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Implementing a regulatory budget: Estimating the mandated private expenditure of the Clean Air Act and Safe Drinking Water Act amendments

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Introduction

A regulatory budget is one of the most promising proposals designed to constrain the costs of regulation.[1] Like a conventional fiscal budget that restricts total spending, a regulatory budget would provide an upper limit on the total costs a regulatory agency can impose on society. As long as the agency operates within its regulatory budget, it would be allowed to issue new rules and enforce its regulations. When the social costs of an agency's activities reach or exceed the cost ceiling, however, the agency would be required to modify new or existing rules – or even eliminate existing ineffective regulations – to meet the budget constraint.

Improved political oversight and efficiency are the most important advantages offered by a regulatory budget.[2] Regulatory agencies would be forced to consider the benefits and costs of their programs on society at large. At present, agencies are constrained by fiscal budgets only. Regulators have few incentives to examine alternative means of accomplishing regulatory mandates and no incentives to take into consideration the added burden compliance places on businesses and individuals. The result is that regulators often do not improve but rather decrease the efficiency of markets, especially when they pursue a single objective.[3]

A regulatory budget would force regulatory agencies to accomplish the following:

- Constrain the private costs of government regulations.
- Establish clear priorities among the government's health, safety, environmental, and economic programs.
- Provide incentives for regulatory agencies to choose the most efficient and effective means of achieving their regulatory objectives by forcing them to consider the costs of regulation.
- Mitigate the effects of regulatory failure.

While these objectives represent clear improvements over existing regulatory processes, regulatory budgeting suffers from a number of serious and potentially

crippling problems. The principal difficulty with implementing a regulatory budget is identifying and measuring the true monetary impact of regulation. One reason is that there is no accepted consensus of what constitutes a 'cost' of regulation and how that cost should be calculated. The costs of regulation are widely dispersed and are often not readily identified in business or individual outlays. Also, to determine the costs attributable to regulation requires knowledge about baseline costs – costs incurred in the absence of regulation. Estimating the incremental costs of regulation is thus a difficult and often subjective activity.

The purpose of this study is to examine the various problems that arise in measuring regulatory costs and, in that light, to propose a feasible methodology for carrying out a regulatory budget. This methodology will then be applied to recent amendments of the Clean Air Act and the Safe Drinking Water Act to assess the feasibility of administering a regulatory budget.

The Clean Air Act and the Safe Drinking Water Act are chosen for three reasons. First, because they were recently amended, they provide a convenient basis for estimating the regulatory costs of new or additional regulations. Second, data on projected and actual compliance expenditures for pollution abatement, which are affected by these laws, are readily available. The methodology currently used in collecting this information can be compared to the methodology of estimating compliance costs proposed in this report. This comparison provides a benchmark for assessing the reasonableness of implementing a regulatory budget using contemporary techniques. Finally, the compliance requirements of these two laws are widely regarded as being particularly burdensome on private businesses and local governments. Thus, a methodology consistent with these specific regulatory programs will provide strong evidence of the feasibility of implementing a regulatory budget.[4]

The study finds that the problems attributable to implementing a regulatory budget are surmountable, in part because many of the tools necessary to estimate the costs of regulation and to administer a regulatory budget are already in place.

For instance, executive branch and congressional organizations routinely estimate future spending in preparing fiscal budgets. The Department of Commerce regularly surveys business establishments to collect information on expenditures due to particular regulatory programs. Further, ever since Executive Order No. 12291 was signed by President Ronald Reagan in 1981, regulatory agencies have been required to conduct Regulatory Impact Analyses (RIAs) prior to issuing major rules. The RIAs include estimates of the anticipated costs, as well as the expected benefits, of regulations whose compliance costs exceed $100 million a year.[5]

These practices can be adapted to a methodology supporting the implementation of a regulatory budget. Of course, this methodology can be expected to evolve over time as part of the budgeting process, just as governmental cost accounting principles evolved following the U.S. Budget and Accounting Act of 1921.[6]

A principle conclusion of this study is the recommendation that the regulatory budget not focus on the total *costs* of regulation. Rather, the emphasis should be placed on *private expenditures* mandated by regulations.[7] The difference between regulatory costs and mandated private expenditures (MPEs) is trivial when regulations require specific outlays by businesses, such as the purchase of pollution control equipment. However, costs and MPEs will differ when regulations restrict or prohibit products or processes. This study will show why a focus on MPEs, rather than current methods of estimating compliance costs, can mitigate the most serious problems with measuring and administering a regulatory budget. Furthermore, the MPE approach most closely reflects the economic concept of *opportunity cost* and is thus a relatively realistic picture of the true social burden of regulation.

Because of the emphasis on MPEs, this study will examine the compliance costs required by federal regulations only. The indirect or welfare losses of regulation will not be directly investigated. Consequently, the methodology proposed in this study will be most applicable to social regulation – regulation of health, safety, and the environment, for instance – rather than to economic regulation. This focus is not a serious oversight. The empirical techniques of estimating the costs of economic regulation are standard within the economics profession, although econometric problems are common. Approaches for estimating the costs of social regulation, on the other hand, are more varied and controversial.[8]

Estimating the costs of regulation

The regulation of economic and social activity has increased substantially during the past 25 years. Between 1970 and 1995 total spending by the 55 federal regulatory agencies increased three times in real terms to $15.6 million.[9]

Estimates of the total social costs of federal regulation – the direct and indirect costs born by individuals and businesses of complying with federal regulations, in addition to the total spending by regulatory agencies – show an even greater burden of regulation. The total cost of administering and complying with regulation was estimated at more than $66 billion in 1976 ($177 billion in 1995 dollars). In 1995 the estimated cost of regulation increased to $420 billion.[10]

Estimating the costs of regulation is difficult, in part because the effects of regulation depend on a variety of factors. These include the motivation for the regulation, the nature of the regulatory process, the instruments used to enforce the regulation – as well as the economic, legal, and political environment of both the regulated and the regulators. Moreover, estimation requires critical assumptions regarding the definition of 'cost' and the benchmark used to make comparisons. For these reasons, it is necessary to specify the assumptions underlying the theoretical framework from which a methodology of estimating regulatory costs is constructed, since 'theory and measurement go hand in

hand.'[11] The following sections examine the baseline chosen, the types of regulation examined, and how the costs of regulation are defined in this study.

Establishing a baseline

A key element of a theoretical framework for estimating the cost of regulation is selecting the appropriate benchmark – answering the 'what' in the question, 'the effects of regulation relative to what?' The approach adopted in this study is to compare the effects of regulation relative to the outcomes that would have occurred in the absence of that regulation. This is in contrast to examining regulatory outcomes relative to those expected if the economy were performing 'optimally' or relative to some alternative regulatory program.[12] The reason is that the appropriate baseline should be defined by the actions mandated by new federal regulations; hence, costs are determined by the expenditures of private agents to meet the new rules. In other words, the selection of an appropriate benchmark is directly related to the type of regulation examined and the method of measuring the social costs imposed by that regulation. (The types of regulation examined and the methodology used in defining 'costs' are outlined in the sections below.) For instance, if regulations require businesses to take a certain action, then the cost of taking that action becomes the 'cost' of the regulation. An important advantage of establishing this benchmark is that it captures the incremental or additional costs imposed upon society by new federal regulations.

