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POWER PLAYS: REGULATION, DIVERSIFICATION, AND BACKWARD INTEGRATION IN THE ELECTRIC UTILITY INDUSTRY

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This paper explores how regulatory oversight influences strategic management. Predictions of the extent to which a firm diversifies and integrates upstream based on transaction-cost economics are developed and then tested among 49 American electric utilities from 1974 through 1986, a period that witnessed increasingly hostile regulatory relations. The results confirm the influence of regulation on both diversification and backward integration, supporting the transaction-cost view of these phenomena. The implications of these findings for the study of interorganizational relations, the concept of implicit contracting as a governance mechanism, and the pursuit of longitudinal theory-building are discussed.

The regulated industry remains a stepchild of the research on management in the for-profit sector. Evidence of its lowly status can be found in almost any organizational data base used to test hypothesized relationships; regulated firms, especially public utilities, are likely to be absent. This general neglect extends to strategic management textbooks (e.g. Porter, 1980, 1985; Quinn, Mintzberg, and James, 1988), which either ignore regulated firms or presume that they adhere fully to norms of competition. And in neither business strategy (Shrivastava, 1987: 83) nor organizational sociology (Galaskiewicz, 1985: 286) has the more rigorous literature found time for the special issues created by public policy constraints on strategy.

This paper's contribution lies in partially filling this gap by focussing on how economic regulation influences two ubiquitous strategic issues—the extent to which a firm should diversify and integrate upstream. The analysis models diversification and backward integration in the closely regulated electric utility industry following a seminal event, the Arab oil embargo of 1973. This sudden and severe environmental jolt (Meyer, 1982) transformed the industry's regulatory character from one of cozy cooperation to one of jagged stridency (Gormley, 1983). The industry's ensuing evolution toward new organizational domains allows us to directly test the efficacy of a transaction-cost explanation of how regulation influences strategy.

CONTEMPORARY ECONOMIC REGULATION AS AN ENVIRONMENTAL INFLUENCE

Electric utilities are public utilities, and so are subject to regulation by state commissions in each of the 50 states (Shepherd, 1985). These statewide Public Service Commissions (also known by other names but herein referred to as PSCs) set prices for the utility's various customer classes and determine an overall allowed rate of return on investment for the utility. This rate of return figure, in theory a proxy for the profitability level the company would attain in a

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competitive market, is updated in each rate case, a legalistic hearing usually held once every 2 or 3 years. This so-called 'economic regulation' differs strongly from social regulation, and public utility regulation differs from the other types of economic regulation applied to trucking and airlines (until recent changes). Most importantly, it is only with public utilities that competition is barred, ostensibly due to their status as natural monopolies. Another important distinction is that public utilities are regulated most energetically at the state, not federal, level. This has permitted differences in regulation from one state to another, and thus a method for studying contrasts across regulatory environments. PSCs vary in their scope, powers, organizational structure, and human and financial resources (National Association of Regulatory Utility Commissioners, 1988). Statewide jurisdiction also keeps the regulatory decision-making apparatus closer to its constituents, though few regulators are elected popularly (most are appointed by the state's governor).

As Hrebiniak and Joyce (1985) point out, the regulated firm scores high on the scales of both environmental determinism and strategic choice. Though preserving much autonomy in staffing, financing, and other managerial activities, the regulated firm nonetheless surrenders many decisions to the regulatory agency. In the case of public utilities, prices, profits, and competition itself are controlled externally. Thus, the relationship between the firm and its regulator establishes an administrative conduit through which many business decisions are channeled (Post and Mahon, 1980).

This conceptualization of the utility-regulator coupling, yields several important points. First, the regulator can withhold resources from the firm as it sees fit. Secondly, the utility firm's task environment (Dill, 1958) is dominated by the need to react to regulators, one reason that many lawyers have ascended the utility ranks as the regulatory process has become more antagonistic and legalistic (Pfeffer and Salancik, 1978: 242). Finally, when the regulated companies and their PSCs have highly divergent agendas, a tendency for both to act opportunistically is likely to surface when their relationship changes markedly.

Such conditions were generated by a major event experienced by the industry—the October, 1973 Arab oil embargo. Three years earlier, the industry had its last year of declining costs, caused by the exhaustion of the scale economies enjoyed during most of the twentieth century. During this earlier era of munificence, greater growth meant lower costs, and consumers and utilities found themselves in a symbiotic relationship. Real fuel costs were falling, conflicts were minimal, and regulation played a minimalist role; in fact, some firms did not approach their PSCs to approve new rates for a decade or more (Joskow, 1974). In the post-embargo years, sharply rising costs in the industry drove a wedge between the interests of utilities and customers, since growth now meant higher costs. The number and complexity of rate of return cases rose, and not surprisingly, powerful tensions between regulators and utilities materialized. To quote Joskow (1974: 313):

> As a result of the changing economic and social environment in which they were operating, the "satisfactory" balancing of different interest groups that had characterized the procedural equilibrium of the 1950s and 1960s was now being quickly destroyed. Regulatory agencies began to receive stronger and stronger "signals" from the external environment in the form of pressure and criticism.

Thus, the comfortable security that had marked PSC regulation gave way to the adversarial relations that persist to this day. This conflictual quality engendered frequent quasi-legal proceedings, such as prudency reviews and formal audits, institutionalizing mistrust on both sides of the regulatory interface.

