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RESEARCH AND INNOVATION: REGULATORY IMPEDIMENTS AND REFORM ALTERNATIVES

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I want to preface my comments by saying that the views expressed here are my own and not necessarily the views of the General Accounting Office.

Government regulation dates at the federal level from the creation of the Interstate Commerce Commission almost one hundred years ago. However, it has only been in recent years that regulation has attracted broad public interest and concern. One reason is the increased scope of federal regulation. Originally, regulation was primarily directed at the economic practices and conditions of public utilities. However, recently there has been a great increase in the number of regulatory agencies and their activities. Since 1970 a number of regulatory agencies have been established, including: the Environmental Protection Agency and the Occupational Safety and Health Administration in 1970, the Consumer Products Safety Commission in 1972, and the Federal Energy Administration in 1974, which has since been absorbed by the new Department of Energy. Unlike most of the

older regulatory bodies, these agencies promulgate regulations which directly and visibly affect many individual citizens. Examples are the recent controversies over the automobile seatbelt-ignition interlock and the effect of pollution control and safety equipment on gasoline consumption.

A second reason for public concern over regulation is a growing recognition of its associated burden. Public discussion of the costs of regulation has occurred in government, in broadcast media, and in articles in newspapers and popular magazines. Very large dollar estimates of the annual costs of regulation to individual families and the country as a whole have been suggested.

One type of cost is associated with regulation's impact on R&D and innovation. Regulation imposes costs when it reduces or redirects research and development, dampens entrepreneurial creativity, and retards the rate of innovation. While there are examples of regulatory induced innovation in industries subject to economic regulation and in activities subject to health, safety, and environmental regulation, the overall impact has been less than desirable.

I would like to discuss this afternoon the following aspects of the problem:

1. How regulation indirectly retards industrial R&D and innovation;
2. Characteristics of regulatory reform that lead to a positive impact on R&D and innovation; and,
3. Several examples of regulatory reform alternatives that embody these characteristics and will promote R&D and innovation if adopted.

How Regulation Adversely Affects Industrial R&D and Innovation

Regulation can retard R&D and innovation through its influence on the level and type of investment, by its impact on the viability of small firms, and by redirecting entrepreneurial creativity.

Research undertaken by private sector firms is conceptualized by economists as investment. The decision to invest in any



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undertaking is conditioned on the expectation that the investment will be profitable. Put another way, the expected future revenue generated by an investment should, if discounted to the present, exceed the discounted costs associated with the investment.

The analysis of research as investment suggests two different ways in which the level of research is affected by government regulation. The first concerns the impact of regulation on investment generally. A business environment conducive to investment generally will also be conducive to research. Therefore, if, as some claim, regulation adversely affects all investment, then R&D will also decline.

Second, regulation can also affect the decision whether to invest in research as opposed to some other asset. The decision to invest in research is influenced by a range of factors that determine the value of the research project to the firm. These include the cost of the research, the probability of a successful outcome, the potential for commercialization, the costs of commercialization, expected revenues, the rate of interest, and the timing of all events. Any government regulation that raises the cost to the firm of research, development, or commercialization of an undertaking, reduces the probability of successful commercialization of potential discoveries, pushes the anticipated revenues that will be earned on a new product farther into the future, or shifts the flow of costs toward the present, will reduce the attractiveness of the initial research and may lead to a decision to invest in another more profitable asset.

Regulation can have such effects by increasing uncertainty, adding delay, taking away the supra-normal profits of a successful discovery, and increasing costs. Any research effort involves uncertainty as to whether there will be a successful outcome. Regulation can increase a project's overall uncertainty by adding, for example, the requirement that the end product and its production process must be acceptable to a number of separate environmental, health, and safety regulators. A successful research discovery cannot be commercialized without the approval of these regulators, and there is no guarantee that the approval will be forthcoming.

Even if approval itself is not expected to be a problem, the process increases the length of time between initiation of research and the introduction of any new product resulting from the research. This delay pushes market introduction farther into the future adding to the uncertainty as to what market conditions will be when a new product is introduced.

Regulatory delay can also reduce research by reducing the value of the expected revenue from a successful discovery. If marketing of a product is pushed farther into the future, the present discounted value of its expected future revenue is less at the time the decision to fund the research project must be made. The added delay may tip the scales against a

research project by making its net present value lower relative to other investment opportunities.

The potential for earning substantial profits is a key motivating incentive behind any risky undertaking whether it be research or purchasing a lottery ticket. To the extent that regulation reduces the profitability of a successful innovation--by either rate of return regulation or other means, such as the forced licensing of patents or the restricting of markets--the rewards of innovation are reduced and the level of research will decline.

Finally, regulation can increase the costs of a project in many ways, such as the direct costs of getting a product approved and the added investment necessary for plant and equipment to be in compliance with health, safety, and environmental regulations. Any regulation that raises the cost of any step of the process from research to commercialization will make the whole project and, hence, the research less attractive.

The importance of considering research within the context of all the steps between laboratory and commercialization should not be underestimated. Research expenditures are often only 10 percent of the total investment costs of a new project. A promising project may not be pursued if the 90 percent of the investment costs required for commercialization, such as plant and equipment, are made too expensive by regulation.

An entirely different way in which regulation reduces research and retards innovation is a consequence of regulation's impact on small firms. There is some disagreement as to the role of small firms in the research and development process. Some believe that small firms are disproportionately important sources of research. Others claim they fill a special niche by commercializing new developments not undertaken by large firms. Whatever the role, most would agree that smaller firms are important to the rate of R&D and innovation.