Ordinarily, measuring costs relative to the 'absence of that regulation' criterion would be troublesome, not only because of the difficulty of defining the appropriate counterfactuals, but also because the 'absence of regulation' does not imply 'no regulation at all.' Markets, businesses, and individuals are subject to different forms of regulatory restrictions (e.g. city zoning ordinances rather than federal waste disposal guidelines).[13] Because businesses and communities are subject to local, state, and federal rules, it may be difficult to assess the marginal impact of federal regulation – a problem known as 'joint causation.'

For example, some local communities may require the testing of water for fluoride levels. If the Environmental Protection Agency also requires the testing of fluoride in water, does the federal rule represent a 'burden' on the local businesses and citizens? Some may argue that the federal regulation does not result in a 'cost' to society in the local communities that require fluoride testing, because the testing would have occurred in the absence of federal regulation.

The approach advocated in this study is to include the cost of treatment required by the federal regulation as a 'cost.' That is, this study ignores the problem of joint causation. There are three reasons for this approach. First, it may not be possible to separate the relative effects of local, state, and federal requirements. Even though there is imperfect information regarding the cost of federal regulation, there is little, if any, organized data available for state and local regulatory costs. Consequently, it would be very difficult for federal

regulatory agencies to assess the marginal impact of their respective regulatory requirements.

Second, as suggested above, the appropriate base cost is defined relative to the action prescribed by the federal regulation. If federal regulations mandate certain actions, then even if they are also required by some other governmental agents, the costs of meeting the federal requirements comprise an additional 'burden' on society and are counted as costs.

Third, by counting the federal rules as costs that are included in the regulatory budget, regulatory agencies will have an incentive not to issue new rules or guidelines that are already being prescribed at the local or state level. This will have the effect of encouraging federal agencies to focus on important and cost-effective regulatory measures that are ignored by other governmental agents. It should be noted that this approach may overstate the actual expenditures resulting from federal regulations; nonetheless, an agency's regulatory budget can be increased to take into account the estimation methodology.

Categories of regulation

Regulations may be analyzed in three distinct categories, based on the nature of the regulatory impact on economic or social activity. These include: (1) regulations that *require* or specify certain actions, such as reducing the emission of particular gasses or conducting specified tests on chemical compounds, (2) regulations that *prohibit* certain activities, such as banning the use of chlorofluorocarbons (CFCs) in aerosol cans, and (3) regulations that *interfere* with the operation of markets, such as price controls or entry restrictions.

The first two categories are most commonly associated with social regulation – regulation involving, health, safety, energy, and the environment. The third group is generally associated with the more traditional economic regulation of specific markets or industries, such as banking, transportation, communication, and utilities. The relationship among the categories of regulation and the costs imposed by the regulation is depicted in Figure 1.

Estimating costs that result from the first type of regulation – regulatory *requirements* – is the least complicated, since the benchmark is determined by conditions existing prior to the enactment of the regulatory rule. For instance, if regulations require the installation of certain safety devices, then the price of the devices and the cost of installation, maintenance, and operation comprise the total cost of the regulation. Cost estimates may be made *ex ante* from current market prices or obtained *ex post* from actual expenditures.

Estimating costs resulting from the second type of regulation is more difficult, because there is no generally accepted way of determining prices for goods or services that do not exist. One approach is to estimate the cost savings expected from the prohibited product or service and then use that figure as the estimate of the compliance cost.

For instance, suppose a factory currently spends $100 on a part for a

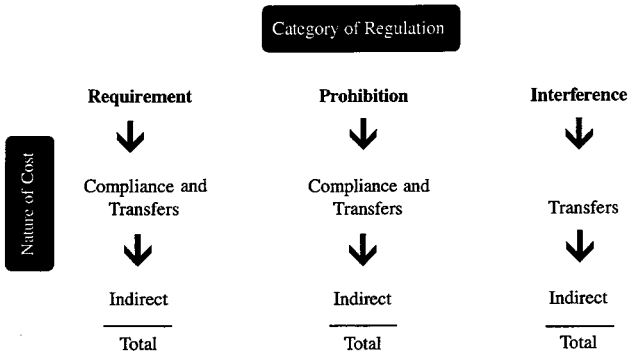

Fig. 1. Regulation and cost relationships.
Source: Author's representation.

particular product and that the factory wants to substitute the $100 part with another component that costs $75. Suppose further that the $75 item is banned by a regulatory agency, perhaps because its use presents a minor carcinogenic risk to workers. If the use of the component costing $75 is prohibited, how shall we determine the cost of the regulation? Since the factory is forced to spend an additional $25 on inputs, we may conclude that the cost of the regulation prohibiting the use of the $75 component is $25.

While this approach may be appropriate if the two items are nearly identical substitutes, it does not adequately characterize the cost of regulation if there are significant differences in quality. For example, suppose there is an inexpensive drug that can perform the same function as an expensive and painful surgery. If the use of the drug is restricted or banned, taking the difference between the expected price of the drug and the cost of surgery as the 'cost' of the regulatory restriction does not fully characterize the social cost of the regulation. While the medical outcome may be the same, the surgery and drug require substantially different ways of organizing the provision of medical care. Surgery requires the construction of surgical and recovery rooms, with expensive equipment and specialized personnel, while drugs often do not require such complementary expenditures. This fact is not captured in a simple calculation of the difference in the cost of surgery and drug treatments.

Furthermore, the $25 cost estimate does not accurately reflect the opportunity costs imposed by the regulation. While the regulation forces the factory to spend an additional $25, the regulation also forces the factory to spend $75 on an item the factory would, under other circumstances, not want to purchase. The fact that $100 has to be spent on an input represents a transfer of $25 from the factory to the supplier, as well as a transfer of $75 from the potential supplier of the $75 component to the supplier of the $100 part. Thus, the total cost of the regulation covers both aspects; the true cost of the regulation is $100, or the cost of the current part.[14]

This suggests that the methodology for calculating the costs of regulations

based on either *requirements* or *prohibitions* is essentially the same. Compliance costs are estimated from the actual or anticipated expenditures of businesses or firms mandated by both types of federal regulations. The appropriate benchmark in each case is the action or type of expenditure the business would have taken in the absence of the particular federal regulation. In other words, it does not matter from a methodological standpoint whether regulations specify what action to take or what action not to take. Under both circumstances, private agents are forced to expend resources in activities that they otherwise would not choose to do. These mandated private expenditures, or MPEs, are opportunity costs and thus constitute the social costs of complying with federal regulations.[15]

The primary advantage of focusing on MPEs is that it does not require the estimation of prices for products and processes not available to the market to assess the 'lost' savings from the prohibited activity. Moreover, the emphasis on MPEs will not create a significant incentive for regulatory agencies 'to ban products or processes to avoid budget constraints on direct spending,' as some have argued.[16] Regulatory 'bans' will show up as regulatory costs in the total spending on 'approved' substitutes or alternative products and processes, just as regulatory *requirements* are reflected in actual expenditures by business firms.

