Volume Title: Studies in Public Regulation

Volume Author/Editor: Gary Fromm, ed.

Volume Publisher: The MIT Press

Volume ISBN: 0-262-06074-4

Volume URL: http://www.nber.org/books/from81-1

Publication Date: 1981

Chapter Title: The Political Economy of Federal Regulatory Activity: The Case of Water-Pollution Controls

Chapter Author: Robert A. Leone, John E. Jackson

Chapter URL: http://www.nber.org/chapters/c11433

Chapter pages in book: (p. 231 - 276)

5

The Political Economy of Federal Regulatory Activity: The Case of Water-Pollution Controls

Robert A. Leone
John E. Jackson

Increasingly, policymakers have resorted to regulation of private corporate activity as a means of achieving socially desirable ends (Schultze 1977; Leone 1977). Despite this growth in regulation, there has been little investigation of the dynamic political process by which regulations are formulated and implemented. There has also been little systematic analysis of the dynamic economic process of regulatory compliance.

Several aspects of the regulatory approach to public problem solving merit investigation. Perhaps the most obvious question is whether regulations achieve desired ends. It is certainly possible for Congress to mandate certain goals and to establish bureaucratic machinery to promulgate the necessary rules; yet these two acts alone do not guarantee attainment of the stated objectives. We leave examination of this most basic question to others who are already so engaged.[1]

To address these questions we present a model of policy-development processes and industry-response processes. At the core of this model are the economic costs and benefits created by regulation and their distribution among firms and regions. Analysts customarily measure total benefits and a limited set of aggregate total costs estimated by comparing the equilibrium prices and outputs predicted with the static economic model.[2] Our model provides for the important role that distributional effects and industry dynamics play in determining regulatory impacts. Distributional effects are required because, among other things, they create many pressures on the political organizations that develop and administer policies. The dynamic analysis is motivated by the hypothesis that the constraints and difficulties firms encounter in the short run in attempting to adjust to specific regulations have important aggregate and distributional implications. These short-run effects relate to the availability of capital and the ease with which different firms can adjust their capital stock and their manufacturing and marketing strategies to new conditions.

Economic Impacts of Regulation

Our analysis begins with costs. The costs of regulation are more difficult to define and more uncertain than those of other public activities. In public-works projects, for example, the principal cost uncertainties are organizational (such as unforeseen delays and unanticipated obstacles to construction) and economic (inflation), and are largely exogenous to decisions about the project itself. Costs of most business regulations also are subject to organizational and external economic uncertainties. But, in addition, these costs depend on factors internal to the regulated industry (such as the rate and direction of technological change), on the existence of capacity pressures within an industry, and on differences in costs between new and existing facilities. Costs also are sensitive to uncertainties created by the regulatory process itself: How much time will be left for compliance? Are standards likely to change? Will enforcement be uniform and equitable? Stated differently, the definition of costs for a public-works project is basically an engineering and managerial exercise; the identification of costs associated with a business regulation is primarily an exercise in dynamic economic and political analysis, with all the attendant difficulties and uncertainties this implies. This distinction is intended to stress the variety of methodological approaches that may be required to analyze regulatory policies.

When not seen from an engineering perspective, costs usually are viewed from the standpoint of the competitive-market model and associated static equilibrium. Viewed this way, regulations prohibit certain production processes, require additional capital and operating expenditures, and increase some factor prices, thus shifting the long-run supply curve within an industry upward. This method is deficient in two important ways: It only estimates aggregate costs, and it ignores all short-run and dynamic adjustment problems.

Distribution of Economic Impacts

The focus on total costs obscures some very important characteristics of regulatory costs. From the standpoint of aggregate efficiency, comparisons of total costs and estimated benefits may be an appropriate decision criterion. However, decisionmakers' objectives are not solely focused on this criterion. Hidden within any specific set of aggregate costs are highly variable consequences for different plants within a firm, for firms within an industry (and among industries, for that matter), and for regions of the country. These distributional effects may run counter to other policy

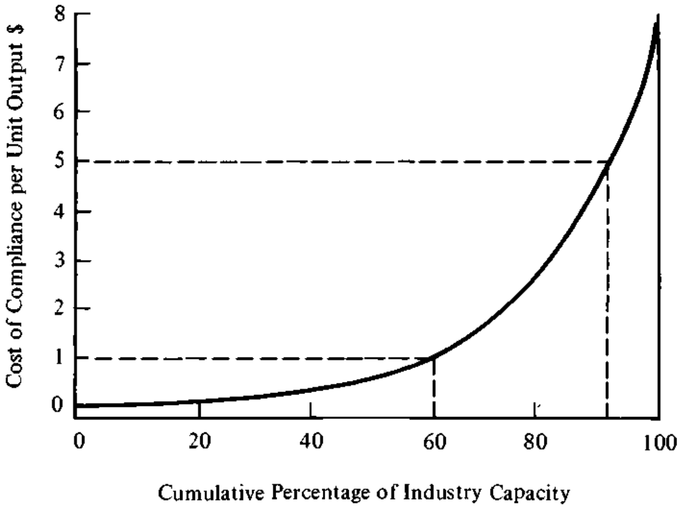

Figure 5.1 Compliance-cost curve.

objectives, such as antitrust goals or regional development concerns. At the same time, the firms and regions most affected presumably will work to influence policy choice. Thus, any eventual policies will not be based simply on aggregate efficiency effects, but will reflect accommodation to political pressures created by distributional effects.[3]

Estimating the distributional impacts of national policies is particularly difficult. For a variety of reasons, the incidence of compliance costs within an industry and among regions need not be uniform. Plant-to-plant differences in costs may be quite large, depending on the nature of regulations, the ages and values of existing capital stocks, and the constraints placed on manufacturing processes by regulations.

However, if the cost structure of each plant in an industry were known, we could measure disaggregated effects of regulatory policies from shifts in the cost curve of each plant brought about by new regulations; and if individual plants were then arrayed in descending order according to their average unit costs, an industry cost curve could be generated.

Figure 5.1 shows the distribution of industry costs due to a hypothetical regulation that results when the compliance costs of individual plants are arrayed in descending order. The vertical axis represents the unit cost of compliance, the horizontal industry capacity. For this hypothetical regulation, 60 percent of the industry (in terms of capacity) can comply with a unit cost increase of $1 or less, while for 10 percent of capacity compliance increases costs by more than $5 per unit of output.

The importance of figure 5.1 is that it can be used to determine which plants will be hardest hit by proposed regulations and which actually may benefit. If an aggregate economic analysis at the industry level yields an overall price increase of $2, close to 75 percent of industry capacity will receive revenue increases that exceed their compliance costs. For the remaining proportion of the industry capacity, represented by the rightmost portion of the curve, the regulations entail an economic loss.

Identifying where individual plants fall on the cost curve is an important component of our impact analysis. Even if the aggregate costs are less than the aggregate benefits, the incidence of costs on certain plants may conflict with other policy objectives, raising questions of whether a program should be implemented. For example, various national policies encourage competition in manufacturing industries and try to prevent the economic decline of various regions. Yet if heavily impacted plants are those of smaller producers or are concentrated in a specific region, the effects of proposed regulations may be to increase concentration in an industry or to exacerbate regional economic disparities. These possible deleterious effects ought to be identified and considered prior to the promulgation of regulations. Other governmental tools may make it possible to overcome such unwanted side effects, but they are seldom used when regulations are taking effect and are altering the structures of industries and the regional distribution of jobs and income.

Short-Run Economic Impacts

Accurate assessment of intraindustry and interregional impacts requires understanding how individual plants may respond to proposed standards, in both the short and the long run. Thus, we try to model how regulatory constraints affect representative plants and how effects on individual plants are distributed among firms and regions. This requires identification of the age and other attributes of the capital stock of various plants, their specific production processes, and their existing effluent control measures. It becomes critical to specify required production changes and capital investments for various plants. These conditions determine both short- and long-run consequences for the industry. New plants may have compliance costs substantially different from those of older plants.

Identification of short-run distributional effects becomes very important when considering alternative regulatory policies. Firms and regions that see themselves suffering from promulgated regulations—even if only

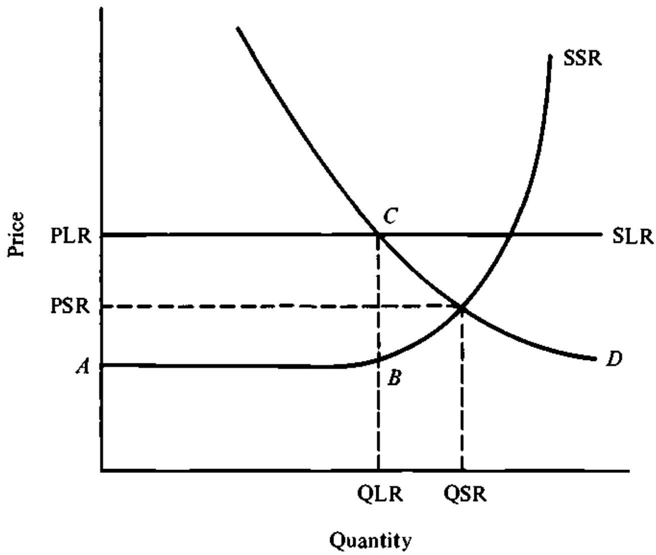

Figure 5.2 Short-run and long-run equilibrium. D: demand. SSR: supply, short-run (based on ascending average variable costs). SLR: supply, long-run (based on total economic costs, including return on investment). QLR, QSR: equilibrium quantity, long-run and short-run respectively. PLR, PSR: equilibrium price, long-run and short-run respectively.

temporarily—are likely to mount campaigns aimed at altering the regulations, weakening their enforcement, or simply preventing further regulation. Conversely, firms and regions benefiting from regulations, either because they receive benefits at relatively low cost or because they gain financially, can be expected to oppose changes in regulations.

Our model is expanded to consider short-run effects as well as distributional impacts. In figure 5.2 we depict a demand curve (D), a short-run supply curve (SSR), and a long-run supply curve (SLR). For the moment, assume that D does not change over time. SSR is an upward-sloping curve which, as described, arrays individual plants in an industry according to ascending average variable costs.

SLR is drawn as a horizontal line, representing the underlying assumption that in the long run an effectively unlimited supply of new capacity can be brought on line at the average total cost (including a return to capital) of the lowest-cost source of new capacity.

Understanding the relationship between SSR and SLR is critical to determining the impact on industry of a government regulation. As drawn in figure 5.2, new capacity is relatively costly. We could just as easily

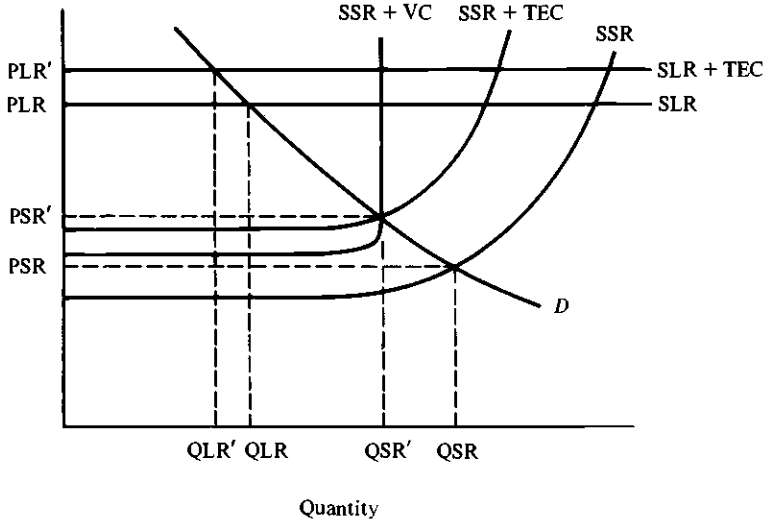

Figure 5.3 Short-run and long-run equilibrium with added costs of regulation (case 1; PSR′ < PLR′). TEC: total economic costs of regulation (including return on investment). VC: variable costs of regulation. All variables with prime are the after-regulation equivalents of the unprimed variables. See figure 5.2 for definitions of other abbreviations.

have depicted new capacity as relatively inexpensive—owing, perhaps, to scale advantages, technical change, or factor substitution. The point, of course, is that the actual relationship between SLR and SSR is an empirical question.

