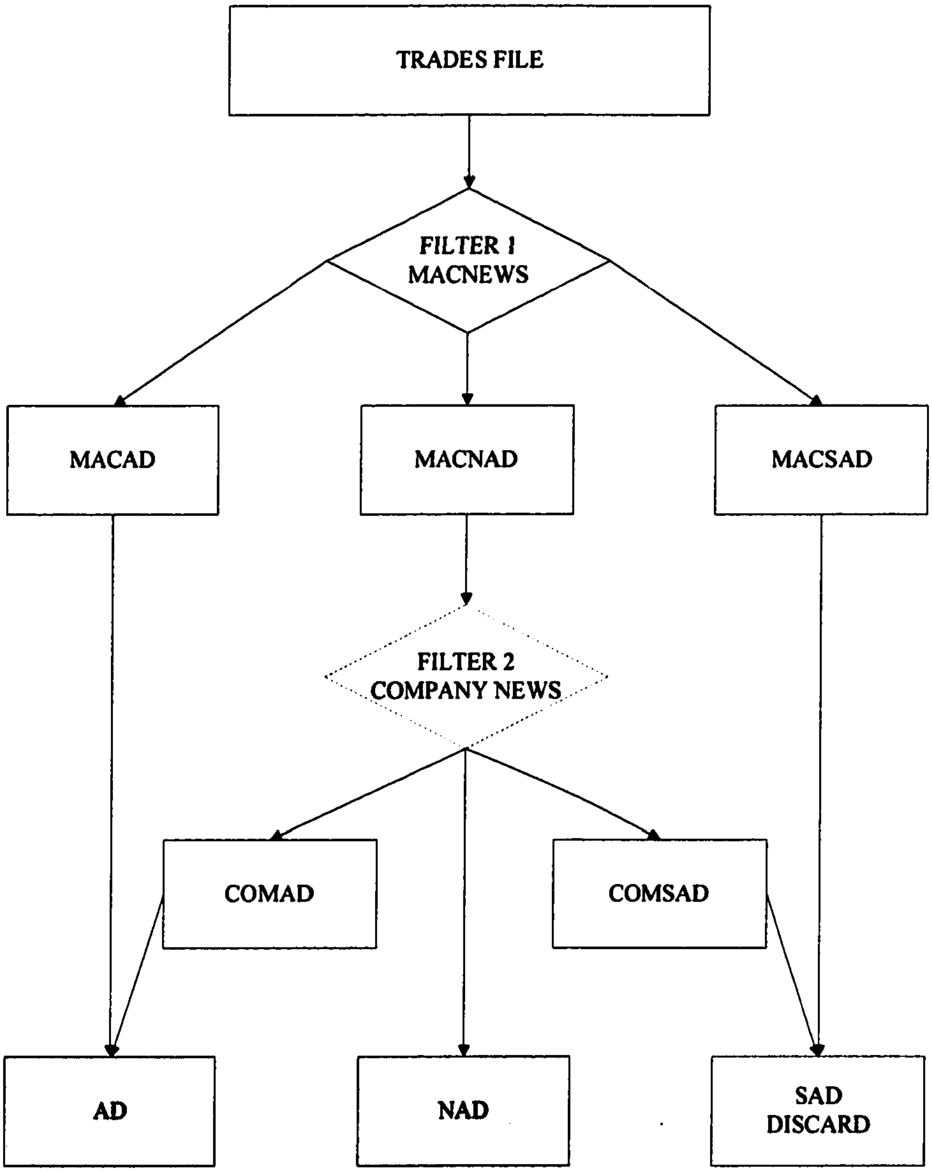


Figure 1: A Schematic Diagram of a Two-step Filtering Procedure

Table 2a: List of Twenty-two Macroeconomic Announcements April-June 2001

A listing of macroeconomic news forecasts, actual release values, and release times are obtained from the Dow Jones News Retrieval Service.

Announcement	Release Date	Release Time	Forecast	Actual	Surprise
Consumer Price Index	17 Apr	8:30 EDT	+0.1%	+0.1%	0%
	16 May	8:30 EDT	+0.5%	+0.3%	-0.2%
	15 Jun	8:30 EDT	+0.4%	+0.4%	0%
Durable Goods Orders	25 Apr	8:30 EDT	+0.5%	+3.0%	+2.5%
	25 May	10:00 EDT	-2.2%	-5.0%	-2.8%
	26 Jun	8:30 EDT	+0.5%	+2.9%	+2.4%
Gross Domestic Product	27 Apr	8:30 EDT	+1.0% Q1A	+2.0%	+1.0%
	25 May	8:30 EDT	+1.4% Q1P	+1.3%	-0.1%
	29 Jun	8:30 EDT	+1.2% Q1F	+1.2%	0%
Producer Price Index	12 Apr	8:30 EDT	0%	-0.1%	-0.1%
	11 May	8:30 EDT	+0.4%	+0.3%	-0.1%
	14 Jun	8:30 EDT	+0.3%	+0.1%	-0.2%
Hourly Earnings	6 Apr	8:30 EDT	+0.3%	+0.4%	+0.1%
	4 May	8:30 EDT	+0.4%	+0.4%	0%
	1 Jun	8:30 EDT	+0.3%	+0.28%	-0.02%
NonFarm Payroll	6 Apr	8:30 EDT	+60,000	-86,000	-146,000
	4 May	8:30 EDT	+25,000	-223,000	-248,000
	1 Jun	8:30 EDT	-25,000	-19,000	+6,000
Unemployment Rate	6 Apr	8:30 EDT	4.3%	4.3%	0%
	4 May	8:30 EDT	4.4%	4.5%	+0.1%
	1 Jun	8:30 EDT	4.6%	4.4%	-0.2%
Housing Starts	17 Apr	8:30 EDT	-1.3%(1.613m)	-1.3%(1.625m)	0%
	16 May	8:30 EDT	-0.8%(1.6m)	+1.5%(1.609m)	+2.3%
	19 Jun	8:30 EDT	-0.6%(1.6m)	-0.4%(1.622m)	+0.2%
Retail Sales	12 Apr	8:30 EDT	+0.1%	-0.2%	-0.3%
	11 May	8:30 EDT	+0.2%	+0.8%	+0.6%
	13 Jun	8:30 EDT	+0.1%	+0.1%	0%
Trade Deficit (Gap)	18 Apr	8:30 EDT	$32.6 bn	$26.99 bn	-$5.61bn
	18 May	8:30 EDT	$29 bn	$33.08 bn	$4.08 bn
	21 Jun	8:30 EDT	$31 bn	$32.17 bn	$1.17 bn
Leading Indicators	18 Apr	10:00 EDT	-0.3%	-0.3%	0%
	17 May	10:00 EDT	+0.1%	+0.1%	0%
	20 Jun	10:00 EDT	+0.3%	+0.5%	+0.2%
Personal Income	30 Apr	8:30 EDT	+0.4%	+0.5%	+0.1%
	29 May	8:30 EDT	+0.2%	+0.3%	+0.1%
Personal Expenditures	30 Apr	8:30 EDT	+0.2%	+0.3%	+0.1%
	29 May	8:30 EDT	+0.4%	+0.4%	0%
Capacity Utilization	17 Apr	9:15 EDT	79.1%	79.4%	+0.3%
	14 May	9:15 EDT	78.9%	78.5%	-0.4%
	15 Jun	9:15 EDT	77.9%	77.4%	-0.5%

Surprise is the difference between the value released by the governmental (private) agency and the forecasted value.

Table 2a: List of Twenty-two Macroeconomic Announcements April-June 2001

A listing of macroeconomic news forecasts, actual release values, and release times are obtained from the Dow Jones News Retrieval Service.

Announcement	Release Date	Release Time	Forecast	Actual	Surprise
Industrial Production	17 Apr	9:15 EDT	-0.1%	+0.4%	+0.5%
	14 May	9:15 EDT	-0.3%	-0.3%	0%
	15 Jun	9:15 EDT	-0.4%	-0.6%	-0.2%
Construction Spending	2 Apr	10:00 EDT	+0.3%	+0.6%	+0.3%
	1 May	10:00 EDT	+0.5%	+1.3%	+0.8%
	1 Jun	10:00 EDT	0%	+0.3%	+0.3%
Factory Orders	3 Apr	10:00 EDT	-3.8% (TTE)	-0.4%	+2.8%
	2 May	10:00 EDT	+1.5%	+1.8%	+0.3%
	5 Jun	10:00 EDT	-2.8%	-3.0%	-0.2%
NAPM Survey	2 Apr	10:00 EDT	42.3	43.1	0.8
	4 Apr	10:00 EDT	Non-Mfg	50.3	No
	1 May	10:00 EDT	44.0	43.2	-0.8
	3 May	10:00 EDT	Non-Mfg	47.1	Yes
	1 Jun	10:00 EDT	43.5	42.1	-1.4
	5 Jun	10:00 EDT	Non-Mfg	46.6	No
Business Inventories	13 Apr	8:30 EDT	-0.1%	- 0.2%	-0.1%
	14 May	8:30 EDT	-0.2% (TTE)	- 0.3%	-0.1%
	14 Jun	8:30 EDT	+0.1%	0.0%	-0.1%
US Treasury Budget	19 Apr	15:49 EDT	Summary	-$50.662 bn	
	18 May	15:13 EDT	Summary	$189.796 bn	
	20 Jun	15:07 EDT	Summary	-$27.919 bn	
Consumer Credit	6 Apr	15:00 EDT	$16.0 bn (TTE)	$13.5 bn	-$2.5 bn
	7 May	15:00 EDT	$9.8 bn (TTE)	$6.16 bn	-$3.64 bn
	7 Jun	15:00 EDT	$9.0 bn (TTE)	$13.9 bn	+$3.9 bn
New Home Sales	25 Apr	10:00 EDT	910,000	1,021,000	+111,000
	24 May	10:00 EDT	975,000	894,000	-81,000
	26 Jun	10:00 EDT	900,000	928,000	+28,000

Surprise is the difference between the value released by the governmental (private) agency and the forecasted value.

Table 2b: List of Twenty-two Macroeconomic Announcements April-June 1994

A listing of macroeconomic news forecasts, actual release values, and release times are obtained from the Money Market Service.