We pause at this point to address an important issue. Studies by several scholars have identified a tendency, first posited by Bernstein (1955), for firms in particular regulated sectors to dominate their regulatory agency across time. This takes place through revolving door hiring practices (Eckert, 1981), legal maneuvering (Stigler, 1971), and strategic use of the administrative process (Owen and Braeutigam, 1978). While we do not wish to brush aside this model of regulation, it is hard to square with the events of the post-embargo years. In fact, during these years, bond rating declines, expenditure write-offs, and other economic losses were experienced at some point by all of the firms in the sample (Navarro, 1985). The arousal of slumbering regulatory agencies in this period has been linked to the rise of

consumerism and the emergence of organized groups representing ratepayer constituencies as potent forces in formal hearings. Joskow (1972) identified a negative effect on rates of return granted to a utility if such a group presented testimony during its rate hearing. In any case, since the sample includes a measure of regulation that varies across states, there is no need to assume that regulators are either a tool of the industry or of the public interest.

In this industry, diversification and backward integration also have direct ramifications for regulatory control. Diversification constitutes moves into new businesses that typically are not regulated, because they lack monopolistic properties. On the other hand, fuel procurement and transportation operations usually are regulated, since if not, the utility theoretically could buy supplies at an exorbitant price and have its upstream subsidiaries (stockholders) profit handsomely at the utility's (ratepayers) expense. Even if it is not regulated, PSCs always retain strong rights to audit utility transactions with upstream affiliates and routinely scrutinize this relationship. For example, Florida's PSC examined the sales by an unregulated fuel transport subsidiary to its utility. The transportation subsidiary had a standard clause in its contract calling for penalties if a customer took possession of less than a minimum tonnage of coal. When the utility, its primary customer, paid a $4 million penalty for falling below its minimum, the PSC acted to redirect this fee back to the utility, which had summarily passed the cost through to its customers (*Electric Utility Week,* 1985).

REGULATORY OVERSIGHT AS AN IMPLICIT CONTRACT

This theoretical section adopts a transaction-cost economic perspective to analyze regulatory oversight of public utilities. As such, it draws on previous work by Goldberg (1976; 1980) and MacNiel (1975; 1978) that views public utility regulation as a contractual arrangement. Using the transaction as a unit of analysis, this perspective explicitly recognizes the conditions that complicate contracting as a means of structuring exchange. When these shortcomings jeopardize the relationship, the prescribed solution is often integration. In the present case (since the alternative of integrating regulators and utilities is impossible) these parties must adopt a form of contracting that is intentionally loose, fashioning provisions that will keep the relationship itself viable, regardless of what any contract in effect might say. This is the basis of so-called 'relational contracts.' Under relational contracting, specific adjustment processes are supplanted by a more administrative governance (Williamson, 1981), offering procedural efficiency (Leblebici, 1985).

Relational contracts have been applied to New England fresh fish markets, where information is incomplete and long-term, personal relationships are the mode of organizing exchange (Wilson, 1980). In this setting, the threat of losing a stable source of supply or demand acts as a monitoring device to co-align the incentives of buyer and seller. Applying this notion to work groups, Williamson (1980) argues that relational contracting is most likely to be found when workers have specific skills and monitoring is difficult. It is a relatively straightforward extension to apply this idea to the relationship between regulators and public utilities. To quote Williamson:

> regulation may be described contractually as a highly incomplete form of long-term contracting in which (1) the regulatee is assured an overall fair rate of return, in exchange for which (2) adaptations to changing circumstances are successively introduced without the costly haggling that attends such changes when parties to the contract enjoy greater autonomy (1985:347)

Thus, the relational contract is an apparatus that is more formal than a simple exchange relationship (Levine and White, 1961) and more explicit than a set of behavioral norms (MacCauley, 1963).

In practice, regulatory rule-making involves sequential adaptations to a system of agreements and compromises that define and cohere this relationship. For example, the institution of mechanisms to more quickly pass through fuel costs into electricity rates, programs to promote conservation, and investigations into utility operations all represent such 'mid-course corrections,' designed to preserve the long term viability of PSC regulation.

In fact, numerous contracts do attend the regulatory relationship; written service area franchise agreements and other *de facto* contracts are

common. But the most pressing issues are resolved without the use of well-specified guidelines, and when the imperfections of the relational contract are combined with the adversarial potential of regulation, the result is a forceful inducement to behave opportunistically. For example, auditing procedures (occasionally used to provide documentation for blocking pass-throughs of costs to ratepayers) depend on highly judgmental criteria. In resolving such issues, knowledge about the utility in question is asymmetric; the utility possesses much more information about the issue at hand than it will convey, and the information sent to regulators is often skewed in favor of the utility. Not surprisingly, battles over access to information germane to an issue at hand rage incessantly. Furthermore, when agreements are struck, monitoring to check performance is an imprecise and cumbersome task. This is especially true when a regulated firm acts opportunistically to overwhelm its agency with paper, delays, and vacuous legal tactics (Owen and Braeutigam, 1978). Opportunism often emerges, for though regulators and utilities are locked in a bilateral relationship, they are more often adversaries than collaborators.

Thus, when the interests of the utility and its regulator diverge, the costs of monitoring this implicit contract escalate, since basic agreements often are brought into question at later dates, and need to be worked through a second time. Within the relational contracting framework, regulatory transaction costs (herein referred to as monitoring costs) include all expenditures associated with planning for possible contingencies, adapting to unforseen circumstances, and compromising on renewed problems. For our purposes, we take these costs to vary with the costs associated with regulatory hearings, audits, and reviews. When these monitoring costs are low, it indicates that smooth adaptation to changing circumstances is the rule. On the other hand, high costs indicate a breakdown in the basic workability of the relational contract and ambiguity with respect to the future tolerance of regulation.