Furthermore, the path the industry follows from SSR to SLR depends on a number of factors, perhaps the most significant of which is the economic longevity of existing facilities. Thus, as drawn in figure 5.2, the long-run equilibrium quantity QLR is less than the short-run equilibrium quantity QSR. The time path of adjustment from QSR to QLR depends on how rapidly the existing capacity is retired.

If the highest variable cost capacity is retired first, then at some intermediate point in time the supply curve will be marked by the points ABC and the long-run price and output levels will have been reached. As more old facilities are retired the supply curve will continue to shift from ABC to SLR, but in so doing it will merely dissipate the quasirents of existing facilities without influencing price and output levels.[4]

In figure 5.3 government regulation is imposed on this situation, and its costs shift both the short- and long-run supply curves upward. Consider first the impact on the short-run curve. The curve labeled SSR + TEC reflects the old short-run supply curve plus the total economic costs

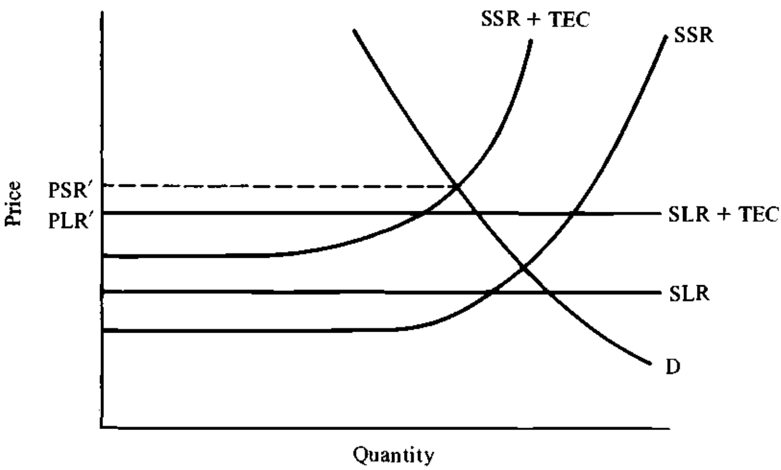

Figure 5.4 Short-run and long-run equilibrium with added costs of regulation (case 2; PSR′ > PLR′).

(including a return on investment) of the government regulation. No rational firm in a fully informed and perfectly competitive market will comply with a regulation unless it can expect to recover the full costs of compliance. This cost recovery need not imply price increases equal to cost increases, however. As part of this recovery, the profit-maximizing firm will count contributions to sunk costs of all prior investments, which it would have to forgo if it did not comply. This new curve is a combination of variable and total economic costs. The maximum capacity a rational firm will bring into compliance will be QSR.

Once compliance investment decisions have been made, short-run behavior will be predicated on an industry's variable cost structure. The curve marked SSR + VC in figure 5.3 is such a curve, for it reflects the old short-run supply curve, the variable costs of government regulation, and the capacity constraint implied by QSR. This short-run curve is now vertical at the desired quantity level, because government regulations force firms to rationalize the industry's capital stock.

A similar vertical shift in SLR is due to added costs of regulation for new facilities. Again, depending on the rate of retirement of old capacity, there is a time path of adjustment from PSR′, OSR′ to PLR′, OLR′.

Nothing in this logic just described requires PLR′ to be greater than PSR′. Indeed, if the costs of retrofitting existing capacity are high and the incremental costs of compliance in new facilities are low, it is quite possible for PSR′ to exceed PLR′ (see figure 5.4.)

Obviously, government regulation, by shifting long-run supply costs, will influence the total size of an industry; as depicted, however, it will not influence profit margins of new plants. However, returns (or quasi-rents) to existing plants will be materially affected by both the height of any vertical shift in the supply curve and the time path of adjustment to the new long-run equilibrium. Furthermore, the economically critical factor is not the average vertical shift, but the shift that occurs at the relevant margin. This may be more or less than the average. For example, if any industry's high-cost producers also have relatively high compliance costs, then the marginal cost of compliance will exceed average costs and new quasirents will be created by regulation. If compliance costs of marginal facilities are low, then regulation will dissipate some quasirents. (In both cases, some quasirents are terminated as the industry contracts.) Whether the net impact on rents is positive or negative is an empirical question we will address below in the context of tissue manufacturing.

It should be clear that to calculate impacts of regulations we must consider short-run effects, and not merely show differences in long-run costs, prices, and outputs. To obtain a better estimate of regulatory costs, the observed time stream of these cost and price increases needs to be discounted.

The above discussion was predicated on the assumption of constant demand. More realistically, demand is likely to shift over time. In some instances, this shift will be upward (as income grows, for example); in other instances, the shift will be to downward (as when lower-cost foreign supplies become available). The addition of a dynamic element to demand only reinforces our conclusion on the importance to impact analysis of the time path an industry follows in adjusting to government regulation.

In this same vein, any movement from a short-run to a long-run equilibrium requires investment, the timing of which can significantly influence the costs of compliance. For example, Leone et al. (1975) concluded that the annualized price per ton customers would pay as a result of the Federal Water Pollution Control Act Amendments of 1972 could be as low as \$2.45 per ton if expenditures for pollution-control devices did not necessitate deferral of investments in production capacity. In contrast, if investments in new capacity were deferred on a dollar-for-dollar basis to allow for financing of pollution control devices, the annualized price per ton could be as high as \$14.20. Under both assumptions, the estimated long-run (15–20 years) price per ton was virtually the same, as would be expected.[5]

Furthermore, short-run costs may have substantial impacts in the long run because they may seriously affect the competitive structure of an industry. If high short-run costs fall disproportionately on the smaller, more marginal plants and firms within an industry, these firms may not be able to stay in business. The result would be a more oligopolistic industry by the time the "long run" was attained. If this is the case, then long-run market conditions will be different from those described by the competitive-market equilibrium discussed above.

There is one further important reason for considering these short-run distributional effects: Members of the public at large, as well as various interest groups, may substantially alter their support for intended policy objectives if they do not perceive the costs initially or if they feel they are bearing a disproportionate share of the costs. People may favor improving water quality and support legislation promising to do so when costs of the program are as vague and hidden as they are in the environmental area; they may also change their positions radically once costs are perceived.

In her insightful article, Dorfman (1975) estimates the total economic costs of air and water pollution-control programs passed in the 1970s and shows that the near-term costs are substantially greater than the long-run costs. She further suggests that the vast majority of these costs are in the form of higher industry costs, which will be passed on to consumers. We think it is fair to speculate that these costs may not have been accurately perceived and fully discussed when the legislation was passed and may have turned out to be far greater than what the public is willing to pay for improved environmental quality. Once these costs begin to be perceived, which will occur as regulations are written and enforced, political support for these programs may erode. Our model of policy development must take such changing forces into account.

We have briefly outlined the model necessary to define and measure economic impacts of proposed regulations on an industry. The remainder of this paper applies the model to development of the 1972 amendments to the Federal Water Pollution Control Act and subsequent rulemaking by the EPA for the pulp and paper industry. We hope to demonstrate how the model is estimated in practice, to indicate the magnitudes of quasirents being created and dissipated by the EPA, and to show where and how costs and rents influence regulatory policy.

Economic Impacts and Congressional Consideration of Water-Pollution Regulations

The 1972 amendments to the Federal Water Pollution Control Act represent a major turning point in the public approach to water-pollution control. Previous legislation required state enforcement of policies based on local water quality. There was a general feeling that this approach had not been effective because each state had a considerable incentive to protect its economic base and thus not to set or enforce strong standards. The 1972 amendments decreed that policy would now be based on uniform effluent standards defined and enforced by the federal Environmental Protection Agency, regardless of the quality of the receiving water or local economic impacts. The act, as passed over a presidential veto, established 1985 as the date for "ending all discharge of pollutants" (EDOP) and set interim standards for 1977 based on "best practicable technology" (BPT) and for 1983 based on "best available technology" (BAT). Not only are the costs of attaining these standards large; they are anything but uniform in their economic impact on different regions and on competitors within an industry.

The passage of this legislation provides important clues about possible reasons for continued use of the regulatory approach to solve important social problems. Prior to passage, there had been growing concern among the American people about environmental problems. Opinion polls record that between 1965 and 1970 the proportion of persons who said water pollution was a "serious" or "very serious" problem rose from 35 percent to 74 percent (Erskine 1972).

Numerous politicians tried to capitalize on this concern by proposing new legislation. The most notable was Senator Edmund Muskie (D, Maine), who was preparing for his expected presidential campaign of 1972 (Ingram 1979). Muskie was chairman of the Air and Water Subcommittee of the Senate Public Works Committee, and thus had a major role in drafting the original version of the 1972 amendments. Muskie had been stung by accusations from Ralph Nader's organization that he was weak on water-quality policy. He responded by promoting a bill embodying the regulatory approach with strong effluent standards. The full Senate Public Works Committee unanimously (16–0) reported the Muskie bill without questioning the regulatory approach or the likely economic consequences. The Senate passed the bill unanimously (86–0) five days later, essentially unchanged.

The Senate's biggest concern appeared to be the expenditures the federal government ultimately might incur. The committee supplemental report (filed by five Republicans) and two of the three floor roll-call votes concerned provisions in the bill providing federal grants to local governments for constructing water-treatment facilities. (The other vote was on a proposal to allow the Small Business Administration to establish a subsidized loan program for small businesses finding it hard to raise necessary capital to install pollution-control devices.) The only alternative to the regulatory scheme was a proposal from Senator William Proxmire (D, Wisconsin) to include an effluent-tax system. This proposal was debated briefly and then rejected on a voice vote.

In the House of Representatives, the Public Works Committee considered the bill in early 1972 and reported its version in March 1972. There were several marked differences between the Senate and the House Committee versions. The most important was that the House would establish as goals rather than as mandatory the zero discharge standard for 1985 and the BAT requirement for 1981 (later amended in conference to 1983). The House version also required a study by the National Academy of Sciences on the environmental, technological, economic, and social feasibility of meeting the 1981 and 1985 goals prior to the mandating of their implementation.[6] Thus, the House Public Works Committee expressed concern over the uncertainty of economic impacts and sought to delay implementation until further study. However, it did not question the regulatory approach or the ultimate objectives. In dissenting reports, Democrats Bella Abzug and Charles Rangel of New York supported a set of modifications, known as the Reuss-Dingell Clean Water Package, and proposed several amendments of their own. These proposals would have reinstituted the Senate language mandating the 1981 and 1985 policies and added other strengthening requirements. A minority report filed by Republicans Roger Zion (Indiana) and John Terry (New York) expressed concern about the long-run economic impacts of the regulations and requested more information on potential price increases, employment impacts, balance-of-trade effects, and budget commitments. They did not propose any specific alterations to the committee version, however. House floor debate focused largely on the stronger Reuss-Dingell amendments, which were defeated, and the municipal-treatment grant program. The final version, passed by the House on a 380–14 vote, was very close to the version reported by the House committee. The final version of the bill, as reported by the conference committee and passed over President Richard M. Nixon's veto, kept the EDOP goals, but mandated implementation of BAT standards in 1983.

