Economic Impact Analysis of Virginia Regulations

Virginia Department of Planning and Budget
Economic and Regulatory Analysis Section

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EXECUTIVE SUMMARY

The choice to use the powers of government to regulate behavior is based on the conclusion by policy makers that their constituents are better off with the regulation than without it. Such a decision requires a set of judgments about the impact of the regulation on the behavior of individuals and firms in the economy and about the value that people place on those changes. These policy choices also necessarily involve choices about the acceptability of the distribution of the gains and loses created by the regulation, as well as their magnitude.

The information needed to make informed policy choices can be difficult to obtain and to interpret. There is, then, a strong rationale for developing standard methods for generating the information necessary to assess the economic value of proposed regulations. Once this information is obtained, it must be presented in a way that facilitates, rather than impedes, the making of reasoned choices.

Under the Virginia Administrative Process Act the Virginia Department of Planning and Budget (DPB) has been charged with the responsibility of assessing the economic impact of new and revised regulations promulgated. In addition, DPB was directed by Chapter 853 of the 1995 Virginia Acts of Assembly, Section 1-79.G to submit its methodology for reviewing regulations to the Joint Legislative Audit and Review Commission. This report on DPB's economic impact analysis methodology fulfills that requirement.

Economic impact analysis (EIA) is a standardized technique for measuring the effects of government actions and for presenting the results of the analysis in a way that can help elected officials make effective policy choices. This report describes in detail the scientific method used by DPB to analyze the economic impact of regulations. It also describes how the data, assumptions, and conclusions are presented to those actually making decisions.

Considering the important alternatives

There are usually many different ways to implement a regulation once the general goal is established by elected representatives. Each regulatory option will imply a different distribution of gains and loses as well as different costs of administration and enforcement.

Subject to considerations of fairness, agencies should choose regulations that achieve the required ends at the lowest possible cost and with the least intrusion into the voluntary choices of individuals and firms. This common-sense requirement maximizes the gain from regulatory action and helps maintain the credibility of government in the eyes of those subject to regulation.

Since added flexibility can reduce the costs of compliance, regulations should specify results rather than specific actions. This leaves the challenge of finding the best way to achieve the results to those with the most knowledge about the particular circumstances of each individual or firm. Maximizing flexibility has the added advantage of giving people incentives to innovate. In the long run, the incentive to innovate is probably the most important cost-reducing element of regulatory design.

Theory and long experience strongly indicate that voluntary trading in markets provides the flexibility and the incentive to find innovations that reduce costs. Thus, it is important that agencies consider whether market incentives can be used instead of traditional "command and control" regulations. For example, allowing firms to buy and sell pollution allowances among themselves may provide a greater level of environmental quality than traditional regulations, while at the same time reducing costs.

Identifying the people and resources affected

An economy the size of Virginia's is enormously complicated. Each individual has his or her own goals and preferences. Each firm has its own technology and management. Regulations change individual rights and responsibilities. In this way, regulations change the incentives that people have and, hence, change the way economic resources are allocated throughout the economy.

Measuring the change in economic activity resulting from a regulation, then, must start with an effort to identify the incentives created by the regulation and then predict the actions that will result from that change in incentives. Analyzing individual and firm responses to changes in incentives is the special province of the discipline of microeconomics. Microeconomics treats the economy as an interconnected set of markets. Once the markets

and their interactions are specified, we can trace the impact of a regulation through the economy by tracing its effect on supply and demand in various markets.

In tracing these effects, an economic analyst can identify those changes in employment, property values, the distribution of costs and benefits, and other impacts attributable to the regulation. It is also possible identify the impact of the changes on resources that may be valued but are not necessarily traded in markets. One advantage of this process is that policy makers and the public are made aware of any unintended consequences of the regulation.

The detail with which the economy is modeled depends on the scale of the effects expected from the regulation. Small changes may be analyzed by looking at one, or just a few, markets. Larger changes may require a simplified model of the whole economy.

Measuring the value of the changes

Having identified the people and economic resources that are affected by a regulation, the analyst should make every reasonable effort to determine how these resources are valued by individuals. It is not enough simply to report the changes in payrolls and other economic activity. These are a measure of the gross impact of a regulation. The gross impact may be quite different from how people value that change. For example, the gain of a job in one industry may be matched by a loss of a job in another. Determining the net value of given changes in economic activity is one of the most important contributions of economic impact analysis to good public decision making.

It is the standard assumption of microeconomics that individual tastes and preferences are the sole source of economic value. This is often referred to as the principle of consumer sovereignty. The standard economic measure of value of a good is the amount of money that would induce a person to voluntarily trade the good. The maximum amount a consumer would pay to receive something is called his *willingness-to-pay (WTP)* for the gain. The minimum amount he would accept to part with something he already has is called his *willingness-to-accept (WTA)* the loss. WTP and WTA are monetary measures of value for economic resources that are consistent with the assumption of consumer sovereignty.

Economic impact analysis uses WTP and WTA to measure the actual values that people place on the changes that a regulation causes in the allocation of economic resources. Most economic valuation techniques work by observing the choices people make and then deriving the monetary value implied by those choices.

The standard case is for a good that is traded in a smoothly operating market. By observing how much of the good a consumer purchases at different prices, we can derive the consumers "demand function" for that good. This mathematical representation of the consumer's choices allows us to estimate the total net value that he or she gets from consuming various amounts of the good.

For goods that are not traded in markets, such as air quality or visits to state parks, we look to consumer choices in related markets for the information needed to estimate a demand relationship. For example, knowing the cost to consumers of getting to and using a park allows us to estimate a demand function for use of the park. This, in turn, provides a way of estimating the total value to consumers of having the park. In this way, economic analysis provides a way of assessing the value of valuable but otherwise unpriced resources.

Accounting for time

Most different regulations have costs and benefits that accrue at different periods of time. However, people generally prefer to have something now rather than later. It follows that regulatory impacts that occur in the future should be given less weight than those that occur immediately.

The process of accounting for this time preference is known as discounting. All future gains and loses attributable to a regulation should be discounted at a rate consistent with the willingness of individuals to trade present consumption against future consumption. The rate at which consumers trade off consumption between periods is called the rate of time preference. It is this rate that should be used for discounting. This rate of time preference is reflected in the inflation adjusted interest rate paid on safe assets traded in private markets. To ensure consistency among choices, all gains and losses from a regulation should be expressed in inflation adjusted terms and discounted at the rate of time preference.

Accounting for risk

Since people place a premium on avoiding risk, a risky stream of benefits or costs flowing from a policy must be adjusted to take account of this risk premium. Measuring the economic value of a policy with a risky outcome involves two distinct steps: 1) a risk assessment that characterizes the probabilities of occurrence of the various outcomes, and 2) a valuation of the risks in terms of individual preferences and costs of avoidance. The appropriate level of risk is a question of policy, not science. The level (and type) of risks should be chosen on the basis of the value that people place on being exposed to those risks.

Risk assessment is the process of listing the possible consequences of an action or event and attaching to each possible outcome a probability that the event will occur. We might be interested, for example, in knowing how a regulation will affect the likelihood that a particular type of building will burn down. A risk assessment would use engineering information to assess all of the ways that the regulation affects the potential for a fire and the resulting probabilities of a fire occurring.

Evaluating the risk associated with some policy action raises a number of difficult scientific issues. In some areas, the scientific uncertainties may be very large. It is crucial that these uncertainties be incorporated into the analysis in a way that allows the valuation of the risks in economic terms. Using the best available scientific information, risk assessments should provide quantitative assessments of the average risk and its spread so that the policy maker can choose the policy that best reflects social preferences for avoiding or accepting risk.