Our argument is that higher monitoring costs lead to inducements for the utility to remove itself from this relationship to the extent possible.[1] It does so because it cannot extend its boundaries outward to include the troublesome exchange partner, as it might do if the transaction was for a key physical input like fuel (Joskow, 1985). Diversification by utilities represents a response to the impossibility of this integration, since it expands their domain to include new businesses that typically are not regulated and therefore not subject to the contracting difficulties plaguing the parent business. Thus,

> *H1: Diversification activity will vary positively with regulatory monitoring costs.*

Given our conception of the connection between regulatory transaction costs and the direction of domain expansion, a straightforward extension of our argument addresses how these transaction costs would influence vertical integration. As discussed above, the institutional idiosyncracies that characterize the product stream in electricity production and distribution make oversight of upstream subsidiaries necessary. We would expect, *ceteris paribus*, that high regulatory monitoring costs would inhibit the incentives to integrate upstream, as uncertainties about future regulatory policies would begin to overtake any gain from stabilizing supply. Thus:

> *H2: Controlling for upstream fuel conditions, vertical integration will vary negatively with regulatory monitoring costs.*

METHODS

Sample and data sources

Sample. The electric utility industry provided a fertile testing ground for these hypotheses. It is a regulated industry, but more importantly for our purposes, that regulation differs across states, allowing variation on that measure. It is price

[1] It could be argued that there is a force countering this tendency. Clearly, if managerial time is limited, greater regulatory monitoring will place further demands on the time of managers. Under such conditions, there would be less time available for the pursuit of diversification. However, it is assumed here that additional human resources are available for this task. Indeed, since the parent business is a well-defined and relatively idiosyncratic one, it is probably in the interest of these firms to bring in outsiders to conduct business in diversified companies. In fact, this has occurred in numerous cases; several utilities with sizeable diversification programs have also geographically separated regulated and unregulated enterprises.

and profit regulated, controls which generally have been more difficult for industries to pervert than, say, entry regulation used in airlines and trucking (Derthick and Quirk, 1985). Finally, among industries regulated as public utilities, the electric utility industry structure made it easier to isolate the influence of state regulation than the telephone industry and offered greater data availability than the gas distribution industry. 1974 was selected as the initial year because it is the first for which two years of data on investments were available, following a change in Federal Energy Regulatory Commission (FERC) reporting requirements that made companies state their actual equity in subsidiaries (in prior years, book values incomparable across subsidiaries were used). It is also the first full year after the Arab oil embargo.

We began with the 182 companies that were designated as 'Major' by the FERC in 1986, a category containing all privately-owned electric utilities selling to more than a very small number of customers. We exclude 85 utilities with federally-mandated limits on diversification, the result of past regulatory policies (Hawes, 1986). The exclusion of 10 firms exempted from annual filings by the Securities and Exchange Commission (SEC) was made, since this exemption produced a major data gap. We removed 19 utilities that are generating subsidiaries of utilities or aluminum companies, since they have little in common with the typical electric utility, except having to make the same FERC filings. We also removed 14 companies that had less than 75 percent of their 1986 sales in their home state. Admittedly, this is a somewhat arbitrary line, but it was drawn in order to balance the need for a viable sample size with the need to isolate state regulation. Excessive missing data prevented the inclusion of four firms, and a fifth was involved in a major merger during the study period. Thus, our total sample size was 49 firms.

Data sources. Electric utilities may have the most comprehensive statistical reporting requirements of firms in any American industry, submitting reports to numerous federal authorities covering virtually every segment of their operations. Individual annual reports submitted to FERC were the source for regulatory commission expenses and investments in operations representing diversification and vertical integration. Although the utility is always the dominant business, some utilities are owned by corporate parents and the subsidiaries are of the parent, not the utility. In this case, we used submissions that the parents must make to the SEC that provide business unit data for both regulated and non-regulated subsidiaries. The annual *Financial Statistics of Selected Electric Utilities* (e.g. Federal Energy Regulatory Commission, 1988) provided the remaining data for the study.

Measures

Regulatory monitoring costs

In general, contractual monitoring costs would remain a theoretical abstraction, as they are rarely quantified. However, on federal reporting forms, each electric utility must state, in dollars, its 'regulatory commission expenses,' consisting largely of labor-based costs incurred in producing and defending rate change requests, responding to inquiries by commissions during various prudence reviews, and numerous other idiosyncratic auditing expenses. Our assumption is that these direct costs are joined by a larger (but proportionate) group of indirect costs associated with other support services, managerial air time, and psychological costs associated with the uncertainties associated with these transaction costs. The exact operationalizations of this and the other variables used appear in Table 1.