Announcement	Release Date	Release Time	Forecast	Actual	Surprise
Consumer Price Index	13 Apr	8:30 EDT	+0.3%	+0.3%	0%
	13 May	8:30 EDT	+0.3%	+0.1%	-0.2%
	14 Jun	8:30 EDT	+0.3%	+0.2%	-0.1%
Durable Goods Orders	28 Apr	8:30 EDT	+1.0%	+0.4%	-0.6%
	25 May	8:30 EDT	+1.0%	+0.1%	-0.9%
	23 Jun	8:30 EDT	+0.5%	+0.9%	+0.4%
Gross Domestic Product	28 Apr	8:30 EDT	+3.3% Q1A	+2.6%	-0.7%
	27 May	8:30 EDT	+2.5% Q1P	+3.0%	+0.5%
	29 Jun	8:30 EDT	+3.0% Q1F	+3.4%	+0.4%
Producer Price Index	12 Apr	8:30 EDT	+0.2%	+0.2%	0%
	12 May	8:30 EDT	+0.2%	-0.1%	-0.3%
	10 Jun	8:30 EDT	+0.2%	-0.1%	-0.3%
Hourly Earnings	1 Apr	8:30 EDT	+0.3%	+0.1%	-0.2%
	6 May	8:30 EDT	+0.2%	+0.3%	+0.1%
	3 Jun	8:30 EDT	+0.3%	+0.5%	+0.2%
NonFarm Payroll	1 Apr	8:30 EDT	+79,500	+239,000	+159,500
	6 May	8:30 EDT	-54,500	-189,000	-134,500
	3 Jun	8:30 EDT	+100,000	-76,000	-176,000
Unemployment Rate	1 Apr	8:30 EDT	6.5%	6.5%	0%
	6 May	8:30 EDT	6.5%	6.4%	-0.1%
	3 Jun	8:30 EDT	6.4%	6.0%	-0.4%
Housing Starts	20 Apr	8:30 EDT	+7.58%(1.42m)	+12.21%(1.47m)	+4.63%
	17 May	8:30 EDT	+2.11%(1.45m)	-0.68%(1.46m)	-2.79%
	16 Jun	8:30 EDT	-1.38%(1.43m)	+3.42%(1.51m)	+4.8%
Retail Sales	13 Apr	8:30 EDT	+1.0%	+0.4%	-0.6%
	12 May	8:30 EDT	+0.3%	-0.8%	-1.1%
	14 Jun	8:30 EDT	0%	-0.2%	-0.2%
Trade Balance	19 Apr	8:30 EDT	-$9.25 bn	-$12.40 bn	-$3.15 bn
	19 May	8:30 EDT	-$11.5 bn	-$10.1 bn	+$1.4 bn
	21 Jun	8:30 EDT	-$10.5 bn	-$12 bn	-$1.5 bn
Leading Indicators	5 Apr	10:00 EDT	-0.2%	-0.1%	+0.1%
	3 May	10:00 EDT	+0.6%	+0.7%	+0.1%
	2 Jun	10:00 EDT	0%	0%	0%
Personal Income	1 Apr	8:30 EDT	+0.8%	+1.3%	+0.5%
	29 Apr	8:30 EDT	+0.7%	+0.6%	-0.1%
	31 May	8:30 EDT	+0.45%	+0.4%	-0.05%
	30 Jun	8:30 EDT	+0.6%	+0.6%	0%
Personal Expenditures	1 Apr	8:30 EDT	+0.7%	+1.0%	+0.3%
	29 Apr	8:30 EDT	+0.5%	+0.4%	-0.1%
	31 May	8:30 EDT	+0.1%	-0.1%	-0.2%
	30 Jun	8:30 EDT	+0.2%	+0.4%	+0.2%
Capacity Utilization	15 Apr	9:15 EDT	83.8%	83.6%	-0.2%
	16 May	9:15 EDT	83.7%	83.6%	-0.1%
	15 Jun	9:15 EDT	83.5%	83.5%	0%

Surprise is the difference between the value released by the governmental (private) agency and the forecasted value.

Table 2b: List of Twenty-two Macroeconomic Announcements April-June 1994

A listing of macroeconomic news forecasts, actual release values, and release times are obtained from the Money Market Service.

Announcement	Release Date	Release Time	Forecast	Actual	Surprise
Industrial Production	15 Apr	9:15 EDT	+0.7%	+0.5%	-0.2%
	16 May	9:15 EDT	+0.3%	+0.3%	0%
	15 Jun	9:15 EDT	+0.1%	+0.2%	+0.1%
Construction Spending	1 Apr	10:00 EDT	+0%	-1.2%	-1.2%
	2 May	10:00 EDT	+2.0%	+0.8%	-1.2%
	1 Jun	10:00 EDT	+1.0%	+0.6%	-0.4%
Factory Orders	4 May	10:00 EDT	+0.5%	+1.1%	+0.6%
	2 Jun	10:00 EDT	+0.3%	-0.1%	-0.4%
	30 Jun	10:00 EDT	+0.6%	+0.6%	0%
NAPM Survey	4 Apr	10:00 EDT	58.0	56.7	-1.3
	2 May	10:00 EDT	56.5	57.7	+1.2
	1 Jun	10:00 EDT	57.2	57.7	+0.5
Business Inventories	14 Apr	8:30 EDT	+0.3%	+0.5%	+0.2%
	13 May	8:30 EDT	+0.2%	-0.2%	-0.4%
	15 Jun	8:30 EDT	+0.3%	+0.2%	-0.1%
US Treasury Budget	21 Apr	15:00 EDT	-$35 bn	-$32.30 bn	+$2.70 bn
	20 May	15:00 EDT	$17 bn	$17.40 bn	+$0.40 bn
	21 Jun	15:00 EDT	-$32.25 bn	-$32.10 bn	+$0.15 bn
Consumer Credit	7 Apr	15:00 EDT	$6.5 bn	$3.5 bn	-$3.0 bn
	6 May	15:00 EDT	$4.8 bn	$7.4 bn	+$2.6 bn
	7 Jun	15:00 EDT	$5.6 bn	$8.9 bn	+$3.3 bn
New Home Sales	29 Apr	10:00 EDT	700,000	739,000	+39,000
	31 May	10:00 EDT	725,000	683,000	-42,000
	28 Jun	10:00 EDT	679,000	738,000	+59,000

Surprise is the difference between the value released by the governmental (private) agency and the forecasted value.

Even though Macroeconomic Nonannouncement Days are free of macroeconomic news, it is possible, and very likely, that idiosyncratic news announcements are released during these days too. These nonannouncement days are then subjected to a second filter that divides them into days that have at least one company announcement (COMAD) and days that have no company or macroeconomic announcement (NAD). To incorporate idiosyncratic news release days into Announcement Days, I first classify idiosyncratic news into two groups: Primary News and Secondary News. Primary News includes firms' earnings forecasts, earnings surprises, earnings announcements, dividends announcements, merger and acquisition related news, stock splits and buyback news, and regulatory news. Secondary News refers to subsidiary news, industry-wide news, and cross-firms, and competitors' news. I assume that the primary news released during the morning before trading starts or during trading time produces a major impact on stock prices; therefore, I include it in Company Announcement Days (COMAD). Secondary News and Primary News released the preceding day(s) before trading time or on holidays are assumed to produce a minor impact on stock prices; therefore, I include them in Company Special Announcement Days (COMSAD). Thus, Macroeconomic Nonannouncement Days show neither macroeconomic news announcements nor any company-specific primary or secondary news announcements and are named Nonannouncement Days (NAD). I then merge Macroeconomic Announcement Days (MACAD) and Company Announcement Days (COMAD) into Announcement Days (AD), and Macroeconomic Special Announcement Days and Company Special Announcement Days into Special Announcement Days (SAD). After the two-step filtering procedure, each utility has different sets of Announcement Days (AD file), Special Announcement Days (SAD file), and Nonannouncement Days (NAD file) for the years 1994 and 2001.

The Nonannouncement Days (NADs) are used as a control group in many of my testing procedures. To avoid any contaminating effects, I discard the SAD file and compare only the responses of stock prices to exogenous impact from macroeconomic news and primary idiosyncratic news between the AD file and the NAD file in 1994 and 2001, respectively, for all six utilities. A list of company-specific news and release times is included in Table 3.

Table 3a: Company-specific News for Utilities April-June 2001

News releases for all six utilities for the period April 1, 2001 to June 30, 2001 on the Dow Jones News Retrieval Service (DJNS) are tracked. Forward-looking Information in the releases is categorized into three types - regulatory [R], primary [P] and secondary [S]. Regulatory information includes all information relating to regulation in the industry. Primary information includes all information relating to earnings, dividends, mergers and acquisitions, stock splits, and buybacks. Secondary information includes subsidiary, industry, cross-firm, competitor, and other information not included in the primary category. In the category of other information, included are information releases that provide unconfirmed information and information unlikely to have an impact on stock prices. Information is also identified by release time. Information released during trading hours (9:30 a.m. EST - 4:00 p.m. EST) is denoted by [T], information released in the morning before trading is denoted [1], information released *i* days before a trading day is denoted -*i* where *i*=1,2,3,. . . . Primary information is denoted by [P], regulatory information is denoted by [R], and secondary information is denoted by [S]. For example, information that is secondary and released the night before a trading day will be denoted [S,-1].