Estimating the costs imposed by regulations of the third type – those that represent interference with the operation of markets – generally requires the construction of econometric models 'based on the demand and supply characteristics of an industry before and after a regulatory change.'[17] These costs are usually not manifested as direct expenditures by business, but rather reflect indirect welfare or 'deadweight' losses to society (Figure 1).

Because the calculation of indirect costs requires more advanced techniques, the methodology for measuring the indirect costs of regulatory interference will not be addressed in this report. The emphasis of this study is on the estimation of the compliance burden and transfer effects of federal regulations rather than on the measurement of indirect welfare losses. Nonetheless, several studies have been made of the impact of federal regulations on the efficiency of specific industries.[18] Because the econometric techniques are fairly standard within the economics profession, however, these studies can form the basis for the determination of the costs of the third type of federal regulation.

Defining a cost imposed by regulation

There are many types of costs imposed by federal regulations.[19] *Administrative costs* consist of the fiscal expenditures of the regulatory agencies on rulemaking and enforcement of federal regulations. These costs are directly reflected in the federal budget and are financed by taxes or debt issuance. They, in essence, represent agency authority over *public expenditures*.

Compliance costs comprise the expenditures by private economic agents attributable to the first two categories of federal regulations mentioned above

– regulatory requirements and prohibitions. They consist of spending that would not have occurred in the absence of the regulations.

Transfers are costs born by one economic agent that are gained by another agent. (Some argue that these are not true economic costs, since they do not represent a real loss of resources.) Both compliance costs and transfers represent agency authority over private expenditures and are the result of regulatory requirements and prohibitions.

Indirect or inefficiency costs represent lost consumer and producer surpluses and are often referred to as 'deadweight losses.' These costs are the result of regulations that interfere with market processes. They are also the result of the compliance and transfer effects of regulation (Figure 1). Deadweight losses can arise from higher prices faced by economic agents; this reflects in some degree agency control over private expenditures. Indirect costs also arise from 'lost opportunities' and consequently do not reflect actual, direct expenditures by economic agents.

Determining what costs to include in the estimation of the 'total' costs of regulation has been a source of considerable controversy. For example, economists Murray Weidenbaum and Robert DeFina include regulations that result in transfers of wealth.[20] However, economists Robert Hahn and John Hird argue that economic transfers and net changes in efficiency should be separated from estimates of regulatory costs, in part because transfers 'lost' by one economic agent are 'gained' by another resulting in no real net loss to society.[21] On the other hand, benefits may be dissipated if interest groups compete for redistributions.[22] In addition, regulatory budgets likely would not be able to distinguish finely enough among compliance costs, deadweight losses, and transfers. This suggests that no distinction between transfers and compliance costs should be made.[23]

The approach adopted in this study is to include both compliance and transfer effects as costs of regulation. This is done because the primary purpose of a regulatory budget is to constrain the 'costs' of regulation, especially in terms of measurable expenditures. By focusing on expenditures as costs, the feasibility of implementing a regulatory budget is improved, since it is not necessary to quantify benefits. This focus also reflects the emphasis on the MPEs imposed by regulations that, as stated above, mirror the economic concept of opportunity costs. However, benefits may be implicitly taken into account in determining the size of the budget allocated to the regulatory agency.[24]

Summary

Federal regulations that require or prohibit actions by economic agents result in mandated private expenditures (MPEs). These can be measured. The relevant benchmark is what spending would have been in the absence of the federal regulation being analyzed. The problem of joint causation, which occurs when federal regulations overlap with state or local restrictions is ignored. In the case

of regulatory requirements, estimates of costs consist of added spending on products and processes by economic agents complying with federal regulation. In the case of regulatory prohibitions, estimates of costs come from spending on current products and processes that would have been replaced by prohibited products or processes. In both cases, costs represent compliance costs as well as transfers, which together represent the MPEs of federal regulations. Indirect effects, such as those arising from regulatory interference, are ignored.

In the following sections this methodology will be applied to recent amendments of the Clean Air Act and the Safe Drinking Water Act. The amendments resulted in new rules that were issued and enforced by the Environmental Protection Agency (EPA). These rules have had the effect of either requiring or prohibiting the activities of private economic agents, resulting in expenditures characterized by MPE. The following sections illustrate how MPEs can be measured – especially relative to current methods used to estimate the compliance costs of federal pollution control laws – to facilitate the implementation of a regulatory budget.

Compliance Costs of the Clean Air and Safe Drinking Water Acts

The Clean Air Act (CAA), originally enacted in 1955, is the primary legislation governing the establishment of regulations over the quality of air.[25] Its purpose is to 'protect and enhance the quality of the nation's air resources,' as well as to 'encourage and assist the development and operation of [national and] regional air pollution prevention and control programs.'[26]

The CAA was amended in 1990 to address four major air quality issues: acid rain, urban air pollution, ozone depletion, and toxic air emissions. Specifically, the CAA Amendments of 1990 require that the government phase out ozone-depleting gases, such as chlorofluorocarbons and carbon tetrachloride, and reduce emissions of sulfur dioxide, nitrogen oxide, and 189 toxic air pollutants into the atmosphere. The federal government is also required to issue regulations that result in substantial reductions of emissions from cars, trucks, and buses and to promote the use of cleaner-burning ('reformulated') gasolines. In addition, the 1990 amendments require a number of industrial and service firms to obtain permits before operating.

The Safe Water Drinking Act (SDWA), enacted in 1974, authorizes the EPA to establish, monitor, and enforce drinking water standards for all public water systems in the United States.[27] The SDWA, in conjunction with the Clean Water Act, comprise the major water pollution laws administered by the EPA.[28] In 1986, Congress amended the SDWA to regulate 83 specific contaminants in the nation's waterways and to mandate the filtration of surface water sources and the disinfection of all public water supplies.

Data on the actual compliance costs of the CAA and the SDWA are available from yearly studies conducted by the Bureau of the Census of the U.S. Department of Commerce (DOC). These reports, called 'Pollution Abatement

Costs and Expenditures' (PACE), are published periodically in the *Survey of Current Business* by the DOC's Bureau of Economic Analysis (BEA).

These reports consist of information derived from two primary surveys. The first is the 'Pollution Abatement Costs and Expenditures' survey of capital outlays and operating spending by manufacturing establishments for pollution control. The second, called the 'Pollution Abatement Plant and Equipment Expenditures' survey, is a similar study of the capital outlays by electric utilities and, to some extent, mining and petroleum facilities.[29] These surveys estimate the expenditures on abatement of air, water, solid waste, and other pollution.