Once the nature and magnitude of the risk have been measured, economic principles can be used to measure the value of that risk. Since risk is something that individuals prefer to avoid, we would expect to observe people who face a risk to spend resources to reduce the risk. These expenditures may take the form of self-protection, mitigation, buying insurance, and buying information. These measures are costly and must be counted as part of the costs of uncertainty. An individual's risk premium is measured after he has adjusted his activities to manage risks. The social costs of risk, then, comprise expenditures on risk management plus any residual risk premium that remains.

Most of the time, allowance for risk should be made by adjusting the monetary values of the uncertain future consumption flow. However, whenever a person faces unfamiliar types of risk, or risks of great magnitude relative to income and wealth, or risks with unusually large or small probabilities, we cannot simply calculate monetary adjustments to the stream outputs. A qualitative balance will be required, taking into account the various dimensions of risk. The analysis should compare the policy choice in question to other choices involving similar types of risk. If an analogous choice can be found, it may help bracket the range of values appropriate for the policy choice under consideration.

Policy choices under uncertainty

It is important to report the results of the economic analysis in a way that avoids giving misleading impressions about the precision of the analysis. Results should always be reported as a range of possible outcomes. The report should include the author's judgment about the most likely outcome, and a measure (possibly quite informal), of the likely dispersion of outcomes around the most likely one. In addition, the analyst should report how costly it would be to reduce the uncertainty of the outcome by buying information or taking mitigating actions. Numerous techniques are available for making judgments about the uncertainties present. Among these are sensitivity analysis, Monte Carlo simulation, and decision analysis. Each of these techniques has strengths and weaknesses, so it is important to select the one most valuable for the given problem.

Any analysis of policy uncertainty should identify the important variables in the analysis. The impact analysis will highlight for the policy maker those variables which can are expected to have a significant impact on the outcome of the policy decision. The analysis should not be so exhaustive that the reporting of the results actually obscures the important uncertainties confronting the policy maker.

Summarizing the results

In summarizing the economic impact of a proposed regulation, a careful balance must be drawn between completeness and usefulness. While all of the components of the assessment should be available for public scrutiny, as a practical matter, decision makers

require a more compact statement of results. Unlike the traditional practice in benefit/cost analysis, it is not the function of the impact assessment to provide a single number on which a decision would be based. It is, rather, a presentation of the key analytical results in a way that makes clear both the best estimate of impact and the range of uncertainty. The policy maker will be able to see not just the final result but the main components that make up the result.

Economic impact assessment uses the tools of microeconomics to help those choosing among different policies make careful, considered decisions. If carefully done, this analysis can help us make better choices by suggesting the most efficient and effective strategies for achieving a given result, and making sure that we are fully informed of the tradeoffs implicit in any policy decision.

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I. INTRODUCTION

A. Guiding Principles and Philosophy

1. Purpose

Regulations touch an enormous range of activities: from the licensing of cosmetologists and lawyers to the receipt of public assistance to the transport and disposal of hazardous substances. How do we decide when it is a good idea to use the power of government to regulate an activity? The answer is that we weigh the good effects we expect from the regulation against the bad effects. We make a judgment that the citizens of Virginia are better off with the regulation than without it. While the idea is simple enough, the implementation is beset by difficult questions of fact and even more difficult questions about fairness and the distribution of benefits and costs.

In order to make effective decisions about whether a regulation is appropriate, we need a way of estimating what the impact of the regulation will be on various dimensions of economic activity. We also need a logically consistent way of measuring the value to the citizens of Virginia of these economic impacts. Economic impact assessment (EIA) is a technique for estimating the value of the economic changes induced by a regulation.[1]

Economic impact assessment (EIA) cannot eliminate the difficulties inherent in social decisions. Rather, it is a procedure that contributes to the decision process by helping the decision maker:

- formulate objectives
- examine the relative effectiveness of alternative approaches
- identify those affected, and
- predict the responses of the firms and individuals affected.

Impact assessment provides a technique for organizing our thinking about the essential

[1] The U.S. Office of Management and Budget (OMB) has developed a guidance document describing the appropriate methods for measuring the economic empact of regulations; see U.S. Office of Management and Budget (1993). The OMB guidance document is a valuable reference on how to carry out economic assessments. It was a valuable resource in the writing of this report. Other references of particular importance were: Gramlich (1990), Zerbe and Dively (1994), and Cropper and Oates (1992).

tradeoffs implied in any regulatory decision. In doing so, it helps to ensure that a regulation will accomplish what we intend, will minimize any harmful unintended consequences, and will make a positive contribution to the quality of life in Virginia.

One of the key contributions of economic impact assessment is that it forces the decision maker to treat explicitly that which is often left implicit in social decisions. Judgments about opportunities precluded by an action, the magnitude of the gains and losses, and the identities of the winners and losers should be treated openly. These considerations are always present, but we often do not make an effort to confront them. Long experience teaches that ignoring these difficult issues can impose large costs on society. Costly mistakes are made which, in the end, reduce the credibility of government as a solver of problems.

Economic impact assessment, when properly done, should force the decision maker to think about the uncertainties surrounding the decision. How much do we really know? What are the likelihoods of the various outcomes? How attractive is the policy in the face of the uncertainties?

The fundamental function of economic assessment is to help ensure that the choices made by the various branches of government are consistent with the values of the individuals that the government represents. A key assumption of the analysis is that government does not have preferences independent of the individuals who elect that government. Economic analysis is guided by the principle of consumer sovereignty; individual tastes and preferences are the sole source of economic value. It is only on the basis of individual preferences that we can value:

- a can of tomato soup
- a faster route to the beach
- less crime
- more parks
- cleaner air
- better employment opportunities.

The value of any good or bad effect of a regulation is measured by individuals' willingness to pay for the gains and accept the losses.

2. Method of analysis

The tools of economic impact assessment are the tools of microeconomics. Partial and general equilibrium modeling, input-output analysis, regression analysis, surveys and gauging expert opinion are among the standard tools of the trade. Naturally, the particular tools used depend on the issues presented by the particular regulation. Also, the level of resources committed to gathering and analyzing data must be sensitive to the importance of the decision being made.

Economic impact assessment applies the principles of microeconomics to estimate: (1) the expected changes in the economy that will result from a regulation, and (2) the value that individuals place on those expected changes. Measuring the expected changes in economic variables due to a regulation is essentially an exercise in economic forecasting. As with any other forecasting techniques, future outcomes are always predicted with some error. However, the exercise is invaluable because all regulations are subject to the law of unintended consequences. The tools of microeconomics are designed to help trace the probable responses to the changes in economic incentives implied by a regulation.

The principle of consumer sovereignty requires that the **value** ascribed to these changes match as closely as possible the value that consumers would place on the changes. The explicit effort to measure the value that people place on a regulatory change is at once the most controversial, yet most valuable, contribution of economic analysis to a policy decision. We are unused to placing dollar values on many intangible and often precious social resources. The effort to do so may strike some as alien and even inappropriate. However, the failure to calculate explicit values on regulatory changes could lead to costly mistakes.

Whenever we use resources for one thing, we may be giving up the possibility of using them for other purposes. If no attempt is made to measure the value of intangibles and precious things, we may find ourselves not valuing them enough in our decisions. Or,

conversely, we may spend resources on one set of valued but unpriced assets only to have given up other, more valuable things.

