MEETING ON ALTERNATIVES TO TRADITIONAL REGULATION

INFORMATION AS REGULATION

by

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EXECUTIVE SUMMARY

1. Governments are increasingly turning toward information provision as a form of regulation. The impetus for this stems from the recognition that many economic and social problems arise from informational inadequacies that impede decisions -- in these cases, information can be a legitimate and effective regulatory tool. As the range of circumstances in which government intervention is potentially desirable continues to expand, more attention will be devoted to informational regulations as an intermediate policy option.

2. Drawing from case studies on how information has been used in the United States to reduce the risk of harmful chemical exposures and to promote energy efficiency, this paper finds a number of advantages and disadvantages with respect to informational regulations. The chief advantages stem from the ability of information to assist in the making of decentralized decisions, particularly in circumstances in which there is heterogeneity. Informational approaches may be best when there are differences in preferences (some people, for example, prefer soft drinks that are low in calories), or differences in effects (only pregnant women need to worry about the effects of alcohol on a fetus). Properly designed, informational efforts can help people make sound decisions in their day-to-day lives, eliminating the need for more intrusive forms of regulatory intervention.

3. Possible Advantages of Informational Regulations

1. Information can influence decentralized decisions that cannot be readily monitored and regulated.
2. Information is an intermediate policy option that may be more feasible from a political standpoint.
3. Information accommodates heterogeneity, such as differences in willingness to bear risk or differences in susceptibility to risk.
4. Information directly addresses market failures arising from inadequate knowledge.
5. Information that provides new knowledge, as opposed to information that reminds people of existing knowledge, can significantly influence behavior.

4. Possible Disadvantages of Informational Regulations

1. The information transfer mechanism needs to be sufficiently effective to ensure that the information is received.
2. Unless care is taken in the content, design, and format of the information provided, it may not be adequately processed.
3. Special care must be devoted to communicating complex knowledge, such as that involving probabilities and long-term effects.
4. Even with effective information, some recipients of the information will choose to ignore it. If doing so leads to substantial losses, more direct regulation may be warranted.
5. Proliferation of information efforts and large amounts of information may lead to information overload and label clutter.
6. Uniformity in the informational vocabulary is preferable to diversity, which may impede people's ability to make relative judgements. This concern is particularly important for products traded internationally.
7. Diverse information requirements may be much more costly than uniform requirements for mass-marketed products.
8. Uncertainties regarding individual responses to information require care and, in some cases, pre-testing in the design of the information program.
9. Overwarning is a potential danger.
INFORMATION AS REGULATION

I. INTRODUCTION

5. Increasingly, governments are using information as a form of regulatory intervention. They are doing so, not simply because they wish to diversify the instruments of government intervention, but, rather, because there are sound economic and policy reasons for using information as a regulatory tool.

6. One factor supporting the use of information as regulation is that other regulatory tools such as command-and-control approaches can be unworkable or impractical in certain situations. For example, the nature of certain behaviors may be such that direct regulation is not feasible. If we are attempting to increase the precautions that workers take when using hazardous chemicals, we can impose regulations directly on their behavior, but compliance with the regulation in their day-to-day work schedules will be difficult to monitor. An alternative possibility is to provide workers with information giving them an understanding of the risks of being exposed to the chemicals, and allow the workers to choose to exercise appropriate precautions in their own interests, even though no regulatory official is monitoring their behavior nor forcing them to take precautions.

7. Political, as well as practical, feasibility can also support the use of information as regulation. Informational regulations are generally viewed as an intermediate policy option. They lie between the regulatory alternatives of taking no action whatsoever, on the one hand, and on the other hand of intervening directly, such as by banning or prohibiting particular activities. The rationale for the intermediate course may stem from uncertainty regarding the consequences of the activity. We may not have sufficient information to ban an activity, but there may be enough scientific evidence about potential harm to warrant the provision of information. This might be the case, for example, with respect to newly-discovered carcinogens.

8. Another variant on this theme is the situation in which the consequences of an activity are well known, but the extent and severity of harm varies. Among the gradations of harm, we may wish to prohibit only the most risky extremes. Light drinking, for example, appears to cause no substantial adverse health effects -- in fact, some studies suggest that it may be beneficial. On the other hand, heavy drinking can pose substantial risks, particularly when combined with operating motorized vehicles. Providing information about alcohol abuse can enable people to better make these distinctions as they choose to restrain their alcohol consumption. In the same way, differences in preferences and in susceptibility can also be accommodated through an informational regulation.

9. The nature of the information provided, and its role in changing behavior, depend on the context. In some cases, information is intended to deter participation in an activity or consumption of a product by groups that might be at risk. Information can also be used to influence the quantity of the activity or product that individuals consume, if they choose to participate in this activity. A third role of information is to influence the precautionary actions that individuals may take with respect to their decisions.

10. In every case, the impetus for government intervention should be the existence of some kind of market failure. Information is closely linked to two kinds of market failures. First, individuals often lack full knowledge with respect to the decisions they make. Informational regulations address these
inadequacies directly by filling in the gaps in their knowledge. Second, information has well-known properties as a public good. Incentives to generate information are inadequate because the party providing information generally cannot reap the full economic gains generated by it. As a result, there is a market failure rationale for the government to assume a role in acquiring and disseminating information that benefits the public.

11. Governments considering the use of information as a form of regulation must confront a variety of issues before proceeding:

- First, is there a rationale for informational regulation? What is the particular inadequacy in the working of the market that the information will address?

- Second, what are the objectives of the information programme? Ideally, the purpose should be to foster sounder decisions and more efficient behavior. If the objectives instead are formulated in terms of, for example, discouraging consumption of a particular product as opposed to allowing consumers to make sound decisions with respect to consumption of that product, there is the possibility that the information will be distorted to achieve a policy end rather than to provide sound and accurate information.

- Third, who should provide the information? Because a government regulates the provision of information does not imply that the government should also be the provider of the information. The government might, for example, establish standards requiring that third parties provide information to consumers. Alternatively, the government might review and specifically approve the information provided, that is, provide a quality control function.