The PACE reports collect information for the following types of pollution abatement expenditures:[30]

- Capital expenditures for pollution abatement structures or equipment added to the production process, and for structures and equipment with built-in pollution abatement features to reduce generation of air pollutants, water pollutants, or solid/contained wastes.
- Operating expenses for pollution abatement equipment; for removal or disposal of pollutants including trash removal or sewage service; for testing and monitoring of emissions or wastes; for pollution abatement audits, reports, studies, or operating procedures development.
- Costs and expenditures for cleaning up contaminants from the site.
- Costs and expenditures for other environmental protection, such as expenditures to reduce noise pollution, radiation, or multimedia expenses.

The methodology used to collect information for the PACE reports has many of the features advocated in the methodology of estimating MPEs outlined above. For instance, the survey assesses both regulatory requirements and prohibitions, including operating expenses and capital outlays for end-of-line structures and production process enhancements.

An example suggested in the survey instructions of a *requirement* to report is outlays for dust collectors, scrubbers, and spill-containment dikes. An example of a *prohibition* to be included in the report is capital outlays for 'conversion to substitute fuels that generate fewer pollutants.'[31] The survey also does not make a distinction between compliance expenditures and transfers.

In addition, the survey is designed to assess expenditures relative to an 'absence of' benchmark. For instance, the instructions state that respondents are to report

> …the pollution abatement portion of the installed cost of enhancement projects intended for environmental protection. Estimate the pollution abatement portion as the *extra* cost of pollution abatement features in structures and equipment (i.e., your actual spending less what you would have spent without the pollution abatement features built-in).[32]

While this is not quite identical to the 'absence of *that* regulation' benchmark proposed above, the instructions can be modified to assess the marginal impact of new federal regulations. Moreover, the benchmark assesses expenditures for all pollution control activities without reference to federal, state, or local requirements. Whether respondents actually state the full cost of compliance or deduct expenditures based on state, local, or voluntary restrictions is not clear.

One specific weakness is that the survey does not assess the full expenditures on equipment or operating expenses in the face of regulatory requirements or prohibitions, except in the case in which 'the primary purpose of the project is environmental protection,' even if there are secondary effects, such as improved production efficiency. Thus, even if a 'project with the primary purpose of improving production efficiency [includes] pollution abatement features added to meet legal requirements,' if the pollution abatement portion is difficult to assess, then the instructions state that these expenditures need not be reported.[33]

It should be noted that the instructions are vague on this point and can be interpreted either way. For instance, in the 'conversion to substitute fuels' example given above, it is not clear whether the full cost of the substitute fuel should be reported, as this study recommends for calculating the cost of 'banning the old fuel,' or whether the incremental cost increase of the new fuel relative to the price of the old fuel should be reported. Ambiguities such as these will need to be resolved for the PACE reports to be able to assess adequately the MPEs of federal pollution control regulations.

Figure 2 shows the total actual and projected spending for air pollution control from 1972 to 2000. Actual expenditures for 1972 to 1993 are obtained

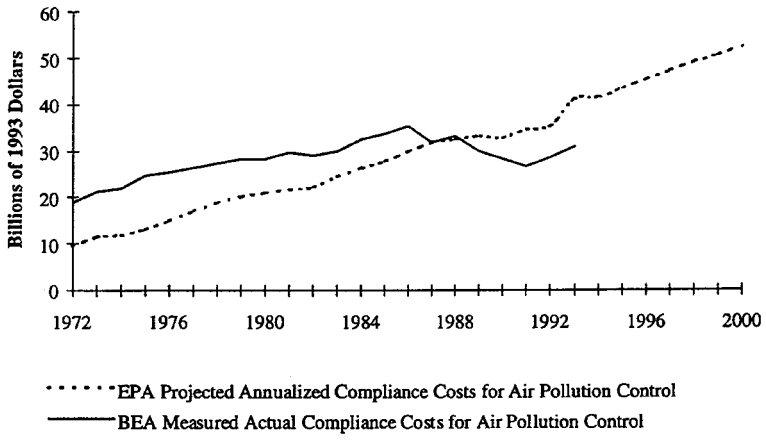

Fig. 2. EPA projected and BEA measured actual spending for air pollution control, 1972–2000. Source: Environmental Protection Agency, *Environmental Investments*, tables 2-1, 3-3, 3-3A, pp. 2-2, 3-20, and 3-21; 'Pollution Abatement Costs and Expenditures' reports publiced in the *Survey of Current Business*, various years.

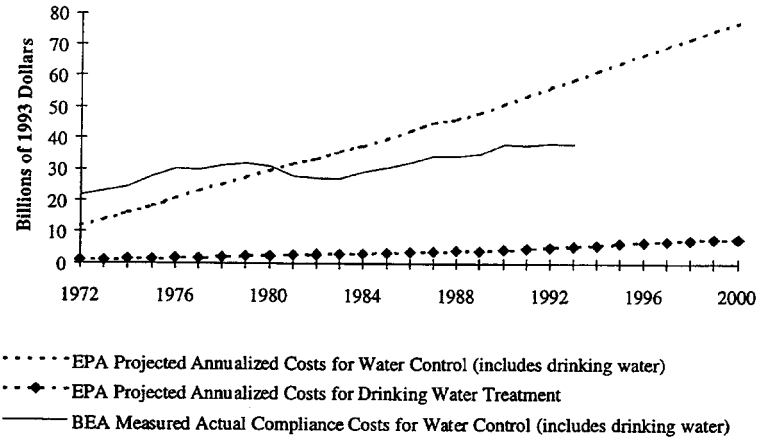

Fig. 3. EPA projected and BEA measured actual spending for water pollution control and drinking water treatment, 1972–2000.
Source: Environmental Protection Agency, *Environmental Investments*, tables 2-1, 4-3, 4-3A, pp. 2-2, 4-22, and 4-23; 'Pollution Abatement Costs and Expenditures' reports publiced in the *Survey of Current Business*, various years.

from the BEA's PACE reports published in the *Survey of Current Business*.[34] The projected estimates for the 1972–2000 period are calculated by the EPA. Projections are determined by summing the expected operating costs for the control of air pollution with amortized estimates of capital outlays, assuming an interest rate of 7 percent and a capital life of 10 years for mobile sources and 25 years for stationary sources.[35]

Spending for air pollution abatement was projected by the EPA to increase throughout the 1972–1993 period from $9.4 billion to $41 billion (1993 dollars).[36] An examination of actual expenditures, as reported by the BEA, shows that the compliance burden for air pollution regulations was higher than expected between 1972 and 1987, increasing from $19 billion to $30.7 billion. However, after 1988, spending was lower than anticipated and actually fell on average to a 15-year low of $26.6 billion in 1991. Interestingly, this 15-year low came one year *after* Congress passed the CAA Amendments of 1990. One possible reason is that the expectation of major changes in legislation and regulation governing the administration of pollution control laws (such as the 1990 CAA) affects both the willingness of economic agents to comply with existing regulations and the enforcement and administration activities of the regulatory agencies. For instance, regulators may adopt a 'wait-and-see' attitude before issuing new regulations or enforcing existing ones to asses the impact of legislative changes on the scope of their regulatory powers. Consequently, business establishments will have an incentive to postpone compliance expenditures until a revised regulatory enforcement regime is in place.