DQE, Inc., (Deregulated)

Date	Time	Details
30 Apr	18:44 ET	1Q net 22c a share vs. 82c [P,-1]
15 May	15:55 ET	Sparkling Water buys Pure Water, Polaris from DQE. [S,T]
24 May	16:07 ET	Quarterly regular dividend 42c, payable 7/1/01, record 6/8 [P,-1]

PPL Corp. (Deregulated)

Date	Time	Details
24 Apr	15:43 ET	1Q Net $1.52/share [P,T]
24 Apr	15:43 ET	PPL to securitize U.S. Electricity Delivery Co. [P,T]
24 Apr	15:46 ET	PPL maintains $1.06/share annual dividend [P,T]
24 Apr	15:49 ET	PPL to separate PPL electric utilities [P,T]
24 Apr	16:11 ET	First Call produced a mean earnings estimate of $3.66 a share for 2001 and $4.01 for 2002. [P,-1]
15 June	23:48 ET	PPL registered a 54% gain in 1Q net income, to $222M, or $1.52 a share, from $142M, or 99 cents, a year earlier, as operating revenues climbed to $1.6B, from $1.4B. For the current quarter, the consensus of analyst estimates reported by First Call runs to 77 cents a share, up from 64 cents in last year's June quarter. [P,-3]

El Paso Electric (Deregulated)

Date	Time	Details
23 Apr	6:01 ET	1Q Oper Net 36c a diluted share. [P,1]

Idacorp, Inc. (Regulated)

Date	Time	Details
4 May	5:00 ET	1Q Net 93c a share vs. $1.12. [P,1]
4 May	5:07 ET	On May 1, 2001, the Idaho Public Utility Commission granted Idaho Power Company a $168.3M PCA rate increase effective immediately. The balance of the original request, $59.1M, has been deferred pending a formal hearing. It is expected that an order will be issued by August 23, 2001. [R,1]

Cleco Corp. (Regulated)

Date	Time	Details
2 Apr	14:34 ET	Cleco sells electric power unit assets to Quanta Svc. [P,T]
27 Apr	15:18 ET	Cleco stock split approved by shareholders. Cleco boosts regular quarterly dividend to 43.5c from 42.5c [P,T]
1 May	16:17 ET	1Q Net continuous ops 51c a share vs. 46c [P,-1]

Otter Tail Corp. (Regulated)

Date	Time	Details
10 Apr	14:59 ET	Otter declares 26c regular quarterly dividend. [P,T]
23 Apr	17:02 ET	1Q Net 45c/share vs. 43c/share. [P,-1]

Table 3b: Company-specific News for Utilities April-June 1994

News releases pertaining to all six utilities for the period April 1, 1994 to June 30, 1994 on the Bloomberg Professional Service are tracked. Forward-looking Information in the releases is categorized into three types - regulatory [R], primary [P] and secondary [S]. Regulatory information includes all information relating to regulation in the industry. Primary information includes all information relating to earnings, dividends, mergers and acquisitions, stock splits, and buybacks. Secondary information includes subsidiary, industry, cross-firm, competitor, and other information not included in the primary category. In the category of other information, included are information releases that provide unconfirmed information and information unlikely to have an impact on stock prices. Information is also identified by release time. Information released during trading hours (9:30 a.m. EST - 4:00 p.m. EST) is denoted by [T], information released in the morning before trading is denoted [1], information released i days before a trading day is denoted $-i$ where $i=1,2,3,\ldots$. Primary information is denoted by [P], regulatory information is denoted by [R], and secondary information is denoted by [S]. For example, information that is secondary and released the night before a trading day will be denoted [S,-1].

DQE, Inc.,

Date	Time	Details
15 Apr	16:08 EDT	DQE issued earnings. Three months ended March 31: EPS $0.70 vs. $0.65, Dividend per share $0.42 vs. $0.40; Twelve months ended March 31: EPS $2.77 vs. $2.68, Dividend per share $1.64 vs. $1.56; Duquesne Light Co.'s total sales to customers: three months ended March 31: 3.1 billion vs. 2.99 billion a year age. [P,-3]
10 May	13:29 EDT	Duquesne Capital L. P. filed with the Securities and Exchange Commission to sell as much as $150 million of preferred securities and plans to lend the proceeds to its parent company, Duquesne Light Co., in exchange for monthly income subordinated debentures. Duquesne Light, a unit of DQE Co., will in turn use the proceeds to repay, redeem or purchase its outstanding securities.[S,T]
24 May	14:03 EDT	Quarterly dividend $.42, payable 7/1/94, record 6/10 [P,T]
28 June	13:13 EDT	Quarterly dividend for preference stock $.70, payable 10/1/94, record 9/9 [P,T]

Pennsylvania Power & Light Co.

Date	Time	Details
27 Apr	10:03 EDT	Pennsylvania Power & Light (Ticker: PPL) reported 12 months earnings ended March 31 $2.07 vs. $2.04; sales to service-area customers rose 5.5% in the 12 months ended March 31. For the 1Q earnings: 70 cents vs. the same earnings a year ago. Since NYSE was closed on April 27 due to the funeral of Richard M. Nixon, the impact of this news would be on the next trading day, April 28. [P,-1].
20 May	09:37 EDT	PPL was cut to intermediate and long-term "neutral" from "above average" by Merrill Lynch & Co. analyst Doris Kelley. The analyst estimates the utility will earn from $2.05 to $2.10 per share in 1994, and from $1.9 to $2.05 per share in 1995. The analyst said the company's $1.2 increase in the annual dividend in February will "be the last dividend increase for the next several year,". [P,T]
25 May	16:04 EDT	PPL declared the regular quarterly dividend of 41.75 cents, payable 7/1, record 6/10. Quarterly dividends on its preferred stock are also declared. [P,-1]
27 May	10:32 EDT	PPL was lowered to "underperform" from "neutral" today at Kidder, Peabody & Co. by analyst Steven Fleishman because of a poor outlook for both earnings and dividend growth. "in our opinion, the current stock price does not reflect the company's declining earnings outlook and lack of dividend prospects going forward," Fleishman wrote in a report. Kidder forecasts operating earnings will fall to $2.05 a share this year and $1.95 a share in 1995 from last year's $2.19. Earnings are expected to suffer again in 1996.[P,T]

El Paso Electric

Date	Time	Details
7 Apr	20:03 EDT	El Paso Electric could end up paying $53 million to attorneys, advisers and mediators in its bankruptcy reorganization case if a judge approves bonuses sought today. [P,-1]
18 May	17:18 EDT	EE reported a net loss of 37 cents vs. $3.2 a year ago. [P,-1]
23 May	14:47 EDT	Central and South West Corporation proposed a rate plan that will extend a freeze in electric base rates for customers of El Paso Electric in Southern New Mexico and will reduce current rates for more than 8,200 low-income households once Central and South West's pending merger with El Paso Electric is completed. It is an effort to retain the right to supply power to the city of Las Cruces. [P,1]

Idacorp Power Inc.

Date	Time	Details
2 May	7:21 EDT	1Q earnings 44 cents vs. 55 cents. The company has proposed a one-year 2.5% power cost adjustment, which would generate an estimated $9.8 million in additional revenue during the 12-month period beginning May 16. [P,1]
30 June	15:38 EDT	Idaho Power filed its first general rate increase request with the Idaho PUC since 1985 in order to make customers' rates more reflective of nine years worth of changes in company costs, investments and expenses. [P,T]

Central Louisiana Electric Co. Inc.

Date	Time	Details
22 Apr	14:02 EDT	Central Louisiana Electric Co. increased its quarterly cash dividend to 36.5 cents a share from 35.5 cents, payable 5/15, record 5/2. The board also declared regular quarterly dividends on all issues of preferred stock. A dividend reinvestment plan is available which allows dividends on its common preferred stock to be reinvested in additional shares of common stock at market price, without commission costs. [P,T]
2 May	16:01 EDT	1Q earnings 36 cents vs. 31 cents. 12 months ended March 31: $1.83 vs. $1.95; EPS (diluted) $1.77 vs. $1.88. [P,-1]

Otter Tail Power Corp.

Date	Time	Details
20 Apr	17:25 EDT	1Q earnings 78 cents vs. 75 cents [P,-1]

3.4 Research Design.

3.4.1: Testing the Difference of Means and Variances

For information purposes, I use a two-sample t-test to determine whether the market reacts differently to macroeconomic news and/or idiosyncratic news, in terms of bid-ask spread (BAS), bid size (BSZ), ask size (OSZ), trading size (TSZ), the number of transactions traded per minute at minute *m* ($NOBS_m$), time between trades in seconds (TBT) and return expressed as percentage for second *s* (RTN_s). There is no *a priori* expectation on the means of other variables, except for the number of transactions per minute. The mean of the number of transactions per minute (NOBS) from the AD file should be significantly larger than that from the NAD file.

3.4.2: Testing the Equality of Variances in Returns

Ross (1989) maintains that the arrival of information has direct impact on the volatility of stock prices in an arbitrage-free environment. In order to observe the stock return responses to release news, I employ the Brown-Forsythe-Modified Levene (BFL) test to examine the volatility differences between days with released news and days without released news. Levene (1960) proposed a statistical test measuring the equality of variances with equal sample sizes. Later, Draper and Hunter (1969) generalized Levene's method to apply to samples with unequal observations. However, Brown and Forsythe (1974) point out that Draper and Hunter's statistic is not robust if the underlying populations are skewed. So instead of using the absolute deviations from its group mean as proposed by Levene (1960), Brown and Forsythe (1974) replace them with the absolute deviations from its group median. Conover, Johnson, and Johnson (1981) compare more than fifty methods for testing the equality of variances and conclude that the Brown and Forsythe (1974) modified Levene (1960) (BFL) F-statistic test is among the most powerful and is, in face, the most robust in departures from normality. This test has been used to test the equality of variances of returns in stock market (Lockwood and Linn 1990) and futures markets (Ederington and Lee 1993, Christie-David and Chaudhry 2000, Aggarwal et al. 2001, Christie-David et al. 2002). For these reasons, I follow this line of research to examine the equality of variances of returns in the stock market, using the BFL F-statistic.

First, I examine the overall equality of the variances between the AD file and the NAD file for each company, using second-by-second stock returns for all trading days in 1994 and 2001, respectively. Thus, the larger the F value (the Overall F value), the more significant the difference between the variances of returns of Announcement Days and Nonannouncement Days. If deregulation is indeed effective, then the F values for the year 1994 are, on the average, smaller than those for the year 2001. Furthermore, not only do the variances of returns between Announcement Days and Nonannouncement Days for the year 2001 show differences, but also the variance of returns of Announcement Days is greater than the variance of returns of Nonannouncement Days for the year 2001 for a utility serving the Positive Rank Group states. Conversely, a company serving the Negative Rank Group states shows no difference between the variances of returns of Announcement Days and Nonannouncement Days or the variance of returns on Announcement Days is less than the variance of returns on Nonannouncement Days for the year 2001. Moreover, the F values of the companies in the Positive Rank Group providing electricity to highly deregulated states are expected to be higher, on the average, than those from the Negative Rank Group.