Some regulation creates economies of scale. That is, large firms are able to meet regulatory requirements at a lower cost per unit of output than smaller firms. Larger firms have an added ability to put smaller competitors out of business as a result of these regulatory induced scale economies. The decline in the viability of small firms due to regulation means that the contribution of smaller firms to the rate of innovation is lost.

The viability of smaller, research-intensive firms is also highly sensitive to the availability of risk capital. These firms typically have no internally generated funds during their early years and must rely on outside capital to function. It has been claimed, for example, that the costs of SEC compliance and the restrictions placed by the Employee Retirement Income Security Act on the uses to which pension funds may be put, have reduced the funding necessary to sustain small research-intensive firms.

Research and innovation can also be reduced by regulations which stipulate the ways in which the regulations must be complied

with. Such regulations are called design standards. Compliance with such regulations is not an end in itself. It is a means of effecting a public policy goal. However, compliance with design standards, as well as efforts to minimize the costs of compliance through legal challenges and other means, redirects entrepreneurial creativity and resources away from developing new and better ways of achieving the public policy objective. Consequently, such regulatory imperatives usually offer less of an incentive to engage in research on the problem. Furthermore, these design standards are static. Their basic inflexibility is increased because they take a long time to establish and an equally long time to remove from the code of federal regulations. For example, last year OSHA announced that it was removing more than 1,100 regulations that were deemed as of no value in promoting worker health and safety. To date, not one of these regulations has been removed from the books. The world is dynamic and technologies, products, materials, and processes are constantly changing. Static design standards retard the process of change rather than harness it to further the policy goals of the regulation.

Finally, regulation can also slow innovation without necessarily lowering the rate of research. All research does not contribute equally to the rate of innovation. Some have claimed that there has been a shift away from long-term, pioneering research into less risky, marginal improvements to known products and processes and into defensive research designed to minimize regulatory liability, among other things.

Characteristics of Regulatory Reform That Will Lead to a Positive Impact on R&D and Innovation

The preceding discussion of the ways in which regulation retards R&D and innovation can be turned about to yield a set of desirable regulatory reform attributes, from the perspective of enhanced R&D and innovation. This list has been expanded by including other attributes derived from economic common sense. Regulatory reform alternatives that embody these characteristics would promote R&D and innovation, or at least reduce the negative impact of regulation on these variables. Not surprisingly, we find on the list, the following:

1. Reduce uncertainty. Alternatives that lower the current level of regulation-related uncertainty would promote investment, in general, and R&D, in particular.

2. Reduce delay. Alternatives that shorten rule-making proceedings and approval processes would increase the present value of expected future revenue from successful research projects and lead to increased research.

3. Increase flexibility. Alternatives that embody maximum flexibility with respect to the ways in which regulatory compliance can be effected promote research designed to develop new and better ways of compliance.

Regulations that tie firms to a fixed technology should be kept to a minimum.

4. Use realistic time frames. Alternatives that provide longer intervals between the setting of a regulation and its effective date offer time to research and develop new ways of compliance.

5. Reduce regulatory scale economies. Alternatives that reduce economies of scale introduced by regulation will strengthen the relative viability of small firms and retain their contribution to R&D and innovation.

6. Do not expropriate the supra-normal profits generated by successful innovations in regulated industries; the return to research will be higher and so will the level of research.

7. Use market signals whenever possible. Do not interfere with the incentives to R&D offered by changing market conditions.

8. Consider the justifications for regulation. Some regulation is adopted because the private marketplace does not and cannot function adequately. In other words, there is a market failure. Examples are natural monopoly, externalities, and inadequate information. Such regulation is instituted to correct the failure and reduce the accompanying undesirable effects. Other regulation, however, is adopted to achieve social and political goals. For example, regulation has been used to alter the income distribution, strengthen national security, protect those deemed worthy of special protection, and provide service to small communities. Regulation used for such purposes is conceptually very different from regulatory activities designed to correct market failure. It is only one of the tools the government employs to accomplish policy objectives. For example, as an alternative to such regulation, the government can change the tax laws, alter government spending, directly provide subsidies or services, or conscript personnel or equipment. Each alternative means may successfully achieve the desired policy objective, but the mechanisms themselves might differ with respect to administrative ease, popularity, cost to the government or the public, and the extent of unintended consequences, such as reduced R&D and innovation. Regulation that does not correct a market failure may perhaps be replaced with other policy instruments that will effect the desired policy objective without regulation's adverse impact on R&D and innovation.

9. When no regulatory reform is feasible, consider steps that will offset regulation's adverse impact on R&D and innovation. There is some regulation that is sufficiently important and well structured, that even though it imposes substantial costs, including a reduction in R&D and innovation, it will not be altered. Such regulation poses a fundamental problem involving a trade-off between different policy objectives--in this case the regulatory objectives, on the one hand, and the goal of promoting R&D and innovation on the other. In such circumstances, steps to advance R&D and

innovation will not come from regulatory reform. Assistance can only come from the recognition that the regulation in question adversely affects R&D and innovation, and some offsetting or compensating steps are justified. They might take the form of special tax considerations, eased access to capital markets, or direct government loans or funding designed to increase the level of R&D.

