Regulatory Decision-Making: An Event Study of a Capital Structure Decision

Carl R. Peterson
University of Illinois Springfield

Karl A. McDermott
University of Illinois Springfield

A public utility's earnings are inherently linked to decisions of the regulatory body. In April 2017 Spire Missouri requested a rate increase that, in part, proposed fifty-four percent equity in its capital structure. On January 31, 2018 the regulatory body held an open meeting in which it appeared to allow only forty-nine percent equity. While this meeting did not represent a final decision, the signal sent concerning likely capital cost recovery should influence the stock price. Using a single-firm, single-event methodology we find evidence that this one event negatively influenced daily returns by approximately three to four percent beyond expected on a normal trading day.

INTRODUCTION

Public utilities are a unique creature in the commercial environment of modern economies. While US law protects private property from confiscation by government, public utilities submit to a regulatory compact that generally provides shelter from competitive entry in return for truncating property rights by submitting to the regulation of its prices. (McDermott, 2012). The ratemaking exercise, implemented through a rate case, represents a complex set of administrative procedures in which a regulator attempts to ascertain the correct level of operating expenses and invested capital. Within the rate case, regulators set a revenue requirement representing total reasonable expenses, including taxes and depreciation expense and the total return on invested capital the utility. To make this calculation regulators employ the concept of an annual test period, called a test year, designed to represent the utility's expected annual costs once rates go into effect. The capital structure of the utility represents the level of invested capital and is generally calculated as a weighted average of the types of capital used in financing the firm. This will include the relative amount of equity capital multiplied by its market price and the relative amount of debt capital multiped by its market price. Part of the regulator's function is to determine the appropriate inputs that enter the capital structure. Since rates are set at a point in time, the assumed capital structure has a direct effect on the amount of cash flow utilities can reasonable expect when rates become effective. A higher equity percentage, all else equal, implies higher cash flow.

The purpose of this paper is to examine how the regulator's approach to the capital structure decision affected the stock price performance of Spire Inc. (SR) during the event. SR is a public utility holding company that owns several natural gas distribution utilities that fall under state regulation.[1] In 2017 Spire

Missouri filed a petition with the Missouri Public Service Commission (MO-PSC) to increase rates for its Missouri jurisdictional utilities. Spire Missouri proposed a capital structure for use in setting rates that it considered reasonable and prudent. The MO-PSC disagreed and decided to reduce the amount of equity capital allowed in the capital structure for setting rates.[2] Under any version of the efficient market hypothesis, information concerning the potential valuation of a stock, in this case a signal from the regulatory body concerning the approved capital structure, is promptly incorporated into the price of the stock, at least when that information is widely known. Using a single-event, single-firm event study framework, we find that once the MO-PSC decided to reduce Spire Missouri's equity portion of its capital structure for the purposes of setting rates, that information was quickly incorporated into the valuation of the SR stock. SR stock's daily returns are estimated to be negatively affected by approximately three to four percent.

The paper is organized as follows: Section II outlines the process by which regulators set utility prices and examines the 2017 Spire Missouri rate case and the expected effect on utility stock prices from the signals concerning capital structure. Section III presents the methodology and the data employed to test the hypothesis with results and comments. In this section we define the event window used to model the timing of the event that is suspected of conveying the latest information concerning stock valuation to investors. The last section is reserved for conclusions and comments.

Review Of Ratemaking Process For Natural Gas Utilities

The focus of ratemaking is the determination of the total prudent cost of serving customers.[3] Regulatory bodies generally utilize some version of the basic revenue requirements equation:

$$RR = OE + WACC \times (V - D) \quad (1)$$

where:

RR = revenue requirement
OE = Operating expenses (including annual depreciation expense and taxes)
WACC = capital structure-weighted average market cost of debt and equity
V-D = rate base or the prudently incurred gross value of property and equipment less accumulated depreciation.

Equation (1) identifies the total cost of service for one year, often called the *revenue requirement.* Prices are calculated based on Equation (1) such that there is a reasonable expectation that when the prices become effective the utility will recover the amount of revenue determined by Equation (1). A significant level of detailed accounting data concerning the utility is audited by an outside accounting firm as well as the regulator. To set the proper level of allowed annual revenues a *test year* is chosen. A test year may represent a historic year, the current year, or an estimate of a future year's costs and the rules for test years vary by jurisdiction.[4] For Spire Missouri, a historic test year was set ending December 31, 2016. Since the ratemaking process takes a substantial amount of time, however, when using a historic test year, the regulator generally allows for adjustments to the revenue requirement for those changes that are *known and measurable* through some period after the test year. In the case of Spire Missouri, the MO-PSC allowed modification to Equation (1) through June 30, 2017 which was then trued up through September 30, 2017.[5]

While Equation (1) may look mechanical, its implementation is far from mechanical. The classic economic explanation for the regulation of utilities is the natural monopoly condition which implies costs are minimized with one provider in the market. (*See e.g.,* Kahn, 1971, Vol. I, p. 11, Vol. II, p. 2). For most public utilities, such as Spire Missouri, large upfront fixed costs result in economies of scale and cause marginal cost to fall below average cost at the market level of output. This leads to the conclusion that, unchecked, a utility will set its output price higher than marginal cost leaving some consumers, who are willing to pay the marginal cost-based price, locked out of the market. Moreover, the natural monopoly condition leads to a concern over incentives to minimize costs. (*See e.g.,* Kahn, 1971, Vol. II, Ch. 2; Joskow, 2008, p. 549). Equation (1), and its implementation by the regulator, is designed to

mitigate the monopoly conditions and its attendant incentive issues to the extent consistent with providing the utility a reasonable opportunity to recover its prudently incurred costs, including its cost of capital. This requires judgment on the part of the regulatory body concerning the level and type of costs properly included in Equation (1). Capital costs are often highly contested in ratemaking proceedings since the cost of equity capital is not directly observable and is generally estimated from market data. In addition, the amount of capital used to support utility assets is often a matter of contentious debate since inclusion of items that are commonplace in unregulated capital structures, such as goodwill from acquisitions, are subject to the discretion of the regulatory body for ratemaking purposes.