- Fourth, what should be the nature and content of the information provided? Do we rely on hazard warnings, such as those on product labels, which appear to be the most prevalently used form of information? Alternatively, do we undertake a public education campaign and require that individuals undergo training and testing (as in the case of certification of drivers and certified pesticide applicators in the United States)? When information is provided, to what degree do we stipulate the content and format of that information? These distinctions are important because of individuals' cognitive limitations. As the subsequent review of informational programmes will indicate, limitations in the ability of people to process information requires that information be structured in a manner that can be processed efficiently.

12. In this paper, I review the most salient policy issues with respect to the use of information as a form of regulation. What do we know about the general principles for informational regulation? How can we apply these principles to other contexts? As part of this study, I examine two case studies. The first case study deals with information provision with respect to different chemical hazards, and the second case study pertains to information provision with respect to energy efficiency.

13. The organization of the paper is as follows. Section 2 outlines the rational for informational approaches, the advantages of information provision, and the potential drawbacks of informational regulations. Section 3 presents a case study on the health hazards of chemicals, which has been, in the United States, the policy area where there has been perhaps the most extensive provision of risk
information. Section 4 considers information provision with respect to energy usage, and Section 5 concludes with a summary of the lessons learned for the design of informational regulations.

II. ISSUES IN THE DESIGN OF INFORMATIONAL REGULATION

The Informational Linkages

14. The overall purpose of informational regulations is to foster better decisions by people in their daily lives. In some cases, the objective is to provide knowledge with respect to potential adverse consequences so that people will exercise appropriate care. Many informational efforts are directed at informing individuals of the risks associated with activities. Other informational programmes are not aimed at risks but instead are intended simply to promote better decisions. Providing consumers with information regarding the mileage rating and fuel efficiency of automobiles is one such type of information. The objective here is not to discourage the purchase of automobiles, but rather to promote an understanding of the fuel efficiency quality characteristic of the particular car so that individuals will make the appropriate choice given their particular circumstances and preferences.

15. Figure 1 below illustrates the linkages involved in the regulatory process. The first link is the provision of information, typically either by government administration or by businesses. This information in turn must be received, processed, and incorporated within the context of the individual’s current knowledge for it to be of any consequence for individual behavior. These links are critical since the information may not reach the intended recipient, or if it is received, it may not affect the recipients’ judgements regarding the consequences of a particular product or activity. Based on the information received, the individual then forms an assessment of the expected utility or welfare level for the different activities, based on the degree of participation in these activities and available precaution-taking options.
16. The individual must then decide whether or not to use the product or engage in the activity. If the individual chooses to pursue the activity, there is an additional informational loop — that is, there must be a choice with respect to the nature of participation in the activity. The diagram illustrates the situation where an individual has a choice between taking precautions and not taking precautions. In many instances, the choices may be more continuous (for example, one can choose the degree of energy efficiency of a home appliance) and will not be restricted to a simple yes-no choice such as this. Based on whatever actions the person takes, there will be some experience with the product or the activity. This experience, together with the knowledge the individual brought to bear initially, will determine the individual beliefs that will form the baseline for subsequent decisions made with respect to the product. These beliefs in conjunction with new information that the individual receives will then govern subsequent behavior.

17. Because of this series of linkages in the system, information will tend to have a long-term effect on behavior. It will influence not only individual perceptions but also the subsequent experiences that are generated. Each of these in turn will influence the baseline information brought to bear on subsequent decisions.

18. Consideration of these diverse linkages in the information processing system highlights the various ways by which a government regulatory effort may fail to have its intended effect. Individuals must receive information, process it, and incorporate it in their risk judgements. This task appears relatively straightforward, but in practice it has proven to be difficult. In many instances, individuals do
not receive the requisite information even though an effort is made to provide it. They may simply not read warning labels on products. In other instances, even if the information is received, they may not revise their judgements or alter their behavior.

19. In such cases, two pivotal principles appear to apply. First, for information to have value it must be new knowledge as opposed to the simple repeating of existing knowledge in an effort to browbeat individuals into changing their behavior. The second principle has more general implications: information must be provided in a form that can be processed, given the cognitive limitations of individuals. In the extreme case, if individuals had unrestricted information processing capabilities, one could provide them with complex scientific information and rely upon them to simply process it and form sensible judgements. In practice, the task for providers of information is to structure the information in a way that can be understood and processed in a much more expeditious fashion.

20. This is not easy. Two major impediments to information provision arise from individuals’ limited cognitive abilities. The first problem is that of "label clutter." If too much information is provided on a warning label, then individuals have difficulty in processing the information. A related problem is that of "information overload." As the warning labels used for different products proliferate, then it becomes more difficult to make distinctions regarding differing degrees of riskiness. If all products are labeled hazardous, then there is no informational content to these warnings. Consequently, it is essential to provide information in a manner that will promote sound relative judgements across the different contexts in which we wish to provide information.

21. The structure and format of the information often proves to be of significance. Antidote information that appears at the bottom of warning labels for hazardous chemicals is seldom read by consumers until after they have experienced a product-related injury (Magat and Viscusi, 1992). Similarly, as will be indicated below, changes in the format of the information that may appear to be inconsequential with respect to label content may in fact have important implications for people’s ability to understand and incorporate the information. Print size, boxes surrounding a particular warning, color, and other aspects of the warning label may be of consequence in particular circumstances. The importance of such efforts should not be overstated, however. Once the information has achieved a sufficient degree of readability, there appear to be very limited effects of increases in print size and related measures on people’s ability to understand the information presented (Magat and Viscusi, 1992).