Regulatory Reform Alternatives and the Promotion of R&D and Innovation

As stated previously, there has developed considerable interest in and support for regulatory reform, both procedural reform and substantive reform. This interest is due in no small part to the burden of regulation, including reduced R&D and innovation. However, reform proposals are advanced to address a full range of regulatory problems and while some will yield positive results with respect to enhanced R&D and innovation, others will not. Any reform proposals should be evaluated on the basis of expected total impact on costs, benefits, and their distribution, and no alternative should be accepted or rejected exclusively on the basis of its impact on R&D and innovation. In some cases, the "best" alternative will not lead to more research or increased innovation.

I would like to mention several regulatory reform alternatives which embody characteristics discussed above that will promote R&D and innovation. The mention of any particular reform proposal does not entail an endorsement because that, of course, would be predicated on an analysis of the estimated full impact of the reform proposal. The proposals fall into the categories of complete or partial deregulation, alternative regulatory mechanisms, and procedural reforms.

Complete or Partial Deregulation

Complete deregulation or partial deregulation is the logical reform alternative when the original justification for regulation no longer exists. If there is no market failure or enduring social or political objective, then there is a considerably reduced case for perpetuating the regulation. Deregulation would restore the available market incentives to R&D and innovation. For example, we currently regulate the well-head price of domestic crude oil and natural gas at a level below that which would prevail otherwise. One consequence of lower energy prices is that we consume too much energy, or so we are told by the government. To remedy the problem, the fuel efficiency of new automobiles is now regulated, and regulation of the energy efficiency of new houses and appliances is probably not far off. The deregulation of petroleum and gas prices would be followed by higher energy prices, which would be the market signal to spur research in alternative energy sources and more efficient ways of using energy. Higher energy prices would create the demand for such products and would probably eliminate the need for

regulation to increase energy efficiency, killing two birds with one stone.

Alternative Regulatory Mechanisms

Several alternatives exist which would change the way regulation is practiced and in the process stimulate R&D and innovation. These include: taxes and fees, performance standards, and tiered regulation.

Taxes and Fees. Some standards can be efficiently replaced by using taxes and fees to change the relative prices faced by consumers and firms. This alternative can have the advantage of both yielding efficient outcomes and minimizing enforcement activities. The behavior of decision makers is altered by changing the relative prices that they face. The socially desirable alternative is made relatively cheaper, and the socially undesirable activity is made more expensive. Desired goals are achieved as individuals adjust their expenditure patterns to the new prices and attempt to maximize their welfare at any given level of expenditures. More of the socially desirable activity is undertaken because it is cheaper, and less of the undesirable activity is undertaken because it is more expensive. Furthermore, research and innovation are stimulated, because firms now have an incentive to find new ways of eliminating the undesirable practices.

For example, Kneese and Schultze (1975) have recommended the use of a pollution tax in place of current mandatory standards for many environmental problems. Each firm would have the choice of paying for pollution or abating it. The correct pollution tax is the one that would lead firms to voluntarily produce the desired level of environmental quality. Those firms for whom pollution abatement was less expensive than the pollution tax would reduce their pollution. Those firms for whom pollution abatement was very expensive would pay the tax and pollute. In the process, the desired level of overall environmental quality would be reached in a more efficient way than with standards. Over time, costs will decline even more because firms have the incentive to develop new, lower cost compliance methods. The practical aspect of such a problem is not that complicated. Some sanitation districts charge industrial users for both the volume and content of their effluent, which are randomly sampled to determine content, and the results are used to compute each firm's sewage charges.

Performance Standards. Performance standards specify desired outcomes, rather than some intermediate process, and leave the firm free to choose how to achieve the required performance goals. Such standards encourage innovation and the development of new less expensive ways of meeting regulatory goals.

For example, the Code of Hammurabi, some four thousand years old, included a very simple building code which specified structural performance rather than specific design requirements. It decreed that the builder of a house which collapsed killing its occupants

would be put to death. Builders were free to innovate, but at the same time not to be irresponsible.

Tiered Regulations. These would set different regulations for different size firms. The objective would be to reduce regulation's disproportionately heavy burden on small firms. Alternatives may vary from eliminating the paperwork burden for small firms to reducing or eliminating substantive compliance requirements. Smaller firms would be subject to a reduced regulatory burden and would be financially more viable. The contribution of smaller firms to innovation would be preserved.

The SEC currently has tiered regulations with respect to filing requirements. Small research-intensive firms would be further aided by increasing the dollar limits the SEC sets for offerings exempt from its filing requirements. Eased access to risk capital would help to develop these firms' contributions.

Some adverse effects of regulation on R&D and innovation can be ameliorated with procedural reforms, that is, changes in the way regulations are promulgated. This alternative has some potential for improving the environment for innovation, but considerably less than substantive reform.

These reforms might include:

1. Soliciting more input than at present from all interested parties;
2. Reducing the potential for court challenges;
3. Providing exemptions from general regulations for limited or trial applications;

4. Formalizing decision-making processes and specifying the elements of the decision function;

5. Providing sufficient lead time for compliance to encourage innovation;

6. Promoting regulatory mediation; and

7. Holding regulations constant over some time period which approximates the planning horizon of the firm. Obviously, in cases of imminent hazard this could not be sustained. However, in other cases, it gives the firm the certainty that the regulatory ground rules will not keep changing.

Conclusion

I would like to conclude with the obvious, and this refers specifically to legislation involving substantive regulatory reform. The legislative process required to achieve fundamental regulatory reform is political. All interested parties attempt to make their interests known, and legislation is passed when a sufficiently large coalition forms behind some specific proposal. Typically, the proposal will include something for each member of the supporting coalition. The scientific community, in general, and R&D managers, in particular, must make their concerns known to legislators if regulatory reform is to include elements that promote R&D and innovation to the greatest extent possible.