In the US, regulators are bound by both the jurisdictional enabling legislation and the US Constitution. The general principles regulators utilize to adjudicate ratemaking are found in Federal case law. In the US Supreme Court's *Bluefield* decision, the Court noted that "[R]ates which are not sufficient to yield a reasonable return on the value of the property used at the time it is being used to render the services are unjust, unreasonable and confiscatory, and their enforcement deprives the public utility company of its property in violation of the Fourteenth Amendment."[6] The Court here is articulating a *used and useful* standard of providing a return on the value of property when it is used to provide service to customers. Later, the Court created a much broader standard:

> [I]t is not the theory but the impact of the rate order which counts. If the total effect of the rate order cannot be said to be unjust and unreasonable, judicial inquiry under the Act is at an end. The fact that the method employed to reach that result may contain infirmities is not then important. Moreover, [the regulator's decision] does not become suspect by reason of the fact that it is challenged. It is the product of expert judgment which carries a presumption of validity.[7]

This is a statement of the *End Result Doctrine*. (McDermott, 2012). The Court, in effect, provides wide latitude to regulators to determine rates if the result of the decision is just and reasonable. The *Hope* Court also made clear that this discretion given to regulators "involves a balancing of the investor and the consumer interests." (*Id.*) The regulator's decision is *presumed* appropriate and courts generally defer to the expert body in these matters unless decisions are obviously flawed based on the evidence.[8] It is in this general context that the rate setting process is adjudicated.

The process by which the regulatory body determines the appropriate revenue requirement is a quasi-judicial procedure. The moving entity, generally the utility when requesting a rate increase, files with the regulator a detailed set of audited financial statements, complete with data documenting the costs of providing service in the jurisdiction being careful to remove those costs that are associated with operations that are not subject to that jurisdiction's authority.[9] In the proceeding under review in this paper, Spire Missouri filed this information with the MO-PSC on April 11, 2017 with an effective date of May 11, 2017. On April 19, 2017 the MO-PSC suspended the filing for further review as provided for under Missouri statute. This action postponed the date that new prices were to become effective for 120 days after the effective date proposed by Spire Missouri. Under Missouri law, however, the MO-PSC may determine that additional time is required for proper review of the request and is permitted to further suspend the tariffs from taking effect for an additional six months.[10] It is common for the MO-PSC to take the full time allowed for under law when reviewing large rate cases such as that filed by Spire Missouri. Since this is customary practice, when a rate case is filed by a large utility in Missouri it is widely expected that the new prices will not take effect until eleven months after the initial filing.

During this eleven-month period the public is invited to provide its input on the proposed rate increase. While some of this input is obtained through public meetings held in the affected service territory, the technical evaluation of the filing is completed in a formal administrative process where sworn testimony is provided. This process is similar to a formal judicial proceeding in which affected parties may request the opportunity to provide criticism and alternatives to the utility's proposals. Since participating in a formal legal proceeding is costly, in most jurisdictions, including Missouri, there are a limited number of active participants. Generally, this will include, in addition to the utility, the technical

staff of the regulatory body, with appropriate legal shields in place to avoid undue influence, representatives of various customer groups (e.g., industrial, residential and commercial) as well as representatives from interested state, local or Federal agencies, environmental groups, gas marketers, and potentially a few other more specialized groups. While many of these groups were represented in Spire Missouri's rate case, the key active participants addressing the issues at interest in this paper were the Staff of the MO-PSC, the Office of Public Counsel (OPC) (representing, *generally*, the interests of customers), and the Missouri Industrial Energy Consumers (MIEC) (representing a select group of large industrial consumers).

Spire Missouri's initial testimony was filed on April 11, 2017. In that testimony, Spire Missouri proposed a capital structure consisting of 42.8 percent long-term debt and 57.2 percent equity and excluding any short-term debt. (Ahern, 2017, p. 17). Over the course of the proceeding, three other parties responded to this proposal with alternatives. The Staff of the MO-PSC proposed an imputed capital structure from Spire Missouri's parent as of the true-up date (September 30, 2017). Staff also included a portion of Spire Missouri's outstanding short-term debt under the theory that some level of short-term debt is used to support utility assets. If approved, this proposal would have reduced Spire Missouri's proposed equity, for ratemaking purposes, to 45.56 percent reducing Spire Missouri's allowed revenue requirement by over $16 million (Murray, 2017).[11] The OPC and MIEC co-sponsored testimony proposing to reduce the equity component to 47.2 percent by adjusting long-term debt based on recent issuances and removing, for ratemaking purposes, goodwill (Gorman, 2017). Spire Missouri filed its true-up proposal on October 27, 2017 reflecting the actual capital structure of the operating company as of September 30, 2017, including the then recent restructuring of its long-term debt. This represents Spire Missouri's final proposed 54.2 percent equity in its capital structure for ratemaking purposes. Hearings were set for December 2017 and the Commission met on January 23 and 31, 2018 to begin discussions of the decision.

METHODOLOGY AND RESULTS

The price of the firm's stock is expected in incorporate all relevant information concerning the value of a firm (Muth, 1961; Fama, 1970).[12] In principle, stocks are priced such that no opportunities exist for arbitrage of information and changes in stock prices should present an opportunity to observe the effect of additional information, at least as it becomes widely known (Schwert, 1981).

Event studies are used to examine the extent and timing of the incorporation of information into the stock price. Many event studies using differing methodologies to evaluate the incorporation of information into stock prices are found in the literature (*See e.g.,* Kothari and Warner, 2009). Some examples include the effects of contract interference during a merger and whether firms are violating international arms embargos (Fama et al., 1969; Cutler and Summers, 1988; Dell Vigna and La Ferrara, 2010). Event studies are used in securities and antitrust litigation to study events such as stock splits, takeovers and mergers, switching state corporate charters, regulatory effects, and many other events that have informational value to investors (*See e.g.,* Bhagat and Romano, 2002b, Schwert, 1981; MacKinlay, 1997).

Ferstl *et al.* (2012) examine the effect on the global nuclear and alternative energy sectors from the 2011 Fukushima-Daiichi nuclear event in Japan. McDermott and Peterson (2012) apply the event study framework to state-regulated electric public utility holding company stock price resulting from a change in an accounting rule interpretation by the regulator. As in securities and anti-trust litigation, event studies are used in public utility litigation. For example, a continuing dispute exists over the effect of alternative cost recovery mechanisms on the cost of equity for a regulated utility (*See e.g.,* Wharton and Vilbert, 2015). Event studies can shed light on equity investor's response to the modification of cost recovery mechanisms approved by regulatory bodies (*See e.g.,* Makholm, 2010).