Consistent with the emphasis on consumer sovereignty, economic impact assessment determines the value of changes due to regulations by observing how individuals make their own choices and inferring from that the value that people would place on the changes. When goods are traded in markets, the price tells us a great deal about the social value of the good. If markets are not available, we look for other clues, such as:

How much do people spend to avoid known risks?

How much do people spend to get to parks?

How much do property values change when something happens nearby?

When these other clues are not available, the best we may be able to do is to ask people how much they value a change. Carefully constructed surveys can reveal a great deal about the sorts of tradeoffs that people are willing to make.

As with all measurements and all forecasts, economic impact assessment is subject to error. There are times when the uncertainty over the range of likely outcomes is small, and there are times when it is very large. Even in the latter case, the decision maker can only benefit by the explicit attempt to describe the limitations of our understanding.

Economic impact assessment uses the tools of microeconomics to help those making decisions about regulations make careful, considered decisions. If carefully done, this analysis can help us make better choices by:

- suggesting the most efficient and effective strategies for achieving a given result, and
- making sure that we are fully informed of the tradeoffs implicit in any policy decision.

B. General Considerations

1. Making key assumptions explicit: All analyses involve certain simplifying assumptions. The construction of these assumptions has a significant influence on the reliability and range of application of the results of the analysis. A well formulated EIA

makes explicit the key assumptions involved in the economic analysis. Such disclosure enhances the usefulness of the analysis to policy makers and the public.

2. Baseline: The appropriate baseline for evaluating the consequences of any proposed regulation is a reasonable estimate of what the world would look like in the absence of the regulation. This baseline should take into account the likely evolution of market factors (*e.g.*, the market response to the undesirable circumstances that a regulation is designed to address) and the effect of outside forces (*e.g.*, involvement by the federal government). Since we can never acually observe the "baseline world" the definition of the baseline is subject to uncertainty. It may be appropriate to consider a number of plausible baselines.

3. Alternatives: As will be discussed at greater length below, whenever possible economic analysis is used to identify the consequences of a range of regulatory alternatives. This exercise is intended to provide information to policy makers and the public regarding the relative consequences of various regulatory scenarios. This information can facilitate informed decisions about which regulatory alternatives best serve the interests of the people of Virginia.

C. Statutory Authority

Principal authority for the economic impact analysis of proposed regulations is provided by Chapter 1.1:1, Section 9-6.14:7.1.G of the Code of Virginia. In addition, Chapter 853 of the 1995 Virginia Acts of Assembly, Section 1-79.G, and Executive Order 13 (94) also pertain to the economic impact analysis of proposed regulations.

Section 9-6.14:7.1.G. requires the Department of Planning and Budget (DPB) to prepare an economic impact analysis of proposed regulations within 45 days of receiving a copy of the regulation from the agency. The section also requires agencies to submit a copy of any proposed regulation to DPB prior to delivering it to the Registrar, and further stipulates that no regulation shall be promulgated for consideration until DPB's economic impact analysis has been received by the Registrar.

According to Section 9-6.14:7.1.G., DPB's analysis of the economic impact of proposed regulations shall include, but need not be limited to: 1) a determination of the public benefit derived from the regulation; 2) the projected number of businesses or other entities to which the regulation would apply; 3) the identity of any localities, types of businesses, or other entities that are disproportionately affected by the regulation; 4) the projected number of persons and employment positions affected by the regulation; and 5) the costs to affected businesses or other entities of complying with the regulation.

Section 9-6.14:7.1.G. further instructs that, although DPB's analysis of the economic impact of a proposed regulation shall represent the department's best estimate for purposes of public review and comment, the accuracy of that estimate shall in no way affect the validity of the regulation. Moreover, any failure to comply with, or otherwise follow, the procedures set forth in Section 9-6.14:7.1.G. shall not create a cause of action or provide standing for any person under Article 4 of Chapter 1.1:1.

Statutory authority for economic impact analysis of proposed environmental regulations, is also provided under 1995 Acts of the Assembly Chapter 853, Section 1-79.G. This section requires DPB to conduct a comprehensive analysis of the costs and benefits associated with all proposed or revised environmental regulations.

According to Section 1-79.G., such analysis shall include, but need not be limited to: 1) benefits to the general public in the form of health, welfare, and safety protection; 2) expansion of tourism and assistance to local governments and regional entities; 3) costs incurred by regulated entities in complying with the regulation; and 4) the public and private costs avoided by the regulation. Section 1-79.G. further stipulates that DPB shall submit a report to the Joint Legislative Audit and Review Commission by September 1, 1995 that specifies the methods the department will use to analyze the economic impact of proposed environmental regulations.

Finally, in setting forth the procedures to be followed for the review of regulations proposed by state agencies, Executive Order 13 (94) reiterates DPB's statutory responsibility

under Section 9-6.14:7.1.G. and requires DPB to perform an economic impact analysis of all proposed regulations.

II. CONSIDERATION OF ALTERNATIVES

Under the authorizing legislation and executive orders, DPB does not conduct a formal economic review until a regulation has been proposed for adoption. While the analysis will consider modifications of the proposed regulations that improve their economic efficiency, it will be largely confined to assessing the impact of the regulation as proposed. Given that, it is important that agencies consider efficiency-improving changes at the earliest stages of designing new or revised regulations.

Government regulation is justified when two conditions are met: (1) when there is good reason to believe that the private behavior of individual consumers and firms will lead to an aggregate outcome that is generally felt to be unsatisfactory, and (2) when government action can be effective at bringing a satisfactory outcome. Implicit in this statement are three dimensions of costs that should be counted in making decisions about regulations. There are the costs of the activity needing some external control: e.g., false advertising, pollution, reckless driving. There are the costs of taking care to avoid the consequences of these activities, costs which will be allocated between perpetrators and victims by law and regulation. In the case of false advertising, for example, consumers may gather more information or producers may be required to provide more information. The third dimension of costs is the administrative cost that the government incurs in regulating the undesirable outcome.

These are all real costs in the sense that resources used are not available for other uses in the economy. In designing a regulation, the agency should seek to minimize the total of these three costs. Not taking any action against false advertising would have zero administrative costs and low producer costs but high costs on consumers. Trying to end every last vestige of dissembling in advertising would require a very large public expenditure that simply could not be justified. Minimizing total social costs of some undesirable activity will always involve a balance between these three dimensions of cost.

That said, there is a wide variety of options available for designing regulations in a way that maximizes the gain from a given level of government activity. Choosing the most

cost effective regulatory strategy is an essential part of the cost minimizing strategy outlined in the previous paragraphs. Too often, the only option considered for a regulation is to make a determination of what individual actions are giving rise to the bad outcome and then to establish a set of uniform, state-wide rules that directly apply the coercive power of the executive branch of government to command individuals to refrain from or undertake a specific set of actions. While this "command and control" style of regulation may sometime be required[2], it will often be the case that other regulatory options may be both cheaper and more effective. In the long run, the choice of the cheapest, most effective, and least intrusive form of regulation will improve the public view of regulation and result in a greater degree of public support and voluntary compliance.

A. The range of options other than regulation

No regulation should be promulgated without the explicit consideration of the following options as alternatives to the "command and control" approach described above.

1. Doing nothing

When an initial case can be made for government intervention to correct some potential market failure or other problem, the agency considering some action should first make an assessment of what private actions are being taken in response. Firms and individuals respond to economic incentives. Often this means that corrective action taken by individuals and firms will substantially mitigate the negative impact of the market failure. Also, government action often displaces any voluntary mitigation of market failures. The lost benefits of such private action displaced must be counted as a cost of the regulation.