22. Informational regulation is one of the few regulatory contexts in which standardization is desirable. Economists frequently advocate performance-oriented regulation to give firms the leeway to find the least-cost approach for reaching the regulatory objective. In contrast, harmonization of regulatory format and vocabulary is highly desirable if people are to make reasonable judgements about the information provided. Use of hazard warning symbols, such as for poisoning or radiation, and hazard warning language pertaining to "caution," "warning," and "danger" should adhere to a uniform vocabulary. In the absence of such systematization, warnings in one context may have a different meaning compared to similar information provided in a different context. This can make it difficult to form reliable judgements. Such concerns may be particularly important with respect to products that are traded internationally. Establishing a common vocabulary for conveying information and having a uniform reference point for hazard symbols may be the most important international policy issue for informational regulation.
23. Even if information content and format are standardised, it may be the case that mechanisms for information provision differ substantially from country to country. Regulators can use multiple informational mechanisms. In some cases, for example, pharmaceutical products and other drugs are accompanied by patient package inserts or warning labels indicating the risks and uses of the particular product, and consumers are free to make their own decisions with respect to product usage (Peltzman, 1987). Other countries have a mandatory prescription requirement whereby a physician must prescribe the drug for it to be used. In this latter case, there is both a learned intermediary in the form of a physician, supported by information that can be used to foster sounder decisions.

**Evidence on Receipt and Processing of Information**

24. In many information provision programmes, individuals unfortunately do not receive or process the information. A study of individuals' recall of labeling information on sodium content in foods (undertaken for the U.S. Food and Drug Administration by Heinbach (1983)) found that only one-fourth of the individuals surveyed were able to recall that sodium content was listed on a product. Perhaps even more striking was the finding that only 40 percent of all of the individuals surveyed could recall having read any ingredient listing for food products even though such lists were required by regulation.²

25. There also may be difficulty in understanding the content of the information provided. Experience with early nutrition efforts documented in the study by Lenahan, et. al. (1973) found that only 15 percent of the consumers surveyed comprehended nutrition labels and fewer than 10 percent utilized this nutrition information in making decisions. Similarly, Heinbach (1981) found that individuals had difficulty dealing with quantitative information provided on the nutrition labels, particularly that dealing with percentages and ratios. Technical nutrition terms such as "polyunsaturated fat," "hydrogenated," and more widely used terms such as "carbohydrates" appeared not to be well-understood. Perhaps because of these limitations, subsequent nutrition labelling efforts in the United States have made a greater effort to foster the use of formats and vocabulary that could promote more general understanding of the information provided.

26. Another potential mechanism for providing information to consumers is not to have an on-product label but rather to have a point-of-purchase display. The study by Russo, et. al. (1986) yielded intriguing results regarding the impact of point-of-purchase displays on consumer behavior. Comparative product information regarding beneficial product attributes, such as positively valued nutrients, appear to have little effect on consumer purchasing behavior. However, information on undesirable product attributes, such as the amount of sugar added to breakfast cereals, was processed by individuals and incorporated in their purchasing behavior. This study suggests that whether or not the information is processed depends in large part on the degree to which consumers believe that the information is important for their decisions.

27. Findings with respect to patient recall of prescription drug information are more favorable. A study by Kanouse, et. al. (1981) examined the degree to which patients were able to recall information on patient package inserts accompanying prescription drugs. Overall, they found that 69 to 74 percent of the individuals surveyed indicated that they had read the leaflets. However, because individuals may rely on physicians as their primary source of information, failure to reach 100 percent of drug users may not necessarily lead to erroneous decisions. Other evidence in Morris, Mazis, and Gordon (1977)
indicates that 88 percent of the users of oral contraceptives claim to have read the patient package insert, though the level of recall of the insert information was considerably less impressive.

28. American consumers also appear to exhibit partial, not complete, information processing with respect to aspirin warning information. Morris and Klimberg (1986) found that about half of all consumers process the risk information on the aspirin warning label. Over half of the individuals surveyed were aware of the contra-indications against using aspirin for flu, and 40 percent could recall a warning about Reye's syndrome without any prompting.

29. Experience with respect to cigarette warnings has been particularly instructive. The potential hazards of cigarettes are well-known, as 99-100 percent of all individuals surveyed indicate that they have heard "cigarette smoking is dangerous to a person's health" and that "cigarette smoking will most likely shorten life." (Viscusi, 1992b) This awareness contrasts with the situation existing before the U.S. government undertook an informational campaign on cigarettes. In 1958, under half (45 percent) of all individuals surveyed believed that cigarette smoking was one of the causes of lung cancer. The first wave of informational efforts took place in the 1960s, including a 1964 government report on the lung cancer risk of smoking and the advent of cigarette warning labels in 1965. By 1969, awareness of the lung cancer risks of smoking had risen to 70 percent, and this figure rose to 81 percent by 1977.3

30. Awareness that smoking is risky does not necessarily mean that the degree of risk is well understood. However, evidence suggests that there is also, in fact, widespread awareness of the degree of the hazard posed by smoking. Based on the range of scientific evidence, the total estimated mortality risk from smoking ranges from 0.23 to 0.46 (that is, the chances that the average smoker will die from smoking-related diseases lie between one out of five to almost one out of two). But individuals surveyed believe that the risks are even higher -- that 43 out of 100 smokers will get lung cancer because they smoke and that 54 out of 100 smokers will die of some smoking-related cause.4 Perceptions of the effect of smoking on life expectancy (that is, the extent to which life is shortened) also exceed the estimated effects. These risk perceptions have greatly influenced smoking behavior. Whereas formerly the majority of the adult population in the United States smoked, at present the figure is now below 30 percent. Per capita cigarette consumption in the United States has dropped to its pre-1950 level, over 40 percent below its peak level in the 1970s.