What role did potential costs and economic impacts play in the passage of these 1972 amendments? There was, of course, the expected conflict between industry, labor, and environmentalist groups over the proposed regulations. Presumably those individuals who would bear a small proportion of the costs and who value environmental quality would be more likely to support the legislation and to expect their representatives to do likewise. Beyond that, our model suggests that some firms and regions will be more disadvantaged than others; some may end up better off, depending upon their location on the compliance-cost curve in figure 5.1. We would then expect to find differences in positions taken by different firms in their testimony before congressional committees, in the behavior of various representatives, in industry and regional presentations and comments to the regulatory agency, and in firms' participation in lawsuits filed over the promulgated regulations, depending upon relative economic impacts. Our concern is how influential these various political activities may be in policy processes.

Perhaps the most conspicuous arena for these political considerations is the House of Representatives, which is organized on a regional basis and comprises legislators closely tied to district concerns. It would be surprising if the expected or most obviously perceived distributional impacts of proposed policies were not influential in the congressional decision process. Thus, by examining regional distributions of costs and benefits one ought to be able to explain, at least in part, the behavior of the House in establishing the regulatory policy.

We have already commented that total costs of the 1972 Water Pollution Control Amendments apparently were not considered in the development and passage of the legislation. However, some of the direct cost and employment effects were sufficiently large and concentrated to have influenced congressional decisions. Other things being equal, such as local pressures for environmental programs, it would be expected that representatives from districts with large concentrations of potentially impacted businesses would be more likely to oppose stronger versions of the bill than representatives from districts likely to suffer little adverse economic impact.

The amendments offered and voted on in the House of Representatives provide an opportunity to examine how these direct regional consequences influenced the legislation. Table 5.1 shows the six (of nine) recorded floor votes taken in the House, which we will analyze.[7] The amendments are ordered in terms of increasing regulatory strength, and presumably in severity of impacts on industry. For example, passage of the Abzug and

Table 5.1 House votes on the 1972 Water Pollution Control Amendments.

Included in Analysis	Location of Amendment Relative to Vote for Passage[a]
Passage of the bill. Passed 380–14.	0.00
McDonald (R, Michigan). Amendment to exempt industries from paying capital costs on federally funded municipal waste treatment plants which they use, in addition to paying user charges for maintenance, operation, and expansion. Rejected 66–337. A Nay vote was considered to be in support of the act.	0.56 (0.12)
W. Ford (D, Michigan). Amendment to guarantee public hearings in EPA investigations of employee firings or layoffs resulting from effluent limitations or orders under the act. Adopted 275–117.	1.52 (0.15)
Reuss (D, Wisconsin). Amendment to require adoption of toxic-pollutant standards and effluent limitations before EPA could transfer permit programs over to the states, and to give EPA permit-by-permit veto power over state programs; amendment would also have eliminated a provision in the bill giving immunity until 1976 to polluters who applied for discharge permits. Rejected 154–251.	2.72 (0.17)
Reuss (D, Wisconsin). Amendment to require industries to use the "best available" water pollution control technology by 1981. Rejected 140–249.	3.04 (0.17)
Abzug (D, New York). Amendment to require impact statements under the National Environmental Policy Act of 1969 for all activities covered by the bill. Rejected 125–268.	3.50 (0.18)

a. For an explanation of the entries in this column see the discussion in the text.

Reuss amendments would have produced a much stronger bill with more severe impacts on manufacturing firms. Conversely, the McDonald amendment was designed to limit impacts on firms by exempting them from capital costs of new municipal waste-treatment plants.

We have categorized legislators who voted according to which amendments they supported or opposed to obtain a measure of support for the legislation. For example, someone voting against all amendments and the bill itself was placed in the first category, while someone who just voted for the bill is put in the second category, and so on. Representatives who voted for all amendments fall into the seventh, or highest, category.[8] The distribution of representatives by respective categories is given in table 5.2. Fifteen representatives did not cast enough votes to be located on the scale and are omitted from further analysis. The scale has a fairly broad distribution, with only some bunching at the upper end. Thus,

Table 5.2 Distribution of representatives voting, by category.

	Category[a]							
	7	6	5	4	3	2	1	Total
No. of representatives	105	42	28	126	89	20	10	420

a. In most instances, the number of categories is equivalent to the number of votes a representative cast for pollution control. A representative who cast a vote for a more stringent amendment, but against a less stringent one, was assigned to a category that would maximize the coefficient of reproducibility.

Table 5.3 Model of House voting on the 1972 Water Pollution Control Act Amendments. Dependent variable: Scale category from table 5.2.

Independent Variables		Coefficient[a]	Standard Error
Constant		4.82	1.64
Demand	Region:		
	Border[b]	−0.78	0.22
	South[c]	−0.81	0.28
	Upper Midwest[d]	0.45	0.23
	Lower Midwest[e]	−0.46	0.21
	Upper West[f]	0.30	0.35
	Lower West[g]	−0.31	0.22
	Population density (log)	0.10	0.04
	Median house value × % owner	0.01	0.21
	Median rent × % renter	0.62	0.54
	Median age in district (population over 25)	0.06	0.02
	% suburban	0.38	0.26
Northern Democrats		1.08	0.15
Southern Democrats		0.66	0.28
Age of congressman (log)		−1.48	0.32
Cost[h]	Primary metals	0.24	0.18
	Mining	−0.02	0.32
	Petroleum extraction	−0.53	0.24
	Paper production	−0.18	0.19
	Paper production × cost/ton	−0.003	0.03

a. These coefficients and the coefficients reported in table 5.1 were estimated using *n*-chotomous multivariate probit techniques.

b. Maryland, West Virginia, Kentucky, Tennessee, Missouri, Oklahoma.

c. Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, Texas.

d. Michigan, Wisconsin, Minnesota, North Dakota, South Dakota.

e. Indiana, Illinois, Iowa, Nebraska, Kansas.

f. Montana, Idaho, Oregon, Washington, Alaska, Wyoming.

g. Utah, Colorado, New Mexico, Arizona, Nevada, California, Hawaii.

h. The primary metals, mining and petroleum extraction variables are dummy variables equal to 1 if the industry is important to the district's economy (as reported by the Almanac of American Politics). Paper production is tons of capacity from *Lockwood's Directory of the Pulp and Paper Industry*. The cost/ton data are derived from Leone et al. 1975.

it should provide a good measure of the positions of most legislators on the issue of water-pollution-control regulations.

The next step is to relate these positions to demands for environmental quality and to the economic impacts in each district. We focus on the pulp and paper industry, and we want to know specifically if the likelihood of a representative's supporting strong environmental legislation decreases if there are pulp or paper mills in the district, and if this support is further reduced if likely compliance costs for district mills would increase.

The model and the statistical method used to explain House voting on the 1972 amendments are described elsewhere (Jackson and Leone 1978), but we can easily summarize its contents and results. The major determinants of a representative's position on the legislation are hypothesized to be the district's demand for environmental cleanup, the likely economic consequences for the district, and the representative's party affiliation and personal preferences. The precise variables used in the analysis, their estimated effects on legislators' positions, and the standard errors of the coefficients are shown in table 5.3.[9]

The statistical method provides an estimate of relative location, or spacing, of votes used to constitute our scale of support for stronger water pollution regulation. The numbers in table 5.1 are these estimated locations, with the vote for passage arbitrarily defined as zero to locate the scale. (The parenthetical numbers are standard errors of estimated locations.) The three amendments in the Clean Water Package are located close together, while the largest distances are between these amendments and the Ford amendment, and between the Ford amendment and the two weakest votes. The magnitudes of distances between votes aid in interpreting coefficients in the underlying model. For example, it would take a difference of at least 1.2 in estimated positions of two representatives to bridge the gap between the Ford amendment and the first Reuss amendment.

The specification of demand variables is based on a model of people's willingness to pay (in dollars) for environmental cleanup, as estimated with data from a 1969 Harris survey (Jackson 1979). This model shows that willingness to pay is strongly related to a person's region and place of residence, age, family size, education, and income.[10] Unfortunately, data on income and education levels of congressional-district residents is not available for 1972.[11] We hope that inclusion of housing-stock variables serves as a proxy for these characteristics. The population-density variable is included to represent estimated willingness-to-pay differences between rural and metropolitan areas. Coefficients on these variables are consistent with the demand model. Only a district's median voter age did not perform as expected. This may be explained by the small variation in this variable and by the fact that what variation exists is largely attributable to the location of large military bases, with their younger nonresident populations. We thus conclude that representatives' positions were related to the environmental demands of their constituents.

The party-affiliation variables are self-explanatory. Northern Democrats exhibited much stronger support for the legislation than did Republicans, with the support of southern Democrats somewhere in between. The results are consistent with the pressure President Nixon put on the House to weaken the bill. The age of legislators is used to proxy their own preferences, and this has the expected sign: Younger representatives show preferences for more stringent regulations.

In addition to economic impacts associated with the pulp and paper industry, we make a crude attempt to include the presence in districts of other industries likely to be adversely affected by the regulations. The *Almanac of American Politics* (Barone et al. 1972) gives a brief summary of the industrical base of each district, compiled from the 1970 census. The variables, primary metal, mining, and petroleum extraction, are simply dummy variables based on whether the almanac mentioned the appropriate economic activity. As such, they may not be completely reliable, particularly for metropolitan areas where census data are not available on a congressional-district level. The authors of the almanac admitted that for these districts the description is based largely on characteristics of the entire metropolitan area. This difficulty may help explain the wrong sign on the primary metal variable, since many steel mills are located in metropolitan areas. It may also be the case that water quality is lower in such districts and the legislator was voting for cleanup in spite of economic effects.

Local compliance costs for the pulp and paper industry are our particular concern here. The importance of this industry to a district is measured by production capacity in thousands of tons per day of mills in the district. Cost data, in dollars per ton to meet 1983 BAT standards, are from the National Commission on Water Quality (NCWQ) study. The NCWQ model used for estimating these costs is the predecessor to the industry model described elsewhere in this paper. Our hypothesis is that the greater the estimated cost of complying with the 1983 standards, the greater the adverse economic impact on a district—in terms of both personal income and employment—and the less likely a representative was to support stronger versions of the 1972 amendments.[12]

There are two alternative hypotheses about the expected signs on the two pulp and paper variables. A naive hypothesis is that paper companies (and, presumably, representatives from districts with economies based on pulp and paper) are sensitive to any regulation that may raise their costs and reduce output and profits. Particularly, given uncertainty about how regulations might be written and enforced, firms may simply be wary of the unknown and oppose any government regulation. If this is the case, we would expect congressional voting to be sensitive to the amount of pulp and paper production in a district, but relatively insensitive to costs, which were only determined after the EPA began to define industry categories and establish effluent standards. The hypothesis based on more sophisticated behavior is that firms are aware not just of their own expected pollution-control costs, but how these costs compare with those of competing firms. With this knowledge, firms estimate their expected change in net worth, not just cost increases. This calculation is based on the shape of the compliance-cost curve of figure 5.1. According to this analysis, firms in the left-hand portion of the curve potentially stand to have increases in net worth because expected price increases resulting from a shift in the aggregate supply curve may exceed their compliance costs, resulting in increased profit margins. Sophisticated firms in the left portion of the curve may actually gain economically from imposition of pollution standards and might be expected to support the legislation. A large negative coefficient on the cost multiplied by the production variable and a positive (or at least a zero) coefficient on the production variable would support this hypothesis.

The estimates do not support the more sophisticated model of firm behavior, but indicate that representatives from districts with pulp and paper mills were less likely to support the legislation. Although the standard error of each coefficient is large, the null hypothesis that pulp and paper presence and costs have no effect (that is, that both coefficients equal zero) can be rejected at the 0.01 level. The χ^2 value for this hypothesis is 10.0 with 2 degrees of freedom. (If the production capacity multiplied by cost per ton variable is deleted, the coefficient of production capacity is -0.20, with a standard error of 0.06.)