The effect of regulatory decisions on the stock price of a utility or its holding company is not directly considered in the litigation concerning Equation (1), yet the connection is often unmistakable. The End Result Doctrine requires a balancing of the interests of both investors and customers. Studying the effect

of economic regulatory decisions on investors can help provide regulators with a more general understanding of the effects of direct regulation on the ability of utilities to raise capital. Further, studying the direct regulation of public utilities would seem a natural extension of the literature on event studies.

The process requires three steps. First, a discrete event is defined. Second, a selection criterion is developed for including firms. In this case the focus is on one firm. Third, an analysis of abnormal returns can provide insight into the effect of the event. (MacKinlay, 1997, pp. 14-15; Bhagat and Romano, 2002a).

Defining the Event

Table 1 provides the basic timeline for the event at issue here. While there are several possible events, this paper focuses and the two days January 31 and February 1, 2018 since the regulatory body made a preliminary decision on January 31 to impute the consolidated capital structure for ratemaking purposes effectively lowering the equity ratio to below fifty percent. These two dates are called the event window. While information concerning the proposals was publicly known prior to these dates, we focus on the event window because all public information known prior to these dates was not final. Proposals are reviewed by the regulatory body, and it is well-known that regulators need not approve all proposals. Not all proposals are likely to provided guidance into a final decision by a regulatory body. Moreover, the January 31, 2018 meeting of the MO-PSC was recognized by the investment community as critical. For example, on the morning of February 1, 2018 CreditSuisse issued an Equity Research note that lowered earnings estimate for SR noting that "regulator deliberations point toward adoption of…consolidated equity ratio rather than… [Spire Missouri's]…proposed…54% equity ratio." (*Note (d), Table 1*). Furthermore, a review of the hourly prices of SR compared to the broader market shows the precipitous drop in the SR price during the event window (Figure 1). As the decision became clear during the MO-PSC meeting, SR's stock price continued to fall. This continued the next day as the results of the meeting became more widely known. We interpret the meeting of the MO-PSC on January 31, 2018 and the subsequent dissemination of the decision the following day as "Bad News" for the value of SR's stock.

FIGURE 1
HOURLY PRICES FOR SPIRE INC. (SR), DOW JONES UTILITY AVERAGE (DJUA) AND THE S&P 500 INDEX (JANUARY 26-FEBRUARY 2, 2018)

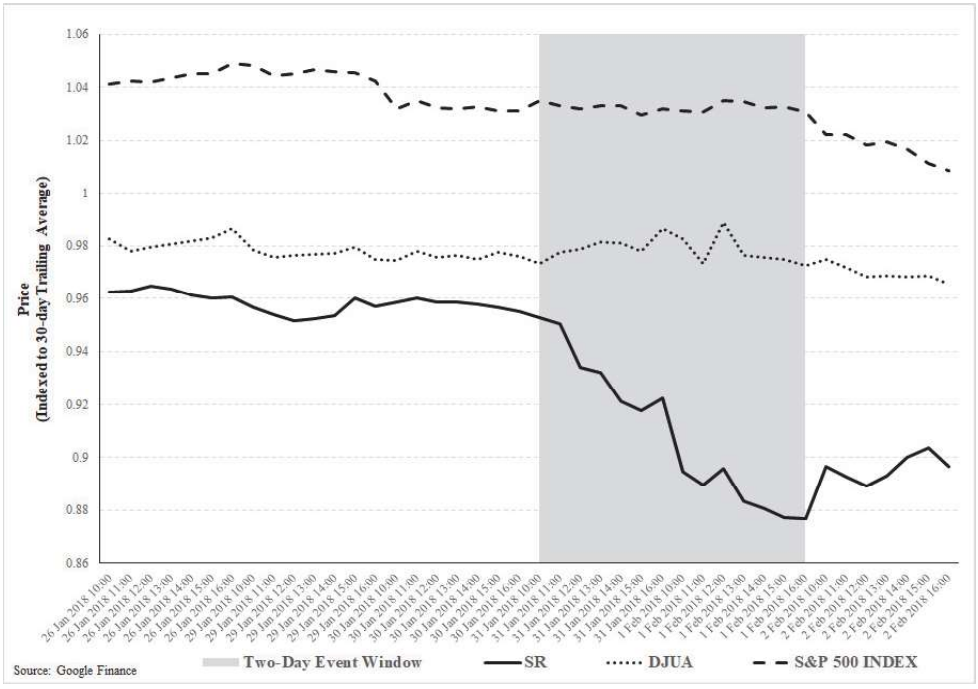


TABLE 1
TIME LINE FOR SPIRE MISSOURI RATE CASE DECISION

Date	Event	Comments
11-April-2017	Spire Missouri files rate case information with MO-PSC with proposed rate effective date May 11, 2018	Equity in capital structure proposed at 57.2 percent.
19-April-2017	MO-PSC suspends Spire Missouri rate case for an additional 10 months after proposed rate effective date	This delay in approving new rates is common
17-October-2017	OPC-MIEC file proposed 47.2 percent equity	Counter proposals, even extreme approaches, are common in litigation.
27-October-2017	Spire Missouri files updated figures for September 30, 2017 implying a 54.2 percent equity component	Updated data presumably reflects Spire Missouri 's actual costs.
21-November-2017	Staff of MO-PSC propose 45.56 percent equity by imputing holding company capital structure and including short-term debt in capital structure	While imputation of holding company capital structure is less common, this was still a proposal and not a final decision.
22-December-2017	Tax Cuts and Jobs Act of 2017 (TCJA) signed into law	This occurred after all data was trued-up to September 30, 2017
18-January-2018	MO-PSC orders Spire Missouri to file adjustments to revenue requirement to account for implications of TCJA. [(a)]	A somewhat unusual request, however, the implications of the TCJA were previously understood. [(b)]
23-January-2018	MO-PSC has first meeting to discuss case. Spire Missouri files information on TCJA as Ordered on January 18	Capital structure issue held off for further review. Implications of TCJA of 2017 was discussed and held for further discussion
26-January-2018	MO-PSC orders a technical conference and hearing to address issues related to the TCJA[(c)]	
31-January-2018	MO-PSC convenes at 9:30am US Central Time (10:30am US Eastern Time) to discuss Spire Missouri decision and determines that the holding company capitalization be used for ratemaking purposes	Commission did not approve using short-term debt in the capital structure; implication of decision is that equity will represent less than 50 percent of capital structure
1-February-2018	CreditSuisse issues new guidance on SR because of the MO-PSC meeting [(d)]	
5-February-2018	MO-PSC holds hearing on implications of TCJA	Parties present various proposals to address TCJA