Figure 3 presents similar spending patterns for the control of water pollution

and the treatment of the nation's drinking water. Actual expenditures are derived from the BEA's published PACE reports. Projected estimates are based on EPA calculations. Projected spending between 1972 and 2000 assumes an interest rate of 7 percent and a capital life of 30 years for water quality equipment and 20 years for drinking water capital investments.[37] Water quality figures include expenditures for water source quality as well as drinking water treatment.

Water pollution control expenditures were expected to increase fourfold between 1972 and 1993, from $11.9 billion to $58.8 billion. However, actual expenditures, as compiled by the BEA, increased only 74 percent, from $21.9 billion in 1972 to only $38.1 billion in 1993.

These figures suggest that forecasting the expected compliance costs of regulations is possible, although with considerable error. In the estimates presented here, initial projections are half of the actual values, and the time trend is also in error.

Part of the reason for the errors may be due to the fact that the projections are derived from regressions of historical cost data and do not include current or up-to-date information of expenditures or regulatory changes in the regression equations. Another hypothesis to explain the gap between projected and actual compliance costs is the incentive to develop new technology to lower the costs of compliance. A period of 21 years is surely long enough to provide opportunity for the private sector to respond in that way. The problem encountered here is the great difficulty of forecasting in advance such scientific and engineering developments. Clearly, more advanced econometric techniques that incorporate reasonable expectations of regulatory change and technological advancements, for instance, can improve the forecasting estimates.

Estimating the costs of the Clean Air Act amendments of 1990

Prior to the enactment of the CAA of 1990, Congress commissioned a number of studies in order to assess the impact of future regulatory rulings. (See the appendix for a description of many of these rules.) Table 1 presents the anticipated annualized costs resulting from the four major issues addressed in the CAA of 1990 (acid rain, urban air pollution, ozone depletion, and toxic air pollutants) as compiled by the EPA.[38] In total, new regulations authorized by the CAA of 1990 are expected to result in an additional $79.1 billion in spending by U.S. businesses between 1993 and 2000.[39] This figure represents approximately 21 percent of all projected compliance expenditures for air pollution control requirements imposed by the EPA during that period.

Several of the studies used to compile the cost estimates examined by congressional committees and compiled by the EPA in its volume on *Environmental Investments* utilize elements of the methodology proposed above for estimating MPEs. For instance, the impact analysis prepared by E. H. Pechan & Associates on urban air pollution estimates costs relative to the assumption

Table 1. Estimated control costs for new air pollution regulations (billions of 1993 dollars).

Regulatory program	1993	1994	1995	1996	1997	1998	1999	2000
Acid rain	–	–	0.39	0.78	0.78	0.78	0.78	1,55
Urban air and ozone								
Stationary sources	3.61	3.63	3.66	4.15	4.63	5.11	5.59	6.08
Mobile sources	1.58	1.60	1.79	1.81	1.83	1.84	1.86	1.71
Toxic substances								
Stationary sources	0.15	0.29	0.66	0.88	1.10	1.47	1.84	2.21
Mobile sources	–	–	0.83	1.66	2.49	3.33	3.33	3.33
Total	5.34	5.52	7.33	9.28	10.83	12.53	13.40	14.87

Source: Environmental Protection Agency, *Environmental Investments*, tables A–A1, p. A-29.

of 'no controls in the absence of regulation.'[40] Similarly, the Energy and Environmental Analysis study of toxic air substances does not make an adjustment for 'voluntary reductions in emissions prior to the proposal of standards' specified in EPA final rules.[41] In other words, both studies ignore the problem of joint causation with respect to the compliance expenditures of economic agents.

These studies recognize that cost estimates may overstate the 'true' impact of federal regulations, however. This is due to the difficulty of estimating federal regulatory effects independent of state, local, or private restrictions on air pollution. It also suggests that the 'absence of federal regulation' benchmark, with an estimation of expenditures that does not deduct the costs imposed by state or local authorities, is a more feasible means of obtaining MPE figures than other approaches. As indicated above, agency regulatory budgets can be inflated to take into account the overstatement of expenditures by economic agents on regulatory compliance.

Estimating the costs of the Safe Drinking Water Act Amendments of 1986

The 1986 Amendments to the SDWA resulted in seven new major final rules issued by the EPA. Additional rules have also been proposed. (These rules are listed in the appendix.) Table 2 presents projected compliance costs for the new regulations authorized by the SDWA of 1986, as compiled by the EPA from national impact analyses.[42] According to projections, total new spending for drinking water treatment from 1993 to 2000 will be nearly $20 billion, or more than a third of projected total spending on drinking water compliance.

Table 3 presents estimates of compliance costs for the seven final rules issued by the EPA following the SDWA of 1986, as well as two proposed rules for 1992. These figures are based on engineering studies published by the EPA and the American Water Works Association (AWWA).[43] These studies suggest that the seven existing rules issued by the EPA following the SDWA of 1986 will

Table 2. Estimated capital and operating control costs for new water treatment regulations (billions of 1993 dollars).

Regulatory grouping	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Grouping one	0.15	0.30	0.31	0.84	1.66	2.11	2.49	3.08	3.29	2.82	2.14	1.78	1.78
Capital outlays	0.04	0.09	0.10	0.45	1.04	1.41	1.66	2.03	2.14	1.63	0.77	0.27	0.27
Control costs	0.11	0.21	0.21	0.38	0.62	0.70	0.83	1.05	1.14	1.19	1.37	1.51	1.51
Grouping two	–	0.30	0.30	0.32	1.36	1.97	2.25	2.73	3.44	3.14	2.49	1.78	1.78
Capital outlays	–	0.09	0.09	0.10	0.81	1.27	1.55	1.76	2.29	2.00	1.26	0.27	0.27
Control costs	–	0.21	0.21	0.22	0.55	0.70	0.70	0.96	1.14	1.14	1.23	1.51	1.51

Grouping one includes final and proposed rules for volatile organic compounds (VOCs), fluoride, surface water treatment, total coliform, phase II inorganic compounds (IOCs) and synthetic organic compounds (SOCs), lead and copper, radionuclides, mandatory disinfection and by-products, and phase IV IOCs and SOCs. Grouping two includes the firs seven rules listed under Grouping one, plus phase V IOCs and SOCs, mandatory disinfection, and arsenic. Rules governing disinfection by-products are not included in Grouping two.
Source: Environmental protection agency, *Environmental Investments*, tables A-2, A-2A, and F-9, pp. A-31, A-32, and F-18.

Table 3. Annual yearly cost of water treatment (millions of 1993 dollars).