Brown-Forsythe-Modified Levene Test Statistic (BFL)

Test statistic: $F_{cal} = \dfrac{\sum_{j=1}^{J} n_j(\overline{D_{.j}} - \overline{D_{..}})^2 (N-J)}{\sum_{j=1}^{J}\sum_{s=1}^{n_j}(D_{sj} - \overline{D_{.j}})^2 (J-1)}$ (1)

where F_{cal} follows an F distribution with J-1 and N-J degrees of freedom. Reject H_0 if $F_{cal} > F(1\text{-}\alpha; J\text{-}1, N\text{-}J)$ (Neter et al. 1996).

$D_{sj} = \left| R_{sj} - \hat{M}_j \right|$ = the absolute deviations from its group median

$j = 1$ for the AD file and $j = 2$ for the NAD file

$s = 1, 2, 3, \ldots\ldots n_s$

n_j = the number of the absolute deviations from its group median in j group

$N = n_1 + n_2$

J = 2 indicating there are two groups: the AD group and the NAD group

$R_{sj} = \ln\left(\frac{P_s}{P_{s-1}}\right)$ "Second-By-Second" stock return from group j where s = 1, 2, 3,....n_j. In the instance when more than one transaction occurs at the same second, P_{s-1} is the first price traded from previous second.

$\hat{M}_j$ = the sample median return computed over the n_j returns in j group.

$\overline{D_{.j}} = \sum_{s=1}^{n_j}\left(\frac{D_{sj}}{n_j}\right)$ = the mean absolute deviation from the median for group j.

$$\overline{D_{..}} = \sum_{j=1}^{J} \sum_{s=1}^{n_j} \left(\frac{D_{sj}}{N} \right) = \text{the grand mean absolute deviation.}$$

3.4.3: Testing the Effects of Macroeconomic News on Returns

Ross (1989) maintains that the arrival of information has direct impact on the volatility of stock prices in an arbitrage-free environment. Using the NAD file as a control, filtering out random effects, the results of BFL test provide insights into the effectiveness of deregulation. If one of the objectives of deregulation, that is, making the utility operations more responsive to market forces, is actually met, then the F-values for utilities in Positive Rank Group should be larger, on the average, than the F-values for utilities in the Negative Rank Group. However, in order to build robustness into my findings, I perform regressions on return volatility for each utility, thereby complementing my comparison between utilities that provide electricity to the Positive Rank Group states and those that provide electricity to the Negative Rank Group states. The measure of volatility (σ_{sc}) is the absolute excess return for a given utility c at second s. Based on priors and findings in the literature, several independent variables have impacted the volatility of returns, in addition to macroeconomic news such as idiosyncratic news, buy-sell indicator, trading volume, bid-ask spread, the sign of return, and time between trades. Thus, I regress volatility on a dummy variable for macroeconomic news, as well as these independent variables too.

Patell and Wolfson (1984) find that it takes only five to ten minutes to adjust security prices in response to earnings and dividend information. Ederington and Lee (1993) examine the impact of macroeconomic news announcements on the interest rate and foreign exchange futures markets and conclude that the majority of the price adjustments occur within the first minute of trading after a news announcement and that high volatility remains for at least fifteen minutes after an announcement and remains slightly elevated for several hours. Based on the literature, it is reasonable to assume that the major impact of news, both macroeconomic news and idiosyncratic news, on stock prices lasts for at most one hour. With this in mind, I set the dummy variable DMAC to 1 for all time periods within sixty minutes from the time of the macroeconomic news release. Similarly, I set up a dummy variable DIDIO for idiosyncratic news. I assign 1 to DIDIO for all time periods within sixty minutes from the time of the idiosyncratic news release. It is possible, and very likely, that macroeconomic news and idiosyncratic news release around the same time; therefore, if DMACRO and DIDIO are both set to be 1, indicating there is an impact to returns from both macroeconomic news and idiosyncratic news; therefore, I reassign DMACRO and DIDIO to be 0.5. Otherwise, DMACRO and DIDIO are to be 0. I set DMACRO (DIDIO) at 1 for the period from 9:30 a.m. to 10:30 a.m. if there is macroeconomic news (idiosyncratic news) announced before trading opens at 9:30 a.m. If there are macroeconomic news and idiosyncratic news announcements before trading opening on the same day, I set DMACRO and DIDIO at 0.5 respectively for the period from 9:30 a.m. to 10:30 a.m.

With the characteristics of market microstructure, many other variables are added in the regression model to capture the dynamic features of return volatility. Hausman, Lo, and MacKinlay (1992) suggest that the buy-sell indicator, the volume, the past price changes, the bid-ask spread, and the time between trades all affect price changes; therefore, I employ a buy-sell indicator (BSI), a standardized volume measure (VOL), the interaction of bid-ask spread and return volatility from the previous transaction

($lag(BAS_{s-1}*\sigma_s)$), the interaction of bid-ask spread, the return volatility, and the sign of return from the previous transaction ($lag(BAS_{s-1}*\sigma_s*I_s^-)$), and the time between trades (TBT). The use of a standardized volume measure (VOL) and a buy-sell indicator are used as a control for bid-ask bounce. The time between trades (TBT) is a measure of liquidity to explain some of the return volatility.

Following Blume, MacKinlay, and Terker (1989) and Hausman, Lo, and MacKinlay (1992), a transaction occurring at time *s* is buyer-initiated or at the ask if the trading price for that transaction is greater than the average of the prevailing bid quote and the prevailing ask quote. A transaction occurring at time *s* is seller-initiated or at the bid if the trading price is less than the average of the prevailing bid quote and the prevailing ask quote. I follow the suggestion of Lee and Ready (1991) and Hausman, Lo, and MacKinlay (1992) that using the prevailing quotes (ask and bid) occurring at least five seconds before the current transaction will account for most of mismatching trade prices to bid/ask quotes. The buy-sell indicator is set at 1 if the trading price is buyer-initiated, -1 if it is seller-initiated, and 0 if it is equal to the average of the prevailing bid-and-ask prices.

Copeland and Galai (1983) maintain that the bid-ask spread and price volatility are positively related. The interaction of bid-ask spread and return volatility from the previous transaction ($lag(BAS_{s-1}*\sigma_s)$) and the interaction of bid-ask spread, the return volatility, and the sign of return from the previous transaction ($lag(BAS_{s-1}*\sigma_s*I_s^-)$) are designed to reflect the return volatility caused by bid-ask spread. Taking lagged terms into account for serial dependencies, I^- is an indicator variable which is set to be 1 if the contemporaneous return is negative and 0 otherwise.

Regression Test for Each Utility

$$\sigma_{sc} = \alpha_0 + \alpha_1 DMAC_{sc} + \alpha_2 DIDIO_{sc} + \alpha_3 BSI_{sc} + \alpha_4 VOL_{sc}$$

$$+ \alpha_5 lag(BAS_{s-1,c} * \sigma_{sc}) + \alpha_6 lag(BAS_{s-1,c} * \sigma_{sc} * I_{sc}^{-}) + \alpha_7 TBT_{sc} + \varepsilon_{sc} \quad (2)$$

1. c = 1,2,3,4,5,6 where c is an index for identifying each utility.

2. $R_{sc} = \ln(\frac{P_{sc}}{P_{s-1,c}})*100$ where P_{sc} is the trading price traded at date *d*, hour *h*, minute *m*, and second *s* and $P_{s-1,c}$ is the first price traded preceding the current second.

3. $\overline{R}_c$ = the average return for a given utility c.

4. $\sigma_{sc} = \left| R_{sc} - \overline{R}_c \right|$ = the absolute excess return for a given utility c for second s.

5. $DMAC_{sc} = \begin{cases} 1 \\ 0.5 \\ 0 \end{cases}$ where $DMAC_{sc}$ =1 for all s ≤ 3600 seconds from time of macroeconomic news release; $DMAC_{sc}$ =0.5 if there exists s≤3600 seconds from time of idiosyncratic news; 0 otherwise.

6. $DIDIO_{sc} = \begin{cases} 1 \\ 0.5 \\ 0 \end{cases}$ where $DIDIO_{sc}$ =1 for all s ≤ 3600 seconds from time of macroeconomic news release; $DIDIO_{sc}$ =0.5 if there exists s≤3600 seconds from time of macroeconomic news; 0 otherwise.

7. BSI_{sc} = Buy-Sell Indicator for the *s*th second.

$$BSI_{sc} = \begin{cases} 1 & If\ P_{sc} > \frac{1}{2}(Ask_{s-1,c} + Bid_{s-1,c}) \text{ , buyer-initiated} \\ 0 & If\ P_{sc} = \frac{1}{2}(Ask_{s-1,c} + Bid_{s-1,c}) \text{ , indeterminate} \\ -1 & If\ P_{sc} < \frac{1}{2}(Ask_{s-1,c} + Bid_{s-1,c}) \text{ , seller-initiaed} \end{cases}$$

Where $Ask_{s-1,c}$, ask quote, and $Bid_{s-1,c}$, bid quote, are the first occurrence quoted at least five seconds before the *s*th second.

8. $VOL_{sc} = \frac{TSZ_{sc}}{TSZ_c}$ = Standardized trading volume for the *s*th second.

= the volume of the trade at the *sk*th second divided by the total volume for a given utility c.

9. $BAS_{s-1,c} = \frac{ask_{s-1} - bid_{s-1}}{(ask_{s-1} + bid_{s-1})/2} * 1000$

= the first bid-ask spread quoted at least five seconds before the *s*th second.

10. $I^{-}_{sc} = \begin{cases} 1 \\ 0 \end{cases}$ where I^{-} = 1 if the contemporaneous return is negative and 0 otherwise.

11. TBT_{sc} = time between trades occurred at second s-1 and second s.

Correction for Autocorrelation and Heteroscedasticity

When time series data are employed in regression analyses, it is necessary to determine if there are autocorrelation and/or heteroscedasticity problems. I use the following procedures to detect the existence of autocorrelation and heteroscedasticity problems and, when these occur, to correct them.

10. Regress σ_{sc} on its lag and use the Durbin h-test to detect the presence of first-order autocorrelation.
11. Once the autocorrelation is identified, I then run a stepwise autoregression model, using Maximum Likelihood method. The stepwise autoregression method initially fits a high-order model with many autoregressive lags and then sequentially removes those that are not significant. This procedure also helps in determining the order of autocorrelation.
12. Use Lagrange Multiplier to test heteroscedasticity.
13. Based on the stepwise autoregression model and Lagrange Multiplier results, I then determine the order of autocorrelation. If a high-order of autocorrelation exists, then GARCH(p,q) is used to correct autocorrelation and heteroscedasticity; otherwise, GARCH(q) is used to correct the autocorrelation and heteroscedasticity.