(a) *Order Directing Filing of Adjustment Information Regarding the Tax Cuts and Jobs Act and Setting Procedural Dates*, MO-PSC Order in File Nos. GR-2017-0215 -0216

(b) "Corporate Tax Reform and Utilities," RRA Financial Focus, S&P Global, Market Intelligence, November 29, 2017.

(c) *Order Setting Technical Conference and Order Setting Hearing*, MO-PSC Order in File Nos. GR-2017-0215, -0216

(d) CreditSuisse, "Another Step Backward for Missouri," Spire Inc., Equity Research, Gas Utilities, February 1, 2018.

Analyzing Abnormal Returns

To investigate the effect of the event on returns to the firm's stock, the traditional approach first calculates the security's daily return defined as:

$$r_t = \ln(P_t) - \ln(P_{t-1}) \quad (2)$$

where:

r_t = return on day *t*
P_t = closing price on day *t*
P_{t-1} = closing price on day *t-1*

The daily return is modeled as follows:

$$r_t^i = X_t^i \beta^i + AR_t^i \quad (3)$$

where:

r_t^i = return on day *t* for firm *i* (as we are interested in one firm *i*=1)
X_t^i = vector of market return for day *i* and potentially other control variables
AR_t^i = (abnormal) return that cannot be explained by the vector of control variables

Of interest in an event study is the abnormal return, dropping the firm index, we can write the abnormal return as:

$$AR_i = \gamma D_i + ar_i \quad (4)$$

where:

D_t = dummy variable taking the value 1 during the event window and 0 otherwise
γ = the true effect during the event window
ar_i = the remaining part of the abnormal return that cannot be explained by the event

AR_i is considered a date-specific location shift of ar_i with the shift parameter γ. We are interested in estimating γ. Substituting (4) into (3):

$$r_t = X_t \beta + D_t \gamma + ar_t \quad (5)$$

t = 1, 2 ..., e_t, where e_t is the event window, when $t \neq e_t$, $D_t = 0$; for $t = e_t$, $D_t = 1$. That is, the abnormal return to the event occurs only during the event window; otherwise $AR_i = ar_i$. To estimate (5) we used data from one hundred trading days prior to the event.

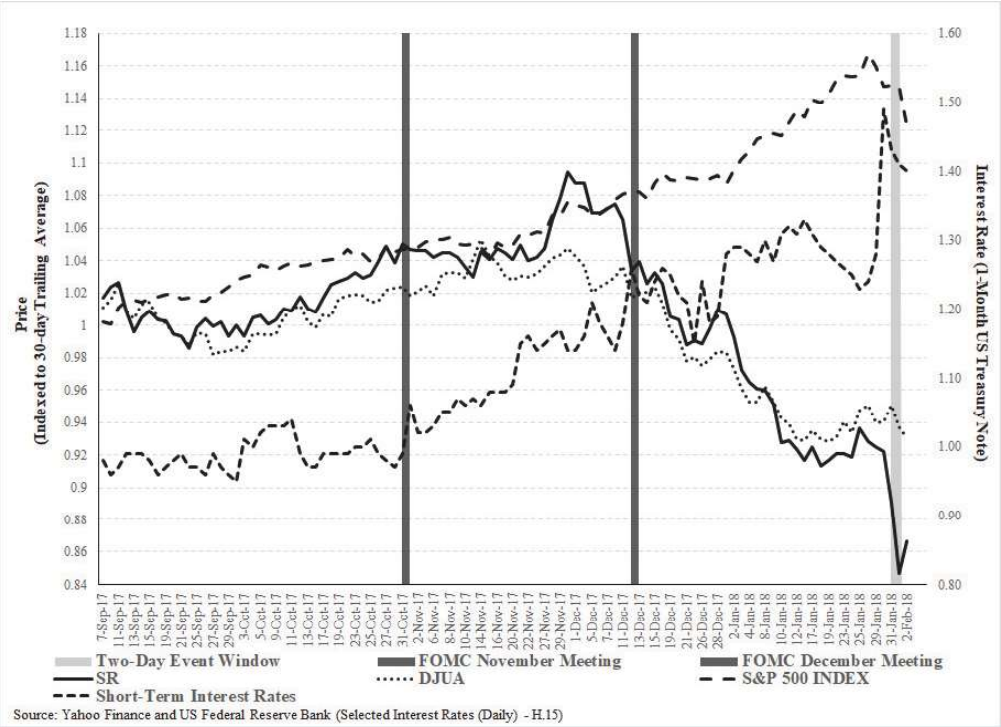
One issue with event studies is the definition of e_t. One might expect an event window is one day, or even one hour, yet often exactly when the information alleged to influence the market becomes public or widely disseminated is not exactly clear. For example, the key negative event from Table 1 is the January 31, 2018 decision to impute a consolidated capital structure reducing Spire Missouri's proposed equity ratio. While this event was certainly public, it seems likely that the signal sent from this one event may have dissipated slowly to the market. This is perhaps best understood when put in the context of a regulatory decision. Unlike a single factor that might affect a company's earnings, e.g., disclosure of previously undisclosed information, a rate case is a complex interaction of numerous factors. Of course, capital structure and the cost of equity are important, other factors in Equation (1), however, also have a direct effect on the total revenue, and in turn, the cash flow a utility can expect going forward. The January 31 meeting addressed, in large part, the capital structure and cost of equity and left other critical issues for later discussion. For example, the effect of the TCJA, which was widely expected by observers

of the utility industry to require a reduction in prices, was left for another day. Indeed, the Commission took a slightly unusual approach by ordering Spire Missouri to file figures relating to the TCJA then left the discussion and hearing of those figures until the week after the event under review in this paper. One could make an argument that since the MO-PSC required a true-up of costs as of September 30, 2017, those factors affecting costs that occurred after that date are excluded from this rate proceeding, including any possible tax reductions due to the TCJA.[13] Alternatively, regulators almost certainly felt pressure to pass the tax cuts onto consumers in the form of lower prices since regulation, it is often argued, is viewed as a surrogate for competition and cost reductions that affect an entire industry are reflected in lower prices.[14] While most investors likely had a general understanding of the effect of the TCJA on rates, the specifics of the adjustments, the timing, and the magnitude was not well understood as of the event window.