For example, in most states, firms use more recycled materials in their packaging than required by law. Part of this is due to cost advantages of recycled materials and part is the result of firms responding to consumer concerns over the possible environmental impact of waste materials. Freon-based aerosol propellants were phased out voluntarily in response to consumer concerns over potential damage to stratospheric ozone.

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[2] Indeed the entire criminal code is built on this model.

Even where there is a good reason to believe that individual behavior is leading to an unsatisfactory outcome, there may not be a good justification for **executive branch** involvement. The most obvious case is where the administrative cost of a regulation would exceed the reasonably expected benefits. This illustrates the obvious need to account very carefully for the administrative resources required to implement a program.

There are a number of instances where dealing adequately with undesirable activities requires considerable case-by-case determination of facts. This type of fact finding is a special province of the judicial branch and using the judicial system rather than direct regulation should be carefully considered.

2. Choosing the appropriate level of government

There are some distinct advantages to regulatory diversity. The people in different parts of Virginia may have different priorities about an issue. Local experimentation may lead to a wider array of options.

Balanced against this is the cost to commerce of varying standards in different locations. The analysis should attempt to determine whether the burdens on commerce arising from different local rules are so great as to outweigh the advantages of diversity. Product safety rules, for example, are best handled at the state level since different standards at different locations could greatly increase the cost of goods to consumers. On the other hand, noise pollution from stereo equipment or drag raceways has a purely local effect and, hence, is best handled locally. The appropriate level of regulation is the smallest unit of government that includes all of the locations affected by the pollution.

3. Using market-like instruments

When a particular outcome is desired, it may be much more efficient to provide economic incentives to achieve that outcome rather than to specify the behavior needed to achieve it. Bad outcomes (or behaviors directly connected to bad outcomes) may be taxed.

Subsidies for good outcomes or, possibly, fees for discouraging bad outcomes are also possible, although design and implementation of these incentives requires considerable care.[3]

Often, it may be possible to use property rights to reduce the need for direct regulation. If property rights can be established in resources that were not ownable before, then markets rather than regulation can be used to allocate the resources. A good example of this is in fisheries regulation. There are a number of circumstances where property rights have been established in fish stocks that were formerly subject to free and open access. Carefully implemented rights-based control has been very successful at protecting the fishery and raising the incomes of those using it. In the wreckfish fishery off of the Georgia coast, the fishermen were granted rights to a percentage share of the allowable catch based on their historical catch in the fishery. The allowable catch is set so as to maintain a healthy fish stock. Since their rights to the fish are secure, fishermen no longer have to race to get the fish as early as possible in the season. This has lead to higher quality fish which can be sold at higher prices which means higher income from the fishery.

Another case of using property rights can be found in the federal Clean Air Act provisions establishing a market for sulfur-dioxide permits. Earlier versions of the Act required EPA to establish technology standards, essentially ordering firms to use particular types of pollution control equipment regardless of the opportunities for discovering and implementing new and innovative technologies. These standards were also oblivious to cost differences among the firms emitting sulfur dioxide.

The new law sets a limit on total emissions and provides that firms be given permits proportional to their historical emissions such that the **total** emissions do not exceed the legal limit. Anyone who wishes may buy and sell these permits. Firms may choose the combination of technology, input mix and emission controls that minimize their costs so long as their emissions do not exceed the number of permits they own. Firms that find it less expensive to reduce emissions will do so and sell their excess permits at a profit. This

[3] See Baumol & Oates (1988).

program will reduce the total costs of reducing emissions by reallocating emissions among firms and by giving strong incentives for innovation in reducing control costs.

B. Elements of good regulatory design

1. Maximize individual flexibility

The key to good regulatory design is to keep the focus on outcomes rather than on the particular actions individuals must take to achieve those outcomes. The more flexibility that individuals have in achieving the desired outcome, the lower will be their costs of compliance. The agency should carefully balance the lower compliance costs against its own higher costs of enforcement. Unfortunately, agencies generally have incentives to keep their own costs low even if costs of compliance are higher. One way around this problem is to charge the regulated parties a fee for increased enforcement which should be more than offset by the lower costs associated with greater flexibility.

One avenue of achieving greater flexibility is for agencies to use more performance standards and fewer engineering (or design) standards. Performance standards are preferred wherever that performance can be measured or reasonably imputed. It would not be appropriate to characterize as a performance standard a rule that is set so that there is only one feasible way to meet it. Performance standards should be applied with a scope appropriate to the problem the regulation seeks to address. For example, where it would not cause other problems, air emission standards should cover the widest possible area: plant, firm, region, rather than the individual stack. The increased flexibility can greatly reduce costs.

2. Avoid uniform standards in a diverse world

There should be a general presumption against standards that are uniform across different people, firms, areas and times. The differences in these characteristics may imply significant improvements in the benefits expected from a regulation.

a) Different sub-populations: Different segments of the regulated population should be treated differently. For example, riveting steel beams for skyscrapers is a riskier occupation than computer data entry. It would be prohibitively expensive to make the former

as safe as the latter and wages will, under the appropriate circumstances, reflect this safety differential. Since some people are much less risk averse than others, the labor market will result in the very risk averse working at computer, and those not so risk averse taking the higher wages for the riveting. It would not make sense to require that all people face the same risks at work as long as the nature of the risks can be understood and workers are reasonably mobile.

Or there may be differences between large and small firms. This differentiation should **not** be made on the grounds that large firms are better able to afford the regulation as this could load disproportionate costs on the most productive sectors of the economy. Differences must be based on perceptible differences in the costs of compliance and the benefits expected from compliance.

b) Different levels of stringency: Agencies should carefully consider how different levels of stringency affect the net gain that can be expected from the regulation. Both the benefits and the cost will tend to rise as the level of stringency rises. After some point, however, the costs will usually start rising more quickly as the value of the added benefits becomes more modest. Before promulgating a regulation, the responsible agency should determine how a small increase or decrease in the stringency of the regulation will affect the net benefits.

c) Different dates of compliance: This flexibility is especially important where significant investment is required for compliance. For example, where extensive planning is required to make adjustments to production processes, forcing early compliance can greatly accelerate the costs of compliance through reduced productivity as well as the increased costs of more rapid implementation. There is always value in delaying capital investments. Whether it is justified depends on the particular circumstances.

d) Different methods of ensuring compliance: Monitoring, reporting and enforcement requirements may be a significant portion of the costs of a regulation. Different methods for ensuring compliance include on-site inspection, periodic reporting, and compliance penalties. The mix of these methods that maximizes the net benefits of the

regulation should be chosen For example, random monitoring is generally cheaper than continuous monitoring, and, yet, it will often be nearly as effective.

Certain structures of monitoring and record keeping can greatly reduce the cost of enforcement. For example, in certain types of fisheries with rights-based regulation, a double entry accounting system has been implemented to reduce the amount of patrol boat time required to enforce the rules. One form that the fishermen are required to fill out was specifically designed to take **more** time than necessary to complete in order to prevent fraudulent activity. The enforcement savings were large relative to the additional costs imposed on the fishermen.

3. Information rather than regulation

When problems arise due to inadequate, incorrect, or asymmetrical information[4], then informational remedies will often be the preferred approach. For example, if workers cannot find out about the risks associated with a job, then wages will not adjust to compensate workers for risk-taking. If consumers cannot assess the safety of a product, then they will not be able to make their purchases match their preferences for risk, and market prices will not adjust to differences in safety. However, it is not generally appropriate to require that all products or all jobs have the same level of safety.[5]

Providing information is generally preferred to the option of limiting peoples' options to remedy informational difficulties. Standardized testing or rating systems (mandatory or voluntary), licensing, mandatory disclosure requirements, and government provision of information are among the options available. Options must be weighed carefully because information can be expensive to provide and because the mandatory provision of information may displace that which was voluntarily provided before.