EPA Rule	EPA	AWWA
Existing rules from SDWA 1986		
Fluoride	7.76	9.00
Phase I VOCs	65.62	102.36
Surface water treatment	568.32	950.13
Total coliform monitoring	144.38	147.49
Phase II SOCs	110.12	n/a
Phase II IOCs	15.73	264.86
Lead and copper	521.54	807.51
Phase V SOCs and IOCs	47.71	71.83
Total existing rules	1,481.19	2,353.18
Proposed rules in 1992		
Radionuclides	487.90	n/a
Enhanced water treatment	959.45	n/a
Total proposed rules	1,447.34	n/a

EPA refers to the Environmental Protection Agency estimate. AWWA refers to the estimate of the American Water Works Association. (The AWWA is a national group of suppliers of drinking water). The AWWA did not provide separate estimates for Phase II SOCs and IOCs, nor did they provide estimates for proposed rules.
Source: congressional budget office, *The Safe Drinking Water Act,* table 1, p. 11.

result in additional compliance costs of $1.5 billion to $2.4 billion (1993 dollars). The difference in estimates is due primarily to different assumptions used by the EPA and AWWA regarding the number of treatment units and the timing of compliance with phase II synthetic organic compound and inorganic compound standards. It should be noted that in the EPA study, 'cost estimates do not deduct the cost of actions that water systems might undertake on their own,' reflecting the MPE methodology proposed here.[44]

Discussion

An analysis of recent amendments to the CAA and the SDWA reveals several lessons with respect to the implementation of a regulatory budget. First and foremost, cost studies and regulatory impact analyses (RIAs) suggest a possible regulatory budget for air pollution and drinking water treatment. Specifically, estimates of pollution control expenditures for new regulations affecting acid rain, urban air pollution, and toxic substances provide a possible 'budget' of $79 billion in compliance costs born by economic agents between 1993 and 2000. Similarly, private expenditures resulting from new regulations for water treatment can be budgeted at $1.5 billion to $2.4 billion a year, or $20 billion for the entire 1993–2000 period.

Moreover, incremental costs of new regulations can be estimated. These may require costly engineering studies or detailed surveys of private expendi-

tures, but estimates of private expenditures mandated by federal regulations is possible to obtain. Information on compliance costs is collected by federal agencies, such as the Bureau of the Census, as well as by private business establishments and associations. These studies can be modified to reflect new regulations or to resolve methodological concerns, especially those raised in this study.

Furthermore, contemporary studies of projected and actual compliance costs contain a number of the elements proposed above in estimating private expenditures mandated by federal regulations. For instance, RIAs and census surveys generally adopt an 'absence of federal regulation' benchmark and ignore the problem of joint causation in assessing compliance costs. Compliance costs, as well as estimates of economic transfers resulting from both regulatory requirements and prohibitions, are often included as well. One general weakness in these current approaches is that it is not clear how regulatory prohibitions are treated. The MPE approach recommends that the cost of regulatory prohibitions be estimated in the same way that costs of regulatory requirements are determined. Further research is needed to assess the feasibility of utilizing this approach for estimating the effects of regulatory prohibitions.

Conclusion

This study examined the feasibility of implementing a regulatory budget using cost estimates of recent amendments to the Clean Air Act and the Safe Drinking Water Act. The principle conclusion reached is that many of the elements necessary for implementing a regulatory budget are already in place. Obstacles often vocalized by opponents to regulatory budgeting can be overcome. Consequently, lawmakers can proceed to implement a regulatory budget.

The study is based on a proposed methodology of estimating the mandated private expenditures (MPEs) resulting from new regulations. The basic elements of the MPE approach include the following:

- The relevant benchmark is the 'absence of the federal regulation.' Specifically, costs are measured according to the requirements imposed by federal regulatory activities.
- Estimates do not deduct the cost of actions required by state or local authorities, nor do they deduct the cost of actions private agents would have taken on their own.
- Requirements and prohibitions are treated the same. That is, estimates of the cost of prohibited activities include the full expenditures for actions taken by economic agents, as if they were required by regulatory agencies.
- Estimates include both compliance costs as well as transfers resulting from federal regulations.

The principle advantages of the MPE approach are that it closely reflects the economic notion of *opportunity cost* and that estimation of compliance costs is relatively feasible, given current survey techniques and data sources. It is the feasibility of this methodology that makes it an attractive part of the budgeting process.

A number of practical and methodological issues need to be resolved, such as how to include indirect costs in establishing and monitoring a regulatory budget. Nevertheless, implementation can proceed. The methodology will likely evolve as lawmakers, regulators, and researchers acquire the necessary skills and information required to make a regulatory budget operational.

Appendix

Final EPA rules issued following the Clean Air Act Amendments of 1990

Following the enactment of the CAA of 1990, the EPA issued a number of new rules. Several of these new rules, divided into acid rain, air pollution, and toxic substances subsections, are described below. The dates in parentheses indicate when the final rule was published in the *Federal Register*.

Acid rain

- *State Operating Permits Program (July 21, 1992).* This rule defines the elements required by states in order to operate a permit-issuing program, as required by the CAA of 1990.
- *Continuous Emissions Monitoring (January 11, 1993, revised July 3, 1993).* This rule establishes requirements for the monitoring, recordkeeping, and reporting of sulfur dioxide, nitrogen oxides, and carbon dioxide emissions.
- *Excess Emissions (January 11, 1993).* Owners and operators of affected plants with excess emissions of sulfur dioxide or nitrogen oxides are to offset the amount to excess with allowances from their Allowance Tracking System accounts.
- *Permits Regulation (January 11, 1993).* This rule sets forth requirements for obtaining operating permits for affected units from the EPA or state permitting authorities.
- *Nitrogen Oxides Emission Reduction (March 22, 1994, revised April 13, 1995).* Coalfired utility plants are required to limit emissions of nitrogen oxide and sulfur dioxide.

Urban Air Pollution and Ozone Depletion

- *On-Board Emission Control Diagnostics Systems (February 19, 1993).* Manufacturers of light-duty vehicles and light-duty trucks are required to install on-board emission control diagnostics systems that will warn the vehicles operator about any malfunction or deterioration that will cause emissions to exceed certain thresholds.
- *Regulation of Fuels and Fuel Additives (February 9, 1994, and August 2, 1994).* This rule prohibits the sale of gasoline that the EPA has not certified as reformulated in the nine regions determined to be the worst ozone nonattainment areas in the United States.
- *Control of Air Pollution from New Motor Vehicles and Engines (April 6, 1994).* Manufacturers of new light-duty vehicles and trucks are required to install on-board refueling vapor recovery systems.
- *Control of Emissions from New and In-use Nonroad Engines (June 17, 1994).* Manufacturers of

nonroad spark emission engines are required to reduce emissions of nitrogen oxides, carbon monoxide, and particulate matter produced by their engines.
- *Phase I Nonroad Spark Emission Engines (July 3, 1995).* Manufacturers of designated engines are required to demonstrate that their products comply with emission standards, through testing, labeling, and certification procedures.
- *Transportation Conformity Rule (August 7, 1995).* This rule establishes the criteria and procedures by which federal, state, and local transportation planning organizations must attain and maintain the national ambient air quality standards.