31. Similar kinds of patterns were exhibited with respect to the market effect of warning labels for saccharin. Evidence of tumors in rats based on a Canadian study of saccharin led to the imposition of a warning label for saccharin-containing products beginning in 1978. A study by Schucker, et. al. (1983) found that the average annual growth rate in diet soft drink sales from 1975 to 1977 was 17.2 percent, and this growth rate dropped to 1.8 percent in 1978. Since Nutrasweet was not yet on the market, saccharin was the sweetener used in these diet products. In contrast, sales of regular sugar soft drinks continue to grow at a steady annual rate of 3 to 6 percent, suggesting that the information provided led to a stark shift in consumption behavior. A subsequent study (Orwin, Schucker, and Stokes, 1984) found that the most influential factor was the media coverage associated with the risk of saccharin. Media publicity pertaining to saccharin risks accounted for a 17 percent drop in consumption, as compared with a four percent decrease in consumption attributable to the warning label per se. Although it is often difficult to distinguish the different influences at work, particularly when they work simultaneously, these results suggest that one's conception of the role of information should not be restricted to on-product warnings but should also encompass broader informational efforts.
32. An early view in the literature was that informational regulations were not effective. This view, however, was based largely on case studies in the United States in which the information provided was not new knowledge. Two examples in this vein included information provided to consumers about electrical hazards, and a campaign to encourage automobile safety belt usage (Adler and Pittle, 1984). The basic difficulty is that these programmes did not provide new knowledge but were intended simply to remind consumers about appropriate courses of action. In contrast, information regarding appropriate measures to reduce the risks of heart disease (Adler and Pittle, 1984) as well as other hazard warning information that provided new knowledge have been found to play important roles in influencing risk judgements (Viscusi and O’Connor, 1984).

Information Costs

33. Unlike most regulatory situations, the cost of informational regulations is not generally a critical concern. Providing information through public information campaigns is generally relatively inexpensive, as are on-product warning labels (although training programmes and other ancillary activities associated with warnings may be quite expensive).

34. Difficulties arise, however, when there is no standardization of information. For example, in the United States, a number of different states were independently considering the implementation of hazard warnings for food and other products about the risks of carcinogens and reproductive toxins. Unique warning requirements in each state would have required not only multiple printings of labels but also separate warehousing and distribution of products, which could have imposed considerable costs on affected firms in industries with regionally or nationally marketed goods.

35. The costs of non-harmonization can be substantial. Separate labeling requirements in five different states for one consumer product would have an annual cost of $50 million, and for a group of 14 products would cost $700 million for transportation and distribution (Viscusi, 1993). Most of these costs are attributable to the inefficiencies of multiple labeling systems, as opposed to a harmonized warning system. It is perhaps because of these inefficiencies that U.S. companies often urge the federal government to impose a pre-emptive national warning policy once individual states have shown initiative or are about to implement separate warning requirements of their own. This was the experience in the United States with cigarette warnings, hazardous chemical labeling regulations, and food warnings.

36. Perhaps the most important cost associated with information efforts is that the decisions and behavior of those informed will be altered. Many warning labels advise workers to exercise care, or consumers to alter product choices. Such changes in behavior may involve the taking of onerous precautions (such as installing new production machines), or purchasing more expensive but higher-quality goods. In some cases, consumers may sacrifice valued product characteristics other than money (such as "low-calory" characteristics in soft drinks). These costly actions may well be desirable, may be in fact the core purpose of the information programme, but because there are real economic costs involved, care must be taken to ensure that the information provided is correct and correctly interpreted so as to result in appropriate reactions. Disproportionate reactions to warning information can impose substantial economic costs without producing corresponding benefits in reduced risks.
37. Another potential danger associated with informational regulations is that it is often difficult to predict their ultimate effects. Because of the complex role of individual’s cognitive limitations and the importance of the structure as well as the content of the information provided, policymakers cannot simply draft informational regulations in isolation in the same manner as they might draft other types of regulation. To ensure that regulatory design is sound, it is often useful to test the information provision on sample groups of recipients to determine its effect and to assess whether other forms of information provision would be preferable. In much the same way as companies engage in test marketing of new consumer products, the government should also recognize that it has limited knowledge of the consequences of informational regulation. We can often expand this knowledge before putting informational regulation into place.

III. RISK INFORMATION AND THE HEALTH HAZARDS OF CHEMICALS

The Role of the Government

38. The chemical industry in the United States is subject to a wide variety of regulations pertaining to the character of the products that can be sold, the pollution that can be generated as part of the production process, and the risk to the workers involved in the production process. In addition, extensive government regulations require hazard warnings for down-stream users about the risks of chemical exposures.

39. These regulations show great diversity in their approaches to providing information. In the case of consumer exposures to chemicals, regulations often state quite specifically the nature of the warnings that must be provided. Pesticide risks, for example, must be addressed through hazard warnings that are explicitly approved by the U.S. Environmental Protection Agency before the product can be sold. There is not, however, strict uniformity in the warnings for pesticide products as there is for pharmaceutical products. The warnings vocabulary for drugs is stringently applied to maintain uniformity.

40. The hazard warning system for chemical exposures of American workers is far less structured. The U.S. Occupational Safety and Health Administration (OSHA) mandates that employers provide hazard warnings to inform workers about the hazards of the chemicals used in the workplace. However, no specific guidelines are provided for the design of these warning systems. The original rationale for this flexibility was to accommodate the voluntary warning systems that were already used by industries when the regulation was enacted in the early 1980s. However, due to the absence of uniformity, interpretation of the warning labels is potentially difficult for workers who may confront labels under different labeling regimes. Although voluntary industry standards developed by a private standards organisation (the American National Standards Institute) frequently serve as a reference, they are not binding and are at best an imperfect substitute for a well-defined hazard warning vocabulary that could be used to establish a standardized approach to warnings across different industrial contexts.
Risk Perceptions and Activity Choices

41. The fundamental purpose of hazard warnings for chemicals is to alert users of the chemicals to potential risks. If our objective was to prevent people from being exposed to the chemicals altogether, the appropriate government policy would be to simply ban the chemicals. Typically, however, the policy objective is narrower, since the economic costs of bans can be high and the health benefits are often uncertain. Usually, government officials intend to create an awareness that enables people to decide if they wish to be exposed to the chemical and, when appropriate, to take appropriate precautions.