Hopefully some of the suggestions contained in this paper will lead to additional thoughts on the ways in which regulatory reform legislation or procedural reform will advance this goal.

Second Session
Discussion

CHARLES V. KIDD, George Washington University: In your tabulation of cost as being reasonable and excessive and so on, what were your criteria of excessive, and how do you go about sorting these things out?

JULIUS E. JOHNSON, Dow Chemical Company: Well, it is subjective, to be sure, and the criteria are detailed in the appendix of the congressional testimony. I can't give you all the details now, but if you want to see them, we can get them into your hands. We tried, in our own biased way, to lean on the side of conservatism because it is very easy to "cry the blues," as you know.

LILLIAN REGELSON, U.S. Environmental Protection Agency: Did you say that the only regulation, up to now, of chemical innovation has been by FDA?

JOHNSON: No, I predicted two years ago that these would be coming and I think they are.

REGELSON: Yes, I understand they are, but pesticides have been regulated for a long time, and yet, people don't talk about it the same way they do about drugs, and I wondered why.

JOHNSON: Well, pesticides are not the innovative process and have not been regulated in the same way as the innovative process in drugs has. Primarily, the clinical aspect of drugs is very closely regulated, and that's part of the innovative process of R&D. In pesticides, you don't have the risks to man in running the field tests. Therefore, they have not yet backed up into that step of innovation nor have they backed up into the lab, although there will be good laboratory practices implemented. In other words, you can invent and get the product ready to go to the market as a pesticide without going through man, if you have all the other animal data to support it, but you can't with a drug. The FDA understandably stepped into that gap.

RICHARD E. QUINN, RCA Laboratories: Allan, in your talk the only disappointing thing you said was that, "These views are my own and not necessarily those of the government." I wonder if you could predict or guess how many of the things which you described today in regulatory reform, deregulation, and all the rest of the alternatives will be coming about in the foreseeable future, let's say in five years?

ALLAN I. MENDELOWITZ, U.S. General Accounting Office: I think you have to look at the big picture. In the current Congress, there have been over one hundred bills introduced on the question of regulatory reform. In the preceding Congress, there were also over one hundred or one hundred fifty bills introduced dealing with the problem. Some of these bills apply to specific, regulated industries such as bills to reform the regulation of the airlines, the railroads, and the trucking industry. Other bills attack the problem across the board by trying to introduce an action-forcing review mechanism into the process, and into this category fall the sunset proposals. There are broad-based bills, such as Senator Muskie's S-2, which apply sunset to programs across the whole government. And, there are bills that deal specifically with regulation, such as S-600, the Percy-Byrd bill which would sunset regulatory agencies.

In addition, there are efforts to directly address the costs of regulation, such as a bill, recently introduced by Senator Benson, which, if passed, would require an across-the-board reduction of the regulatory compliance costs of 5 percent a year for five years. That is, it is targeted to effect a 25 percent reduction in compliance costs. So there are a tremendous number of bills in the hopper. There is a lot of interest and support. I think there has been some progress, and I think there will be more progress because the problem is not going away.

I also think the direction of some of the reform is moving along the lines I outlined here. For example, the Environmental Protection Agency is currently considering the creation of air rights, essentially a market for pollution. Achieving success is a question of sustaining political pressure. It is a question of building the supporting coalitions.

One of the reasons why regulatory reform has been so difficult to achieve is that everyone is for regulatory reform only when it is discussed in the abstract. I remember going to a conference held a couple of years ago in Washington called, "The National Conference on Regulatory Reform." The kick-off consisted of a debate between Ralph Nader and Milton Friedman, and they literally stood up there and told each other how absolutely correct the other was. Ralph Nader told Professor Friedman how correct he was, and Professor Friedman told Ralph Nader how correct he was. Everyone engaged in a lovefest as long as regulatory reform was talked about in generalities. But, as soon as it gets down to specifics, the coalition

supporting regulatory reform disappears. The coalition disappears, I think, because regulatory activity involves substantial redistribution of income; you can't change the regulatory ball game without taking something away from someone and giving something to someone else.

I think recognition of this gives us some insight as to how to develop regulatory reform proposals, along lines outlined here, that are politically viable. Namely, you have to come up with proposals that essentially compensate in some way those who are going to be hurt. I think the airline bill is typical of this. The two parties who stood to lose from deregulation of the airlines were, first, some small communities which claimed they would lose service if airline regulations were abandoned and, secondly, employees of airlines who had seniority. Since the beginning of airline regulation in the 1930s, not a single trunk line in American aviation has ever gone bankrupt. Falling firms have always been merged into healthy firms and no employees have ever lost job seniority. No investors have ever lost out totally, either. Well, one of the possibilities that appears on the horizon is that individual airlines in a deregulated environment will be allowed to go bankrupt like other companies (including W. T. Grant). The labor unions with their seniority systems are concerned about this possibility because employees in firms that went bankrupt would lose their seniority.

So in order to get legislation passed, the bill now contains provisions for everyone. Consumers will be better off because the price of air fare is coming down with deregulation. There is a guarantee in the bill providing for subsidized service to small communities so that they are sure service will be provided in the coming decade. It is a provision that costs relatively very little in terms of potential dollar expenditures by government. There is a labor protection provision in the bill. That is typical of how you have to go about building coalitions and support for regulatory reform if you want to implement these types of things.