Diversification and backward integration

Numerous measures of diversification have been proposed, usually based on the number of separate businesses controlled by a firm (Gort, 1962) or the breadth of those businesses, as determined by a calculation involving Standard Industrial Classification (SIC) system designations for those businesses and their proximity to the parent's SIC code (Berry, 1971; Caves, *et al.*, 1980; Palepu, 1985). These mathematical approaches to diversity tend to correlate with the more descriptive ones developed by Rumelt, who used the revenues of a particular subsidiary and its 'relatedness' to the parent company to categorize diversity (Rumelt, 1974). In our case, figures for revenues were unavailable, but we could obtain figures showing the level of equity invested in each of the subsidiaries of a company, a measure usually not reported for most firms and probably a better assessor of the level of investment in firm diversity. An additional benefit

Table 1. List of measures

REGULATORY MONITORING COSTS. The 'regulatory commission expenses' of the utility, limited to those costs directly attributable to the home state's PSC, and exclusive of all costs for other regulatory bodies, such as those at the federal level and other states. A three-year moving average of costs, each placed in 1986 dollars, was used to measure regulatory monitoring.
DIVERSIFICATION. The absolute dollar amount of equity (in $1986) held by the parent in subsidiaries that do not represent vertical integration.
BACKWARD INTEGRATION. The absolute dollar amount of equity (in $1986) held by the parent in all subsidiaries engaged in the location, procurement, and transportation of natural gas to the electric utility and its gas distribution affiliates.
FIRM SIZE. Total net assets of the firm, expressed in billions of constant 1986 dollars.
SALES GROWTH. The utility's 3 year average kilowatt-hour sales growth rate.
ORGANIZATIONAL FORM. Coded 1 for multidivisional structures, 0 otherwise.
DISCRETIONARY CASH. A measure of discretionary cash, formed by taking the difference between internally-generated cash and construction expenditures. A 3-year moving average is used, expressed in $1986. The measure is usually negative, indicating that on average utilities consumed more cash than they produced by internal means.
ORGANIZATIONAL FORM DISCRETIONARY CASH. An interaction term formed by multiplying the previous two terms together.
GAS % OF REVENUES. Percentage of total utility revenues comprised by natural gas distribution activities.
GAS PRICE CHANGE. 3-year moving average of real natural gas price changes.
GAS % REVENUES PRICE CHANGE. An interaction term formed by multiplying the previous two terms together.

of this measure is that it avoids problems associated with simply adding numbers of subsidiaries, since this implicitly equates the importance of each subsidiary as an investment. Also, since subsidiaries that do not represent backward integration generally are not regulated, all represent diversity with respect to that critical dimension. To measure the extent of backward integration, we sum up equity in all subsidiaries engaged in the location, procurement, and trasportation of natural gas to the electric utility and its gas distribution affiliates. Diversification and backward integration are mutually exclusive categories (i.e. one is not a subset of the other).

Control variables

Both diversification and backward integration have been tied to firm size maximization (Reid, 1968; Mueller, 1969) and low growth in the parent market (Penrose, 1959; Chandler, 1962). The latter was noted in the professional literature associated with the focal industry (Cavanaugh, 1981; Henriques, 1984). Cash resources also have been linked to diversification (Jensen, 1986; Griffin, 1988) on their own, and when the firm has adopted a multidivisional form (Russo, 1991). The latter case suggests that the interaction of cash and the use of a multidivisional form will positively influence diversification.

Uncertainty of supply conditions

In the regressions to explain backward integration, we entered measures for the change in gas prices and for the ratio of revenues the company derived from gas distribution activities, in order to control for the effect of upstream uncertainty and dependence on natural gas. We also included an interaction term, since high values of both measures may be needed to trigger integration activity. That is, rapidly escalating gas prices may not matter to a company that requires little of the product, and a company with high relative gas revenues may not integrate if prices are stable. If this interaction term is

significant, it would indicate that backward integration is linked to environmental uncertainty, a finding that is consistent with transactions cost economics.[2]

Data analysis

In order to test hypotheses concerning the connections between regulatory monitoring and diversification and backward integration, we employed a pooled, cross-sectional time series for the years 1974 through 1986.

Because regulatory costs are partly a function of firm size, some adjustment to remove size effects is prudent. We chose to use an initial regression that estimates baseline regulatory costs as a function of firm size and employees. We used the same two-stage approach detailed below, but controlled neither firm-specific nor period-specific effects, since both of these influences should not be removed when estimating regulatory costs. Once baseline costs are determined, we use the difference between actual costs and these baseline values as our independent variable. This approach pinpoints deviations in regulatory costs from expected norms, given those size factors. Thus, the equations to be estimated are:

Diversification = f (Firm Size, Sales Growth, Discretionary Cash, Organizational Form, Discretionary Cash * Organizational Form, Regulatory Monitoring Costs)

and

Backward Integration = f (Firm Size, Sales Growth, Gas % of Revenues, Gas Price Change, Gas % of Revenues * Gas Price Change, Regulatory Monitoring Costs).

We made several statistical corrections to remove the possibility of spurious significance and to account for trends from the data.[3] First, serial correlation, a problem with most time series and many panel analyses, had to be mitigated. Typically, serial correlation acts to deflate standard errors and correspondingly inflate significance levels. To correct for this problem, we used Kmenta's (1986: 619) two stage approach, which uses an initial regression to estimate an autocorrelation coefficient for each firm. This coefficient is then used to remove error correlations and a second regression is run, producing corrected estimates. We also control firm-specific effects by inserting a separate intercept term for each firm in the equations, yielding a 'fixed-effects' model (Hsiao, 1986). Finally, contemporaneously-correlated errors can produce spurious significance if two variables move with time; in our case both regulatory costs and diversification rose in later years, so if the influence of time was omitted from the equation, a false relationship might be indicated by the regression. In order to control these correlations, 13 separate dummy variables, one for each year, were inserted into regression equations.