42. The discussion here focuses first on the effects of chemical labels: (1) on risk perceptions; and (2) on willingness to participate in activities involving exposure. Table 1 below summarizes the principal results for a study of over 300 chemical workers. All the workers in the sample worked with chemicals as part of their jobs in the chemical industry. The workers were presented with labels for one of four different chemicals: sodium bicarbonate, chloroacetophenone (causes eye watering), asbestos (can cause cancer), and TNT (an explosive). Workers were first asked to assess the risk before being given the warning information, and then, after seeing the warning label, were asked to assess the risks of their jobs assuming that they would work with the chemical associated with the label. In addition, they were asked how much their wages would have to increase if they were to work with the chemical.
Table 1

Chemical Worker Responses to Hazard Warning Labels
(Means of Variables for Each Labeling Group*)

<table>
<thead>
<tr>
<th>Risk Variable</th>
<th>Sodium Bicarbonate</th>
<th>Chloroacetophenone</th>
<th>Asbestos</th>
<th>TNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Belief (Before Warning)</td>
<td>.12</td>
<td>.10</td>
<td>.09</td>
<td>.10</td>
</tr>
<tr>
<td>Risk Belief (After Warning)</td>
<td>.06</td>
<td>.18</td>
<td>.26</td>
<td>.31</td>
</tr>
<tr>
<td>Wage Increase Needed (0-1)</td>
<td>.03</td>
<td>.48</td>
<td>.71</td>
<td>.82</td>
</tr>
<tr>
<td>Risk Premium ($1982)</td>
<td>0</td>
<td>1,919.01</td>
<td>2,995.59</td>
<td>5,158.31</td>
</tr>
<tr>
<td>Quit (Before Warning)</td>
<td>.23</td>
<td>.10</td>
<td>.13</td>
<td>.10</td>
</tr>
<tr>
<td>Quit (After Warning)</td>
<td>.00</td>
<td>.23</td>
<td>.65</td>
<td>.73</td>
</tr>
<tr>
<td>Take Job Again (Before Warning)</td>
<td>.67</td>
<td>.82</td>
<td>.80</td>
<td>.76</td>
</tr>
<tr>
<td>Take Job Again (After Warning)</td>
<td>.90</td>
<td>.58</td>
<td>.11</td>
<td>.07</td>
</tr>
</tbody>
</table>

*The risk premium figures are conditional upon facing an increased risk and being willing to accept a finite risk premium. Source: Viscusi and O’Connor (1984).

43. Table 1 summarizes the responses to the chemical labels. Risk assessments before receiving the warning ranged from 0.09 to 0.12, where the metric used is a linear scale in which the workers indicated the probability of a job accident. After receiving the hazard warning information, the risk assessments went down for the group given the warning for sodium bicarbonate, which is what one would expect because of the low risks associated with household baking soda. Indeed, the perceived risk level, 0.06, is identical to the accident rate for the chemical industry in the year of the survey, which is the pertinent reference point once the job has been purged of chemical hazards. Risk perception increases with the other three hazard warnings, most of all for asbestos and TNT. Working with these latter two substances
is the equivalent to holding a job that poses a risk of accident per year of roughly three in ten, which is five times the overall accident rate in the chemical industry.

44. If the underlying economic model behind the hazard warning policies is correct, altered risk beliefs should change worker attitudes toward bearing risks. The next two rows in Table 1 indicate the fraction of workers who indicated that they would need a wage increase to work with each chemical and the amount of the wage increase per year that they would require. For the sodium bicarbonate sample, 3 percent indicated they needed a wage increase, but the level of the increase was zero so that overall no wage increase was required for this substance, which respondents viewed as making their jobs safer. By contrast, the fraction requiring wage increases for the other chemicals ranged from 48 percent to 82 percent, and the amount of the wage increase ranged from just under $2,000 per year to over $5,000 per year.\textsuperscript{5}

45. Many individuals were unwilling to bear these risks without sufficient increases in wages. Such changes in activity choices are also expected effects of information. For example, 23 percent of the sodium bicarbonate sample was considering quitting before receiving the warning -- this figure dropped to zero after being told that they would be exposed to a very safe chemical. By contrast, the "quit" intentions for the other three chemicals escalated after the warning. The greatest increase was for TNT -- workers intending to quit rose from 10 percent to 73 percent after receiving the warning label. Similarly, attitudes toward being willing to take the job again, which are summarized in the bottom two rows of Table 1, also changed dramatically after receiving the warnings. Overall, 23 percent more workers would be willing to take the job again if the chemicals at the workplace were replaced by sodium bicarbonate. For the hazardous chemicals, the willingness to take the job again plummeted -- only 11 percent of the sample would be willing to work with asbestos and only seven percent with TNT. These data indicate the clear effect of hazard warnings, not only on risk perceptions, but also on choices about engaging in risky activities.

\textit{Effects on Precautionary Behavior}

46. If individuals choose to use hazardous chemicals, then it is often essential to exercise appropriate precautions. Commercially available chemicals are often formulated so that risks of exposure are substantially reduced if the chemicals are used properly. However, considerable danger could arise with their misuse as, for example, in the case of insecticides that are not diluted appropriately.

47. To investigate the effect of hazard warnings on the use of safety precautions, let us consider two different sets of experimental results. Table 2 below presents the difference in subject responses to four different hazard warnings for household bleach. Subjects were given products with one of four different labels. The first label indicated in Table 2 includes no warning information. The second label is the label for the largest selling U.S. brand of bleach, Clorox. The third label is that for a brand of bleach marketed by a particular food store chain (the Kroger company) known as Bright bleach. The final label is what we designate a Test
label as it has been reformulated to structure the information in a way that marketing experts view as being more readily processed than current label structures.