MARTIN J. COOPER, National Science Foundation: Allan, you discussed the use of restrictive standards, the so-called design standards, and their inhibiting influence on innovation. This is an area where R&D can have considerable influence. The alternative, of course, is performance specification. Do you see any evidence that the federal government, in its regulatory actions, is moving toward greater use of performance standards in the areas of procurement and regulatory requirements? There's been talk of it, but the question is, is anybody doing anything about it?

MENDELOWITZ: I can't speak to the question of procurement. I know very little about procurement although I could venture a guess that after the GSA scandal, they might be willing to innovate.

In the area of regulation there are a good number of performance standards. The regulation of automobile pollutants is an intermediate performance standard, and, because it is a performance standard, we see a half dozen ways of meeting that standard. We have catalytic converters which most companies use, but in addition we have other alternatives: Chrysler has a microprocessor which controls the air mixture; Honda has a stratified charge engine; the Wankle engine is still on the market; and use of the diesel engine is growing rapidly. So we do have performance standards. I think there is a growing recognition of their potential.

I must say, though, that I'm under the impression that not all industry and business decision makers like performance standards. If you are given a design standard, and you know that you and all of your competitors have to comply with it, you are all on the same plateau. With performance standards, there is the potential for someone gaining a competitive edge by innovating to meet the regulations. I'm under the impression some people in the private sector don't like this added bit of competition. They don't want to have to worry about how to meet the standard. They want to be told what it is and they'll meet it, and then they will know they are on an even par with all their competitors.

So this is a question which should also be addressed to the private sector. How many people out there are really interested in performance standards? They are great from my perspective. From the perspective of the firm's manager or president who has to be concerned about his firm's share of market profitability, competitive position, etc., they may not always be that great.

GERALD GRAZE, Research Foundation of City University of New York: Dr. Mendelowitz, on the whole, I don't think that the universities are hurt too badly by regulation, but one big problem is the lack of uniformity or standardization among so many different government agencies. Within any one agency you may have a large number of programs. When GAO sneezes, the agencies usually respond. Very frequently when the Investigations Division does a study of equipment inventory, or the like, it is followed six months later by increased regulation. How about having GAO investigate the lack of standardization and uniformity among the agencies, or among the different programs, and perhaps needle OMB to take some stronger action on this score? I think this would have an important effect in reducing the burden of paper work and regulatory work generally for the universities.

MENDELOWITZ: I shall be happy to pass those suggestions along. The conflict that you allude to is a two-part problem. One involves the lack of coordination in requests for information which come from the government to the private sector. I remember last year while giving a talk at the Brookings Institute during

a government-industry seminar, a gentleman from a large corporation stood up and said, "You know we have to file industry data with three different agencies. We have to file with the Department of Commerce, the Federal Trade Commission, and with the Securities and Exchange Commission." He went on to say that all three request similar data, but they request it according to different industry definitions and at different levels of aggregation. "So," he said, "We have to start from scratch every time we supply data. We can't even aggregate up from the lowest level of aggregation to the highest level of aggregation for data desired because of different definitions." And he said, "How come?"

So, I looked into it. It turned out that the Department of Commerce's requests for information had to be approved by the Office of Management and Budget. The Federal Trade Commission's request for information and their forms must be approved by the General Accounting Office. And, the Securities and Exchange Commission, because it believes the operative law does not apply to it, doesn't file its forms with anyone. The GAO is on record as recommending that the entire approval process be consolidated into one centralized operation and turned over to OMB; this also would apply to the Securities and Exchange Commission. So, we are doing something there.

The second type of problem, I think, deals with a much more fundamental problem of overlap and conflict in regulation. You know all the stories. The OSHA inspector goes into an animal slaughter house and looks at the tile floors which are nice and shiny and slippery and says, "Listen, you can't have these floors because every time there is blood on the floor your workers in the slaughter house are going to slip, fall, and hurt themselves. It's too dangerous. You have to have some kind of rough floor." So the slaughter house was equipped with a rough floor. Then the Animal Plant Health Inspection Service inspector came in and said, "You can't have this rough floor. It's not sanitary. It is impossible to sanitize it. You have to have a smooth, shiny floor." This problem really is not the fault of the bureaucrats. This is a fundamental trade-off problem between different policy objectives--on the one hand, the objective of pure, safe, and clean food and, on the other hand, the safety of workers. Unfortunately, in this area, there is not much that can be done at any level other than Congress, when it comes to policy conflict and overlap.

GRAZE: I would suggest that though the examples you give are valid for certain industrial situations and certain university situations, a real examination would show much, much unnecessary variation among the agencies, particularly in the mechanical aspects and even also in policy questions. I think it warrants some GAO time and effort.

MENDELWITZ: I will be happy to pass it along to the appropriate, responsible authorities.

WILLIAM P. RANNEY, National Aeronautics and Space Administration: I find myself left somewhat confused by the following situation. There is a materialistic view that says, "If the price is right, industry and other commercial enterprises will obviously follow right along with the price forcing function." So a very major part of our regulation is to make people do certain things which they would not do if they stuck only with the materialistic push of having the right price. You are warping the system away from the free search for profit. I therefore find it a little confusing among the several options for deregulation to find two or three categories which essentially said, "Well, we'll diddle the price. And if we diddle the price by taxes, fees or selective relief from costs in the regulation business, then obviously good things will happen." I've never been able to understand why people thought that right things were going to happen just because the price was right, when the whole basis for regulation is that the right things aren't happening just because the price is right.