We assume January 31, 2018 was the first trading day in the event window. Yet dissemination of the result of the January 31, 2018 meeting were more broadly known by the morning of February 1, 2018. To address this, we use two different event windows: a single-day (January 31, 2018) and a two-day event window (January 31, 2018 – February 1, 2018).

We next address the variables in the vector X_t. Investors can diversify firm-specific risk by purchasing a well-diversified portfolio but cannot diversify the broader market risks. This suggests that the return from a broad measure of assets will influence the return to any individual stock. While in theory a market measure of return should include all possible assets, in most event studies the return to the market is measured with respect to the S&P 500 Index or an even broader market index such as the Center for Research in Security Prices (CRSP) Value Weighted Index or the CRSP Equal Weighted Index (MacKinlay 1997, p. 18). In this case, however, we consider the broader market less important than other utility stocks. For the purposes of estimating abnormal returns for a utility, we utilize a measure of the returns to utility stocks measured by changes in the Dow Jones Utility Average (DJUA) rather than the broader market. This approach captures the sector-specific market effects which are likely to affect returns to utility stocks, at least over a brief period. That regulated utilities are somewhat different financially from non-regulated companies is not a new concept (*See e.g.,* Taggart, 1981, Bradley, *et al.*, 1984). One consistent fact of regulated utilities is higher leverage relative to the broader universe of publicly-traded firms.[15] The implementation of price-making through Equation (1) can, effectively, lower bankruptcy costs, allowing utilities to undertake more debt. Moreover, utilities are highly capital intensive implying that interest costs are a significant driver of expenses. Indeed, unregulated markets and utility returns are often not highly correlated, and utility returns may correlate with interest rates as shown in Figure 2. Short-term interest rates started to rise as the US Federal Reserve's Open Market Committee (FOMC) was meeting on October 31-November 1, 2017 even though the FOMC determined to maintain the then-current Federal Funds rate target.[16] It appears, however, expectations of future increases in the Federal Funds rate were realized as short-term interest rates started to rise ahead of the FOMC December 12-13, 2017 meeting and continued to increase into early 2018. At the same time, the DJUA and SR, both were trending upward, at least since early September 2017, flattened out and both began to fall after the December FOMC meeting, even as the broader market rose. Despite this, and consistent with previous research, we report results using both the daily returns to the DJUA and the daily returns to the S&P 500 Index as the independent variable. Other factors might also affect the firm's returns beyond the market proxy. Such factors may include firm size, asset base or other firm-specific variables. Since we are estimating the response over a relatively short period—one hundred trading days—other factors which may affect the firm's return over a long adjustment period are unlikely to change significantly (*See Note 17*). In addition, we know of no other obvious external events during the estimation window that might affect this firm's returns.

FIGURE 2
DAILY PRICES FOR SPIRE INC. (SR), DOW JONES UTILITY AVERAGE (DJUA), THE S&P 500 INDEX AND SHORT-TERM INTEREST RATES (SEPTEMBER 7, 2017-FEBRUARY 2, 2018)



Source: Yahoo Finance and US Federal Reserve Bank (Selected Interest Rates (Daily) - H.15)

RESULTS

Our reported results are found in Table 2. The dependent variable in each equation is the daily return on SR common stock. The DJUA, the S&P 500 Index, and the SR prices were all adjusted to remove the effects of dividends and splits. The coefficient (γ) on the event window dummy is negative in all cases which is consistent with the event providing "Bad News." The magnitude of the effect is similar across each of the model specifications, ranging from approximately 3.3 percent to 4.4 percent. The p-values suggest that the likelihood that we are rejecting the null when the event had no effect on the daily return of SR is low. Further, the definition of the event window does not seem to affect the results strongly. It appears from this evidence that the event probably occurred roughly equally over the two days. The choice of a market proxy, however, is important. Using the standard approach of explaining a stock's return to the overall market proxy does not appear to work well with a utility, at least during the one-hundred day estimation window used to create Table 2. In both definitions of our event window we cannot reject the hypothesis that the market returns, as proxied by the S&P 500 Index, have no effect on the returns to this utility. This conclusion is tempered somewhat by recognizing that these are daily returns used over a relatively brief period and the p-values from the hypothesis tests range from 14 to15 percent for the non-directional alternative hypothesis. While somewhat higher than normally considered by researchers as reasonable probabilities of a Type I error, it seems likely that market returns have some influence on the return to utility stock.[17] The main result of including the broader market, as opposed to the utility-specific market measure, is the fit of the equation. The R is noticeably lower in the equations using the broader market measure and the standard errors are larger. In both cases, the 2-day window provides a slightly better fit.

These results, while encouraging, may be misleading since there is evidence that the t-ratios calculated by the OLS regressions in Table 2, in general, may provide bias results because the abnormal returns may not be normally distributed, especially when studying only one firm (Brown and Warner, 1985; Gelbach *et al.* 2013). The problem for the t-test occurs in testing the extreme values. If the abnormal returns are not from a normal distribution, one has trouble making sense of cut-off values from an unknown distribution. Appendix A reports the Shapiro-Wilk and Shapiro-Francia tests and the Stata Skewness/Kurtosis test, which is an adjusted Jarque-Bera test. We also present the Normal Q-Q plots for abnormal returns from each model. In most cases, we do not reject normality of the abnormal returns, though the p-values are not strongly convincing. We do reject normality at the five percent level using the Skweness/Kurtosis test in two cases. The normal Q-Q plots suggest that normality may be questioned, though the extent of the non-normality is debatable. To address the potential for non-normal abnormal returns, we also apply the sample quantile approach as discussed next.