Table 2

Effects of Bleach Labels on Precaution-Taking  
(Percentages)

<table>
<thead>
<tr>
<th>Precaution</th>
<th>No Warning (n=51)</th>
<th>Clorox (n=59)</th>
<th>Bright (n=42)</th>
<th>Test (n=44)</th>
<th>Maximum Incremental Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do not mix with toilet bowl cleaner (if toilet badly stained).</td>
<td>16</td>
<td>23</td>
<td>36</td>
<td>40</td>
<td>24</td>
</tr>
<tr>
<td>2. Do not add to ammonia-based cleaners (for particularly dirty jobs).</td>
<td>69</td>
<td>68</td>
<td>69</td>
<td>84</td>
<td>16</td>
</tr>
<tr>
<td>3. Store in childproof location.</td>
<td>43</td>
<td>63</td>
<td>50</td>
<td>76</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: Viscusi and Magat (1987)

48. The first two precautions listed in Table 2 pertain to the risk of chloramine gassing. If bleach is mixed with either toilet bowl cleaner or ammonia, chloramine gas forms. This gas, which has adverse respiratory effects, is the leading source of accidental poisoning among U.S. adults. Hazard warnings are effective in reducing both kinds of misuse of the product, as the fraction of the sample that would not mix bleach with toilet bowl cleaner for badly stained toilets is increased by 24 percent, and the fraction of the sample that would not add bleach to ammonia based cleaners is increased by 16 percent. Similarly, the fraction of the sample that would store products in a childproof location is increased by up to 33 percent. It is noteworthy that this warning had almost 100 percent effectiveness among households with children at risk.

49. A similar pattern, shown in Table 3 below, is observed with respect to different labels for drain openers. The three warning labels examined for drain openers are for Drano/Red Devil Lye, the Test label formulated to better organize the information, and a label on which the warning information from the Drano label has been purged. The potential effect of these
set of warnings is substantial, as the fraction of the subjects willing to wear rubber gloves to avoid getting chemicals on their skin can be increased by up to 19 percent. Similarly, the labels increased precaution-taking with respect to storing the product in a childproof location, as 90 percent of households with children under five years of age will safely store the product with the Drano/Red Devil Lye label. The Drano/Red Devil Lye label performed more effectively than the better organized test label because risk information took a much larger fraction of the label.

Table 3

Effect of Drain Opener Warnings on Precautions Taken

<table>
<thead>
<tr>
<th>Precaution</th>
<th>Percent of Sample Taking Precaution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Warning</td>
</tr>
<tr>
<td>Wear Rubber Gloves</td>
<td>63</td>
</tr>
<tr>
<td>Store in Childproof Location (Households with Children Under Five)</td>
<td>70</td>
</tr>
<tr>
<td>Store in Childproof Location (Households with No Children Under Five)</td>
<td>48</td>
</tr>
</tbody>
</table>

Source: Viscusi and Magat (1987), tables 4.3 and 4.6, and calculations by the author

50. The overall implication of these findings is that hazard warnings can be effective in altering behavior. However, it is important to recognize that although precaution-taking may increase, not all members of the sample will find it desirable to undertake precautions. The failure to exercise precautions may be a rational choice, because individuals may simply find the precautions too onerous. Not all of us wear safety belts in cars, although we may well understand the benefits of doing so. Some of us smoke, although we know we are more likely to die earlier because of it. Regulatory administrations often have difficulty accepting that individuals voluntarily choose to accept risks, but allowing for differences in individual preferences is precisely one of the strengths of the information approach. Alternatively, of course, failure to take precautions may mean that individuals do not adequately understand the risks, due to a failure of the information approach.
Structure and Format of Information

50. The differing effectiveness of the warning labels discussed above is attributable in part not only to the content of the labels but also to the structure. The bleach labels used in Table 2 varied substantially. The Bright label, for example, gave more prominence to the warning information, placing it at the top of the warning. Similarly, the Test label organized the information more clearly than did the other two labels, contributing to its efficacy. In contrast, the Test label in Table 3 did not perform as well as did the Drano/Red Devil Lyce label, apparently because this label included less risk information than did the existing market label.

51. Testing for the effect of the structure and format of information requires that one hold constant the amount of information provided and its character. Once this is done, several conclusions emerge. First, print size matters. Increasing the print size on a label to make it more readable is generally advantageous. However, once the print size has achieved a sufficient degree of readability, further increases do not increase the impact of the label on consumer processing of the information.

52. Second, the structure of the information presented matters. Organizing the information so that it is better understood, using methods such as boxes around pertinent information to highlight the information, and similar manipulations of the warning label structure can be influential. However, it is important to recognize that these manipulations also have diminishing marginal effectiveness. Moreover, labels should not be judged in isolation. It is, for example, true that a warning label may have a very strong effect in a particular context if it is as visible and as strident as possible. However, using a bold warning that is not justified will dilute the effect of other warnings. It is essential to use an appropriate structure and format for the information given the level of the risks. Warning language should not be manipulated simply to increase the impact of the label. Rather, it should be used to indicate the level of the risk with respect to a reference point within the hazard warnings vocabulary.

53. A third general lesson is that it is important not to inundate consumers with excessive information. The reason why label structure is consequential is that individuals have limited cognitive abilities. Similarly, labels that are cluttered and contain excessive amounts of risk information or situations in which there is a proliferation of labels may be counterproductive by creating a situation of information overload. Experimental results suggest that labels in which there is inordinate detail in risk information succeed in conveying a sense of riskiness to the consumer. However, the label clutter makes it difficult for the consumers to understand the character of the risks and the nature of the precautions to be taken (Magat and Viscusi, 1992). Since many of the principal risks arising from products stem from taking the incorrect precaution or using the product improperly, it is essential that these messages be conveyed in a manner that is not obscured by an attempt to create a sense of alarm about the prospective risks.
IV. INFORMATION AND ENERGY EFFICIENCY

54. Provision of information is not limited to situations involving risk, although risk is perhaps the most frequent reason for providing information. Increasingly, there has been emphasis on promoting energy conservation through the provision of information. One such type of programme gives consumers information on the energy efficiency of appliances, by means such as energy efficiency stickers for refrigerators. Similarly, automobiles sold in the United States bear information on the number of miles per gallon that consumers can expect, enabling consumers to make the appropriate tradeoff among fuel efficiency and other automobile attributes. Various public utilities have also made efforts to promote energy efficiency by users of household electricity.