MENDELWITZ: I'm happy you asked the question. I think that the confusion is tied to the extent to which private costs and societal costs do or do not coincide. When a firm uses the environment as a garbage dump, it uses up a resource, the environment, and it imposes costs on other people. For instance, if I live in a community where there are a lot of firms with nonscrubbed smoke stacks, burning high sulphur coal or whatever, I may find myself washing my clothing more often because they get dirty from the airborne dirt. I may find myself painting my house more often. I may also find my health impaired. The cost to the firm of production is less than the cost to society of production because society bears the cost of the environmental degradation. The firm does not. When you have a divergence between private cost to the firm and the real resource cost imposed on society by the production process, you can improve the situation by raising production costs to the firm to reflect the environmental damage. This is a situation where the price system does not give the right signals because there is this divergence between private and societal costs. This situation is what is known as a market failure. The intervention that is recommended in the case of environmental damage is to require firms to pay for their pollution so that private costs and societal costs coincide. Firms will then have a natural incentive to lower their pollution. In areas where private costs and societal costs coincide, you would not want to tinker with prices because firms should be making the right decisions to begin with.

COOPER: Chuck, you made an eloquent plea for more rational consideration of research, particularly on university campuses. The new Department of Health, Education and Welfare NIH guidelines for genetic engineering, so-called DNA research, has pushed the responsibility for oversight onto the research

performer. At this point in time, it means an added problem on college campuses. Would you care to comment on this approach and, in particular, on the adequacy of the universities to assume this burden?

KIDD: Among the obligations of universities, I think that more effective self-regulation is high on the list. The capacity to act competently on these matters of social interest is the price universities will have to pay if they are going to avoid detailed governmental regulation. Therefore, the return to the campuses of responsibility for recombinant DNA, etc., I regard as fundamentally good. It poses a challenge to the universities which I imagine they will be able to meet as they met other challenges of this kind. I imagine there will be a sort of normal curve on this thing. The great bulk of the universities will do a competent job. A few on the upper tail will be superb, and you will probably have some well-publicized failures. Biologists aren't as aware as M.D.'s sometimes of the trickiness of biological experiments. We've had examples in the past in California and elsewhere where people have been a little careless. But I think it is a job of real education, and universities must recognize the significance of the problem and deal with it themselves. I think on recombinant DNA we managed to avoid a really serious error in national policy, and that was to legislate the content of safety standards and in effect begin down the path of control of research by the federal government. But the price, I think, is competence in the universities.

NILS Y. WESSELL, Alfred P. Sloan Foundation: You made reference in your remarks to the need for review of government-university relationships and some passing reference to a commission. I want to make sure that the audience is aware of the fact that there is such a commission in existence, sponsored by the Sloan Foundation, under the chairmanship of Louis Cabot of the Cabot Corporation in Boston. Carl Kaysen is the full-time staff director of the commission. It consists of about twenty-five individuals of considerable stature, the great majority of which, I might add, are not from the academic community although the academic community is well represented. The commission has been in existence for about a year. It will have another year or year and a half to go. We have appropriated \$2.5 million for the work of the commission as evidence of the earnestness of our concern for the problem.

The commission's goal will be to produce a series of public policy recommendations having to do with what the commission believes to be improvements of the government-university relationship. I mention the existence of this commission not to suggest that all of you from the universities need only sit on your hands and wait for its recommendations. On the contrary, I mention it in the hope that those of you with a concern, with suggestions to make, with problems to describe and

communicate to the commission, will do so. It has offices in Cambridge. I'm sure the commission and the staff would be anxious to have information from you, and may even invite you to appear at its meetings or at least at staff meetings to communicate further with the commission.

KIDD: Thank you. I should have mentioned the Sloan Commission which is indeed very important. They have already produced excellent, usable results. The article in Science, which I mentioned, was the consequence of one Sloan financed self-examination in universities. There were twenty-one others. They constitute, in my judgment, the best assessment, thus far, of the effect of regulation on specific universities. I agree also that this is a process that will probably take years. We have something with tremendous bureaucratic inertia to reverse, and I would imagine it will take a number of initiatives from different directions to bring about a situation that I would consider more normal and productive.

KENTON W. ZARHT, Planning Consultant: The universities are themselves a regulatory agency in the sense that they govern the standards for the Ph.D.'s whom they send to the government agencies and to Congress to interpret and analyze and make recommendations about what ought to be done. My question is, "Are the universities themselves giving thought to this problem of the increased numbers of 'experts' they are sending out to solve the problems of our government?"

KIDD: I don't know whether it is adequate or not, but certainly the work of the schools of business, the schools of public affairs, and the departments of economics and political science is producing numbers and quality. I have a prejudice on that. I think the young people are better trained now than they have ever been, but that is an arguable point.

DONALD L. BAEDER, Hooker Chemical Corporation: The Dow Chemical Company, as has been mentioned, has made a real attempt to quantify the cost of regulation and the amount of unnecessary regulation. I personally think this is a very good way to go. If the costs of regulation are really mounting in the university, it seems to me it would be worthwhile for the universities as a group to try to get together to quantify them, so that the taxpayers can begin to know what the real costs of regulation are in the education of our college trained people.

I would encourage all of my colleagues in the industry to do the same thing that Dow did. And, I hope there is a ground swell in industry to really begin to generate what the costs are. I can tell you right now, for example, that just the investment capital in our own corporation for meeting regulatory requirements is running about 8 percent per year. That has to be one of the major contributors to inflation.

KIDD: Eight percent of what? Of your sales?