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[4] Information asymmetry may arise when the information is a public good. Then buyers may not be able to purchase the information needed to judge the quality of goods in the market while sellers may have incentive not to reveal that information. An inefficient allocation of goods may result.

[5] On this, see Viscusi (1983).

4. Making markets

Regulatory methods that simulate the actions of markets as closely as feasible should be given careful consideration. By their nature, they maximize the flexibility of the individuals and firms affected, and they reduce the amount of information needed by the regulators. Market-like approaches include fees, subsidies, non-criminal penalties, marketable rights, changes in legal liabilities, changing (expanding) property rights and requiring bonds, insurance or warranties.

Greatly increased use of market approaches is being used especially in the field of environmental regulation. Tradable permits, offsets and intra-firm transfers have been used under the federal Clean Air Act. A program in North Carolina allows sewage treatment plants to buy two units of reduction in nutrient pollution from farmers for each unit they release over a certain limit. This program allowed some treatment plants to reduce total flow of nutrients into the water without installing very costly additional treatment equipment. Incentive-based regulations are even being considered in regulating toxic wastes.

C. Alternatives the agency has considered

The economic impact assessment of proposed regulations in Virginia will determine whether the agency proposing the regulation has considered a reasonable range of alternative regulatory strategies. Agencies should specify what options were considered and the grounds for rejecting any reasonable alternatives that would have increased compliance flexibility. The discussion of alternatives should be sufficiently complete to allow the analyst to make an independent judgment about whether the grounds for rejection of more flexible alternatives were sufficient.

III. IDENTIFYING THE PEOPLE AND RESOURCES AFFECTED

The first step in measuring the economic impact of a regulation is to ask, what will the regulation actually do? Most regulations establish a set of rights and responsibilities of individuals and firms. In this way, regulations set up implicit and explicit incentives that will, to varying degrees, modify the behavior of the people who come under the purview of the rule. These behavioral changes in turn will lead to a change in the way individuals and firms allocate the resources under their control. These changes in rights and responsibilities and changes in the ultimate allocation of resources in the economy have value to people. How we measure the value people place on these changes is the subject of a later section of this paper. It is the purpose of this section to describe how to trace the actual effects of a regulation in reallocating rights and resources.

A. Changing rights and changing incentives

In most cases, a change in a regulation implies a change in some individual's rights. Even if a regulation is intended only to clarify who has what rights, it will change the value of the right by reducing the risk associated with its exercise. Normally, the ownership and quality of a right will be associated with the value of some economic resource. Occupational licenses affect the value of investments in occupational skills. Environmental rules, by their very nature, involve the allocation of imperfectly owned resources among competing users. Land values for some will rise while, for others, they will fall. Tax rules may raise or lower the value of different types of labor.

The analysis of the economic impact of a regulation must start with an effort to identify the rights that are allocated, who has their rights changed and what resources will have their values changed by the rights allocation itself. A change in the rights associated with some resource will change its value in producing goods or consumer satisfaction. This will result in changes in that resource's price. Changes in the relative prices of goods will change the way they are used in the economy.

Regulations change incentives by placing prices on some actions. Often the prices are implicit. The regulation specifies a certain behavior and doing that thing costs a certain

amount while not doing it costs some other amount. It is the special province of microeconomics to estimate the behavioral response to a change in the price of some activity. Even when prices are implicit the measurement is not different in kind from estimating a demand curve or a supply curve.[6]

B. Predicting how resources will be reallocated

Every regulation, therefore, changes the prices of some assets and some behaviors. These new prices will change the relative rewards to various activities and lead to a reallocation of social resources. Generally, it will be the case that a change in one market will lead to changes in others as well; e.g., a change in the price of coffee will be felt in the market for tea. To determine the overall change in the allocation of resources due to a regulation and how people value that change, the analysis must trace the effects of the change through all of the relevant markets. The techniques for tracing the impact of regulations through the economy fall into two categories: input-output analysis and equilibrium analysis.

1. Input-output analysis

Input-output (IO) models are sometimes called Leontief models, after their inventor, Wassily Leontief.[7] The first step in constructing an IO model is to estimate statistically the amount of various inputs that are used to create various outputs. The outcome of this estimation process is an array of fixed coefficients that specifies the amount of labor and other inputs (*e.g.*, machinery, energy, and raw materials) required to make a single unit of that commodity (*e.g.*, automobile tires). By calculating these coefficients for all industry groups in the economy, it is possible to determine how changes in the production of any one commodity affect the demand for all other commodities.

IO models do not themselves specify the amount of labor and capital available to the economy, nor do they specify the final demand for goods and services. However, once the base level of economic activity is specified, the analyst can assess how a regulation affects

[6] The estimation may suffer from practical constraints on the observability of the variables, but the theory is the same.

[7] See Leontief (1951).

economic activity by noting any resource changes likely to result from the regulation and then recomputing the level of all inputs and outputs implied by this change.

Given this information, it would be possible to use a regional input-output model to determine the direct and indirect economic impact of the proposed regulation. The direct economic impact would be the changes in the primary market affected by the regulation. The indirect economic impact would be the reduction in output and employment that would occur in other industries because of the changes in the primary industry. These measures provide an indication of the changes in economic activity in the region that would likely follow if the proposed regulation were adopted.

It is important to keep in mind the difference between changes in economic activity and net economic benefits. The changes in activity in the markets primarily affected by the regulatory change will cause ripples throughout the rest of the economy. For reasonably small policy changes, it is a straightforward matter to estimate the gross effects on economic activity. An increase in the demand for one good will increase the amount demanded of inputs to making that good available; and those increased inputs will increase the amount demanded of other inputs, etc. These effects are known as multipliers. The total gross impact of the initial change can be traced through the economic multipliers using a regional input/output model.

Input-output models are different from general equilibrium models in that they are simply a way of accounting for resource flows under the assumption that policies, relative prices, and technology are not changing to any noticeable extent. General equilibrium models trace price and quantity changes based on explicit behavioral assumptions about how people respond to changes in economic variables.

This measure of gross economic impact is **not**, by itself, a measure of the net benefit of the activity. As will be discussed at length in another section, a resource change has value in economic terms only insofar as it increases either firm profits or consumer satisfaction. Without knowing about individual preferences and firm production functions, some restrictive

assumptions must be made to make any conclusions about net economic benefits from changes in gross economic activity.

In relatively efficient markets, there will be no appreciable net effect of a change in economic activity unless there is a change in price or unless markets were not operating efficiently. Since they assume fixed relative prices and do not allow for substitutability of one resource for another, input/output models must be used with some care. Nonetheless, in the appropriate cases, input/output models may provide an inexpensive way of assessing the impacts of a regulation. Often, however, it is necessary to allow markets to adjust to the changes in relative prices implied by a regulation. When this is the case, the appropriate analytical tool is equilibrium analysis.[8]

2. Equilibrium analysis

The concept of equilibrium analysis is not at all difficult. It simply means that the analyst must specify a demand curve and a supply curve in each market affected by the regulation. The next step is to note the impact of the subject regulation in the markets for goods directly affected by it. The regulation could change the supply curve, the demand curve or the price. Since the supply and demand curves map out the value that buyers and sellers place on various quantities of the good traded, changes in the curves or in the price will imply changes in the amount and distribution of social surplus in that market.