Toxic Air Emissions

- *Chemical Accident Prevention Program (January 31, 1994).* This rule establishes a list of regulated substances and thresholds and defines requirements for owners or operators of stationary sources concerning the prevention of accidental releases.
- *National Emission Standards for Hazardous Air Pollutants (HAPs) (general provisions) (March 16, 1994).* This rule codifies general procedures and criteria necessary to implement emission standards for stationary sources that emit one or more of the 189 HAPs specifies in the CAA of 1990.
- *Refrigerant Recycling Regulations (August 19, 1994, and November 9, 1994).* Persons servicing air-conditioning and refrigeration equipment are required to observe certain service practices to reduce emissions. Ozone-depleting compounds contained in appliances are to be removed prior to disposal of the appliances, and all air-conditioning and refrigeration equipment, except for small appliances, are to be provided with a servicing aperture that will facilitate recovery of refrigerant. In addition, the regulations restrict the sale of refrigerant and establish a leak repair requirement for equipment.
- *Halogenated Solvent Cleaning (December 2, 1994).* This rule requires various solvent cleaning machines to meet certain national emission standards for hazardous air pollutants.
- *Aerospace Manufacturing Facilities (September 1, 1995).* Aerospace manufacturing and rework facilities are required to control emissions of a number of hazardous air pollutants.
- *Marine Tank Vessel Loading Operations (September 19, 1995).* This rule requires reasonably available control technology to limit air emissions of volatile organic compounds and hazardous air pollutants from new and existing marine tank vessel loading operations.

EPA rules issued following the Safe Drinking Water Act Amendments of 1986

The 1986 Amendments to the SDWA resulted in seven new major final rules issued by the EPA. Additional rules have also been proposed. These rules are as follows (with the date the final rule was published in the *Federal Register* in parentheses):

- *Fluoride (April 2, 1986).* Systems must test for fluoride. If it is found to be above allowable levels, they must change their operations or take other actions to lower the level.
- *Phase I Volatile Organic Compounds (VOCs) (July 8, 1987).* Water systems must sample for VOCs. When the compounds are found, the source of the VOCs must be removed or treatment must be undertaken.
- *Surface Water Treatment (June 29, 1989).* All water systems must be treated to control bacteria and other microbes. Affected systems are required to disinfect and install a subset of systems to filter their water.
- *Total Coliform Monitoring (June 29, 1989).* Systems are required to conduct monthly tests for coliform bacteria.
- *Phase II Synthetic Organic Compounds (SOCs) (January 30, 1990, and July 1, 1991).* Vulnerable water systems must test for SOCs. If the contaminants are found, the source of the SOCs must be removed or the water supply treated to remove them.

- *Phase II Inorganic Compounds (IOCs) (January 30, 1990, and July 1, 1991).* All community water systems must monitor for regulated IOCs. If IOCs are found, their levels must be adequately reduced or treatment must be undertaken.
- *Lead and Copper (June 7, 1991).* Water systems must target homes with a high risk of lead and copper contamination and conduct tests in those locations. If contamination is found, water systems must reduce the corrosiveness of the water or replace materials containing lead under the control of the water system. Water systems are not required to replace customers' pipes containing lead.
- *Phase V SOCs and IOCs (July 25, 1992).* Same as Phase II SOCs and IOCs.
- *Radionuclides (proposed).* This rule would set standards for radon-222, radium-226, radium-228, uranium, and adjusted gross alpha emitters in drinking water.
- *Enhanced Water Treatment or Mandatory Disinfection (proposed).* This rule would expand controls established under the Surface Water Treatment rule and require control systems for disinfectants and disinfection by-products.

Notes

1. A sampling of previous analyses of the regulatory budget includes Samuel Hughes (1995). *Regulatory Budgeting*. Washington University, Center for the Study of American Business working paper, August 30; (1991–1992) 'Regulatory accountability and the regulatory budget,' *Regulatory Program of the United States Government*. Office of Management and Budget, April 1, March 31; John F. Morrall, III (1992). 'Controlling regulatory costs: the use of regulatory budgeting.' Regulatory Management and Reform Series, no. 2, Organization for Economic Cooperation and Development, Paris. Robert E. Litan and William D. Nordhaus (1983). *Reforming Federal Regulation.* New Haven: Yale University Press, ch. 6; Richard Fullenbaum and Joseph E. Kasputys (1978). 'The regulatory budget: concepts and information requirements,' *Regulatory Reform Seminar: Proceedings and Background Papers*. U.S. Department of Commerce, Office of the Secretary, October 17, pp. B1–B55.
2. Litan and Nordhaus. *Reforming Federal Regulation.*
3. 'Tbe regulatory budget,' pp. 33–34.
4. The Clean Air Act was amended in 1990. The Safe Drinking Water Act was amended in 1986.
5. In 1993, President Bill Clinton issued Executive Order No. 12866, which repealed and replaced the RIA requirements mandated by Executive Order No. 12291 with somewhat similar provisions.
6. 'Regulatory accountability and the regulatory budget,' pp. 6–7.
7. The term 'private expenditures,' as used here, is a shorthand for nonfederal outlays, including state and local government expenses in meeting federal regulatory requirements.
8. See Robert W. Hahn and John A. Hird (1991). 'The costs and benefits of regulation: review and synthesis,' *Yale Journal on Regulation.* Winter, pp. 233-278, for an excellent discussion.
9. Warren, Melinda and Barry Jones (1995). *Reinventing the Regulatory System: No Downsizing in Administration Plan*. St. Louis: Center for the Study of American Business, Occasional Paper 155, July.
10. Weidenbaum, Murray and Robert DeFina (1978). *The Cost of Federal of Economic Activity.* Washington, DC: American Enterprise Institute, May; Thomas D. Hopkins (1995). 'Profiles of regulatory costs.' Report to the Small Business Administration, November. See also Thomas D. Hopkins (1991). 'Cost of regulation.' Rochester Institute of Technology working paper, December; Litan and Nordhaus. *Reforming Federal Regulations*, and Hahn and Hird, 'The costs and benefits of regulation.'
11. Joskow, Paul L. and Nancy L. Rose (1989). 'The effects of economic regulation,' in R. Schmalensee and R. D. Willig, eds. *Handbook of Industrial Organization*. Elsevier Science Pub., p. 1451.
12. See Joskow and Rose. 'The effects of economic regulation,' p. 1453.