BAEDER: No, 8 percent of our capital which runs maybe one third of the sales per year. But it must be a major factor in inflation of prices within the industry because these costs have to be passed back in the competitive system that we are in. But, I have a feeling that it is difficult for the public to understand the trade-offs that are involved here unless they know what the real costs are.

KIDD: Yes, I think you are right. I may have been wrong in saying that that can't be done or shouldn't be done. Universities should probably do more of this, even if only on a minimum basis, to indicate the true cost which is staggering.

MENDELOWITZ: I'd like to speak on that point. I got started working on regulations three years ago by critically evaluating the \$130 billion estimate of the cost of regulation, and I do want to introduce a note of caution here. One is that it is very difficult to estimate the cost of regulation, and there are no dollar figures that are really good measures. Some costs are quantifiable--administrative and compliance costs--but a big chunk of the real costs are not.

Secondly, the methodology for estimating the costs varies. I have passing familiarity with the method used by Dow, for instance, and I would consider a major part of the process that they use in coming up with their figures to be inappropriate. On that basis, I would disagree as to the usefulness of the numbers they came up with.

When you talk about regulatory costs adding to inflation, there is something you have to bear in mind, and that's that while regulation in the aggregate may not be efficient (it may be a costly way of getting where you are going.), you do get some things in exchange for a big chunk of the regulations. I don't want anyone to interpret this as a defense of any particular regulation or regulatory activity. I'm talking in terms of the aggregate. And, one reason why it appears to increase the rate of inflation is that it is the result of a statistical artifice. The national income and product accounts and the consumer price index are not exact depictions of what's out there. They are estimates and there are defects in them. One of the defects is that the benefits of regulation and the costs of not regulating don't show up. So you don't really get the full impact of regulation by saying, "This is what regulation costs and this is what it did to inflation," without taking into account the benefits associated with regulation when there are benefits.

ANTHONY P. SIMKUS, U.S. Army Research Office: I would like to talk about Public Law 95-224. All the services are trying to find a simplified type of contract with respect to universities. One of the big things in that legislation is the requirement concerning grants and contracts that you

declare yourself, whether you are acquisition or assistance on some of these grants. I think we are going to shift away from the grants into a very simplified contract, perhaps by next year. It follows the Navy's basic ordering agreement concept, and all three services, I think, are going to agree under DOD on a concept that will make it easier for the universities. Another thing we are doing is placing some of the responsibility of management with the universities and letting you provide that service for your campuses.

CHARLES G. DARRELL, Naval Ocean R&D Activity: I'd like to comment on that from the Navy point of view. Earlier this morning we commented on mission-oriented research as opposed to fundamental or basic research. The mission-oriented research serves the taxpayers' purpose in that we go to Congress to justify that research, but it is mission research. We are probably better off with a contract than we are with a grant because then we get what we paid for. The Navy spends a lot of effort on staffing the Office of Naval Research with respected members of the scientific community so that we do do that.

BAEDER: I would like to carry the dialogue a little further on this cost-benefit. I agree that it is very difficult to make these kinds of analyses. But, if you have some questions about the approach that Dow is taking, I would urge you to put them in writing because I'm sure that Dow and the rest of the industry is interested in developing a creditable way of measuring this.

By the same token, I think it is very essential that we begin to quantify benefits. I think it is dangerous to say there are benefits without being pushed to try at least to quantify them, because I think we are dealing in most cases with compromises that have to be based on some judgment of cost-benefit to our people.

NORMAN WAKS, The MITRE Corporation: I'm sure the methodological problems are largely common to industries and universities. In addition to measuring these things in terms of the cost and the benefits, I think we should be measuring and comparing the cost to whom and benefits to whom and see if those two relate to each other. I know the Department of Commerce in their study is beginning to accept that notion but do not, according to correspondence with me, know how to implement it. The real trick, after you have measured cost and benefits, is to try to bring together some subjective way of finding out who gets the benefits and who bears the cost--those may be entirely different things. The greatest benefit may be great because you don't have to pay for it.

MENDELOWITZ: I'm not familiar in detail with the Dow study but there are several aspects about the methodology that I question. One is that they included, as a cost of regulation, all costs associated with regulation irrespective of whether the firm would have

voluntarily undertaken any expenditures in that area without the regulation. There are areas--health, safety, environment, etc.--where industry voluntarily spent funds to pursue objectives later specified in regulation. I think it is inappropriate to lump together all expenditures associated with regulation. I think the appropriate cost would be the incremental cost associated with regulation, that is, the difference between what the industry would have spent without the regulation, and what they do spend because of the regulation.

The Business Round Table is currently undertaking a study of the cost of regulation, which is being supervised by Arthur Anderson & Co. They have some thirty-five or forty firms associated with the Business Round Table which are taking part in an effort to quantify in a single year the cost of regulatory compliance in some areas in those firms. They worked out a methodology whereby they allow only the difference between what the firm would have spent and what they did spend.

Secondly, the Dow methodology allowed no provision for subtracting from regulatory costs any cost reductions associated with regulation. And we do have some, for example, in the case of PVC, production costs decreased because less of the product involved evaporated into the air due to steps taken to protect the workers.

Another area I questioned was the appropriateness of including in the current cost of regulation, all the capital expenditures made in the year of the study. If I understand it, there is no depreciation in the Dow methodology. Whatever was spent by the firm for capital acquisitions, for the year in which the study was made, is included as the capital cost of regulation. If it turned out that it was a year in which there was an abnormal amount of capital purchases, pursuant to regulation, the capital cost of regulation would be overstated. If it is a year in which there is an inordinately small amount of capital accumulation associated with regulation, then the capital cost would be understated.