There is a set of circumstances where it is quite reasonable for the equilibrium analysis to be limited to the market directly affected by the regulation or a few closely related markets. When the scope of the analysis is limited in this way, it is called partial equilibrium analysis.

For regulations with broader impacts, it becomes necessary to construct a model that reflects the structure of the entire economy. This model needs to account for labor and capital entering the economy, the production technologies and the preferences of individuals that

[8] The name "equilibrium analysis" derives from the underlying assumption that most markets adjust in a way that sets the demand for the good equal to the supply.

drive demand for the final outputs of firms. Such a model is called a general equilibrium model.

General equilibrium models are much more expensive to create than are partial equilibrium models, but once created, they are easily solved by computer. As the number of markets to analyze increases, partial equilibrium analysis quickly becomes impractical since the number of interactions that must be traced from market to market rises extremely fast as new markets are added. Partial equilibrium analysis has one additional drawback. Over time, as working and saving adjust to the new regulation and as businesses make long-run adjustments in production technology, the effects of the regulation can expand far beyond the original set of markets analyzed in partial equilibrium. Thus, the analyst should take care to examine whether long-run adjustments to the regulation will make partial equilibrium analysis less reliable.

a. Partial equilibrium analysis: If changes in supply or demand in the directly affected market do not have significant impacts on supply or demand in other markets then the analysis can focus on the primary market. In partial equilibrium analysis, the net economic impact of a regulation is the sum of changes in four things: consumer surplus, producer surplus (profits), government revenue and external effects. Consumer and producer surplus will be discussed in the next section. External effects occur when the actions of one firm or individual have a direct effect on someone else without there being some voluntary exchange in a market. Pollution is the classical example; effluent from one firm's production process may hurt the profits of those downwind by increasing their laundry expenses. Often, these four elements of net economic impact can be described graphically as the area under the appropriately defined supply and demand curves.

Even if a change in the primary market changes supply or demand in a few other markets, partial equilibrium may still be used as an approximation of the net economic impact so long as the changes in other markets are small and changes in consumer income are small. When there are no market imperfections in the secondary markets, the analysis is straightforward. Two cases are relevant. First, if the price in the secondary market does not

change, then there are no changes in economic welfare due to the change in the secondary market. Second, when price does change in a secondary market, then one must account for the feedback on the primary market. Once the feedback is accounted for, the welfare change is approximated by the change in the primary market alone.[9]

b. General equilibrium analysis: As already mentioned, for more than a few markets or when the changes in income are significant, general equilibrium (GE) analysis is required. GE analysis is especially important when there is a significant affect on the labor-leisure choice or on capital investment.[10]

A GE model uses a set of mathematical equations to describe (in a highly simplified way) the preferences, resource endowments, and production technology in an economy. It is also required that some assumptions be made about whether markets are competitive or not and about government spending constraints and trade with other economies. The complexity of GE models depends on the problem being examined. For some purposes, it may be possible to use a highly aggregated picture of the economy while for others much more detail may be necessary. In choosing the level of aggregation, the researcher wants to treat separately any two individuals, firms or markets that may show a large degree of interaction resulting from the regulation being examined. It is this interaction (or substitution) between groups and markets or over time that gives rise to changes in net economic welfare.

Studies have demonstrated that, for regulations with relatively large impacts, partial equilibrium models can give results quite different from the theoretically preferred GE models. The reason is that, over time, regulations affecting one market can result in changes in the supplies of labor and capital and changes in the mix of inputs and outputs. These general equilibrium responses can have economic effects that go far beyond the changes in the primary market. These general equilibrium effects cannot be effectively captured by fixed-coefficient input-output models.

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[9] For a discussion of this point, see Harberger (1964) and Zerbe and Dively (1994).

[10] Hazilla and Kopp (1990) make this point forcefully in a general equilibrium analysis of environmental regulations.

Once the markets with price changes are identified, it is relatively straightforward to identify the groups of firms and consumers who may see some net change in their well-being from the regulatory change. An important dimension of a regulatory decision is how the regulation will change the distribution of benefits apart from their size. When gains or losses are concentrated on a few individuals, decision makers may wish to redesign the regulation or consider compensating losers or charging gainers. The analyst should, where possible, identify the likely gainers and losers without making judgment about the appropriateness of the redistribution.

The decision about whether partial or general equilibrium analysis should be used in calculating changes in economic well-being is ultimately a matter that must be left to the informed judgment of the analyst. This decision should be based on sound economic reasoning and an examination of the particular characteristics of the regulation under consideration. The analyst should be careful to make clear the basis for his ultimate decision.

Take, as an example, a proposal to limit worker exposure to cotton dust. The immediate impacts are that factories will have to spend money on equipment and engineering to reduce exposures and that workers will have better health and, hence, lower medical bills at some point in the future. While these immediate impacts would likely constitute the major impact of the regulation, there may be others. An increase in costs of production will also cause the price of cotton to rise or possibly a shift in production away from areas with more stringent regulations. The demand for various types of labor could rise or fall. Wages in the cotton industry may fall as the factories become less dangerous places to work. Cotton production in the state may fall due to reduce local demand. The magnitude of these shifts must be estimated either based on data from prior experience, economic theory, or data on similar experiences elsewhere.

Once we have estimated the immediate impact of the cotton dust standard on firms and workers in this market, we can trace the path of physical consequences through the economy. However the physical consequences are not the same as the net economic effect. Firms ultimately care about profits, not costs *per se*. Workers care about their overall satisfaction

which is a function of both money and health, as well as job security and other things. And effects elsewhere in the economy are not likely to be large enough to cause any significant changes in other markets. (There will be much more discussion of these possible "secondary effects" in the next section of this report.) This allows us to conclude that a partial equilibrium analysis focusing on the increased costs of production and the resulting changes in health and earnings of workers will capture all of the important changes in net economic welfare in Virginia.

IV. MARKET AND NON-MARKET VALUATION OF RESOURCES

A. General principles

1. Individual preferences as the source of value

Having identified the people and economic resources that are affected by a regulation, the analyst should make every reasonable effort to determine how these resources are valued by individuals. It is the standard assumption of microeconomics that individual tastes and preferences are the sole source of economic value. This is often referred to as the principle of consumer sovereignty. Unfortunately, economic methodology provides no *direct* way to measure levels of satisfaction or dissatisfaction associated with a regulation. The difficulty arises because there is no agreed upon way to measure (much less compare) the level of satisfaction of individuals.

The best measure of changes in individual circumstance due to some regulatory action is an individual's willingness-to-pay (WTP) to receive some gain and willingness-to-accept (WTA) payment for giving up something over which on has control.[11] These express an individual's willingness to give or receive money in exchange for things that are of value to them. As such, they measure the "opportunity cost" of using resources for one thing rather than another. Since all transfers are expressed in dollar terms, these value measures allow the analyst to aggregate values across individuals and across different types of economic resources.

For firms, WTP and WTA amount to the same thing: a change in the firm's expected level of profits. This is because firms are generally assumed to have as their sole objective maximizing their after-tax profits. Thus, all actions can be compared in terms of their effects on firm profits alone. A gain of profits for which a firm would have a certain WTP is the mirror image of a loss of profits with a WTA of the same magnitude but opposite sign.

[11] While WTP and WTA may at first seem to be mirror images of each other, empirical evidence clearly indicates that this is not the case. Differences between these two measures will be addressed in the discussion that follows.