GARCH (p, q) Regression Model

$$y_t = x_t'\beta + \upsilon_t \qquad (3)$$

$$\upsilon_t = \varepsilon_t - \varphi_1\upsilon_{t-1} - \ldots\ldots - \varphi_m\upsilon_{t-m} \qquad (4)$$

$$\varepsilon_t = \sqrt{h_t e_t} \qquad (5)$$

$$h_t = \omega + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^2 + \sum_{j=1}^{p}\gamma_j\varepsilon_{t-j} \qquad (6)$$

CHAPTER 4

EMPIRICAL RESULT

4.1: Summary Statistics

For statistical analysis of the seven variables (see Tables 4a and 4b), I use a two-sample t-test to measure the market's movement as it reacts to macroeconomic news and to idiosyncratic news, both in terms of the seven variables for the years 1994 and 2001: bid-ask spread (BAS), bid size (BSZ), ask size (SZ), trading size (SZ), the number of transactions traded per minute at minute *m* ($NOBS_m$), time between trades in seconds (TBT), and return expressed as percentage for second *s* (RTN_s).

The analysis provides substantial information. For instance, the BAS in 2001 is always larger on announcement days than on nonannouncement days for utilities in the Positive Rank Group. Conversely, the BAS in 2001 for utilities in the Negative Rank Group is always smaller on announcement days than on nonannouncement days, except for the Otter Tail Corp. Using DQE, Inc., (deregulated) and Idacorp, Inc., (regulated) as examples, I find that the ratio for DQE, Inc., is 1.0292, suggesting that the BAS on announcements days is 2.92% larger, on the average, than the BAS on nonannouncement days, a statistic that is significant at a 1% level. But the ratio for Idacorp, Inc., is 0.9451, indicating that the BAS on announcement days is, on the average, 5.49% smaller than the

BAS on nonannouncement days, where again the difference shows a 1% level of significance. The BAS ratios in 2001 indicate that BAS tends to be larger on announcement days for deregulated utilities and smaller on announcement days for regulated utilities, with one exception, the Otter Tail Corp. The BAS ratios in 1994 (see Table 4b) show that there is no difference between the BAS on announcement days and the BAS on nonannouncement days, with one exception: the BAS of PPL on announcement days is smaller at a 10% level of significance. Copeland and Galai (1983) suggest that bid-ask spread and price volatility are positively related; therefore, my findings may suggest that deregulated utilities are more responsive to the arrival of news with larger spreads because of the risk associated with the news releases.

Bid size and offer size exhibit varied findings. Bid sizes are larger on announcement days than on nonannouncement days for utilities in the Positive Rank Group, with the difference being significant at a 1% level of significance. Conversely, bid sizes are smaller on announcement days than on nonannouncement days for utilities in the Negative Rank Group, with one exception, Idacorp, Inc. Although the bid size of Idacorp, Inc., is larger on announcement days, the figures are not significant. However, offer sizes are consistently larger on announcement days than on nonannouncement days, with the difference being significant at a 1% level for all utilities in 2001. The bid sizes and offer sizes in 1994 do not provide any systematic findings.

Like the offer sizes, the number of transactions per minute presents strong and systematic evidence that there are more transactions occurring on announcements days than on nonannouncement days for all utilities in 2001 and 1994, with the difference being significant at a 1% level of significance, except for the Otter Tail Corp. in 2001, with no significance, and Central Louisiana Electric Co., Inc., in 1994 with a 10% level of significance. The statistics for trade sizes do not present a systematic pattern. However, the time between trades on announcement days is smaller than the time between trades on nonannouncement days for all five utilities, except for the Otter Tail Corp., because market participants tend to react frequently when there is news released. No systematic pattern is reflected in the return statistics. I do find that returns tend to be more positive on nonannouncement days than on announcements days; however, returns reveal no significant differences between announcement days and nonannouncement days for utilities in the Negative Rank Group. The summary statistics for 1994 do not offer new insights regarding the influence of time lapse between trades and the level of returns.

Table 4a Summary Statistics and Test for Differences in Means between AD and NAD for 2001

	$\frac{BAS_{AD}}{BAS_{NAD}}$	$\frac{BSZ_{AD}}{BSZ_{NAD}}$	$\frac{OSZ_{AD}}{OSZ_{NAD}}$	$\frac{NOBS_{AD}}{NOBS_{NAD}}$	$\frac{TSZ_{AD}}{TSZ_{NAD}}$	$\frac{TBT_{AD}}{TBT_{NAD}}$	$\frac{RTN_{AD}}{RTN_{NAD}}$
Deregulated							
DQE	1.0292***	1.1132***	1.1937***	1.6257***	1.2873	0.8370***	-0.4439**
PPL	1.0029	1.0990***	1.1380***	1.4999***	1.1926***	0.9712**	-0.1724***
EE	1.0351***	1.1209***	1.0796***	1.4551***	0.9943	0.9460	-0.3395
Regulated							
IDA	0.9451***	1.0288	1.0564***	1.4135***	1.3219	0.9415***	8.7000
CNL	0.8787***	0.8257***	1.0505***	1.3805***	0.8617***	0.9394**	-0.5426
OTTR	1.1071***	0.8871***	1.3310***	1.1599	1.0759	1.1675**	1.6612

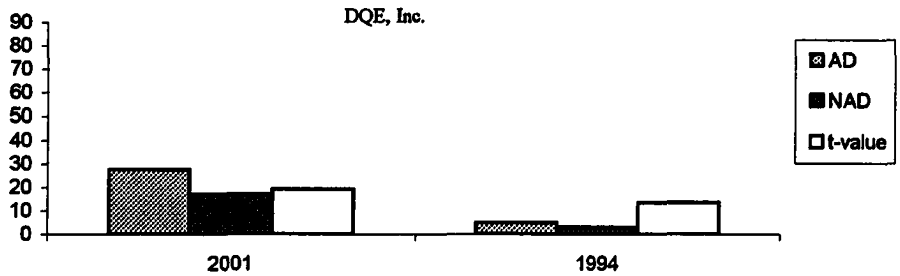
* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

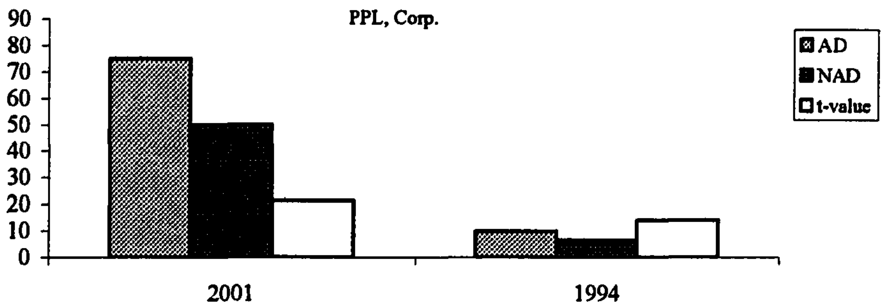
Table 4b Summary Statistics and Test for Differences in Means between AD and NAD for 1994

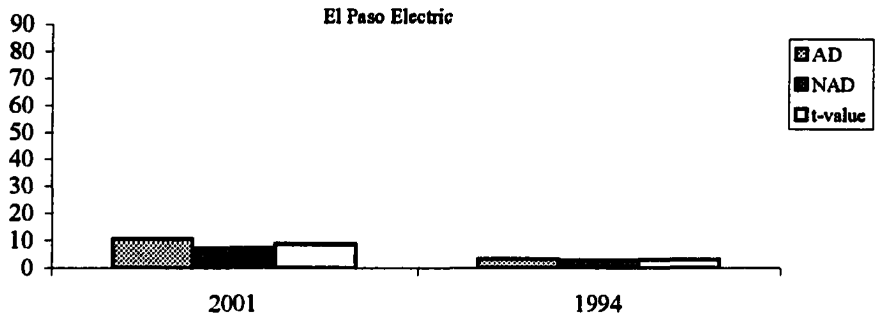
	$\frac{BAS_{AD}}{BAS_{NAD}}$	$\frac{BSZ_{AD}}{BSZ_{NAD}}$	$\frac{OSZ_{AD}}{OSZ_{NAD}}$	$\frac{NOBS_{AD}}{NOBS_{NAD}}$	$\frac{TSZ_{AD}}{TSZ_{NAD}}$	$\frac{TBT_{AD}}{TBT_{NAD}}$	$\frac{RTN_{AD}}{RTN_{NAD}}$
DQE	0.9993	0.7848***	0.8960***	1.7188***	1.0715	0.9948	-0.5357
PPL	0.9781*	1.2871***	1.2774***	1.5259***	1.3111	1.0767**	0.1100
ELPAQ	1.0765	1	1	1.2170***	1.0171	1.3205***	-2.2685
IDA	0.9914	0.8613**	0.8952**	1.3974***	1.4135**	1.0598	0.2273
CNL	1.0022	1.0081	0.9509	1.1127*	1.4435**	1.0078	-0.5521
OTTR	0.9865	1	0.9945	1.2938***	1.0452	0.8982	-0.8748

* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

Two key statistical inferences may be drawn from Tables 4a and 4b. First, the summary statistics in Table 4a provide evidence that utilities in the Positive Rank Group are more responsive to news than utilities in the Negative Rank Groups, as supported by the BAS statistics in 2001. The BAS statistics in 1994, the year before deregulation, show that there is no significant difference between the volatility of the BAS on announcement days and the BAS on nonannouncement days, with only one exception, the Pennsylvania Power & Light Co. Even though the Pennsylvania Power and Light Co. exhibits a difference between the volatility of the BAS on announcement days and the BAS on nonannouncement days at 10% level of significance, it is in a wrong direction indicating the volatility of nonannouncement days is actually greater than the volatility of announcement days before regulation. This suggests that utilities are buffered by regulation and are therefore indifferent to exogenous impact–economic factors. Second, the number of transactions (NOBS) exhibits a noteworthy pattern: the number of transactions per minute presents strong and systematic evidence that there are more transactions occurring on announcements days than on nonannouncement days for all utilities in 2001 and 1994. The higher number of transactions across five of the six utilities on announcement days over nonannouncement days validates the two-step filtering procedure I use to separate announcement days from nonannouncement days. *A priori*, if the two-step filtering procedure is sound, then the number of transactions on announcement days would be greater than the number of transactions on nonannouncement days, since market participants are expected to react rapidly and frequently to the news releases. Figure 2 illustrates the number of transactions per minute (NOBS) and the t-value of the difference between the means of announcement days and the means of nonannouncement days for utilities in the Positive Rank Group (deregulated), and Figure 3 shows the same information for utilities in the Negative Rank Group (regulated).