Gelbach *et al.* (2013, p. 518) suggest a surprisingly simple method to address the non-normality problem using a sample quantile (SQ) approach. In concept, the SQ approach is similar to the Chow test for testing differences in the regression coefficients from one observation to the next (*Id.* pp. 503-504). The intuition is straightforward. Consider a single event study of one firm using one-hundred trading days of data and further assume that the Type I error rate is set by the investigator at five percent. If one sorted the fitted residuals, the fifth smallest residual is the sample 0.05-qunatile which is a consistent estimator of the population quantile (*Id.*, pp. 497-498, citing Walker, 1968).

To run the SQ test we follow Procedure 1 in Gelbach *et al.* (2013, p. 518). This procedure begins by finding the fitted abnormal returns from the non-event days, sorted by smallest to largest or:

$$\widehat{ar}_s = r_s - X_s\hat{\beta} \text{ where } s \in \{1, 2, \dots, e_t - 1\} \quad (5)$$

where $\widehat{ar}_1 \leq \widehat{ar}_2 \leq \cdots < \widehat{ar}_s$

The next step calculates the sample α-quantile of the realized values, $\widehat{ar}_s$. For example, if we wish to limit the Type I error, rejecting the null hypothesis when it is true, a typical α is 0.05. The α-quantile then equals $\times\, \alpha$. In this case $n = 100$ since each equation uses a one-hundred trading days estimation window prior to the event window, and the α-quantile equals five. Gelbach *et al.* (2013, p. 497) show that finding the fifth least value of the fitted abnormal returns , which the authors signify as $\hat{y}_\alpha$, and comparing that to the estimated event parameter will provide a simple test of H_0: $\beta_e = 0$ versus H_1: $\beta_e < 0$ where β_e is the estimated event parameter ($\hat{\gamma}$) from Table 2. Under this approach, the authors argue that one can reject the null that the event has no effect on the returns if $\hat{\gamma} < \hat{y}_\alpha$. The fitted abnormal returns are reported in Table 2 for $\alpha = 0.05$ and $\alpha = 0.10$

The results of the SQ test confirm those of the standard approach. We still reject the null hypothesis that the event had no effect on the returns and we conclude that the using either of our event windows indicates abnormal returns to the MO-PSC decision on capital structure.

TABLE 2
OLS RESULTS AND SQ TEST FOR EQUATION (5)

	DJUA as Market Proxy		S&P 500 Index as Market Proxy	
	1-Day Event Window	2-Day Event Window	1-Day Event Window	2-Day Event Window
Equation:				
R^2	0.5820	0.6680	0.1361	0.3053
Adjusted R^2	0.5735	0.6613	0.1184	0.2913
Standard Error	0.0063	0.0062	0.0090	0.0090
F-stat	68.23	99.61	7.72	21.75
Coefficients:				
Market Proxy	0.9117	0.8975	0.3279	0.3339
Standard Error	0.0874	0.0845	0.2261	0.2268
p-value	0.0000	0.0000	0.1502	0.1443
Event Dummy ($\hat{\gamma}$)	-0.0435	-0.0405	-0.0328	-0.0410
Standard Error	0.0064	0.0045	0.0091	0.0065
p-value	0.0000	0.0000	0.0005	0.0000
SQ Test:				
5^{th} Least Fitted Abnormal Return	-0.0124	-0.0127	-0.0173	-0.0173
10th Least Fitted Abnormal Return	-0.0089	-0.0089	-0.0115	-0.0115
Observations	101	102	101	102

Notes: Dependent variable is daily return to Spire Inc. (SR) for each equation. Data begins September 7, 2017, 100 trading days prior to event window, and runs through the end of the event window. 1-Day event window is January 31, 2018; Two-day event window is January 31 through February 1, 2018. p-values for the market proxy and event dummy are reported for the non-directional alternative hypothesis. For the SQ test the alternative hypothesis posits negative abnormal returns.

CONCLUSIONS

Regulatory bodies with ratemaking authority have a great deal of influence on the expected earnings of utilities. In the situation under review here, the Missouri Public Service Commission applied an approach to determining the appropriate capital structure for ratemaking that lead investors to the conclusion that capital costs were less likely recovered going forward. We expected to find evidence that the Commission's decision was associated with a negative abnormal return for SR and utilizing a traditional approach we did find such evidence. And despite concerns over normality of the abnormal returns, we utilized the SQ approach to adjust for this bias which tended to confirm the results from the standard approach. Indeed, The SR stock exhibited negative abnormal returns of approximately three to four percent as a result of the MO-PSC decision.

Regulators, in attempting to balance the interests of consumers and investors, are constantly confronted with interpretations of the potential effects of their decisions, in terms of future economic growth, financial stability of the utility, and the ability of the utility to raise capital to meet future needs of

customers. At the same time the regulator is charged with serving this role as a replacement for the market in judging the justness and reasonableness of the costs being included in the rates paid by consumers. With one eye on the present and one eye on the future regulators are engaged in multiple balancing acts. In some cases, the future effects of their decisions are known only when capital proves difficult to raise, yet the process of regulation is, in effect, continuous and responsive to the economic and financial facts as such facts become known. If the effect of a decision creates increasing financial costs or earnings that exceed the allowed returns, this information is fed into the continuing monitoring of a utilities financial conditions and will prompt appropriate consideration in future rate cases. In this case we found that the decision of the regulator had a negative influence on the stock price of the utility almost immediately.