The basic two-stage model beings with this regression:

$$Y_{it} = \alpha_i D_i + \pi_t D_t + [\beta_1 X_{it,1} \ldots + \beta_J X_{it,J}] + e_{it} \quad (1)$$

where: α_i is a 1×49 vector of intercepts for 49 firms, D_i is a 49×1 vector whose ith entry is 1 and 0 otherwise, π_t is a 1×13 vector of intercepts for t years, D_t is a 13×1 vector whose tth entry is 1 and 0 otherwise, β_j is the regression coefficient for independent variable j, and $X_{it,j}$ is the matrix containing values for independent variable j for each of the observations. In order to correct for serial correlation (manifested here as error terms e_{it} and $e_{i,t-1}$ that are not independent), the residuals from Equation (1) are used to construct an autocorrelation parameter for each firm, ρ_i, using the Kmenta

[2] Unfortunately, we do not have information on either the number of alternative suppliers to the company or contractual terms in the contracts. This additional information would allow us to test for the efficacy of a transactions-cost economics explanation of backward integration as a response to contractual issues between suppliers and utilities. It would also permit an examination of resource dependence theory in this context.

[3] Two observations with extremely high, outlying values for regulatory costs were dropped. In both cases, the values exceeded six standard deviations from the mean. We also were confronted with missing data for 6 and 3 of 635 observations for diversification and backward integration, respectively. Linear interpolation was used to produce numbers for these observations.

technique.[4] The second stage uses these parameters to produce a transformed equation:

$$Y^*_{it} = \alpha_i D^*_i + \pi_t D^*_t + [\beta_1 X^*_{it,1} \ldots + \beta_J X^*_{it,J}] + u_{it} \quad (2)$$

where:

$$Y^*_{it} = Y_{it} - \rho_i Y_{i,t-1}$$

$$\text{or } Y^*_{it} = \sqrt{(1-\rho^2)}\, Y_{it} \text{ for 1974,}$$

$$D^*_t = D_t - \rho_i D_{t-1}$$

$$\text{or } D^*_t = \sqrt{(1-\rho^2)}\, D_t \text{ for 1974,}$$

$$D^*_i = D_i - \rho_i D_{i,t-1}$$

$$\text{or } D^*_i = \sqrt{(1-\rho^2)}\, D_i \text{ for 1974,}$$

$$X^*_{itj} = X_{itj} - \rho_i X_{i,t-1,j}$$

$$\text{or } X^*_{itj} = \sqrt{(1-\rho^2)}\, X_{itj} \text{ for 1974,}$$

$$u_{it} = e_{it} - \rho_i e_{i,t-1}$$

$$\text{or } u_{it} = \sqrt{(1-\rho^2)}\, e_{it} \text{ for 1974,}$$

and u_{it} is random from observation to observation. OLS regression is then applied to Equation (2).

In the case of both diversification and backward integration, we also present a second regression equation that relates *changes* in the regulatory variable to *changes* in diversification or integration during the course of a year. Here, the independent variables other than regulatory costs are identical to the first equation. In this way, we can ascertain the impact of changes in regulatory monitoring, not just the absolute level, and possibly gain insights into the process under study. The statistical procedure used is the same as that just described, except that the fixed effects for both firms and time periods are removed, as their presence in the equations did not enhance the model's fit, as measured by a multiple-partial *F*-test (Pindyck and Rubinfield, 1981: 255).

RESULTS

Descriptive statistics

Table 2 shows variable means at three year intervals from 1974 through 1986. Investments in diversified activities remained flat until 1980, and climbed steadily thereafter, as many utilities accelerated their diversification programs. Backward integration, however, rises to a peak in 1982 and then declines, as firms reduced their upstream presence. The average firm size follows an upward path, and shows that for most of the period, the net assets of the typical utility exceeded $2 billion. As a result of structural changes in the industry, such as conservation and the completion of new power plants, both sales growth and discretionary cash fluctuate during the study period. The diffusion of the multidivisional form in the industry is shown clearly by the organizational form variable, which rises monotonically. The primary variable of interest, regulatory monitoring costs, shows a slow but steady upward trend, reflecting the increasing complexity of the regulatory relationship and the increasing activity of PSCs. Finally, average gas distribution revenues as a percentage of total utility revenues are steady throughout the period, while gas price changes show considerable variation.

Table 3 provides correlations among the variables, using a random year for each firm. This method prevents the artificially high correlations that occur from repeated measurements on the same relationship year after year in panel data.

Investments in diversification

Table 4 shows the results of the regressions used to explain diversification by our sample of 49

[4] The autocorrelation coefficient is estimated by using the residuals of Equation (1) as follows:

$$\rho_i = \frac{(\Sigma e_{it} e_{i,t-1})}{\sqrt{(\Sigma e^2_{it})}\ \sqrt{(\Sigma e^2_{i,t-1})}}$$

Note that in practice, there is no need to transform the firm-specific dummy variables between Equations (1) and (2), since after this change, the dummy variable would still take on one of only two values (0 or $(1-\rho_i)$) for any firm. Thus, the product of these new dummies and any estimated coefficients from regressions using the transformed variables would be the same as using a series of 0–1 dummy variables and their coefficients. Also, using this method, it is clear that models which employ a single ρ for all observations may be mis-specified; in Model (1) and Model (3), the means and the (standard deviations) of the 49 ρ_is were 0.46 (0.27) and 0.77 (0.15), respectively.