For consumers, WTP and WTA are not generally the same.[12] Which measure is appropriate will depend on the initial assignment of property rights. WTP is relevant when the individual does not have rights to the resource in question. WTA is relevant when he does.

When a person does not own some good, the economic value of the good is constrained by that person's wealth, the upper limit on what he or she could pay and, hence, on what he or she will pay. There is no such upper limit on how much a person would freely accept to part with something already owned. The assignment of rights in existence when a regulation is proposed determines which of these measures (WTP or WTA) is the appropriate measure of economic value. WTA will never be less than WTP and under some circumstances WTA may be much larger than WTP.

Economic theory suggests, and experimental evidence has convincingly demonstrated, that people pay more to keep something they already have than to purchase the identical item when they do not already have it. This is true even when the choices are small relative to total wealth.[13] Thus, WTA measure of a loss is greater than WTP for a gain. This implies that the value of a regulation will depend (sometimes critically) on the initial assignment of property rights and on whether the gains and losses are felt by firms or individuals.

As it turns out, WTP is often much easier to estimate statistically from observed behavior than is WTA. For this reason, WTP is often the preferred measure, but one must keep in mind that it will generally produce a downward bias (of unknown size) on the estimate of the value that people place on losing a resource that they believe is already theirs.

The use of WTP and WTA as measures of economic value simply reflects the societal choice to allocate resources in markets rather than through some other mechanism. It values resources more or less the way markets do and, hence, is consistent with this larger social choice. That is not to say that society cannot or should not make choices about changing the

[12] This discussion relies heavily on Kopp and Smith (forthcoming).

[13] Although the evidence that this difference exists is very strong, there is not yet agreement about why it exists. What is clear is that the magnitude varies both across individuals and across the goods consumed by a given individual.

distribution of income, only that whatever choices are made will be reflected in individual willingness to pay (or accept) measures.

WTP and WTA measure how much an individual values consumption of some tangible or intangible resource. Thus, it is straightforward to think about the value of resources that are shifted by a regulation. WTP measures an individual's gross value of some good. The **net** value of the resource is the WTP minus what was paid to acquire it. This net value of one additional unit of some good consumed is called the **marginal consumer surplus**. As long as an individual's subjective value of obtaining something is above his cost, he receives a net gain (or surplus) from the additional unit consumed.

This leads directly to one of the most important principles of economic valuation, that is, for relatively small changes in the quantity of goods traded in a properly functioning market, the "value" of an extra unit traded is equal to the market price of that good. Naturally, it follows that, for goods not traded in markets, price cannot provide this signal of value.

Suppose a consumer can purchase an extra unit of a good for $10. If he values the extra consumption at more than $10 (given all of his other options for spending his money) then he will buy; otherwise, not. But as this consumer buys more and more of this good, we would normally expect that the value of yet more of it will tend to moderate. Eventually, the consumer will decide that the next $10 is best spent on something else. That is, given his other opportunities for consumption (his opportunity cost), another unit of the good in question is just not worth another $10. This implies that the consumer will keep buying the good up to the point where the gain of the last unit is just about equals to the cost of the last unit[14]. For our consumer, the last unit he purchased was worth about $10 (maybe just a bit over), or, alternatively, the value of one more unit would be worth about $10 (maybe just a bit under).

[14] Cost is in terms of other consumption forgone.

Thus, when we observe goods being purchased in the marketplace, it is a reasonably good approximation to assert that the consumer's value (willingness to pay) for the last unit of a good purchased (or of one more unit) is equal to the market price. Making one additional unit of this good available to society would be valued at approximately the market price.[15] Another way of saying this is that consumers will get a **net** gain of close to zero for consuming one more (or one less) unit of the good if it is purchased at the market price. [16] Naturally, the other units purchased will have some positive net value (consumer surplus).

The same logic applies to firms selling a good. A firm will continue to sell more as long as there is a profit in it. Profit is the selling price minus the cost of production[17]. So if it costs a firm $6 to produce a good that can be sold for $10, the firm will continue to expand in order to increase its profits. As costs rise, the profit on additional units will diminish. However, the firm will continue to sell additional units until the last unit does not generate any profit. This is the point where the cost of the additional unit is $10, the market price.

In well-functioning markets, then, the price gives both the cost of producing the last unit of the good sold and the value to consumers of that last unit. The production and sale of all of the units up to the last one have given rise to profits for producers and consumer surplus for consumers. However, on that last unit sold, the marginal unit, the social cost of producing it exactly equals the benefits of consuming it. It is one of the most valuable characteristics of markets that they provide for production and consumption of goods up to this point and no further.

At the individual level and in the aggregate, WTP for an additional unit of a good is closely approximated by the demand curve and the cost of providing a unit of a good is measured by the supply curve. When markets function reasonably well, a given supply curve and a given demand curve will give rise to a price at which the demand equals the supply. At

[15] The same argument applies to reducing the supply of the good by one unit.

[16] When consumption of some good can only change by large increments, this approximation is not appropriate for an individual choice but may still work well at the level of the total market for that good. For example, an individual's decision to buy a house will not satisfy this marginal rule although the last dollar spent on the house will. And in the aggregate, there will always be someone who is just indifferent between buying and not buying at the current prices.

[17] Costs are defined to include a normal rate of return on investments.

this point, the value of another unit to a user of the good is exactly the same as the cost of supplying that additional unit in the market. The part of the demand curve that is above the price maps out the total consumer surplus from consuming all units of the good. The part of the supply curve below price shows the profits from supplying the good. Profits and consumer surplus combined measure the net social value of consumption of the good. This result only applies to cases where the observed supply and demand curves measure the appropriate WTP or WTA.

In fact, the divergence of supply and demand curves from their associated value measures is one of the primary justifications for government intervention in the economy. This will occur whenever there is monopoly (or significant market power) in a market, whenever property rights are not well-defined in all things that people care about or when some other government action (for whatever reason) prevents markets form operating normally.

2. Distinguishing costs and transfers

Most regulations will have two types of effects: efficiency effects and distributional effects. Efficiency effects change the amounts of various resources that are used and hence available to society. However, regulations will also cause a redistribution of resources between groups of people. Consider what happens when there is an increase, for whatever reason, in the price of some good. There will be some contraction of actual resource use as a result. This will change the total amount of consumer and producer surplus available to society; that is the efficiency effect. However, on all of the units of the good that are still produced, the price increase has caused a transfer of consumer surplus to producer profits. This transfer has important distributional consequences but is not associated with a gain or loss of surplus to society.

While the redistribution of resources will not enter into the net benefit calculation, every economic impact statement must report the distributional consequences of the regulation being analyzed. Valuing this redistribution should be left to the judgment of the

policy maker who is more directly responsive to the public. It is not a judgment that can be made on economic terms alone.

There are a number of areas where the mixing of real costs and transfer payments is a particular problem: monopoly profits, insurance payments, indirect taxes and subsidies and distribution expenses. Regulations may either protect or prohibit monopoly profits. The change in monopoly profits is a redistribution between producers and consumers but does not reflect a change in the real costs of production. The proper measure of resource costs is the change in the sum of producer and consumer surplus.

If a worker safety regulation reduces the insurance premiums of firms, the reduction in premiums is not itself a benefit of the regulation. The correct measure is the monetary value of improved safety plus any savings of administrative and enforcement costs due to a reduction in claims. Suppose that a change in risk induces a change in insurance premiums that are matched by reductions in insurance claim payments. The changes in premiums and claims payments are offsetting transfers, not net benefits or costs.