Overall, voting was not sensitive to estimated compliance costs. For a district with the maximum capacity (6,500 tons per day), the predicted effect on congressional voting of a $10 per ton cost difference (the maximum difference among districts) is only -0.20.[13] For smaller cost differences or for districts with less capacity, expected voting differences will be even smaller.

In contrast, the mere presence within a district of 6,500 tons of daily pulp and paper production capacity at the average compliance cost of \$6 per ton affects a representative's vote by -1.30.[14] Each 1,000-ton decrease in capacity increases the expected support for pollution-control regulations by 0.20 at the average compliance cost of \$6 per ton. The significance of these magnitudes can be ascertained by consulting table 5.1 for differences in locations of votes.

We conclude from these results that congressional voting on the 1972 amendments was sensitive to potential direct economic effects on a district, but in a rather unsophisticated manner. Representatives did not seem to be pressing a possible economic advantage to their region by supporting legislation that would give local mills a competitive advantage; they simply opposed regulations affecting local industry.

An obvious rationale for the relative unimportance of variations in compliance costs in explaining congressional voting is that intraindustry impacts were not known at the time the legislation was considered. The development of a regulatory policy is largely defined by the stream of administrative decisions made by the regulatory agency once the legislation is passed. In the case of the 1972 Water Pollution Control Act Amendments, the bill simply specified that industry had to satisfy effluent standards consistent with the BPT by 1977 and the BAT by 1983 for given industries and industry subcategories. It was left to EPA to define the subcategories, to specify what constituted BPT and BAT standards for various industries and subcategories, and to establish the norms. Only when the EPA begins this process are firms able to predict how they will be affected. Without these predictions, one might expect a strong, general opposition to the concept of being regulated (possibly in anticipation of adverse economic consequences), with no variation in opposition in response to variations in economic impacts.

Administrative Rulemaking and Regulatory Impacts

The fact that distributional consequences within an industry (and thus between regions) are not defined until rulemaking regulatory processes begin has strong implications for the effect of distributional impacts on policy processes. The regulating agency (in this case the EPA) determines these impacts, which implies that the agency and not the Congress becomes the focus for the political forces they generate. The question now to be asked is: How, and to what extent, are an administrative or regulatory agency's rulemaking and enforcing decisions affected by pressures related to the economic consequences of their decisions? A brief glimpse at this process, and at possible influences of economic effects, is obtained by noting that the EPA published three different versions of BPT and BAT standards for a large section of the pulp and paper industry. These different versions and solicitation of industry and public comments are part of the required rulemaking procedure. Subsequent alterations of the standards and industry categorizations provide clear evidence of accommodation to various pressures from segments of the industry and from environmentalists.

Investigation of the question posed in the preceding paragraph and analysis of different standards proposed by the EPA require that we estimate for a segment of the pulp and paper industry the detailed model described in the first section of this paper. This is done for the tissue portion of the industry.

In estimating impacts of regulations, first it is necessary to identify the distribution of costs the tissue industry will confront in meeting the regulations. That is, we must estimate the compliance-cost curve (figure 5.1). Second, these costs must be translated into price effects and microlevel impacts. The specific procedures used to calculate the costs the tissue industry will incur in complying with mandated water-pollution reductions and associated total costs of manufacture are described elsewhere (Leone 1980). Here, we merely note that these costs are estimated on a plant-by-plant basis. This is done by taking cost levels estimated for "representative" or hypothetical mills and regressing them on various mill characteristics. The resulting equations permitted estimation of costs for sixty-four existing mills in the industry.[15]

In calculating pollution-control costs, we assume that each plant will minimize the discounted present value (with an interest rate of 15 percent) of compliance costs for the anticipated sequence of 1977, 1983 and 1985 standards, and that all in-process or end-of-pipe changes that reduce pollution loads and yield a 15 percent return will be made. Occasionally, this assumption may not be valid. For example, the 1985 standards are merely a "goal" in the 1972 act. If they are not enforced, then on a present-value basis a company may take a different course of action to meet the 1983 standards. Furthermore, we ignore issues of regulatory uncertainly; that is, we assume that standards are known and will be strictly enforced.

The principal benefit of this microlevel cost orientation is that it permits simulating the distributional consequences of regulation which we argued are so important to understanding the political economics of business regulation.

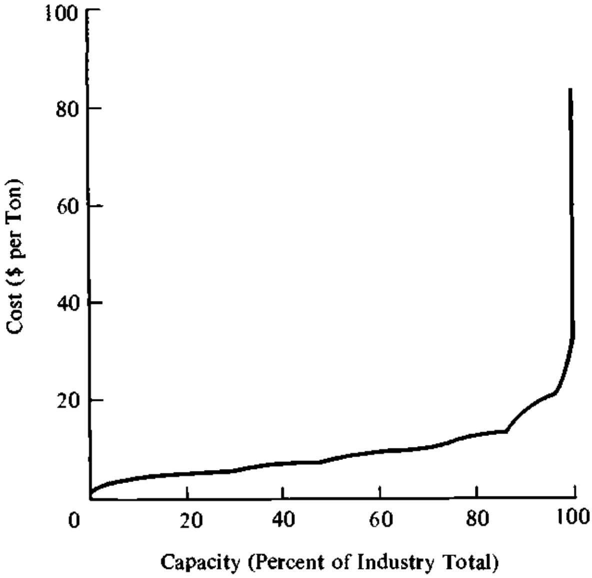

Figure 5.5 Estimated 1977 BPT compliance-cost curve (economic-cost basis).

The estimated compliance-cost curve for the tissue portion of the pulp and paper industry for 1977 BPT effluent control levels is shown in figure 5.5. The BPT costs range from $1.85 to $82.82 per ton.[16] About 80 percent of capacity has unit costs of $12.34 per ton or less. The average economic cost for the tissue industry is $9.41 per ton.

Figure 5.6 is identical in construction to figure 5.5, but shows various definitions of total manufacturing costs estimated in 1974 prices.[17] The middle curve reports total costs of production on an accounting cost basis before the act; thus, it excludes all water-pollution-control costs associated with the act except those with a rate of return of 15 percent on the required investment. The range of production costs is substantial: from $556 to $693 per ton. The weighted average cost of $613 per ton is exceeded by thirty-five of the sixty-four mills in our sample, which indicates that the lower-cost mills are predominantly the larger ones.

Although it cannot directly be discerned by comparing figures 5.5 and 5.6, it is worth noting that there is no obvious correlation between a mill's BPT compliance costs and its total manufacturing costs. It is not the case, for example, that mills with high production costs necessarily have high BPT compliance costs. Accordingly, to understand the economic consequences of BPT regulations it is not sufficient to examine

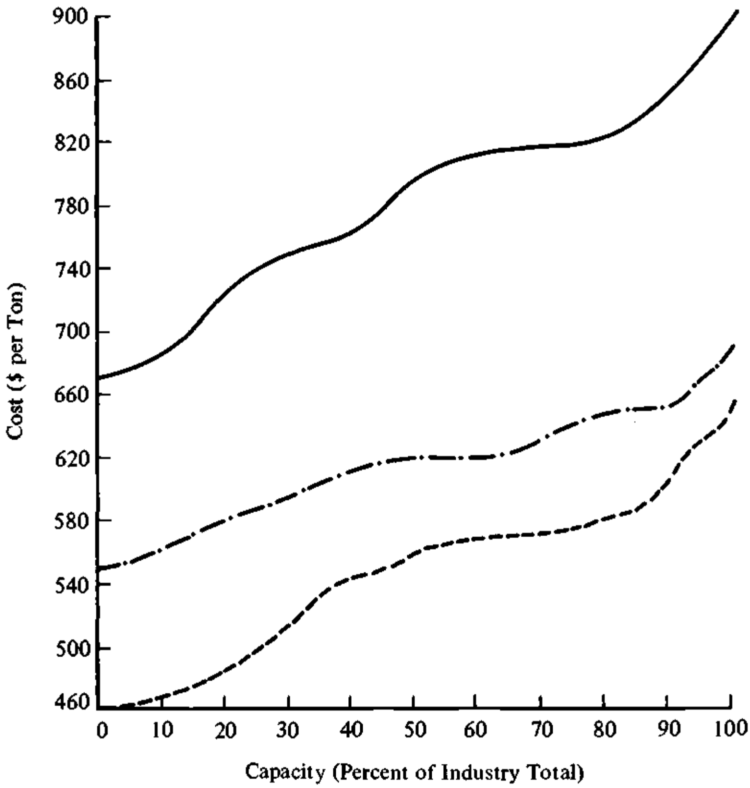

Figure 5.6 Various definitions of total cost of production for the tissue industry. Solid line: economic-cost basis, BAT. Dash-dot line: accounting-cost basis, before the act. Dotted line: variable-cost basis, before the act.

the distribution of BPT costs alone; it also is necessary to examine the underlying distribution of manufacturing costs.

Because the accounting cost numbers in figure 5.6 represent total costs, they are not relevant to short-run decisionmaking. Thus, we also report in figure 5.6 our estimates of the variable costs of production without effluent controls. These figures reflect costs observed in the second quarter of 1974. At that time, the capacity-utilization rate in the tissue industry was approximately 94 percent and a typical price for tissue was $638 per ton (Arthur D. Little, Inc., 1974). In view of the extensive possibilities for error in our cost-estimation procedures, these observed price and utilization levels are quite consistent with the numbers shown in figure 5.6. Indeed, at a 94 percent utilization rate, figure 5.6 implies a price of $627 per ton; at a price of $638, figure 5.6 forecasts a utilization rate of 97 percent. These predictions are very close to the observed values.

Table 5.4 The tissue industry's costs of production with BPT controls in place (1974 prices, accounting-cost basis), by mill.

Mill Total Cost with BPT Controls ($ per Ton)	Percentile Ranking of Mill with BPT Controls	Mill Capacity (Tons per Day)	Identification No. of Mill	Percentile Ranking of Mill with No Controls
559.33	7	648	2	7
560.35	10	204	4	10
574.93	12	208	42	13
581.00	17	453	50	18
582.35	18	104	57	11
587.87	21	272	49	21
589.46	22	68	16	22
591.57	31	816	1	31
601.99	32	29	11	32
604.12	33	116	38	35
604.35	35	181	55	34
613.89	37	133	44	41
614.18	39	172	20	37
614.66	39	37	30	39
614.78	41	140	10	39
618.14	43	181	43	43
619.31	43	36	12	47
619.68	47	362	53	47
620.06	48	45	8	48
621.85	49	90	63	49
623.04	49	18	58	48
623.51	50	72	7	60
623.91	59	816	47	58
624.51	60	54	27	59
627.04	60	45	3	68
629.37	61	36	22	66
630.00	65	408	51	64
631.20	66	72	61	66
633.06	66	45	33	65
633.82	67	40	31	67
633.87	67	31	46	69
634.19	68	54	9	67
635.47	69	58	15	68
636.29	69	58	32	70
638.28	70	108	5	74
639.71	71	27	36	69
641.22	71	36	37	71
641.78	72	72	59	73
642.74	72	7	41	47
643.39	72	22	48	69
643.39	73	22	62	70
643.45	73	22	34	74
645.06	73	31	21	71
645.67	73	18	26	71
646.81	75	145	52	77

Table 5.4 (continued)

Mill Total Cost with BPT Controls ($ per Ton)	Percentile Ranking of Mill with BPT Controls	Mill Capacity (Tons per Day)	Identification No. of Mill	Percentile Ranking of Mill with No Controls
648.31	75	22	24	71
649.09	77	155	64	76
649.18	77	22	35	72
651.70	85	725	54	90
653.69	87	136	14	82
653.96	90	222	17	80
654.43	90	12	28	72
656.93	90	7	25	43
659.37	91	126	29	91
662.81	92	108	39	92
668.03	93	90	19	94
670.67	94	22	23	93
670.71	94	68	18	93
673.19	95	48	60	96
678.01	96	93	45	96
680.93	98	167	6	98
684.09	99	67	13	99
692.88	100	77	56	100
697.34	100	36	40	100

Deviations may be attributed to two phenomena. First, most assuredly, is the rudimentary nature of our costing procedures. Second, we incorporated all profitable internal and external process changes into the costs shown in figure 5.6. In practice, not all mills in 1974 had yet adopted these cost-saving measures; furthermore, the fact that savings manifest themselves principally in lower variable costs partially explains our understatement of price at the observed utilization rate.[18]

Total manufacturing costs in 1977 with BPT pollution controls in place are shown in table 5.4, which shows the same kind of information presented graphically in preceding figures. The second column shows the percentile ranking of each mill after BPT controls; the rightmost column shows the same ranking without controls. A comparison of these two columns indicates some interesting competitive consequences of BPT regulations. For example, without controls mill 25 ranks at the 43rd percentile of industry costs; with BPT controls it ranks at the 90th percentile. The economic circumstances of mill 25 are almost surely politically sensitive, given its dramatic shift in relative competitive position after imposition of BPT effluent controls.