Finally, any firm engaged in business directly tied to selling products to other firms, necessary to satisfy their regulatory requirements, should subtract from the firm's cost of regulation any supra-normal profits from these regulation-related activities.

JOHNSON: I think you will recall that I complained mostly about the excess and not about the base, which we considered an appropriate part of social costs. On the first point you made, until the entire industry is involved, you can't single out a company and criticize them for including it because all others who have not incurred the same cost have a free ride for that particular point. Once it is an industry problem, then maybe your point is valid.

On the subtraction of benefits yielding therefrom, at this stage, I don't think we subtracted benefits in this equation. Maybe later on in the refinements of this we should

do so. But, I think, at least the approach is a start, and the incorporation of this methodology by Arthur Anderson is a refinement. I think we can improve this to a point where, relatively, it will have some meaning. We don't make a big claim for the precision of the original study. But I don't agree on your first point, as long as industry acts voluntarily.

KIDD: I think anyone working in this field knows how tricky and difficult these estimates are, and I think Dow is to be applauded for making a pioneering effort. I'm also sure you will run into trouble with the concept of methodology, but that is something which can be profitably worked on.

MENDELOWITZ: Yes, I would like to second that. I didn't mean to denigrate it as an effort. I think it is desirable, and I'm the last one to complain about efforts to quantify the costs and benefits of regulation. All I was trying to do was to introduce a note of caution which said, "This is only a start so don't take the number and run with it."

RANEY: Charlie Darrell talked about the Defense Department initiatives to deregulate basic research that is done in universities. Jordan Baruch said something about the Mansfield Amendment, which misstated the force of that regulation. He said, in effect, that all work done by the Defense Department had to have a direct relationship to a military function. That, in fact, was essentially the language of the original Mansfield Amendment which lasted approximately one year, at which time it was replaced with other language in the bill and still stands. Other language in the bill says that all research supported has to have a potential relationship to a military interest.

But Jordan's version, which was the original one, still stands in the minds of many in the Defense Department and in much of the academic community as the operable requirement. There are various side effects of this particular "regulation" which are really no longer appropriate, but they still exist. There is a general feeling in the academic community, from their mistaken reading of what the appropriate regulation is, that the Defense Department cannot be interested in things that do not have a direct and easily traceable connection to a military operation. This, in the minds of most people who thought about the problem, constitutes a real cost to the proper performance and good relationship between the university research community and the Defense Department, because half of the younger members of the academic community seem to be turned off and scared away and assume that the Defense Department isn't interested. That, I think, was never contemplated by the people who put out the original regulation, if you want to call it that, but it is a very real problem.

As I said, the original perception still persists in much of the Defense Department as well. What has happened in the intervening

years is that a considerable bureaucracy and set of bureaucratic procedures have been built up in order to be able to demonstrate compliance with that sort of guidance. During the past couple of years, there have been at least two advisory bodies which have advised the Defense Department that that is counter-productive because it's been too tightly managed. The result is that there are serious attempts going on in the Defense Department to deregulate and to try to get away from point-by-point compliance with a regulation that is no longer in force. It's hard to walk the cat back particularly when that particular regulation was not something that was alien to the general way of doing business in Defense Department acquisition.

I think there are a lot of ways to try to work around either the real requirement of the perception of the requirement, and some of those are going on. The procurement business is an example. The new procurement law gives people in the Defense Department a choice of saying they are doing acquisition, which is not really appropriate for basic research, or that they have an assistance program, which is not really appropriate for basic research sponsored by the Defense Department, because the goal, indeed, is not assistance to the academic process. Given a choice of two things which are not quite appropriate, the question is, "How do you thread your way through these inappropriate choices?" We are trying to put together a common contract instrument which is flexible enough so that it doesn't have the undesirable characteristics of a straight military procurement but also doesn't have the inappropriate appearance of being an assistance program. And I think if other people really want to try to work with the system and yet find a way in and around several options, no one of which is really quite right, it can be done.

Now, to try to deregulate the conduct of the Defense Department's research program

really takes people of considerable quality, who can keep their eye on what the fundamental job is rather than what the latest set of written guides, which are never very complete, may say. To do that properly costs a lot of money because they have to be high quality people and they have to be paid well.

I guess my point in bringing this up is simply to point out that to do a proper job in regulation, in working around and through regulations that are inappropriate, is going to cost some money. There is no way around it and you have to make up your mind that it is going to cost money, but the cost, hopefully, will be well worth it because if you fail to do that, the costs are even greater. Trying to quantify those costs is almost hopeless. But it gets me back to the earlier remarks that the universities are being made to bear all these costs, and it really is inappropriate. I tend to agree, but in order to carry that argument forward and to make it look like more than just a complaint, because all of a sudden new costs are being added, there has to be some way to think through the business of what would be the social costs if the universities, in fact, were not doing the things they have been told to do. That ignores the business of whether they are appropriate or too complex. To make a clean argument about where the costs to society should be allocated, again we get back to the business of, "What are the social costs?" Society is paying anyway because of too many people on welfare, too many missed opportunities to be competitive in the international environment, etc. And society is going to have to pay something to avoid those larger costs or to get over paying them. Should they be dumped on the Congress? Should they be dumped on the universities as they are now? It seems to me that one has to explore a little more broadly where the costs should be assigned in society before we make a complete argument about whether it is appropriate to have them show up in university budgets.