Table 2. Variable means

	1974	1977	1980	1983	1986
1. Diversification ($millions)	3.76	4.08	3.61	14.47	53.96
2. Backward integration ($millions)	3.34	10.57	16.62	14.54	3.63
3. Firm size ($billions)	2.09	2.20	2.21	2.52	2.66
4. Sales growth (%)	5.85	5.11	3.45	0.80	2.46
5. Discretionary cash ($millions)	−126.89	−46.17	−71.50	−26.50	90.86
6. Organizational form	0.00	0.02	0.04	0.08	0.29
7. Interaction of 5. and 6.	0.00	−6.11	−7.03	−3.55	32.15
8. Reg. monitoring costs ($thousands)	183.35	237.70	257.67	390.71	496.06
9. Gas distribution revenue (%)	13.54	12.93	14.16	15.30	12.03
10. Gas price change (%)	8.50	29.50	7.80	11.00	−12.90
11. Interaction of 9 and 10	115.10	381.45	110.47	390.71	−160.24

N = 49 All dollar figures in constant $1986.

Table 3. First order correlations[a,b]

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Diversification	100										
2. Backward integration	−2	100									
3. Firm size	28	45	100								
4. Sales growth	−22	−12	−13	100							
5. Discretionary cash	39	−3	−16	−5	100						
6. Organizational form	1	6	3	18	3	100					
7. Interaction of 5. and 6.	−06	−18	−25	13	8	−44	100				
8. Reg. monitoring costs	62	14	49	−31	0	6	−22	100			
9. Gas distribution revenue	−15	30	−5	3	4	6	13	−17	100		
10. Gas price change	−20	−2	−27	0	−25	−28	22	−14	2	100	
11. Interaction of 9. and 10.	−11	20	6	−6	−8	−11	3	−7	55	49	100

[a]With panel data, correlations computed by pooling all observations results in greatly overstated significance levels, because multiple observations on a given relationship are included. Therefore, one year for each firm in the study was randomly chosen. Data for those 49 firm-years were pooled and correlation coefficients and significance were computed. Results appear above.
[b]Correlations at or above |28| are significant at the 5 percent level.

firms for the years 1974 through 1986. The first equation estimates the level of diversification; the second its one-year change. In the first equation, firm size is significant and positive, suggesting that greater size and diversification are linked. Sales growth does not affect diversification, suggesting that incursions into new domains are not necessarily a response to saturated or declining parent markets in this industry, and countering the espoused theories (Mintzberg, 1978) of the industry reported in the business press (Cavanaugh, 1981; Henriques, 1984). Discretionary cash exerts a positive influence on diversification—the more cash on hand, the more likely it will be applied to new or existing unregulated ventures. Although the primary effect of organizational form is insignificant, the interaction term formed by multiplying discretionary cash and form is significant, supporting the idea that the presence of both contributes to diversification. This dovetails with Russo's (1991) finding of a link between the presence of surplus cash and the adoption of the M-form, which was then used as an 'enabling device' to facilitate diversification via cash resources.

The regulatory monitoring costs variable is significant and positive in Model (1), supporting Hypothesis 1. The coefficient indicates that each unit of one thousand dollars of direct regulatory expenses translates into roughly a 14 thousand

Table 4. Regression results—diversification[a,b,c]

	(1) Dependent variable: Level of diversification	(2) Dependent variable: Change in diversification
Firm size	10.411***	1.414**
	(2.807)	(0.506)
Sales growth	0.191	−0.089
	(0.399)	(0.267)
Discretionary cash	0.064***	0.025***
	(0.014)	(0.007)
Organizational form	11.310	12.986*
	(7.412)	(5.247)
Discretionary cash organizational form	0.324***	0.199***
	(0.043)	(0.031)
Regulatory monitoring costs	0.014*	
	(0.006)	
Change in regulatory monitoring costs		−0.0006
		(0.0016)
$\bar{R}^2$	0.421	0.169

[a]Number of observations: 635.
[b]Standard errors in parentheses. Significance levels, based on two-tailed tests: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
[c]Separate intercepts for years and firms in Model (1) omitted for clarity.

dollar increase in diversified investments (which are measured in millions). Given an assumption of linearity in the effect of regulatory monitoring, the difference in diversification between one firm with no monitoring costs and another with twice the mean level of monitoring is about $9 million, using Model (1). While not an extremely large number for the typical corporation, the number is close to the overall mean for the diversification variable, $12.5 million. So the relative magnitude of the influence of the regulatory variable is not trivial.

Model (2) estimates how the independent variables influence changes in diversification. A lower level of the variation in changes in diversification is captured by the variables. Firm size is again significant; growing firms tended to increase diversification, though growth in sales did not have this effect. Changes in the cash position and organizational form were both significant predictors of changes in diversity, as was their interaction. This shows again the intertwining influences of these variables. But changes in regulatory costs had no effect on changes in diversification. Put together, Models (1) and (2) suggest that both internal and external phenomena can drive diversification, but that upward changes in diversification are rooted primarily in internal factors. Perhaps the initial stimuli to diversify comes from the outside, and once in motion, internal constituents provide the momentum for further commitments.

Backward integration

Results of the regressions appear in Table 5. As with diversification, a higher level of variation is explained in the model to estimate the level of the dependent variable rather than changes in that variable. In this case, the second equation explains little of the variation in the dependent variable.