55. Many of the concerns pertinent to the analysis of warning labels are also relevant to energy efficiency information. It remains important to transmit the information effectively and clearly. Moreover, the structure and format of the information often proves consequential.

56. Table 4 below summarizes the experimental results from a field test of different types of information on housing energy efficiency provided to homeowners. The overall objective of the energy efficiency information was to encourage energy conservation investments, such as increased insulation or installation of storm windows. The information was transmitted, not through warnings, but rather through an ‘energy audit’ in which the electric utility provides information to consumers on the energy savings for a wide variety of energy efficiency measures. For each of the different energy efficiency measures available for the household, information was provided pertaining to the cost of the installation by a contractor. Information was also given on how homeowners could do the work themselves. Information on cost-savings was also provided.
Table 4

Energy Efficient Investment Decisions

<table>
<thead>
<tr>
<th></th>
<th>Number of Subjects</th>
<th>Total Investment Cost ($)</th>
<th>Total First Year Energy Savings ($)</th>
<th>Total Savings / Total Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Sample</td>
<td>122</td>
<td>1,876.35</td>
<td>275.27</td>
<td>0.1680</td>
</tr>
<tr>
<td>Format 1</td>
<td>31</td>
<td>1,875.90</td>
<td>252.10</td>
<td>0.1572</td>
</tr>
<tr>
<td>Format 2</td>
<td>23</td>
<td>1,582.09</td>
<td>258.96</td>
<td>0.1835</td>
</tr>
<tr>
<td>Format 3</td>
<td>23</td>
<td>1,718.39</td>
<td>268.35</td>
<td>0.1770</td>
</tr>
<tr>
<td>Format 4</td>
<td>22</td>
<td>2,269.64</td>
<td>320.82</td>
<td>0.1688</td>
</tr>
<tr>
<td>Format 5</td>
<td>23</td>
<td>1,953.00</td>
<td>286.26</td>
<td>0.1573</td>
</tr>
</tbody>
</table>

Source: Magat and Viscusi (1992), Table 8.1

57. Table 4 considers the results for five different informational formats. Format 1 is the control format, which is the current energy audit approach used by the electric utility. Format 2 is a modification of format 1 in which the financial benefits of the energy savings are presented as a "payback period" (the period of time required to recover the cost of the investment by cost-savings from lower energy use). Format 3 involves a switch in the columns of the energy audit information in which the energy savings information is presented to consumers before the cost information, thus highlighting the benefits of the energy conservation measure. Format 4 makes several changes in the structure of the information provided to change the reference point households use to make their energy decisions. Instead of considering the first year energy savings, format 4 structures the information so that consumers will view the energy savings as a reduction of an undesirable effect (reduction of annual energy costs) rather than increasing a benefit (energy savings). The economic
substance of the information provided is not altered, but the psychological framing is. The final format listed in Table 4 is format 5, in which the special rates offered by the utility for homeowners who install five energy conservation measures are highlighted.

58. The total investment column of the table indicates the total energy conservation investments selected by the subjects. In every case, it is noteworthy that the provision of the energy conservation information led to energy conservation expenditures. Moreover, it is particularly noteworthy that format 4, which restructures the presentation of the information to exploit individuals' psychological propensity to avoid undesirable effects, has the largest impact on investment cost expenditures. Format 4 is also associated with the highest first-year energy savings. Indicating the special rates available for clusters of energy conservation measures in format 5 also leads to higher energy savings than in the first three formats. The total energy savings per dollar invested shown in the last column of Table 4 do not differ greatly across the different formats. The main difference is that better energy efficiency information increases the scale of investments rather than the efficacy of the investments undertaken.

59. Although energy efficiency information can alter behavior, the types of contexts in which it has been used tend to involve capital goods or long-term investments in which special attention must be devoted to the temporal aspect. The energy efficient audit information presented in Table 4 was based on a study in which there was some attempt to address the long term aspect by noting the payback period for the investment. However, this effort to convey the present value of longer term decisions to consumers is the exception rather than the norm. In the case of mileage listings for automobiles, consumers are aware of the different fuel efficiency of autos but are not informed of the effects that these fuel efficiency differences will have on the long-run operating cost of the vehicle. These shortcomings can erode the effectiveness of these information programmes, given the capital goods nature of investments relating to energy.

60. Studies of the implicit discount rate (a measure of the degree to which people prefer to have wealth today rather than next year) that consumers exhibit with respect to energy efficiency regulations of various kinds suggest that consumers often act with a very high implicit rate of discount with respect to the energy consequences of these investments. To the extent that this is the case, they will place inadequate weight on the long-term energy savings and will not exhibit sufficient restraint with respect to energy usage.

61. A study of air conditioner purchase and utilization by Hausman (1979) found that the implicit rates of discount displayed by consumers with respect to the differing energy efficiency of these air conditioners ranged from five percent to 89 percent per year for different income groups. The overall sample estimates on which he placed the greatest weight yielded an implicit rate of discount of 26 percent.

62. Gately (1980) employed a similar analysis to assess the implicit rates of interest that purchasers of household refrigerators used in weighting the long term energy savings
associated with different refrigerator models. Despite the energy efficiency information provided for these products, he found that the estimated discount rate for different groups ranged as high as 300 percent. Indeed, the lowest discount rate that he calculated for any of the groups purchasing the product was 45 percent. Dubin's (1986) analysis of the weighting of the energy savings associated with different water heaters yielded similarly high implicit rates of discount -- on the order of 44 percent for the fuel expenditures associated with that product.

63. But the lowest implicit rates of interest that have been found for energy use for durable products such as these have been estimated for automobiles. Dreyfus and Viscusi (1994) found that the implicit rate of time preference that purchasers of used cars exhibited with respect to the fuel efficiency properties of these vehicles ranged from 11 percent to 17 percent. Although these estimated rates of interest exceed the real rates of interest in the economy, they were in line with the actual rates of interest that consumers paid on automobile loans.