For most mills, relative shifts in competitive advantage are far less dramatic than the shift experienced by mill 25. For example, twenty-six mills are relatively worse off after BPT controls; that is, they have percentile rankings higher after BPT than before. Only fifteen of these mills have shifts of two percentile points or more. However, the largest shifts occur at the high-cost end of the spectrum, precisely where they are most important from the standpoint of economic survival. Note, for example, that in addition to mill 25, mills 28, 17, 14, 35, and 24 all have relatively major shifts at the high-cost end of the spectrum.

Seventeen mills have improvements in their relative total-cost position after BPT; eleven of these shift by two or more points. Thus, overall, forty-three of sixty-four mills in our sample experience a relative shift in competitive advantage that is due to BPT effluent controls.

These relative cost shifts have two distinguishable, but related, impacts on the economics of an individual plant. The first effect is obvious: The higher a plant's relative costs, the lower any quasirents it might earn. Thus, relative cost shifts due to regulations create and dissipate quasirents earned by producers. There is a second impact, however, which is distinguishable from the first. The lower a plant's percentile cost ranking, the less vulnerable it is to changes in an industry's overall economic conditions. Thus, a plant that shifts to a lower ranking because of regulation may be able to sustain a higher rate of capacity utilization than its disadvantaged competitors.[19] In sum, a favorable shift in the cost ranking of an individual plant both increases the plant's margins and reduces the likelihood that its full capacity will be underutilized.

Alternative abatement standards imply different mill costs and quasirent distributions. The EPA's water-pollution-control effort in moving from BPT to BAT and then to EDOP can create or destroy competitive advantages. We suggest that one dimension of competitive advantage is a plant's costs relative to its competition. These shifts in competitive advantage are summarized in table 5.5 for tissue producers at mandated water-pollution-abatement levels. If nothing else, this table quickly demonstrates the likely complexity of political forces set in motion by water-pollution controls. As noted earlier, of sixty-four mills in our sample, seventeen are in a relatively better cost position after BPT standards are in place. For only two or three of these mills is the improvement at all substantial. In contrast, twenty-six mills experience a relative loss of competitive advantage. For about half a dozen, the deterioration is substantial. In other words, gains and losses are not symmetrical in absolute magnitude. Primarily, this is because some very small facilities experience significant deterioration in their relative positions, but, being small in aggregate, their losses do not result in large gains for other mills.

Table 5.5 Percentile ranking of mills in the tissue industry.

Identification No. of Mill	No Controls	BPT	BAT	EDOP	BAT Replacement
1	31	31	31	31	21
2	7	7	7	10	7
3	68	60	60	60	66
4	10	10	10	2	18
5	74	70	70	67	29
6	98	98	99	98	62
7	60	50	59	48	85
8	48	48	48	41	83
9	67	68	67	68	93
10	39	41	39	40	81
11	32	32	32	35	62
12	47	43	43	59	84
13	99	99	97	99	45
14	82	87	87	85	64
15	68	69	69	68	94
16	22	22	22	13	46
17	80	90	90	88	54
18	93	94	94	94	45
19	94	93	93	93	60
20	37	39	41	39	88
21	71	73	73	86	98
22	66	61	61	67	91
23	93	94	94	95	99
24	71	75	75	90	99
25	43	90	90	100	100
26	71	73	75	91	99
27	59	60	60	58	86
28	72	90	90	95	100
29	91	91	91	90	90
30	39	39	37	41	82
31	67	67	68	70	92
32	70	69	69	69	93
33	65	66	66	70	95
34	74	73	73	70	96
35	72	77	76	91	99
36	69	71	71	74	97
37	71	71	71	74	97
38	35	33	35	33	78
39	92	92	92	92	96
40	100	100	100	100	100
41	47	72	73	99	99
42	13	12	12	12	12
43	43	43	43	43	48
44	41	37	37	37	23
45	96	96	96	96	59
46	69	67	67	71	94
47	58	59	58	57	75
48	69	72	72	89	90

Table 5.5 (continued)

Identification No. of Mill	No Controls	BPT	BAT	EDOP	BAT Replacement
49	21	21	16	16	51
50	18	17	21	22	20
51	64	65	66	65	42
52	77	75	75	73	89
53	47	47	47	47	59
54	90	85	85	84	37
55	34	35	34	35	66
56	100	100	100	100	76
57	11	18	13	17	83
58	48	49	49	67	89
59	73	72	72	72	87
60	96	95	95	94	97
61	66	66	61	65	92
62	70	73	72	89	90
63	49	49	49	59	86
64	76	77	77	76	44

Note: These are total accounting costs except the right most column, which reflects replacement costs on an economic basis.

Given that BPT standards are in place, a move to BAT standards yields very few changes in relative competitive position. Indeed, only five mills experience an absolute change of ranking of three or more percentile points. Thus, it appears that BAT standards principally affect the height but not the shape of the industry's effluent-control-cost curve. Under such circumstances, it would be expected that the industry would be able to sustain a fairly unified political position against BAT standards. EDOP standards, however, produce relatively large shifts in competitive advantage within the industry.

Whenever the politics of pollution controls are discussed, the issue of plant closings invariably receives a great deal of attention. Our analysis yields some interesting insights on the closure question.

On an economic basis, management will choose to close a facility rather than invest in pollution-abatement equipment if it cannot expect to earn an adequate return on its pollution-control expenditures. Thus, if the anticipated product price is less than the sum of variable costs of manufacturing plus economic costs of pollution control, a facility will be closed. Examined in this way, the estimated price increase due to BAT controls is about $4 per ton. Alternatively, if it is believed that investors cannot make perfect decisions and precisely estimate the desired level of industry capital stock, the price for tissue can be determined after firms have complied with BAT standards by examining variable costs of production with BAT standards in place.[20] At a 94 percent capacity utilization rate, variable costs with BAT are $3 higher than variable costs without effluent controls. The discrepancy of $1 per ton from the two different methods is well within our estimate of error. Since $3 or $4 would constitute a price increase of less than 0.5 percent and since tissue demand is relatively price-inelastic, we ignored any quantity effects.[21]

If producers correctly forecast a $3 price increase and make their pollution-control-compliance decisions on that basis, five of the sixty-four facilities in our sample will close. (These five represent less than 4 percent of total capacity; hence, their closing would not influence our estimate of the BAT price.)

Of these five closure candidates, only one was among the fifteen highest-cost facilities when measured on the basis of unit costs of abatement. In other words, the cost of regulatory compliance is a poor predictor of plant closings. Indeed, three of the five closure candidates had BAT costs less than the industry average, and two of these had costs less than half the industry average.

In contrast, all five closure candidates were among the top ten most costly plants when ranked on a variable-cost basis. It would be "correct" to conclude—as most closure impact studies do—that these facilities would have closed anyway, since they are the highest-cost facilities in the industry. Furthermore, they represent less than five percent of industry capacity and thus could reasonably be expected to constitute the 5–6 percent of capacity one would expect to retire in any given year or two simply by the process of normal economic depreciation. However, their demise is clearly accelerated by pollution-control regulations (how much is difficult to say in the absence of a dynamic model of industry investment).

If it is assumed that these plants close two years earlier than they would have otherwise, the capital losses associated with plant closings can be calculated. Variable costs per ton prior to pollution controls for our closure candidates are reported in table 5.6. Note that four of the five already had average variable costs that exceeded the preabatement price of $638 per ton. Thus, they were already operating, if at all, on the thinnest of margins. Indeed, in the aggregate these five facilities would need to forgo a $5 per ton contribution (price minus variable cost) on their entire output (which is highly unlikely) for the capital loss (present value at 10 percent) due to pollution controls to equal $1 million.

This analysis merely illustrates that important capital losses due to pollution controls are not found in the closing plants. Consider mill 3.

Table 5.6 Variable costs per ton (1974 prices) for mill closure candidates, with no controls.

Identification No. of Mill	
59	$634
52	640
60	643
23	655
40	692

It will not close because of pollution controls. However, prior to imposition of controls it had total costs of $625 per ton, and thus was earning an accounting profit of $13 per ton. Mill 3 has a capacity of 45 tons per day; it is a high-cost mill, with a life expectancy of, say, ten years. With BAT controls, its revenue rises by $3 per ton; however, its economic costs of BAT compliance rise by about $8 (they are relatively high because capital must be recovered in 10 years). Thus, its profit rate drops to $8 per ton—a loss of $5 per ton. The capitalized value of this $5 per ton loss for ten years at fifteen percent is about $400,000.

In fact, only two mills, representing less than 2 percent of industry capacity, have economic costs of BAT compliance that are less than the $3 per ton price increase. Recall from table 5.5 that BAT raises the curve in figure 5.4 for all firms but does not alter the ranking significantly. Thus, the remaining fifty-seven mills which can economically justify compliance do so only by taking a reduction in the economic returns they were earning prior to pollution controls. The capital losses associated with all these changes in rents swamp the capital losses due to plant closures; the potential capital loss for mill 1 alone is $13 million.

An aggregate industry estimate of potential capital losses associated with dissipated quasirents can be calculated as follows: The average economic cost per ton with BAT (after plant closures) is $11.82; the added revenue is $3. The capitalized value of the resulting $8.82-per-ton loss for ten years at 15 percent is $130 million. Thus, effluent-control regulations have the potential of dissipating large quasirents. These losses do not affect the marginal decisions of managers of existing facilities, but they certainly do influence the overall profitability of this industry.

The political entanglements created by these potential losses raise intriguing questions of public policy. In effect, our analysis suggests that a major economic consequence of water-pollution controls may be better measured by the resulting redistribution of wealth than by the price and quantity effects that receive so much attention.

These capital losses have been described as "potential" because thus far we have ignored any dynamic consequences of effluent controls. We now turn to issues of economics of new mills so as better to understand these dynamic impacts and the long-run price and profit effects. Figure 5.6 reported the total economic costs of replacing existing facilities in the tissue industry, assuming that these mills comply with BAT standards. A similar calculation of replacement costs prior to controls shows virtually no change in the rankings of the lowest-cost mills. Thus, BAT regulations do not seriously affect the overall geographic and technological thrust of the tissue industry. However, BAT controls do add $10–15 per ton to the price required to justify investment in this industry—approximately a 2 percent increase in total costs.