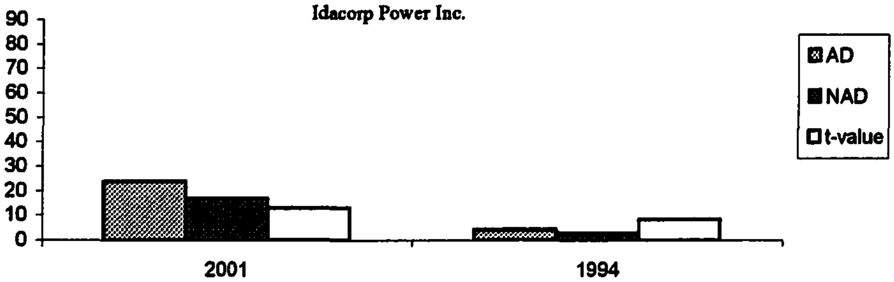


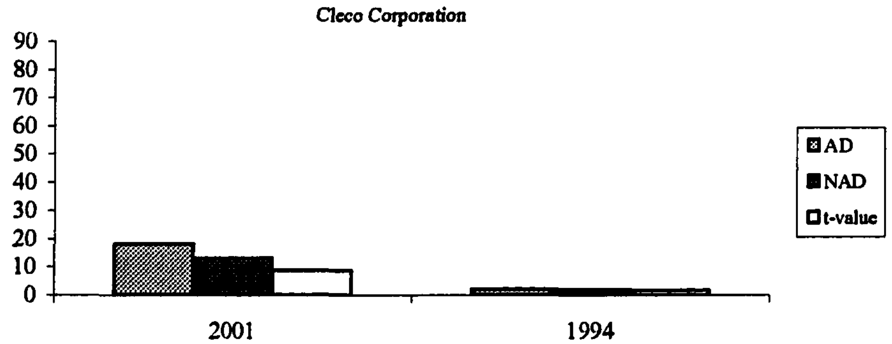


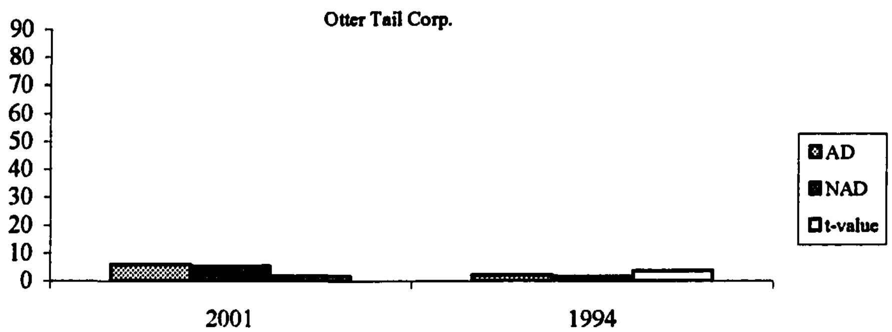
Utility Name	Groups belonged	2001			1994		
		$NOBS_{AD}$	$NOBS_{NAD}$	t-value	$NOBS_{AD}$	$NOBS_{NAD}$	t-value
DQE, Inc.	High-Rank Group	27.59	16.97	19.045***	4.94	2.87	13.473***
PPL Corp.	High-Rank Group	74.94	49.96	21.441***	9.88	6.47	13.981***
El Paso Electric	High-Rank Group	10.55	7.25	8.56***	3.27	2.69	3.049***

$NOBS_{AD}$ is the average number of transactions per minute for a given company across all AD days.
$NOBS_{NAD}$ is the average number of transactions per minute for a given company across all NAD days.
* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

Figure 2: NOBS between ADs and NADs for Deregulated Utilities







Utility Name	Groups belonged	2001			1994		
		$NOBS_{AD}$	$NOBS_{NAD}$	t-value	$NOBS_{AD}$	$NOBS_{NAD}$	t-value
Idacorp Power Inc	Negative-Rank Group	23.92	16.92	12.974***	4.02	2.88	8.201***
Cleco Corporation	Negative-Rank Group	18.08	13.09	8.732***	1.97	1.77	1.682*
Otter Tail Corp	Negative-Rank Group	5.94	5.12	1.56	1.96	1.51	3.628***

$NOBS_{AD}$ is the average number of transactions per minute for a given company across all AD days.
$NOBS_{NAD}$ is the average number of transactions per minute for a given companyacross all NAD days.
* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

Figure 3: NOBS between ADs and NADs for Regulated Utilities

Table 5a: Summary Statistics and Test for Differences in Variance between AD and NAD for 2001

	$\frac{BAS_{AD}}{BAS_{NAD}}$	$\frac{BSZ_{AD}}{BSZ_{NAD}}$	$\frac{OSZ_{AD}}{OSZ_{NAD}}$	$\frac{NOBS_{AD}}{NOBS_{NAD}}$	$\frac{TSZ_{AD}}{TSZ_{NAD}}$	$\frac{TBT_{AD}}{TBT_{NAD}}$	$\frac{RTN_{AD}}{RTN_{NAD}}$
Deregulated							
DQE	1.9273***	1.3466***	1.5270***	1.8451***	21.9803***	0.7310***	1.3387***
PPL	1.1283***	2.4324***	1.5179***	1.2971**	1.5317***	0.8588***	1.1796***
EE	1.2808***	1.6065***	1.6038***	2.2599***	0.5099***	0.9756	2.8540***
Regulated							
IDA	0.8870***	0.0988***	1.2308***	1.0604	176.5353***	0.9026***	0.9134***
CNL	0.8683***	0.7053***	1.2382***	1.2906**	1.1049***	0.7938***	0.8772***
OTTR	1.2272***	0.7328***	2.5984***	0.9851	1.2944***	1.0984**	0.9884

* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

Table 5b: Summary Statistics and Test for Differences in Variance between AD and NAD for 1994

	$\frac{BAS_{AD}}{BAS_{NAD}}$	$\frac{BSZ_{AD}}{BSZ_{NAD}}$	$\frac{OSZ_{AD}}{OSZ_{NAD}}$	$\frac{NOBS_{AD}}{NOBS_{NAD}}$	$\frac{TSZ_{AD}}{TSZ_{NAD}}$	$\frac{TBT_{AD}}{TBT_{NAD}}$	$\frac{RTN_{AD}}{RTN_{NAD}}$
DQE	0.6843***	0.7288***	0.4080***	1.7077***	0.9239	0.9371	0.9389
PPL	0.8899**	1.6908***	1.9818***	1.6290***	2.2940***	1.3273***	0.9701
ELPAQ	1.5761	N/A	N/A	1.9897***	0.8918*	1.4878***	1.7678***
IDA	2.5046***	0.7631***	0.8437**	1.9248***	5.7936***	1.1017*	1.9439***
CNL	1.0003	0.8856*	1.2704***	1.2201	5.1246***	0.9539	0.9480
OTTR	0.8975	N/A	N/A	2.0062***	0.8460	0.8109*	1.1262

* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

I also examine variances and the differences in variances between announcement days and nonannouncement days for 2001 and for 1994 for all seven variables. (see summary statistics in Tables 5a and 5b.) Similar to the finding presented in Table 4a, all utilities in the Positive Rank Group exhibit larger BAS variances on announcement days than on nonannouncement days. This is true for only one utility, Otter Tail Corp in the Negative Rank Group. Idacorp, Inc., and Cleco Corporation, on the other hand, exhibit reversed results; that is, the BAS variances on announcement days are smaller than the BAS variances on nonannouncement days. Bid sizes and returns show contrasting results between the Positive Rank Group and the Negative Rank Group. The variances of bid sizes are significantly larger on announcement days than on nonannouncement days for utilities in the Positive Rank Group, whereas this finding is reversed for utilities in the Negative Rank Group: variances of bid sizes are smaller on announcement days than on nonannouncement days. Similarly, the variances of returns are significantly larger on announcement days than on nonannouncement days for utilities in the Positive Rank Group, a trend that is also reversed for utilities in the Negative Rank Group. No significant contrasts are found for the offer sizes, the number of transactions, and the trading sizes. In the time between trades, there are smaller variances on announcement days than on nonannouncement days for all utilities except for Otter Tail Corp. This is consistent with the findings of the differences between the mean values on announcement days and the mean values on nonannouncement days, and supports the premise that market participants tend to react frequently to news releases. (see Table 5b for summary statistics of variances for all seven variables.) Statistics show that there are no obvious findings except that, on the average, the differences in variance between announcement days and nonannouncement days are less significant in 1994 (before deregulation) than are those in 2001 (after deregulation).

4.2: Results of BFL F Tests

The results of BFL F test (reported in Table 6) for the year 2001 indicate a strong contrast in response to news between utilities in the Positive Rank Group and utilities in the Negative Rank Group. The ratios of the standard deviation for the announcement days to the standard deviation for the nonannouncement days (STD_{AD}/STD_{NAD}) are all greater than one for utilities in the Positive Rank Group. This indicates that the return variances on announcement days are consistently greater than the return variances on nonannouncement days for deregulated utilities. Conversely, STD_{AD}/STD_{NAD} are consistently smaller than 1, indicating that the return variances on announcement days are smaller than the return variances on nonannouncement days for regulated utilities. For instance, the ratio for DQE, Inc., (a deregulated utility) is 1.16, whereas the ratio for Idacorp. Inc., (a regulated utility) is 0.96. This provides strong evidence to support my argument that utilities that are highly deregulated are no longer buffered by regulation and thus respond to news releases more strongly. Comparing the p-values from the Positive Rank Group to those from the Negative Rank Group, I find that all variances on announcement days are significantly larger than variances on nonannouncement days. For instance, the F-value for DQE, Inc., is 11.1522, and its p-value 0.0008, significant at 1% level of significance. Conversely, the F-value for Idacorp, Inc., is 16.0282 and its p-value 0.0001, but its variance values indicate that the variance on nonannouncement days is significantly larger than the variance on announcement days. For Otter Tail Corp, there is no significant difference between the variance of announcement days and the variance of nonannouncement days since p-value is 0.5711.