In both models, firm size is strongly linked to backward integration, but negatively. The larger the company, the less likely it is to integrate. This may follow from the fact that lower firm size would be reflected in a smaller geographic area and access to fewer alternative suppliers of natural gas, subjecting the firm to small numbers bargaining conditions (Williamson, 1975: 26) or

Table 5. Regression results—backward integration[a,b,c]

	(3) Dependent variable: Level of backward integration	(4) Dependent variable: Change in backward integration
Firm size	−8.092***	−0.115
	(1.541)	(0.256)
Sales growth	−0.114	−0.158
	(0.210)	(0.165)
Gas % of revenues	−0.023	−0.149*
	(0.174)	(0.070)
Gas price change	−0.414**	−0.003
	(0.155)	(0.062)
Gas % revenues * price change	0.013**	0.015***
	(0.005)	(0.004)
Regulatory monitoring costs	−0.025***	
	(0.004)	
Change in regulatory monitoring costs		−0.006***
		(0.001)
$\bar{R}^2$	0.498	0.069

[a]Number of observations: 635.
[b]Standard errors in parentheses. Significant levels, based on two-tailed tests: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
[c]Separate intercepts for years and firms in Model (3) omitted for clarity.

to a concentration of resource control (Pfeffer and Salancik, 1978: 50), both of which are consistent with those theories of backward integration. There is no evidence that backward integration is a response to low growth.

The results with respect to gas prices and usage support the idea that uncertain upstream conditions increase the propensity to integrate upstream. Unexpectedly, gas price increases are negatively related to upstream integration. This is best interpreted by considering the effect of this variable and the interaction term. Given linearity, the net effect of increased gas prices is decreased integration until the percentage of revenues from natural gas distribution exceeds 32.6 percent.[5] So unless this sector of the business is relatively large, the tendency is for lower integration as gas prices rise. One reason for this may be the increasing complexity and complication in natural gas markets during the study period. Firms with low levels of gas revenues may have left this activity rather than remain in such problematic territory.

As with diversification, we are primarily interested in the effect of the regulatory variable. In Model (3), a strong negative effect of regulatory monitoring costs on backward integration is shown: as these costs rise, backward integration levels decline. This indicates that as the transaction costs associated with the regulation increase, so do trepidations about moving into fields that will place more pressure on those agreements and compromises.[6] This in turn suggests that regulatory uncertainty is fundamentally different from other forms of environmental uncertainty, where vertical integration reduces risks. Here, due to the direct control over the firm possessed by regulators, the opposite is true. And substantial disintegration took place during the study period; after peaking in the early 1980s, average levels of vertical integration into natural gas declined monotonically through 1986.

Model (4) provides insight on the influences on changes in vertical integration. However, the overall level of explained variance is low, so the coefficients in this equation should be interpreted with caution. As with diversification, firm size is insignificant in this equation. In this equation, the percent of revenues from gas activities is insignificant and the gas price increase is significant, the reverse of the pattern in Model (3). Performing an analogous exercise as for Model (3), we obtain a negative effect on backward integration until gas price increases exceed roughly 9.7 percent. Here, the intuition is that there is a threshold level of resource pricing beyond which firms consider integrating to assure supply. Going beyond this interpretation or trying to square the results of Model (3) with (4) with respect to gas prices and usage would be highly speculative, so we will limit our conclusion to the observation that patterns of these two variables and backward integration are intricate and complex phenomena that necessitate more fine-grained data to analyze fully.

The coefficient on the change in regulatory costs is significant and negative, indicating that increases in the level of regulatory monitoring can trigger decreases in vertical integration. Thus, changes in regulatory monitoring influenced backward integration but not diversification. Firms in this sample appear to be more concerned with the threat of regulatory initiatives to disallow the passage of gas costs through to customers rather than the opportunity of unregulated returns via diversification. Hence, this pattern is consistent with the finding that individuals are more sensitive to threats than opportunities (Jackson and Dutton, 1988).

DISCUSSION AND CONCLUSION

This study tested a model of how regulation would influence two typical strategic decisions—the extent to which a firm should diversify and integrate upstream. The model was based on transaction-cost economics, which spotlights the transactional interface between organizations. Our results suggest that the cost associated with monitoring a contract and adapting to changed

[5] Model (3) indicates that the effect on backward integration of the two variables is 0.0127 (Gas % Revs*Gas Price Change) − 0.4139 (Gas Price Change). To obtain the change in backward integration due to Gas Price Change, we simply differentiate this expression with respect to the Gas Price Change. The expression equals zero when Gas % Revs is 32.6 percent.

[6] A possible criticism of these findings was that the direction of causality was reversed—that is, that backward integration induced greater regulatory expenses. However, a review of documents submitted by these firms showed that none of the formal cases before PSCs were listed as related to backward integration (or diversification). Most were rate and prudency hearings.

circumstances is a contractual dimension that may have value in other research settings.

The results on diversification support Hypothesis 1. The greater the monitoring effort of the regulatory agency, the greater the diversification by the firm. Thus, burdensome environmental relationships do drive expansion into activities out of the reach of that oversight. Whether diversification in this industry will forever remain untouchable by regulators may yet be questioned,[7] but firms in the sample acted as though they were confident of their autonomy in this regard.

With respect to backward integration, our results strongly support Hypothesis 2. Firms in this sample tended to reduce their presence upstream the more actively they were monitored by regulators. Here, we would like to point out again that much disintegration took place in this industry. Thus, while the organizational economics literature has almost always asked the question: when does a firm internalize transactions?, this study addressed the converse question: when does a firm *externalize* a transaction? One answer, apparently, is that externalization takes place when transaction costs are *higher* under unified governance. Viewed in this manner, our results are consistent with the notion of the organization as an entity averse to risks, among them the risk of opportunistic behavior by an exchange partner.