ENDNOTES

1. SR was created from the former Laclede Group. Laclede purchased Missouri Gas Energy in 2013 and added gas utility properties in the southeast US between 2014 and 2016. Spire Missouri provides natural gas delivery services in Missouri and consists of the former Laclede Gas Company (LGC) and Missouri Gas Energy (MGE). Spire Missouri East (the former LGC) serves approximately 630,000 customers in the eastern portion of Missouri in and around the city of St. Louis. Spire Missouri West (the former MGE) serves roughly 500,000 customers in the western portion of the state in the cities of Kansas City, St. Joseph, Joplin and over 150 other communities in the region. As a gas distribution utility, Spire Missouri operates the physical delivery system serving retail customers in its service territory in Missouri and purchases natural gas using a portfolio of resources including contractual rights to gas storage. Gas commodity is sold in Missouri through a pass-through tariff called a purchase gas adjustment (PGA) which provides recovery of the costs of the gas commodity portfolio and does not include any profit margin to the utility. SR also owns gas distribution utilities in Alabama and Mississippi and operates an unregulated gas marketing business. SR anticipates commencing operation of a gas pipeline late in 2018 which would fall under the jurisdiction of the Federal Energy Regulatory Commission. Spire Missouri's PGA, and SR's non-Missouri utilities and unregulated operations and not the subject of the proceeding described in this paper.
2. In the next section we discuss the regulatory process for setting rates. In general, the rate setting process is a benchmarking process in the sense that regulators judge whether the utility has sufficiently justified its proposed costs those costs that are justified, in the regulator's view, are used for the purposes of setting rates. Regulated utilities have the discretion to operate the utility in the manner they see fit, which may or may not coincide with how the regulator views the cost associated with operation of the utility. Throughout this paper we discuss the capital structure decision for the purposes of setting rates. By this we mean the adjudication of Equation (1) described in the next section. A utility's actual capital structure, and any other actual cost, could deviate from that approved for rate setting purposes.
3. This section is based on McDermott *et al.* (2006). *See also,* McDermott (2012) and McDermott and Peterson (2012).
4. A hybrid of these approaches are also used by some regulatory bodies.
5. *Order Adopting Procedural Schedule and Delegating Authority*, MO-PSC, May 24, 2017 in File Nos. GR-2017-0215 and GR-2017-0216.
6. *Bluefield Water Works and Improvement Co. v. Pub. Serv. Com'n of the State of West Virginia,* 262 U.S. 679, 690, 1923.
7. *Federal Power Com'n v. Hope Natural Gas Co*., 320 U.S. 591, 603 (1944).
8. These principles are reiterated in Missouri case law.
9. Modern public utilities are generally organized as holding companies. In addition to jurisdictional utilities, operating companies within a holding company may include utilities outside the jurisdiction of the regulator or non-regulated entities.
10. These two actions were taken at the same time by the MO-PSC, as is common. *See Notice of Contested Case and Order Suspending Tariff and Delegating Authority*, MO-PSC, File No. GR-2017-0215, April 19, 2017.
11. Spire Missouri's initial request would have increased total revenue requirement by $58.1 million for LGC and $50 million for MGE. Under Missouri regulatory practice a portion of capital expenditures that occurred after the previous rate setting proceeding are included in current rates charged to consumers. The

cited figures incorporate those costs currently charged to customers that occurred after the last rate proceeding and additional costs Spire Missouri proposed for inclusion in rates going forward.

12. This section relies on, and updates, a similar discussion in McDermott and Peterson (2012).
13. Though certainly any verifiable tax expense reductions going forward are incorporated into the utility's rates during the next rate proceeding. In many jurisdictions, the regulator also has the authority to order a *show cause* proceeding which requires the utility to prove the reasonableness of its prices. This is a somewhat unusual step and is generally only taken when regulators are confident that some factor has changed to cause utility profits to exceed, on a going forward basis, a reasonable level. US natural gas and electric utilities faced wide-spread show cause cases after the Tax Reform Act of 1986 and, by late 2017 most observers expected some degree of price reductions due to the TCJA.
14. For example, Bonbright (1961, p. 93) suggests that regulation sits in the place of competition. The potential effect of the TCJA on utility rates was widely reported in the popular media and many states moved quickly, even as the law was being passed, to put utilities on notice of potential price reductions because of the tax changes. *See e.g.,* Leavenworth (2018).
15. Recently, utilities, as a group, have undertaken deleveraging strategies, yet utility leverage remains higher than non-regulated industries. *See e.g.,* Peterson and McDermott (2017). *Also see* Sanyala and Bulan, (2011, Table 3A).
16. The FOMC did, however, note that it "expects that economic conditions will evolve in a manner that will warrant gradual increases in the federal funds rate." Federal Reserve Press Release, November 1, 2017.
17. The results reported in Table 2 were tested using various estimation windows up to one year. The resulting parameter estimates were insensitive to the choice of estimation window. The parameter estimates on the S&P Index market proxy become more precise as the estimation window expands (i.e., sample size increases). The fit of the equations, however, does not. Perhaps, over a longer period, a firm-specific variable is omitted, though we have not explored that issue for this research. When the estimation window is shortened, again the parameter estimates are not materially affected, though there is some marginal increase in the goodness of fit. Conceivably, if there are firm-specific factors affecting the returns, those are less likely to influence returns over shorter time frame (e.g., the size of the firm or the degree of capital investments is not likely to change over a few weeks or months but may well change over a year or more). For sake of brevity and for ease of calculating the SQ test, we only report results using the one-hundred-day estimation window.

ACKNOWLEDGEMENTS

The authors wish to thank Trisha Faulkner for her assistance. Any errors or omissions are solely the responsibility of the authors.

REFERENCES

Ahern, P.M. (2017a). *Direct testimony*. Filed in Missouri Public Service Commission Case Nos. GR-2017-0215 and GR-2017-0216, April 11.

Bhagat, S., & Romano, R. (2002a). Event studies and the law: Part I: Technique and corporate litigation*American Law and Economics Review,* 4(1), 141–68.

Bhagat, S., & Romano, R. (2002b). Event studies and the law: Part II: empirical studies of corporate law. *American Law and Economics Review,* 4(2), 380-423.

Bradley, M., Jarrell, G.A., & Kim, E. H. (1984). On the existence of an optimal capital structure: Theory and evidence," *The Journal of Finance*, 39(3), 857-878.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies, *Journal of Financial Economics,* 14(1), 3-31.

Cutler, D.M., & Summers, L.H. (1988). The costs of conflict resolution and financial distress: Evidence from the Texaco-Pennzoil litigation, *The RAND Journal of Economics,* 19(2), 157-172.

DellaVigna, S., & La Ferrara, E. (2010). Detecting illegal arms trade, *American Economic Journal: Economic Policy,* 2(4), 26-57.