This seemingly small change actually is quite important to the dynamic performance of the tissue industry. New mills are high-cost producers; thus, this added 2 percent would not merely dissipate a quasirent that otherwise would have been earned by new producers, but would influence the marginal economics of this industry. By influencing marginal economics, it would significantly impact the quasirents of existing producers —indeed, it would likely raise their quasirents in the long run by the total $10–$15-per-ton economic-cost differential. In other words, because new facilities are high-cost, existing producers would recoup the quasirents they appear to have lost in our earlier comparative static analysis.

Compare the situation in the tissue industry in 1974 (before controls) with that in 1984 (post-BAT). Presumably, in this period 20–25 percent of existing capacity would have been retired owing to physical depreciation. The marginal producers, therefore, would all have new facilities. This would necessitate a return on the margin of total economic costs, and hence prices would be set on this basis. As shown in figure 5.3, all existing capacity would have to operate at virtually 100 percent utilization for this to occur. In these circumstances prices would have to be at least $679 per ton, the break-even cost of the lowest-cost source of new capacity shown in figure 5.6. Of course, new facilities would also have high cost in the absence of controls.

Thus, our scenario is the same for 1984 without controls, except that the break-even price is only $669 per ton—the lowest cost source of new capacity in the absence of controls. Consequently, the long-run effects of BAT controls do not make the industry any more or less sensitive to the business cycle, because the marginal producers are the new producers in either case. However, BAT controls would create a $10 price umbrella over the rest of the industry, wiping out their potential losses in quasirents due to controls and extending the economic life of old plants. Thus, viewed in long-run perspective, BAT controls are likely to reduce plant closures and increase profits for existing producers. The higher prices dictated by this process contract the overall size of the industry, but this manifests itself in fewer new plants rather than in lower profits for the existing ones.

Fewer new plants implies lost economic opportunities for regions that would have housed new plants and gains for regions that find their old plants more profitable. Since the price elasticity of demand is low and the price increases due to controls are small, the impact of pollution controls on total capacity need not be very great; the total capacity of the tissue industry declines only 0.5 percent. The second effect is quite substantial, however; the price umbrella of $10 per ton significantly increases profits of existing plants. The existence of quasirents may justify some life-extending investments. Increases in quasirents due to BAT controls would create still greater incentives for such investments.

The preceding discussion illustrates the complexities of analyzing the political economy of business regulation. Three methodological conclusions emerge. First, to determine the impacts of costs associated with regulatory policies, it is essential to understand the nature of the underlying costs of production upon which they will be superimposed. High costs of compliance cannot simply be equated with negative economic impacts. Second, we observed that regulations can create and dissipate quasirents of important magnitudes, but to appreciate the true impacts of shifts in competitive advantage it is essential to consider costs of production associated with marginal sources of capacity in an industry. Third, any final assessment of net impacts on industry of alterations in quasirents requires a careful analysis of the timing of these changes. We have suggested that losses in early years are likely to be offset by gains in later years; whether the net result is capital losses or capital gains to individual competitors depends critically on time streams of cost and price increases.

Regulations create and dissipate quasirents, which undoubtedly accounts for much of the political maneuvering of economic actors faced with regulation. We examine this hypothesis by analyzing various standards proposed by the EPA. When the EPA established compliance requirements for 1977, it did so in three steps. In 1975 the agency proposed a set of standards. The industry commented on these, and the EPA subsequently revised them in 1976. These standards were again revised before

Table 5.7 Proposed effluent standards in three tissue-industry subcategories.

	Influent Load[a] (Pounds per Ton)		Pounds Removed per Ton					
			1975 Proposal		1976 Proposal		1977 Proposal	
	BOD[b]	TSS[b]	BOD	TSS	BOD	TSS	BOD	TSS
Bleached kraft	80	100	12.7 (84%)	20.6 (79%)	13.9 (83%)	30.2 (70%)	14.2 (82%)	25.8 (74%)
Deinking	65	220	14.0 (79%)	25.3 (89%)	18.9 (71%)	28.4 (87%)	18.8 (71%)	25.9 (88%)
Nonintegrated tissue	30	75	8.4 (72%)	8.5 (89%)	8.5 (72%)	11.8 (84%)	8.5 (72%)	11.8 (84%)

a. Raw loads are based on representative mills.
b. Biological oxygen demand (BOD) and total suspended solids (TSS) are two important measures of water pollution in the tissue industry.

they became final in 1977. Changes for three typical subcategories of the tissue industry are reported in table 5.7.

Note that the standards were not always made less stringent in subsequent rounds. In two of these subcategories, standards for total suspended solids (TSS) were more stringent in 1977 than those proposed in 1976. For the most part, however, these tighter standards were not more costly; that is, the relationship between waste treatment and cost is not a monotonic continuous function. With a given removal method, it may be possible to raise standards without raising costs. For example, primary waste treatment might effectively remove 30 percent of all biological oxygen demand in a plant's waste stream. A standard that requires 25 percent removal has no higher cost than one that requires 20 percent removal under these circumstances.

The net effect of EPA's three efforts was to relax standards and lower the overall height of the compliance-cost curve. However, it is necessary to consider the shape of the compliance-cost curve as well as its height, for it is alterations in shape that determine changes in quasirents due to pollution controls. The flatter the compliance-cost curve, the smaller the additional rents.

It seems reasonable to hypothesize that the EPA, as a political agency, seeks to flatten the compliance-cost curve and thus avoid creating or dissipating substantial competitive advantages as a result of its pollution-control activities. Indeed, in conversation with a representative of a pulp and paper industry trade association, we were told that the lobbying objective of that association was to "flatten our curve."

It is difficult to test the hypothesis that the EPA tries to flatten the curve, because of the nature of effluent-control technology and the

Table 5.8 Cost changes (per ton) due to changes in proposed standards.

Subcategory	Compliance Cost, 1975 Proposed Standard	Change in Cost, 1976 vs. 1975 Proposed Standard	Change in Cost, 1977 vs. 1976 Proposed Standard
Bleached kraft:			
Low cost	$ 1.52	−$0.03	0
Average cost	6.74	− 0.08	0
High cost	21.04	− 0.25	0
Deinking mills:			
Low cost	$ 3.39	− 0.27	0
Average cost	7.38	− 0.32	+$0.30
High cost	27.68	− 1.52	+ 0.30
Nonintegrated mills:			
Low cost	$ 1.21	− 0.11	0
Average cost	5.72	− 0.49	0
High cost	69.44	− 5.90	0

available data. As a rule of thumb, a particular treatment system is thought to remove a given percentage of raw waste; for example, primary treatment typically removes 30 percent of the raw-load biological oxygen demand (BOD). Though we have no information on actual raw loads for individual plants, we have been advised to assume that loads are constant among plants using similar technology.[22] With such an assumption, a given change in standard is a constant percentage change in required treatment for all competitors and shifts the compliance-cost curve a constant percentage distance at all points. This necessarily flattens the curve. However, tissue manufacturers fall into several subcategories, so the EPA can further alter the shape of the compliance-cost curve for this industry as a whole by differentially changing standards for each subcategory. This strategy would produce the flattening we predict with our "equal pain" hypothesis; however, this flattening, if observed, would not be a consequence of the way the data are constructed.

Percentage changes in compliance costs associated with the subsequent rounds of effluent standards for tissue manufacturers in three subcategories are shown in table 5.8. Note that the subcategory with the lowest average cost (nonintegrated tissue) experienced the greatest reduction in costs with subsequent versions of the BPT standards. However, this category's low average cost masks its very high maximum cost. Bleached kraft, with the lowest maximum compliance cost, experienced the least reduction in its average costs in subsequent rounds.

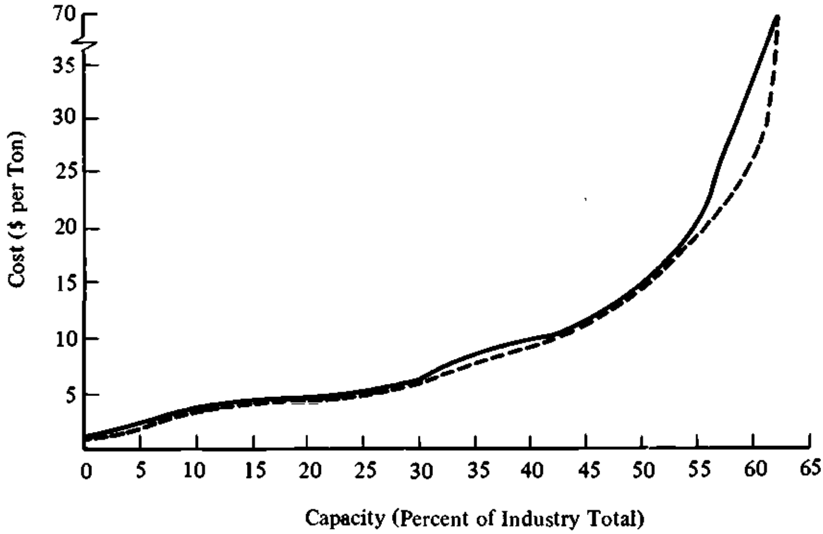

Figure 5.7 Estimated compliance-cost curves for three versions of 1977 BPT standards. Solid line: 1975 version. Dashed line: 1976–1977 versions (the two curves are virtually indistinguishable).

Within each subcategory, the low-cost tissue producers experienced the greatest percentage but lowest absolute cost reductions. Thus, flattening of the MCC curve is observed because higher-cost producers receive the largest absolute decreases in costs.

Cost-versus-capacity results for tissue manufacturers are shown in figure 5.7. Between 1975 and 1976 (the two rounds that matter most) the low-cost plants experienced an $0.11-per-ton reduction in costs, versus $5.93 per ton for the high-cost mills. The average dropped by $0.23 per ton. In interpreting the impacts of these cost reductions, it is important to note that rents earned are determined by two components: a producer's own costs and those of the industry's marginal producers.

For comparison with the earlier discussion, assume that this industry operates at 94 percent of capacity. The absolute decrease in costs at the relevant margin due to the less stringent 1976 standard is between $0.20 and $0.50 per ton, as determined by the shift in total production costs that results from the shift in compliance costs shown in figure 5.7. Because this is the relevant margin for determining prices, we predict a price drop of that magnitude. Our low-cost producer has a cost savings of about $0.11 per ton with the less stringent standards, while high-cost producers save up to $6.00 per ton; the average decrease is $0.23 per ton.

Table 5.9 Differences in cost and waste loads associated with standards announced in 1975 versus those announced in 1977.

Subcategory	Change in Average Cost per Ton	Change in Pollution (Pounds per Ton)	Cost per Pound[a]
Bleached kraft	−$0.08	+1.2[b]	$0.067
Deinking mills	− 0.30	+4.9[b]	0.065
Nonintegrated	− 0.49	+3.3[c]	0.148

a. Without knowing how the EPA "trades off" BOD versus TSS, we cannot compare the numbers for nonintegrated mills with those for the other subcategories.
b. For this subcategory, the binding constraint is the BOD standard; lower costs yield higher levels of BOD in the subcategory's effluent.
c. For this subcategory, the binding constraint is the suspended-solids standard; lower costs yield higher levels of TSS in the subcategory's effluent.

Thus, the EPA appears to have reduced the average cost of pollution abatement and the price of tissue to consumers by roughly comparable amounts. Furthermore, it appears that the reduction in standards yields distributional impacts consistent with the equal-pain principle. Low-cost producers receive cost decreases less than the price decrease ($0.11 per ton versus $0.20–$0.50 per ton); high-cost producers' cost decreases exceed the price decrease ($5.93 per ton versus $0.20–$0.50 per ton). For the average producer, costs and prices decrease by comparable amounts.