Although our equations to estimate changes in diversification and backward integration did not explain much of the variance in those changes, they are instructive for showing the importance of changes in regulatory monitoring to changes in backward integration. There, the threat associated with increases in regulatory monitoring led to decreases in integration. The response of firms, then, to greater increases in monitoring was to retreat to the home turf and defuse the threat of regulatory reprisals in the most fundamental way: by removing their presence in the threatened domain.

Our findings are compatible with the models cited above that place interactions with regulatory commissions at the focus of managerial actions by regulated companies. Not surprisingly, observers of firms experiencing deregulation and other competitive changes have discussed the tendency for those firms to retain this focus, to the exclusion of customers and competitors (Robertson Ward and Caldwell, 1982). On a deeper level, the results support the notion that regulatory confinements leave a deep imprint on the firm's employees (Schlesinger, *et al.*, 1987) and on organizational 'routines' (Nelson and Winter, 1982), the modes of conceptualization and procedure that evolve within these organizations. Thus, the question of how to nurture the human assets necessary for attaining success in fundamentally new ventures is a potent challenge for managers trying to assess their organization's capabilities in a changed environment.

The study also sheds light on how exchange partners act across time. During the study period, conflict in the regulatory arena was ignited by large rate increases, ambitious construction programs, and the ascendancy of organized intervention in the hearing process. Given that internalization of this the utility-regulator exchange is impossible, perhaps it will be replaced by a different type of regulatory compact. In fact, several PSCs have recently begun examining a fundamental change in regulation. Telephone utilities, exposed to many of the same regulatory monitoring costs as electric utilities, have fashioned agreements with regulators releasing them from profit constraints provided they 'cap' customer rates at or below prespecified levels and maintain service quality. Such an agreement relaxes the need for regulators to vigorously monitor company activities, since prices and reliability are relatively easy to verify. Of course, there are problems with applying this approach to electric utilities, including the potential need to recontract if another spike in energy prices occurs, for example. But in the absence of an environmental jolt, a new interorganizational relationship between regulators and utilities may be forthcoming. This adjustment in the nature

[7] Consider this excerpt from a letter sent to the California Public Utility Commission, perhaps the most vigilant and active regulatory commission in the nation. It had approved a corporate restructuring by one of the companies under its oversight that would accelerate diversification, but in doing so it had attached numerous, ambiguously defined conditions on that action. The company's response to the Commission's decision includes this passage:

> Your Decision goes beyond the point of regulatory diligence and is, in fact, an intrusion into the management of nonregulated enterprises. It contains several conditions that the Board believes would severely hamper this or any company's ability to compete successfully in a free market. Two, in particular, ... would unduly burden our diversified businesses and *make them so unpredictable as to be unmanageable.* (Page, 1986, emphasis added).

of interorganizational relations fits into the organizational economics framework, which in this case predicts that parties will try to adopt a new form of contracting to reduce their transaction costs. However, it also highlights one of the model's weaknesses—change processes—since it says little about this transformation itself.

The results have public policy implications that go well beyond the scope of this paper. Some, however, are worth mentioning because they are of interest to strategic management theorists. The fact that diversification varies with regulatory monitoring provides evidence that PSCs have broken with their historical tendency to act as a barrier to competition (Anderson, 1980) or to be impotent (Stigler and Friedland, 1962; Meyer and Leland, 1980). This sleepy past is a fond memory for the typical utility. Now, that tranquility has been upset by anxiety-creating regulatory initiatives. But though it can disrupt a utility's best laid plans, whether the regulatory constraint can, in a fundamental sense, restrict the autonomy of utilities remains a crucial issue. Our results provide indirect support that regulation matters, because organizations in our sample attempted to evade regulation when choosing new domains of activity.

Thus, our results challenge the revisionist view of economic regulation as a tool of the regulated industry rather than of the public interest. For example, authors studying the railroad (Kolko, 1963), trucking (Robyn, 1987), and long distance telecommunications (Brock, 1981) industries have assumed a revisionist perspective, arguing that regulatory commissions develop a client-like posture toward the industry they oversee. However, our results suggest that this so-called 'capture' theory of regulation may prevail only under a particular circumstance—the lack of conflict among the parties to regulation, including the industry's customers. During the munificent decades preceding 1970, a cozy relationship may have enveloped regulators and electric utilities. But in the convulsive period that followed, consumer mobilization and conflict marked regulatory relations, and utilities and regulators became adversaries. Evidence supporting a sequence of somnolence, conflict, and regulatory activism can be seen currently in the liability insurance industry, where issue saliency is in ascendancy, and with it, pressure for regulatory reform at the federal and state level.

As a final note, we urge researchers to delve further into the issues that attend situations where firm boundaries cannot be extended around meddlesome environmental elements. One advantage of this program would be its ability to inform the debate on whether the step from full internal governance to some form of interorganizational relationship represents a fundamentally different governance structure, or whether this point lies on a continuum between full integration and arm's length transactions, where intermediate positions are, as Robins (1987: 83) puts it, 'a matter of degree rather than distinctions in kind.' It also would provide us with the means to study relations between organizations that are neither competitors nor confederates, enriching our knowledge of strategy-making under a regulatory constraint.

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