Fama, E. F., Fisher, L., Jensen, M.C., & Roll, R. (1969). The adjustment of stock prices to new information," *International Economic Review,* 10(1), 1-21.
Fama, E.F. (1970). Efficient capital markets: A review of theory and empirical work, *Journal of Finance,* 25(2), 383-417.
Ferstl, R., Sabastian, S., & Wimmer, M. (2012). The effect of the Japan 2011 disaster on nuclear and alternative energy stocks worldwide: An event study, *Business Research*, 5(1), 25-41.
Gelbach, J.B., Helland, E.A.. & Klick, J., (2013). Valid inference in single-firm, single-event studies, *American Law and Economics Review*, 15(2), 495-541.
Gorman, M.P. (2017). *Rebuttal testimony*. Filed in Missouri Public Service Commission Case Nos. GR-2017-0215 and GR-2017-0216, October 17.
Joskow, P.L. (2008). Incentive Regulation and its Application to Electricity Networks, *Review of Network Economics*, 7(4), 547-560.
Kahn, A. E. (1988). *The economics of regulation: Principles and institutions*. Cambridge: MIT Press.
Kothari, S.P., & Warner, J.B. (2009). Econometrics of event studies. *Handbook of corporate finance, Vol. 1*, E. Eckbo (ed.), Elsevier, Amsterdam, The Netherlands.
Leavenworth, S. (2018). Utilities celebrate Trump's tax cuts but will customers benefit? *McClathcy DC Bureau,* January 9, updated January 10, accessed at http://www.mcclatchydc.com/news/nation-world/national/economy/article193817264.html (accessed on February 15, 2018)
MacKinlay, A.C. (1997). Event studies in economics and finance, *Journal of Economic Literature,* 35(1), 13-39.
Makholm, J.D. (2010). *Rebuttal testimony*. Filed in Case Nos. 09-E-0715, -0716, -0717, -0718, New York Public Service Commission.
McDermott, K.A. (2012). *Cost of service regulation in the investor-owned electric utility industry: A history of adaption*. Edison Electric Institute, Washington, DC.
McDermott, K.A., & Peterson, C.R. (2012). The Illinois Commerce Commission's pro forma adjustment rule: An event study of regulatory decision-making, *Advances in Business Research*, 3(1), 53-62.
McDermott, K.A., Peterson, C. R., & Hemphill, R.C. (2006). Critical issues in the regulation of electric utilities in Wisconsin, *Wisconsin Policy Research Institute Report,* 19(3), 1-69.
Murray, D. (2017). Surrebuttal testimony. Filed in Missouri Public Service Commission Case Nos. GR-2017-0215 and GR-2017-0216, November 21.
Muth, J.F. (1961). Rational expectations and the theory of price movements. *Econometrica,* 29(3), 315-335.
Peterson C.R., & McDermott, K.A. (2017). *Regulation and capital structure: Exploring the puzzle*. Preliminary working paper presented at Advanced Workshop on Regulation and Competition, 36th Annual Eastern Conference, Center for Research in Regulated Industries, Rutgers University.
Sanyala, P., & Bulan, L. (2011). Regulatory risk, market uncertainties, and firm financing choices: evidence from U.S. electricity market restructuring. *The Quarterly Review of Economics and Finance*, 51(3), 248– 268
Schwert, G.W. (1981). Using financial data to measure effects of regulation, *Journal of Law and Economics,* 24(1), 121-158.
Taggart, R.A. (1981). Rate-of-return regulation and utility capital structure, *Journal of Finance*, 36(2), 383-93.
Walker, A.M. (1968). A note on the asymptotic distribution of sample quantiles. *Journal of the Royal Statistical Society, Series B (Methodological),* 30(3), 570-75.
Wharton, J., & Vilbert, M. (2105). Decoupling and the cost of capital. *The Electricity Journal*, 28(7), 19-28.

APPENDIX A

TABLE 3
NORMALITY TESTING OF THE ABNORMAL RETURNS IN THE ESTIMATION WINDOW FOR ESTIMATIONS REPORTED IN TABLE 2

Market Proxy = DJUA; Event Window January 31, 2018

	Observations	W	V	z	Prob>z	Pr(Skewness)	Pr(Kurtosis)	Adj chi2(2)	Prob>chi2
Shapiro-Wilk	100	0.97642	1.946	1.477	0.06977				
Shapiro-Francia	100	0.97939	1.876	1.243	0.10687				
Skewness/Kurtosis	100					0.0649	0.9583	3.5	0.1734

Market Proxy = DJUA; Event Window January 31, 2018 - February 1, 2018

	Observations	W	V	z	Prob>z	Pr(Skewness)	Pr(Kurtosis)	Adj chi2(2)	Prob>chi2
Shapiro-Wilk	100	0.97666	1.927	1.455	0.07284				
Shapiro-Francia	100	0.97968	1.849	1.215	0.11212				
Skewness/Kurtosis	100					0.0688	0.9543	3.41	0.1820

Market Proxy = S&P 500 Index; Event Window January 31, 2018

	Observations	W	V	z	Prob>z	Pr(Skewness)	Pr(Kurtosis)	Adj chi2(2)	Prob>chi2
Shapiro-Wilk	100	0.98041	1.617	1.067	0.14311				
Shapiro-Francia	100	0.97855	1.952	1.322	0.09321				
Skewness/Kurtosis	100					0.0279	0.1321	6.61	0.0368

Market Proxy = S&P 500 Index; Event Window January 31, 2018 - February 1, 2018

	Observations	W	V	z	Prob>z	Pr(Skewness)	Pr(Kurtosis)	Adj chi2(2)	Prob>chi2
Shapiro-Wilk	100	0.98035	1.622	1.073	0.14155				
Shapiro-Francia	100	0.97849	1.958	1.328	0.09211				
Skewness/Kurtosis	100					0.0277	0.1317	6.62	0.0365

Notes: All tests were performed using Stata. The Stata Skewness/Kurtosis test is a modification of the Jarque-Bera test, adjusted for smaller sample sizes. Dependent Variable: Daily Returns to SR; Independent Variables: Daily Return to Indicated Market Proxy and Event Window Dummy

FIGURE 3
NORMALITY PLOTS FOR ABNORMAL RETURNS BY EVENT WINDOW AND MARKET PROXY