One could argue, of course, that the distributional consequences of the EPA's actions are incidental to its efforts to develop a rational environmental policy. Indeed, a policy that maximized environmental quality would equate cost—on the margin—across sources of pollution. (Strictly, the equation should be between incremental benefits and incremental costs. A proper assessment of this tradeoff would require geographic and other details.)

Differences in cost and waste loads associated with changes in standards can be observed in table 5.9. The evidence for the bleached kraft and deinking subcategories suggests that the EPA values BOD, on the margin, at about 6.5–6.7 cents per pound and that the leveling of the compliance-cost curve may be a result of the EPA's efforts to achieve an efficient environmental policy. Unfortunately for our purposes, the observed flattening of the tissue industry's compliance-cost curve is largely the consequence of changes in standards for nonintegrated producers. For these facilities, however, TSS is the constraining pollutant, and the rates at which the EPA "trades off" TSS for BOD are not known. Thus, we cannot now conclude whether the observed flattening of the compliance-cost curve is attributable to the EPA's response to an equity (equal pain) or an efficiency (equal marginal cost) criterion.[23]

Evaluating Regulation as a Social-Policy Tool

The model developed earlier in this article and its application to water-pollution controls in the pulp and paper industry provide several important insights into the use of business regulation to achieve selected public goals. These insights concern both how the effects of proposed regulations are modeled and how effectively public institutions consider these effects in formulating policy.

Perhaps the principal insight is that one must model industry on a disaggregated basis and in a dynamic context in order to measure the economic impacts of proposed regulations. This conclusion holds even if one is interested only in aggregate costs of regulations. Shifts in industry supply curves resulting from regulations are a function of the relationship between marginal costs imposed on individual plants by regulations and plants' existing cost structure. If the highest marginal control costs fall predominantly on the lowest-cost producers, the shift in the aggregate industry supply curve and the ultimate consumer burden will be relatively small. If the highest marginal control costs are incurred by the otherwise highest-cost producers, the resulting shift in the aggregate supply curve and changes in market prices could be quite large. Given the heterogeneous nature of the cost structures of firms in an industry, we conclude that virtually the only way to obtain information on an industry's "relevant margins" is with a highly disaggregated model such as the one developed here for the tissue segment of the pulp and paper industry.

Our efforts also reveal that the model should be dynamic as well as disaggregated. Many of the consequences of regulation surface as firms try to adjust their capital stock and rationalize operations to the new, regulated circumstances. These short-run costs are important both in determining the total cost of imposing regulations and in affecting the structure of the industry. For example, if short-run effects fall predominantly on small, marginal producers, the results might be the demise of these marginal producers (regardless of whether they could have been viable in the long run), large short-run price increases, and a more oligopolistic industry. Use of aggregate, static models and sole reliance on engineering-cost calculations of the capital and operating costs of regulatory compliance will miss these important effects entirely.

The model also points out the sensitivity of overall economic impacts to the administrative decisions of regulatory agencies. This is demonstrated by our analysis of the EPA's development of regulations for the tissue industry, where even relatively small changes in regulatory standards or definitions have large distributional impacts. The 1–3 percent reduction in BPT standards proposed by the EPA in 1976 relative to those proposed in 1975 constitutes a small reduction in overall pollution control. The analysis also implies that the aggregate cost savings to consumers is small; prices dropped by 0.03–0.07 percent ($0.20–$0.50 per ton on a base of $638 per ton). However, the redistribution of potential profits among firms is quite large.

From a policy-formation perspective it is important that administrative decisions are made by regulatory agencies well after Congress has made the decision to adopt a regulatory approach and legislated requirements to set standards. Because of this "decoupling" of legislative and administrative processes, it is extremely difficult for information about economic costs and their incidence to influence the initial decisions about the regulatory process. We feel that, because of the difficulty of predicting economic costs and the late timing of the decisions most relevant to costs, the choice to proceed with regulations and the decisions about their stringency are made without adequate attention to economic impacts.

The disincentives for adequate consideration of costs are compounded by the largely private nature of production and pollution-control costs. Most public activities require specific authorization and appropriation of public funds. Particularly with the present budget process, Congress is required explicitly to consider the costs of specific programs with respect to those of other programs, increased taxes, or larger deficits. These same procedures do not apply to most regulatory policies, however, because most costs of these programs never appear in government budgets. Dorfman (1975) estimated that in the long run only about 25 percent of the total abatement costs of air and water pollution-control programs passed in the early 1970s will be borne by the public sector. Since this includes state and local funds as well as federal, we may presume that Congress has passed legislation for which it must account for only a small proportion of the abatement costs. In light of this "off the balance sheet" financing and the absence of accountability, one may expect Congress to grant easy passage to privately expensive programs, particularly if they have attractive benefits.

Our findings are consistent with this hypothesis. Indeed, Congress was clearly under pressure from the public and from environmental interest groups "to do something about the environment" in 1972. We contend that the difficulty in predicting or even observing regulatory costs and the fact that many of these costs are not publicly funded help explain why Congress gave them so little consideration. In retrospect, it is rather striking to note that virtually all the Senate deliberations and important parts of the House debate concerned the size of the federally funded municipal-waste-treatment grant program, although it made up only a small fraction of total program costs. Although some representatives did try to raise questions about potential impacts of the regulations, and the House even considered a delay in mandating the 1985 and 1983 standards pending a National Academy of Sciences study on feasibility and impacts, these cautions were rejected. We pose an obvious question: If Congress were politically responsible for funding the full impact of its water-pollution program, would the legislation have passed both houses by so wide a margin?

A related difficulty concerns the timing of important decisions in the regulatory process and its consequences for rational social policymaking. We have already noted that the EPA's administrative decisions are important determinants of overall policy. It would be expected that potential impacts, such as those documented here, would influence both the legislative and administrative development of regulatory policy. Unfortunately, information on such impacts is not known to the Congress, and is not readily calculable, during the legislative process. Furthermore, the only institution potentially able to take these impacts into account (the EPA), like most administrative or regulatory agencies, is not structured to respond properly. In the first place, the EPA has little choice but to implement regulations mandated by the Congress. The agency cannot explicitly, and probably cannot even implicitly, decide that costs exceed possible benefits—either in the aggregate or even in local situations—and weaken the standards. Secondly, most administrative agencies will be lobbied and pressured by groups motivated by distributional impacts. But it is not clear that many agencies are institutionally structured to respond explicitly and rationally to such pressures. Thus, agency decisions undoubtedly reflect responses to "politically" motivated pressures, but we can have little confidence that these are socially appropriate responses for which an agency can or should be held accountable.

A final problem with the regulatory approach—and, in our view, the biggest weakness of our model—relates to uncertainty. A large array of complex and poorly understood factors influence the final regulations and their impacts. They range from the dynamic market structure of an industry, and its rate of technological change, to the narrow bureaucratic behavior of a regulatory agency. The effects of these and many other elements on promulgated standards are virtually impossible to predict, for policymakers, regulators, or businesses. It should be stressed that these uncertainties are not simply the conventional absence of information about the probability of various exogenously determined stochastic outcomes. Much uncertainty of regulatory effects is endogenous to the process. Incremental decisions of each participant, public and private, at each step in the development and promulgation of regulations, alter market structures and condition the subsequent behavior of individual firms and political actors. Given the magnitudes of the microlevel impacts of even small administrative decisions, we would expect that the endogenous character of uncertainty would significantly affect decisionmaking processes.

The length and complexity of the theoretical empirical exercise we have described in this paper should, by itself, be evidence for one of our principal conclusions: If it is easy for legislators to pass regulations, it is far from easy to accommodate adequately the complex and indirect effects of these regulations in the policymaking process. This suggests to us the need for caution in adopting regulatory prescriptions for social ills.

The Economic Development Administration provided the principal financial support for this research. Resources for the Future provided additional support. We are grateful to Professors Robert Dorfman, Malcolm Getz, John Meyer, and Roger Schmenner for their critical comments during the progress of this research. We are indebted to Gene Flood for his efforts to satisfy our constantly expanding data requirements.

Notes

1. See, for example, Kneese and Schultze 1975; Jacoby and Steinbruner 1973; National Academy of Sciences 1974. These studies examine policies intended to improve environmental quality, but reflect a continuing focus of analysts on the wider problems of controlling externalities through government regulation. A more general "Study of Federal Regulation" is now being prepared by the Committee on Government Affairs of the U.S. Senate. Much of the literature on regulation now focuses on issues of regulatory reform. This volume itself is a product of such a focus. See also Domestic Council Review Group on Regulatory Reform 1977 and any issue of *Regulation*, a magazine published by the American Enterprise Institute of Washington, D.C. Theoretical analysis of regulatory reform proposals fill the pages of the *Bell Journal*. Indeed, articles on regulatory reform are too numerous to mention. For a concise discussion of general principles, see Edley 1977.

2. National Academy of Science 1974 illustrates the complexities of this type of study. For a more disaggregated treatment of similar issues see Harrison 1975.

3. See Buchanan and Tullock 1975 for a discussion of some distributional consequences of different forms of regulation.

4. In our terminology, quasirents equal the difference between price and economic costs for new facilities, and the difference between price and variable costs for existing facilities.

5. The present value of $2.45/ton-year at a 10 percent discount rate is $24.50. The $24.50 rate is the present value of the time stream of the annually varying price increases actually forecast in Leone et al. 1975.

6. In other differences, the House version authorized an additional $4 billion for construction of local treatment plants, limited the EPA's control over state permit programs, restricted the ability of environmental groups to sue industry and the federal government over implementation of the act, and created an Environmental Financing Agency to help local governments pay their share of treatment-plant construction costs.

7. The other three all contain references to issues unrelated to the regulation of water quality, such as the authority of the Appropriations Committee, which make them poor indicators of the position of representatives on the issue of effluent standards.

8. For readers familiar with Guttman scales, this scale has a coefficient of reproducibility of 0.96 and a minimal marginal reproducibility of 0.77. These terms indicate that 96 percent of all votes cast fit the pattern (anything over 90 percent is considered a good scale) and that 77 percent could be correctly predicted by assuming that all representatives voted with the majority on each roll call.

9. The estimation procedure recognizes that the voting variable is a set of ordinal categories based on voting patterns described in tables 5.1 and 5.2. We do not know where each amendment is located on some underlying proregulation dimension, and we have grouped together representatives who may have different true positions but whose positions fall between the same two amendments. These problems make the dependent variable an interval measure of support for the regulations and thus inappropriate for ordinary least-squares regression. The estimation procedure used in this case is the *n*-chotomous extension of the multivariate probit model, which estimates both the location of the amendments and the parameters of the underlying relationship with the explanatory variables that make the observed grouping of legislators most likely. For a complete discussion, see Zavoina and McKelvey 1975.

10. The estimated equation is $\log(\text{Willingness to pay}) = -0.78 - 0.62 \times \text{South} + 0.04 \times \text{Midwest} + 0.19 \times \text{West} + 0.34 \times \text{Suburb} - 0.11 \times \text{Town} - 0.58 \times \text{Rural} - 0.33 \times \log(\text{Family size}) - 0.53 \times \log(\text{Age}) + 1.51 \times \log(\text{Education}) + 0.99 \times \log(\text{Income})$.

11. Demographic data on congressional districts are available for the session beginning in 1973. Unfortunately, the massive redistricting demanded by the courts after the 1970 census significantly altered most districts' composition, making the 1973 data useless for analyzing votes in 1972.

12. Our own analysis shows that this is too simplistic a representation of a complex reality. For example, eleven of thirteen tissue-paper manufacturers in New England suffered a deterioration of relative competitive advantage due to the 1977 standards, but twelve of the thirteen actually reap a competitive advantage when the standards are tightened to the 1983 level. See Meyer and Leone 1978.