64. What these findings suggest is that it may not be sufficient to provide information on energy efficiency so that it reaches the consumer and is processed. In the case of risk information, the difficulty involved is that individuals have a tendency to make erroneous decisions when dealing with low probability events and more generally in dealing with probabilities that are difficult to understand. Similar kinds of cognitive problems must be addressed with respect to energy efficiency. In particular, choices involving energy efficiency almost invariably involve some capital investment so that there must be an effort to incorporate appropriate information about the long-term consequences of energy conservation. The examination of energy audits indicated that it is feasible to influence investment decisions in a desirable manner, but the long-term complexities of the decision must be recognized and incorporated in the design of the informational effort if the regulation is to be effective.

V. POLICY LESSONS LEARNED

65. Governments are increasingly turning toward information provision as a form of regulation. The impetus for these efforts stems from the recognition that many economic and social problems arise because of informational inadequacies that impede decisions, and that in these cases information is a legitimate and effective regulatory tool. As the range of circumstances in which government intervention is potentially desirable continues to expand, more attention will be devoted to informational regulations as an intermediate policy option.

66. Table 5 below summarizes the advantages and disadvantages of using information as a form of regulation. The chief advantages stem from the ability of information to assist in the making of decentralized decisions, particularly in circumstances in which there is heterogeneity such as differences in preferences or differences in effects (in susceptibility to risk, for example). Properly designed, informational efforts can lead to sound decisions by people in their day-to-day lives, eliminating the need for more intrusive forms of regulatory intervention.
Table 5

Possible Advantages of Informational Regulations

1. Information can influence decentralized decisions that cannot be readily monitored and regulated.
2. Information is an intermediate policy option that may be more feasible from a political standpoint.
3. Information accommodates heterogeneity, such as differences in willingness to bear risk or differences in susceptibility to risk.
4. Information directly addresses market failures arising from inadequate knowledge.
5. Information that provides new knowledge, as opposed to information that reminds people of existing knowledge, can significantly influence behavior.

Possible Disadvantages of Informational Regulations

1. The information transfer mechanism should be sufficiently effective to ensure that the information is received.
2. Unless care is taken in the content, design, and format of the information provided, it may not be adequately processed.
3. Special care must be devoted to communicating complex knowledge, such as that involving probabilities and long-term effects.
4. Even with effective information, some recipients of the information will choose to ignore it. If doing so leads to substantial losses, more direct regulation may be warranted.
5. Proliferation of information efforts and large amounts of information provision may lead to information overload and label clutter.
6. Uniformity in the informational vocabulary is preferable to diversity, which may impede people's ability to make relative judgements. This concern is particularly important for products traded internationally.
7. Diverse information requirements may be much more costly than uniform requirements for mass-marketed products.
8. Uncertainties regarding the individual response to information require care and, in some cases, pre-testing in the design of the information program.
9. Overwarning is a potential danger.

67. To be successful, however, the design of informational regulation requires more than assigning a group of government officials to draft the regulation. The ultimate efficacy of the information effort will depend on the degree to which it provides new information in an effective manner. This efficacy in turn will be greatly influenced by the cognitive limitations that affect individuals’ processing of the information they receive. As a result, the
disadvantages of informational regulation listed in Table 5 include several cautionary notes with respect to the need for attending to the structure, format, and content of the regulatory program. Many of these disadvantages can be addressed in the design of an effective regulatory system -- they are not insurmountable obstacles that inevitably impede the viability of information as a regulatory mechanism.

68. Perhaps the chief concern with respect to an international organization such as the OECD is the need to develop a uniform informational vocabulary. This concern is perhaps the paramount issue in the design of informational regulations by national governments. As the world economy becomes increasingly interactive, there will be a need to standardize the informational vocabulary across countries so that recipients of information will have a well-defined reference point for processing the information they receive. Informational regulations consequently differ from many other regulatory regimes in that diversity and performance-oriented approaches are not desirable attributes. Establishing uniform reference points that are comparable across products, activities, and countries is the most salient policy need for this regulatory approach.
REFERENCES


LENAHAN, R.J., et al. (1973) "Consumer Reactions to Nutritional Information Labels on Food Products" Journal of Consumer Research 4: 119-128


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NOTES

1. This paper has been prepared by W. Kip Viscusi, George G. Allen Professor of Economics, Department of Economics, Duke University, Durham, NC, 27708-0097, U.S.A., phone 919-660-1833, fax 919-684-8974.

2. This study may overstate the degree to which people ignore information since it was undertaken only a year after mandatory nutrition labeling regulations were put in place. Moreover, salt content and other aspects of nutrition labeling may not be pertinent to individuals who are not at risk. What is important is that individuals who have an important medical need to restrict their sodium intake receive the information and act upon it. This distinction was not identified by the study.

3. These statistics are based on Gallup poll results that are presented in Viscusi (1992b).

4. These statistics are also drawn from the original survey results reported in Viscusi (1992b).

5. The implicit value per statistical job injury based on these statistics is in line with other studies of accidents. In 1990 U.S. dollars, the implicit value of an injury for these chemical workers is $13,810 - $17,761. This figure is comparable to other estimated implicit values of injuries of the same severity, i.e., recordable injuries and illnesses that lead to some interruption of work but not necessarily a lost work day. For a comparison of the various studies on valuation of job injuries, see Table 4-2 of Viscusi (1992a).

6. The measures included were: ceiling insulation, attic ventilation, wall insulation, floor insulation, storm/insulated windows, storm/insulated doors, shading sun exposed glass, caulking doors/windows, weather strip doors/windows, water heater insulation wrap, clock thermostat, duct insulation, pipe insulation, flu opening mechanism, electrical or mechanical emission systems, replacement of oil burner, replacement of furnace, replacement of heat pump, replacement of central air conditioner, and load control devices.