Examining the BFL F test for utilities in 1994, the year before deregulation, (Table 7), I find that there are no differences in return variance between announcement days and nonannouncement days for four of the six utilities. For two of the three utilities that belong to the Positive Rank Group, I find the ratios to be less than 1 and their p-values are insignificant in 1994, but I find these same two utilities have ratios greater than 1 with a significance level at about 1% level in 2001. This too supports the premise of increased responses to news releases when utilities move from a regulated environment to a deregulated environment. On the other hand, Table 7 shows that all three utilities belonging to the Negative Rank Group are regressed in response to news releases. For instance, the STD_{AD}/STD_{NAD} ratio for Idacorp Power, Inc., is greater than 1 and significant at 10% level of significance in 1994, whereas the STD_{AD}/STD_{NAD} ratio changes to less than 1 with a 1% level of significance. Similarly, Cleco Corporation (named Central Louisiana Electric Co., Inc., in 1994) shows a ratio of 0.97 and insignificant in 1994, whereas its ratio is 0.94 with a significance level at 1% in 2001. Furthermore, Otter Tail Corp (named Otter Tail Power Corp. in 1994) shows a ratio of 1.06 and insignificant in 1994, whereas its ratio changes to 0.99 and insignificant in 2001. This shows the responses to news are regressed for all three utilities belonging to the Negative Rank Group. Taken together, Table 6 and Table 7 suggest that the process of deregulation has increased the responses to news releases. These findings appear to be robust, even considering size and capital structure differences. For instance, the PPL Corporation has the largest assets and debt-to-equity ratio in 2001 but an F-value less than DQE, Inc's. Even in 1994, the PPL Corporation (named Pennsylvania Power & Light Co. in 1994) still has the largest assets and larger debt-to-equity ratio than, for instance, Idacorp Power, Inc., but the PPL Corporation does not respond to news more than Idacorp Power, Inc. For example, in 1994, PPL Corporation has the STD_{AD}/STD_{NAD} ratio of 0.98, F-value of 0.5438, and p-value of 0.4609, but Idacorp Power, Inc., has a ratio of 1.39, an F-value of 2.7956, and a p-value of 0.0946.

Table 6: BFL F Tests for Differences in Return Variance between AD and NAD for 2001

	N_{AD}	N_{NAD}	$\frac{STD_{AD}}{STD_{NAD}}$	F – value	p – value
Deregulated					
DQE, Inc.	10696	6575	1.16	11.1522	0.0008
PPL Corporation	29267	19511	1.09	6.6238	0.0101
El Paso Electric	4088	2801	1.69	3.1454	0.0762
Regulated					
Idacorp, Inc.	9318	6590	0.96	16.0282	0.0001
Cleco Corporation	7033	5093	0.94	11.0759	0.0009
Otter Tail Corp	2131	1705	0.99	0.3210	0.5711

Table 7: BFL F Tests for Differences in Return Variance between AD and NAD for 1994

	N_{AD}	N_{NAD}	$\frac{STD_{AD}}{STD_{NAD}}$	F – value	p – value
DQE, Inc.	1883	1011	0.97	0.0508	0.8216
Pennsylvania Power & Light Co.	3814	2482	0.98	0.5438	0.4609
El Paso Electric	1117	866	1.33	18.1529	<0.0001
Idacorp Power Inc.	1489	944	1.39	2.7956	0.0946
Central Louisiana Electric Co. Inc.	526	322	0.97	0.1986	0.6560
Otter Tail Power Corp.	433	245	1.06	0.0942	0.7589

The BFL F-statistic is: $F_{cal} = \frac{\sum_{j=1}^{J} n_j(\overline{D_{.j}} - \overline{D_{..}})^2 (N-J)}{\sum_{j=1}^{J}\sum_{s=1}^{n_j} (D_{sj} - \overline{D_{.j}})^2 (J-1)}$ where F_{cal} follows an F distribution with J-1 and N-J degrees of freedom.

$D_{sj} = \left| r_{sj} - \hat{M}_j \right|$ is the absolute deviation from its group mean and r_{sj} is the return at second s from group j. $\hat{M}_j$ is the sample median return computed over the n_j returns in j group. $\overline{D_{.j}} = \sum_{s=1}^{n_j} \left(\frac{D_{sj}}{n_j} \right)$ is the mean absolute deviation from the median for group j. $\overline{D_{..}} = \sum_{j=1}^{J} \sum_{s=1}^{n_j} \left(\frac{D_{sj}}{N} \right)$ is the grand mean absolute deviation where D_{sj} is summed over all n_j seconds of j groups and N is the total number of absolute deviations from its group mean of j groups. J is 1 for AD group and 2 for NAD group. Reject H_0 if $F_{cal} > F(1-\alpha;$ J-1, N-J)

4.3: Results of Regression Tests

Using the NAD file as a control to filter out random effects, I find that the results of the BFL F test provide evidence that the process of deregulation has increased the responses to news releases. In order to build robustness into my findings, I perform regression tests on return volatility. It is not surprising that the results of regression tests show that utilities in the Positive Rank Group exhibit more pronounced responses to news releases than the utilities in the Negative Rank Group.

Table 8 shows the results of regression tests for 2001 using Maximum Likelihood method with 3 lags to correct autocorrelation problems.[35] All utilities in the Positive Rank Group show pronounced responses to macroeconomic news releases at a 1% level of significance. Idacorp, Inc., and Cleco Corporation in the Negative Rank Group show mild responses to macroeconomic news at a 10% level of significance, whereas Otter Tail Corp shows no responses to macroeconomic news. The positive sign of coefficients for macroeconomic news indicates that macroeconomic news increases return volatility.

Other variables used in the regression tests also exhibit some significant information. In general, the deregulated utilities respond more often to the standardized volume measure than the regulated utilities do. And time between trades is significant at a 1% level of significance across all utilities. The buy-sell indicator is negative and significant for five of six utilities. This negative coefficient of the buy-sell indicator denotes a bid/ask bounce. For instance, if the previous trades were buyer-initiated trades, then it is expected that the subsequent trades will be seller-initiated trades, a

[35] Heteroscedasticity usually does not occur in time-series data. For precautionary reasons, I use the procedures described in Chapter 3 to detect and correct autocorrelation and heteroscedasticity for utilities in 2001. Results of significances of independent variables are not much different from results reported in Table 8 and Table 9.

transaction shift that will cause price bounces from ask to bid, hence a price change that becomes negative. Conversely, if the previous trades were seller-initiated trades, then it is expected that the next trades will be buyer-initiated trades, a transaction which will cause price bounces from bid to ask, hence a price change that becomes positive.

The interaction of bid-ask spread and return volatility from a previous transaction (lag ($BAS_{s-1}*\sigma_s$)) is significant for all utilities, indicating that market participants take into account the bid-ask spread as well as the risks. The interaction of bid-ask spread, return volatility, and the sign of return from a previous transaction (lag ($BAS_{s-1}*\sigma_s*I_s^-$)) is positive and significant for only three utilities; therefore, it is not clear whether the negative returns have a larger impact on the return volatility.

In order to check overall improvement in news responses from 1994 to 2001 in BFL F tests, I conduct regression tests for 1994. The results (Table 9) show a strong contrast to the results in the 2001 sample. I do not find significant increases in responses to macroeconomic news from any of the six utilities in 1994, and, overall, I find less response to other variables as well. This suggests that there is an overall improvement from 1994 to 2001 in terms of responses to exogenous variables. In addition, the responses to macroeconomic news are stronger for utilities serving in highly deregulated states. This provides empirical evidence that utilities respond more vigorously to market forces in a deregulated environment.

Table 8: Regression Tests for Deregulated Utilities and Regulated Utilities in 2001

	Deregulated Utilities			Regulated Utilities		
	DQE	PPL	EE	IDA	CNL	OTTR
Constant	0.000557***	0.000181***	0.000994***	0.000403***	0.000575***	0.002504***
D_{macro}	0.000154***	0.0000549***	0.000436***	0.0000417*	0.0000798*	0.000294
D_{idio}	0.000980***	-0.000129	-0.000210	0.000673**	-0.000064	0.000457
BSI	-0.000087***	-0.000029***	-0.000146***	-0.000057***	-0.000071***	-0.000045
VOL_{adj}	0.00000096992**	0.0000170***	0.0000203***	0.00000030199	0.0000480***	0.0000631
$Lag(BAS_{s-1}*\sigma_s)$	-0.004844***	-0.0147***	-0.000799**	0.009165***	0.002228*	0.006082***
$Lag(BAS_{s-1}*\sigma_s*I^-)$	0.002203	0.0107***	0.0102***	-0.002272	0.002956	0.003229***
TBT	0.00000065061***	0.0000012904***	0.00000026194***	0.00000052657***	0.00000065487***	0.0000016596***
Total R^2	0.0511	0.0602	0.2362	0.0608	0.1	0.1185

* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

Table 9: Regression Tests for Regulated Utilities in 1994

	DQE	PPL	ELPAQ	IDA	CNL	OTTR
Constant	0.001394***	0.002050***	0.009514***	0.001003***	0.002345***	0.006601***
D_{macro}	0.000133	-0.000063	0.003167	-0.000082	-0.000019	0.001481
D_{idio}	-0.000847	-0.000362	-0.000764	-0.000684	-0.000453	N/A
BSI	0.0000421	-0.000117***	0.002684***	-0.000188***	0.000401***	0.000242
VOL_{adj}	0.0000211**	0.0000139***	-0.000473	0.0000590***	0.0000140	-0.000639**
$Lag(BAS_{s-1}*\sigma_s)$	0.005535*	0.000458	0.006484***	0.0220***	0.006075	0.007343**
$Lag(BAS_{s-1}*\sigma_s*I^-)$	0.003345	0.002514	-0.002750***	0.0759***	0.0105**	0.001173
TBT	0.00000029411***	0.000000023047	0.000002193**	0.00000025338***	0.00000013702**	0.00000023972
Total R^2	0.0364	0.0410	0.1238	0.2362	0.0602	0.0659

* Significant at the 10% level of significance
** Significant at the 5% level of significance
*** Significant at the 1% level of significance

CHAPTER 5

CONCLUSION

The deregulation of the electric utility is designed to reduce government intervention, to let the interaction of supply and demand determine wholesale power price, and to encourage competition in retail markets so that customers may choose their power suppliers, based on options of low rates or high-quality services. With this in mind, I examine one particular purpose of deregulation in the electric utility industry–making utility operations more responsive to market force. My premise is that utilities that provide electricity to highly deregulated states will be more responsive to market forces than those providing electricity to regulated states. To investigate this issue, I use the following sampling procedures: First, to identify two categories of utilities, I identify states that are moving toward to customer-choice model and states that specifically reject the customer-choice method of deregulation. The Retail Energy Deregulation (RED) Index, 2nd edition, July 2001, from the Center for the Advancement of Energy Markets provides a sound basis to categorize these states, using 22 attributes. Second, I sample two extreme groups from their ranking distribution: the Positive Rank Group states and the Negative Rank Group states. Third, for each category, I find three utilities serving predominantly highly deregulated states and three utilities serving regulated states.