13. $-0.003 \times \$10/\text{ton} \times [(6{,}500 \text{ tons/day})/10^3] = -0.20$.

14. $(-0.18 - 0.003 \times 6\ \$/\text{ton}) \times [(6{,}500 \text{ tons/day})/10^3] = -1.30$.

15. These 64 mills have a total capacity, by our estimate, of 2.9 million metric tons of tissue per year. Lockwood's estimate of "practical maximum capacity" is 4.0 million tons per year. The difference stems, first, from problems associated with identification of the capacity of a single product in multiproduct operations, and, second and more important, from the lack of publicly available information on the capacity of several important mills in this industry. The magnitude of this difference is disturbing, but, practically and conceptually, our results do not appear sensitive to this discrepancy.

16. These are total economic costs; that is, they include a 15 percent return on investment.

17. These are total accounting costs; that is, they include depreciation and other fixed charges but exclude a return on investment.

18. A third explanation is that this industry does not operate according to strictly competitive principles. Our cost estimates are not sufficiently accurate to permit us to make a judgment on this point.

19. Astute managers may make capital investment decisions in a regulated environment on the basis of this effect. See Greening and Leone 1977. As significant regulations (particularly, price controls of one form or another) become more pervasive, this may be an increasingly common managerial practice.

20. Variable costs of manufacturing plus variable costs of BAT. In other words, economic costs of BAT determine whether a mill will or will not comply; but once this decision is made, prices will be set on the basis of variable costs alone.

21. Arthur D. Little, Inc. (1977) estimated the price elasticity of demand for tissue to be −0.45.

22. This was the advice of Ivan Metzger of Belmar, N.J., water and waste-water program management consultant to this and numerous other projects.

23. For a more detailed discussion of administrative reactions to the competitive effects described here, see Koch and Leone 1979.

References

American Paper Institute. 1974. *Monthly Statistical Summary*, November.

Arthur D. Little, Inc. 1977. *Economic Impacts of Pulp and Paper Industry Compliance with Environmental Regulations*. Cambridge, Mass.

Barone, Michael, Ujifusa, Grant, and Matthews, Douglas. 1972. *Almanac of American Politics*. Boston: Gambit.

Buchanan, James, and Tullock, Gordon. 1975. "Polluters' profits and Political Response: Direct Controls versus Taxes." *American Economic Review* 65: 139–147.

Dorfman, Nancy, and Snow, Arthur. 1975. "Who Will Pay for Pollution Control? The Distribution by Income of the Burden of the National Environmental Protection Program, 1972–1980." *National Tax Journal* 28: 101–115.

Edley, Christopher. 1977. Toward a Framework for Analysis of Regulatory Reform. Mimeographed. Harvard University.

Erskine, Hazel. 1972. "The Polls: Pollution and its Cost." *Public Opinion Quarterly* 36: 120–135.

Greening, T., and Leone, R. A. 1977. Energy Corporation of Louisana (A) and (B). Cases 9-678-054 and 9-687-055. Intercollegiate Case Clearing House, Boston.

Harrison, David. 1976. *Who Pays for Clean Air?* Cambridge, Mass.: Ballinger.

Ingram, Helen. 1979. "The Political Rationality of Innovation: The Clean Air Amendment of 1970." In Ann F. Friedlaender (ed.), *Approaches to Controlling Air Pollution*. Cambridge, Mass.: MIT Press.

Jackson, J. 1979. Measuring the Demand for Environmental Quality with Survey Data. Working paper, Center for Political Studies, University of Michigan, Ann Arbor.

Jacoby, Henry D., and Steinbruner, John. 1973. *Clearing the Air*. Cambridge, Mass.: Ballinger.

Kneese, Allen V., and Schultze, Charles L. 1975. *Pollution, Prices and Public Policy*. Washington, D.C.: Brookings Institution.

Koch, C. J., and Leone, R. A. 1979. "The Clean Water Act: Unexpected Impacts on Industry." *Harvard Environmental Law Review* 3: 84–111.

Leone, R. A. 1977. "The Real Costs of Regulation." *Harvard Business Review*, November–December: 57–66.

———. 1978. Derivation of Production Costs for Tissue Producers. Working paper, Harvard Graduate School of Business Administration.

Leone, R. A., Startz, R., and Farber, M. 1975. The Economic Impact of the 1972 Amendments to the Federal Water Pollution Control Act on the Pulp and Paper Industry: A Report to the National Commission of Water Quality by the National Bureau of Economic Research. National Technical Information Service report PB-248801.

Meyer, J. R., and Leone, R. A. 1978. "The New England States and their Future: Some Implications of a Changing Industrial Environment." *American Economic Review* 68: 110–115.

National Academy of Sciences. 1974. The Costs and Benefits of Automobile Emission Control, Vol. 4. Prepared for Senate Committee on Public Works.

Schultze, Charles L. 1977. "The Public Use of the Private Interest." *Harper's*, May: 43–62.

United States Domestic Council Review Group on Regulatory Reform. 1977. The Challenge of Regulatory Reform. Report to the President.

Zavoina, William, and McKelvey, Richard. 1975. "A Statistical Model for the Analysis of Ordinal Level Dependent Variables." *Journal of Mathematical Sociology* 4: 103–120.

Comment

Allen V. Kneese

I am extremely impressed with the research reported in this paper. General statements about indirect effects of pollution-control regulations and about the distribution of costs and benefits among firms, regions, and individuals are to be found in the literature, but this paper represents the most far-reaching attempt at quantification of these effects and of linking the results to the political processes involved in implementation that I have seen. The authors' research has yielded some important insights. For example, I blush to admit that it had never occurred to me that some (or, as the authors show, perhaps many) firms in an industry could actually benefit from pollution regulation. This is an important finding that, again as the authors show, may yield important insights into both the legislation and the implementation of pollution-control policy.

Editor's note: At the conference, Professor Kneese provided a brief legislative history of various water-pollution-control amendments. For a full discussion see Kneese and Schultze 1975 (listed in references above).

Comment

Richard Zeckhauser

Contemporary theories of government regulation are distressingly incomplete. Rarely are their assumptions or conclusions put to rigorous test. In many ways this is understandable. At least in the federal sphere, a single agency is generally responsible for dealing with a particular problem; we have no opportunity to make judicious comparisons among different regulatory approaches. Variation occurs only over time, with too many factors changing simultaneously to permit strong conclusions. Many of the most important variables elude quantification.

When solid data are not available, it becomes all the more important to pull together every shard of information. This is not easy to do in the area of regulation. An understanding of political science, empirical analysis, economic model building, and business behavior would be required for an effective "assembly job." This is what Leone, a business administration professor with a background in economics, and Jackson, a quantitatively oriented professor of political science, have attempted in this article, which explores the links between political decisions on regulation and their anticipated economic consequences. That their success is limited does not diminish their accomplishment.

This is an ambitious and unconventional article, ranging widely from theoretical models to empirical analyses, from legislative to administrative behavior, from the purely economic to the predominantly political, from broad economic magnitudes to data on individual mills. Some exercises are more successful than others.

The authors are to be applauded, for instance, for undertaking statistical work to explain congressional voting patterns on environmental legislation. The data, however, do not fully support their conclusion that "congressional voting on the 1972 amendments was sensitive to the potential direct economic effects on a district." Only one of the five variables they employ to represent economic activity affected results in a statistically significant manner. Two had values not worth distinguishing from zero. Of the remaining two, which are about equal in significance, one had a sign contrary to prediction. Hardly an impressive record.

Leone and Jackson then go on to a more sophisticated model, which if validated would be a considerable contribution. The notion is that firms may be primarily concerned with the way environmental impositions will affect their position within their industry, rather than with the effect on the industry in general. Through a more sophisticated investigation, a firm may determine that a proposed regulation would hurt it less than others and would thus represent a source of competitive advantage. In this case, the congressional representatives of relatively advantaged firms might be more receptive to the proposed legislation. This hypothesis should appeal particularly to economic determinists and regulatory cynics. It goes one step beyond the common refrain that once regulation is imposed, the surviving members of the industry are likely to welcome its continuance. Leone and Jackson suggest that firms will make an *a priori* assessment of whether proposed regulatory measures will hurt or help them relative to their competitors. The observed voting patterns do not validate this hypothesis. It is not clear, however, whether firms do not make such assessments or whether congressmen do not vote according to the interests of firms within their districts.

Indeed, the sad news is that the variables that are most significant statistically are the very ones we would have suspected were important had we never heard of economics: geographic region and party affiliation. (There is so much collinearity between "South" and Southern Democrat" that it is hard to know what to make of the interaction between region and party.) One other variable is significant: the age of the representative. Leone and Jackson merely conclude that "younger representatives show preferences for more stringent regulations than older ones." Perhaps age is just the correlate here, and the real factor is recency of election. If the electorate is becoming more sensitive to the environment, and if incumbents have some tendency to adhere to their former views, then the newly elected, who are likely to be younger, are also likely to be more environment-minded. Alternatively, a long incumbency may merely provide concentrated political interests (in this case, it would be those opposed to environmental programs) greater opportunity to exert their pressures.

Leone and Jackson have constructed an interesting independent variable for their vote-prediction model, basically a count of how many proenvironment issues a congressman has favored. Such constructed variables, when there is a natural spectrum but not a natural scale, may have unusual properties—particularly when there is a clustering at one extreme, as there was here with the proenvironment group. The use of variables of this sort demands caution in testing hypotheses or drawing any other statistical conclusions. To avoid misinterpretation, the authors should have said a bit more about their estimation techniques.

In the last portion of their article, Leone and Jackson delve into specific data on the tissue industry. They go down to the level of individual mills to judge differential cost impacts and differential effects in terms of quasirents (and in some cases viability itself) in the face of EPA effluent standards. These standards were proposed in 1975, revised in 1976 in response to industry comment, and revised once again when they became final in 1977. By exploring how the EPA responded to the predicted effects of its impositions on the distribution of quasirents, the authors hope to shed light on administrative decisionmaking in general. Their central hypothesis is that political pressure would lead the EPA to design its standards to pursue what might be perceived as equity objectives as opposed to those of efficiency (equal marginal cost of cleanup across firms). Equity, as always, is an ambiguous concept. At the very least, however, it would seem to connote that some firms should not be driven out of business while others suffer mildly or even benefit. That is the interpretation it is given here. Unfortunately, insufficient data prevent the authors from testing this hypothesis.

In formulating this hypothesis, Leone and Jackson are in accord with much contemporary thinking about the formulation of government policy. In response to both political pressure and appeals to equity, government agencies and actors (legislative, administrative, and executive) are thought to avoid solutions that would impose large costs on an identified group of parties. In future studies, perhaps of other industries, it seems likely that the authors could bear out their models and conjectures.

The chief weakness of this article is that it conveys little useful factual knowledge. To some extent this may be due to inadequate data. Some of the major hypotheses, however, may remain unvalidated for a more fundamental reason: they may simply not be true. If so, disproof would be an important contribution in itself.

At least in the deductive portions of the article, Leone and Jackson have carried economic models of political phenomena beyond conventional analyses. They suggest that both agency and legislative decisions will be strongly influenced by economic consequences, and further that it may be important to consider the distributional consequences within an industry and to distinguish short- and long-term effects. They raise two important questions that remain open: Can the behavior of political and bureaucratic man, or at least his actions in the regulatory arena, be explained as a response to economic factors? If so, can he or his constituents and pressure groups be as sophisticated in their assessments as are the models of this paper? This ambitious essay suggests that future efforts by Leone and Jackson may make an important contribution to resolving these issues.