13. Ibid.
14. It is recognized that this approach is controversial. However, estimating the total cost of mandated inputs or processes may be an easier method of calculating the 'costs' of federal regulation, since it does not require the consideration of 'quality' differences when one product or process is substituted for another. Moreover, the regulatory budget allocated to federal regulatory agencies can be inflated to take into account that these 'total' costs are being calculated. That is, the regulatory budget can be $100 in this case, instead of $25.
15. While MPE closely reflects the economic notion of *opportunity cost*, it is something less than *total opportunity costs*, since it does not fully capture all welfare and efficiency losses from indirect impacts of MPEs. For instance, because the $75 input is not used, as described in the example above, the producer of the $75 input does not pay its employees for producing the input. The employees, in turn, do not spend their earnings on goods and services, which represent an economic loss to society. However, some of this efficiency loss is restored by considering that the employees of the manufacturer producing the $100 input are being paid. Sorting out the net economic consequences of these 'indirect' effects is practically impossible. Nevertheless, by considering $100 as the cost of regulation prohibiting the use of the $75 input, rather than $25 as the cost, we move closer to capturing the full opportunity costs of federal regulations.
16. 'Regulatory accountability and the regulatory budget,' p. 6. See also Morrall, 'Controlling regulatory costs,' p. 14.
17. Hahn and Hird, 'The costs and benefits of regulation,' p. 239.
18. For a general overview, see Joskow and Rose, 'The effects of economic regulation.'
19. For a summary, see Marvin H. Kosters (1979). 'Counting the costs,' *Regulation*, July/August, pp. 17–25.
20. Weidenbaum and DeFina. *The Cost of Federal Regulation of Economic Activity*, p. 8. They state that '… transfers that arise as a side effect of regulation … are included.'
21. Hahn and Hird. 'The costs and benefits of regulation,' p. 236.
22. Posner, Richard A. (1975). 'The social costs of monopoly and regulation,' *Journal of Political Economy* 83 (4), pp. 807–827.
23. DeMuth. 'The regulatory budget,' p. 34.
24. Ibid., p. 32.
25. Other air pollution control laws include the Radon Gas and Indoor Air Quality Research Act of 1986 and the Radon Pollution Control Act of 1988.
26. 'Clean Air Act,' *Compilation of Selected Acts Within the Jurisdiction of the Committee on Energy and Commerce*. Committee on Energy and Commerce, U.S. House of Representatives, Washington, D.C.: Government Printing Office, February, p. 7.
27. See 'Safe drinking water act,' *Compilation of Selected Acts Within the Jurisdiction of the Committee on Energy and Commerce*. Committee on Energy and Commerce, U.S. House of Representatives, Washington, D.C.: Government Printing Office, February, pp. 787–852.
28. The Marine Protection, Sanctuaries and Research Act also controls water pollution.
29. See Gary L. Rutledge and Christine R. Vogan (1994). 'Pollution abatement and control expenditures, 1972–92,' *Survey of Current Business*, May, pp. 36–49.
30. The following information is taken from the U.S. Bureau of the Census, Current Industrial Reports, *Pollution Abatement Costs and Expenditures, 1993*. U.S. Government Printing Office, Washington, D.C., p. A–7.
31. See U.S. Bureau of the Census, *Pollution Abatement Costs and Expenditures, 1993*, p. A–12.
32. Ibid.
33. Ibid.
34. Rutledge and Vogan, 'Pollution abatement and control expenditures, 1972–1992' and Gary L. Rutledge and Christine R. Vogan, 'Pollution abatement and control expenditures, 1993,' *Survey of Current Business,* May, pp. 36–45.
35. The projections are based on historic cost data from the PACE reports between 1972 and 1987. The data is used to construct time series trends for future cost projections (1988 to 2000) as

well as extrapolations back to 1972. For a complete description of how the projections are determined, see Environmental Protection Agency, *Environmental Investments: The Cost of a Clean Environment*. Washington, D.C.: Island Press, 1991, pp. 1–9 to 1–12 and note to table 3-3, p. 3–20.

36. All dollar figures are in 1993 dollars.
37. See Environmental Protection Agency, *Environmental Investments*, note to table 4-3, p. 4–22.
38. These studies include the following: For acid rain control, *Economic, Analysis of Title V (Acid Rain Provisions) of the Administration's Proposed Clean Air Act Amendments (H.R. 3030/S. 1490)*, prepared for the EPA by ICF Resources, Inc., September 1989; for urban air pollution, *Ozone Nonattainment Analysis: A Comparison of Bills*, prepared for the EPA Office of Air and Radiation by E. H. Pechan & Associates, Inc., January 1990; for toxic substances, *Analysis of Costs of Hazardous Air Pollutant Controls Under H.R. 3030, H.R. 2585, and S. 816*, prepared for the EPA Office of Air Quality Planning and Standards by Energy and Environmental Analysis, Inc., January 25, 1990.
39. The estimates include annualized control costs only.
40. E. H. Pechan, *Ozone Nonattainment Analysis*, p. 33.
41. Energy and Environmental Analysis, *Analysis of Costs of Hazardous Air Pollutant Controls*, p. 4–6.
42. See U.S. Environmental Protection Agency, Office of Drinking Water, *Estimates of the Total Benefits and Total Costs Associated with Implementation of the 1986 Amendments to the Safe Drinking Water Act*, November 1989. The estimates presented here include the existing and proposed rules listed in the appendix under SDWA of 1986, as well as rules governing arsenic and mandatory disinfection of water. Not included in the estimated is the disinfection by-products rule.
43. For a discussion, see Congressional Budget Office, *The Safe Drinking Water Act: A Case Study of an Unfunded Federal Mandate*. U.S. Congress, Washington, D.C., September 1995, pp. 10–12.
44. Congressional Budget Office, *The Safe Drinking Water Act*, p. 10.
45. It should be noted that survey response bias – in which respondents overstate or understate compliance expenditures – may be a source of concern. The extent to which this bias affects the implementation of a regulatory budget will need to be addressed in further studies.
46. See Congressional Budget Office, *The Safe Drinking Water Act*, pp. 4–5. The rule descriptions that follow are taken from this report.
47. Figures obtained from Environmental Protection Agency, *Environmental Investments* Numbers converted from 1986 dollars to 1993 dollars (with 1986 = 1.00) as follows: the 1990 price deflator used is 1.188. This number is derived from Rutledge, Gary L., and Christine R. Vogan, 'Pollution abatement and control expenditures, 1993,' *Survey of Current Business*, May, 1995, p. 42 and Rutledge and Vogan, 'Pollution abatement and control expenditures, 1972–1992.'
48. Numbers converted from 1986 dollars to 1993 dollars (with 1986 = 1.00) as follows: the 1990 price deflator used is 1.200, derived from Rutledge and Vogan, 'Pollution abatement and control expenditures, 1993' and Rutledge and Vogan, 'Pollution abatement and control expenditures, 1972–1992.'
49. Figures converted from 1992 dollars to 1993 dollars (with 1992 = 100) as follows: the 1992 deflator used is 1.035 and is derived from Rutledge and Vogan, 'Pollution abatement and control expenditures, 1993' and Rutledge and Vogan, 'Pollution abatement and control expenditures, 1972–1992.'