To measure the success of the deregulation process of each state, I examine utilities' responses to market forces, comparing utilities providing electricity to highly deregulated states with those providing electricity to regulated states in 2001. In order to develop a more accurate and robust base of reference, I also examine the responses of the specified utilities to market forces for the year 1994 (the year preceding deregulation). Next, I identify twenty-two of the most important microeconomic news releases by governmental and private agencies as a proxy of market forces for 2001 and 1994. To measure the instantaneous responses of stock prices to these news releases, I then secure intraday trade and quote data from the New York Stock Exchange Trade and Quote database for the sample period of April to June of 2001 and April to June of 1994. I use a two-step filtering procedure to separate trade and quote data into two files: the announcement days file (AD file) and the nonannouncement days file (NAD file). The AD file for each utility contains the following data: the bid-ask spread (BAS), the bid size (BSZ), the offer size (OSZ), the trade size (TSZ), the number of transactions traded at minute *m* ($NOBS_m$), and the time lapse between trades in seconds (TBT) on days that have at least one news release (macroeconomic news and/or idiosyncratic news), whereas the NAD file for each utility contains the same set of data but on days that have no news releases. The NAD file is used as a control to filter random effects.

After the trade and quote data are separated into Announcement Days file and Nonannouncement Days file, I conduct a t-test and identify two key statistical inferences from the summary statistics. First, the summary statistics of the BAS provide evidence that utilities in the Positive Rank Group are more responsive to news releases than utilities in the Negative Rank Groups for the year 2001. The BAS statistics in 1994, the year before deregulation, show that there is no significant difference between the volatility of the BAS on announcement days and the BAS on nonannouncement days, with only one exception, the Pennsylvania Power & Light Co. This suggests that utilities are buffered by regulation and are therefore indifferent to exogenous impact–macroeconomic factors. Second, the number of transactions (NOBS) exhibits a significant pattern: the number of transactions per minute presents strong and systematic evidence that more transactions occur on announcements days than on nonannouncement days for all utilities in both 2001 and 1994.

Ross (1989) maintains that the arrival of information has a direct impact on the volatility of stock prices in an arbitrage-free environment. For my study, I investigate the stock return responses to release news, using the Brown-Forsythe-Modified Levene (BFL) test to examine the volatility differences between days with released news and days without released news. The results of BFL F test (reported in Table 6) for the year 2001 indicate a strong contrast in response to news between utilities in the Positive Rank Group and utilities in the Negative Rank Group. The ratios of the standard deviation for the announcement days to the standard deviation for the nonannouncement days (STD_{AD}/STD_{NAD}) are all greater than 1 for utilities in the Positive Rank Group. This indicates that the return variances on announcement days are consistently greater than the return variances on nonannouncement days for deregulated utilities. Conversely, the ratios of STD_{AD}/STD_{NAD} are consistently smaller than 1, indicating that the return variances on announcement days are smaller than the return variances on nonannouncement days for regulated utilities. This provides strong evidence to support my argument that utilities that are highly deregulated are no longer buffered by regulation and thus respond more strongly to news releases. Examining the BFL F test for utilities in 1994, the year before deregulation, (Table 7), I find no differences in return variance between announcement days and nonannouncement days for four of the six utilities. For two of the three utilities that belong to the Positive Rank Group, I find the ratios to be less than 1 and their p-values insignificant in 1994, but I find that these same two utilities have ratios greater than 1 with a significance level at about 1% level in 2001. These findings also support the premise of increased responses to news releases when utilities move from a regulated environment to a deregulated environment. My findings appear to be robust, even considering size and capital structure differences. For example, the PPL Corporation has the largest assets and debt-to-equity ratio in 2001, but an F-value less than DQE, Inc's. Even in 1994, the PPL Corporation (named Pennsylvania Power & Light Co. in 1994) still shows larger assets and larger debt-to-equity ratio than, for instance, Idacorp Power, Inc., but the PPL Corporation does not respond to news more strongly than Idacorp Power, Inc.

My last test, a regression test, examines the effects of macroeconomic news; idiosyncratic news; standardized volumes; a buy-sell indicator; the interaction between bid-ask spread and return volatility from a previous transaction (lag ($BAS_{s-1}*\sigma_s$)); the interaction between bid-ask spread, return volatility, and the sign of return from a previous transaction (lag ($BAS_{s-1}*\sigma_s*I_s^-$)); and time lapse between trade on return volatility. The results of the regression test support the findings from BFL tests that all utilities in the Positive Rank Group show pronounced responses to macroeconomic news releases at a 1% level of significance, whereas fewer responses are shown in the Negative Rank Group for the year 2001. Furthermore, the regression tests of 1994 give evidence even more striking—findings show that none of the utilities respond to macroeconomic news releases. Given the strong and significant responses from the utilities in the High Rank Group and fewer responses from the utilities in the Negative Rank Group for the year 2001, the findings for the year 1994 reconfirm my conjecture that deregulation in the electric utility industry does, in fact, make utility operations more responsive to market forces and that deregulation is indeed effective for states that implement a customer-choice model. Both BFL F tests and regression tests provide substantial empirical evidence that utilities respond more vigorously to market forces in a deregulated environment and that deregulation is indeed effective in states that implement a customer-choice model.

The contributions of this study to the power industry may be identified as follows: (1) the success of deregulation depends largely on each state's restructuring plan; therefore, this study provides state and federal legislatures with empirical evidence of the effectiveness of deregulation; (2) the findings of this study will influence the way state and federal legislatures enact utility laws; (3) this study provides empirical evidence of successful deregulation models; therefore, a further study of the restructuring policies of successful deregulation models could be done to improve the competition of the electric utility industry in all states; (4) this study provides methods that may be applied to other deregulated industries.

APPENDIX I

RED INDEX SCORES AND ATTRIBUTE LISTING

RED INDEX SCORES AND ATTRIBUTE LISTING

Exhibit 3-1: RED Index Scores in July 2001[36]

Seq. No.	States	Rank	Score
1	Pennsylvania	1	66
2	Texas	2	65
3	New York	3	64
4	Maine	4	62
5	DC	5	56
6	Maryland	5	56
7	New Jersey	7	47
8	Arizona	7	47
9	Virginia	9	45
10	Illinois	9	45
11	Montana	11	44
12	Connecticut	12	43
13	Michigan	13	42
14	Massachusetts	14	41
15	Ohio	15	39
16	Rhode Island	16	36
17	California	17	34
18	Delaware	18	31
19	New Hampshire	19	27
20	Oregon	20	24
21	West Virginia	21	17
22	Arkansas	21	17
23	Nevada	23	12
24	New Mexico	24	9

[36]Source is from Retail Energy Deregulation (RED) Index, 2nd edition, July 2001, pp. 136-138, Center for the Advancement of Energy Markets. A score of 0 indicates that a state is still implementing the traditional monopolistic model; a score of 100 indicates that a state is completely and effectively implementing the customer choice model, whereas a negative score indicates that a state explicitly rejects the policies of restructuring in the retail energy market.

Seq. No.	States	Rank	Score
25	Vermont	25	6
26	Kentucky	26	3
27	Washington	27	2
28	Alaska	28	0
29	Florida	28	0
30	Georgia	28	0
31	Hawaii	28	0
32	Indiana	28	0
33	Iowa	28	0
34	Kansas	28	0
35	Missouri	28	0
36	North Carolina	28	0
37	North Dakota	28	0
38	Oklahoma	28	0
39	South Carolina	28	0
40	South Dakota	28	0
41	Tennessee	28	0
42	Utah	28	0
43	Wisconsin	28	0
44	Wyoming	28	0
45	Nebraska	51	-8
46	Colorado	51	-8
47	Idaho	51	-8
48	Alabama	51	-8
49	Louisiana	51	-8
50	Minnesota	51	-8
51	Mississippi	51	-8

Exhibit 3-2: Attribute Listing[37]

A. Competitive Framework Cluster
1. Does a detailed plan exist?
2. What percentage of customers are eligible?
3. What percentage of customers have switched?
4. What safeguards prevent utility/affiliate favoritism?
5. How standardized are business practices?
6. Is billing a competitive service?
7. Is metering a competitive service?

B. Generation Cluster
8. What is the market structure for generation?
9. How controlled is the wholesale market?
10. Do stranded costs meet a market test?
11. Are stranded cost charges fixed?

C. Consumer Cluster
12. Are suppliers granted effective access to customer information?
13. Is a comprehensive consumer education program required?
14. How are default customers handled?

D. Distribution Cluster
15. Do default prices allow effective competition from suppliers?
16. Are default rates properly set?
17. Is performance-based pricing used for network facilities?
18. Are efficient pricing principles used for network pricing?
19. Do policies impede small-scale generation?

E. Commission Cluster
20. Are gas and electric policies integrated?
21. Has the commission reengineered its processes for new regime?
22. Is commission budget commensurate with new responsibilities?

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[37] Source is from Retail Energy Deregulation (RED) Index, 2nd edition, July 2001, pp. 5-6, 41-71, Center for the Advancement of Energy Markets.

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