Taxes have distributional consequences. There are two distinct cases. Where a good is subject to an indirect tax that applies only to that good or narrow class of goods and where the good is mobile, the good should be valued at its pre-tax price. The reason is that the good is not being consumed at the expense of consumption in the private sector and thus should be valued at its real resource cost, the pre-tax price. The tax revenues are a transfer. In other cases, such as generally applied taxes or immobile goods, resources should be valued at their market price since this price reflects the value of the goods in private hands. To use a lower price would result in resources being reallocated from a higher valued use to a lower valued one with a resulting loss in surplus.

Certain types of reported distribution expenses are actually transfers. Normally, a change in the price of a good will not change the distribution costs associated with that good. However, distribution expenses are often reported in percent-of-price terms. Thus, if a regulation changes the price of a good it would be incorrect to scale distribution costs accordingly. Even if the charges actually paid for distribution change with price, this would

not be a reflection of real costs but of a transfer of monopoly profits to the distributor. A change in reported distribution expenses should be counted only insofar as they reflect actual changes in distribution costs.

3. Common counting errors

a) Double counting: Often it is possible to measure both the benefit stream due to a regulation and a change in the value of an asset associated with the benefits. For example, an improvement in navigability of a river will result in lower shipping costs. The lower shipping costs may cause an increase in property values along the river. It would be a mistake to add these benefits together, since the latter is merely a reflection of the market valuation of the former. One way to see this is to note that, if the government could charge a price equal to the marginal navigation benefits conferred, then the property value would not change at all.

b) Counting cash flow rather than net benefits: A given government action will give rise to downstream effects. Improved navigation will allow cheaper shipping and hence lower cost goods, hence more goods sold. While it may be interesting to know the gross increase in economic activity due to a government action, this is definitely not a measure of the economic benefits of the improved navigation. First, we are only interested in the **net value added** at each stage, that is, increased sales minus the real cost of those sales. Second, it is easy to overcount the impact by crediting the project with downstream benefits that would have occurred anyway. In an economy where resources are more or less fully employed, downstream benefits have an opportunity cost equal to their price and hence they make no net contribution to consumer or producer surplus. If the argument is made that resources are not fully employed, then care must be made to apply the appropriate value in a logically consistent manner.

B. Principles for the valuation of resources traded in markets

1. Using market prices

In economic terms, Virginia is a "small, open economy." Since Virginia is a relatively small part of national (even global) economic activity, and since goods, capital and labor can flow freely across the borders of the Commonwealth, there are few actions that Virginia can

take that would change the market price of these resources.[18] This is important in assessing the value of a change in economic activity due to a regulation. The economic cost of a resource used as a result of a regulation is its social opportunity cost; that is, what would be the value of the resource in its best alternative use (in its use absent the government regulation)? For goods traded in markets, their opportunity cost is usually their market price.[19]

Any outputs (primary or secondary benefits) of a government action should also be valued at their opportunity cost. For a large class of goods traded in markets, this will imply that an increase in the availability of these goods due to a governmental action will have a zero net economic value. Where goods are mobile, any increased output will simply displace goods already used optimally in the private sector.

This principle is often misunderstood. Suppose a government action results in the employment of one individual. Generally, the employment itself will have no net economic value. This is because the person employed will generally be drawn from another job at which, in equilibrium, he was being paid the value of his product to his previous employer. If there are not enough workers of similar quality in Virginia, one will be hired from out-of-state. Either way, there is no net gain to the current population from the employment itself. If the worker is drawn from the ranks of the unemployed, there may be a positive benefit from the employment itself, but this is the much less likely case. The presumption must be that any traded goods drawn to a use by a government project have an opportunity cost equal to their benefit in the newly created position and, hence, a zero net economic value.[20]

Returning to the earlier example of the cotton dust exposure standard, it might be argued that the installing of the control equipment, although a cost from the firm's point of

[18] This is, of course, a "long run" argument. Depending on how mobile traded resources are, adjustment could take a significant amount of time. Also keep in mind that not all things can be traded across boundaries: land, certain special amenities, and even reputation for a certain quality of life.

[19] Even in the presence of tax or subsidy distortions, the correct opportunity cost to use is the market price. This insures that government use of the resources does not replace private activity of higher value.

[20] This is not necessarily true in the short run. Fixed costs can lead to rigidities in the movement of resources and a divergence between benefits and opportunity costs. In the long run, however, if markets function properly, these differences cannot be maintained.

view, has some social benefits because people will be employed making the equipment, and the equipment makers will make a profit on the equipment. And this activity will, in turn, generate more work and more profits. And so on. The difficulty with this argument is that unless these other resources were idle[21] and are drawn into production by the regulation, then they are being removed from some productive use in the private economy.

The standard has not increased employment but rather shifted the workers from building houses to building cotton dust scrubbers. Given that there are plenty of workers in neighboring Maryland who could do this work, there is every reason to believe that the increased construction will not have any net employment benefit to Virginia workers. Even if workers wages are raised a bit by an increase in demand for this kind of labor because of, say, a lag in labor migration, much of the increase will come at the expense of firm profits (since they will have to pay higher wages) and will not constitute a net gain. Again, given labor mobility, any such gains for workers would probably be short-lived.

What, then, is the difference between the benefits of the cotton dust standard on firms and workers in the cotton industry and the "secondary" effects in other markets? The answer is that the initial regulation would have been justified on the grounds that the supply and demand curves in the "market" for worker safety did not accurately reflect WTP or WTA measures. So, when this market is in equilibrium, there is no reason to believe that a marginal gain to workers equals the marginal loss to the firm. It could be smaller or larger. That is precisely what the economic impact assessment is supposed to determine. Unless there is reason to believe that there are distortions in the secondary markets, then changes there will not have any significant net effect on economic well-being.

2. Whose benefits count?

Virginia's status as a small, open economy raises another important issue, one requiring that an explicit value judgment be made prior to the analysis. Any change in the pattern of resource use in Virginia will result in some migration of capital and labor across

[21] By idle resources, we mean labor or capital that is offered up at the current market price but left unused. This market cannot be in equilibrium because this "excess supply" should lead to a price adjustment that sets supply equal to demand.

state lines. All income earned on capital, labor or land is paid to people, but the people earning the income may not be from Virginia. The question then arises, how should the benefits to non-Virginians be counted? Suppose that a job created in Virginia is filled by a person from Michigan. While the spending of that individual may lead to some downstream benefits, the job itself is not a gain to any Virginians present at the time the decision was made. For the purposes of judging the economic benefits of government action, only those gains and losses felt by current residents will be counted.

A similar argument can be made for government actions that change interstate flows of capital. Suppose that someone from Alabama invests $10,000 in Virginia. For the capital to be drawn here, a flow of interest payments equal to the opportunity cost of capital must be sent back to Alabama. Unless there is some reason to believe that the market for capital is distorted in Virginia, the capital flow itself by someone from out of state has no net economic value. It is only valuable if the investment enhances the productivity and returns earned by local labor and capital. The same argument applies if the capitalist from Alabama moves to Virginia to make the investment. Then the income stays in Virginia, but it accrues to someone who was not in the state when the decision on the project was made. There may be net benefits from the local spending by the immigrant, but the investment income itself is not a benefit of the government action.

3. Using shadow prices when market prices are distorted

It is possible that, even for traded goods, price may not equal opportunity costs. This may happen when some resources are unemployed, when some resources are not mobile and when there are significant economies of scale or scope. Any proposal that depends on an assertion that traded goods are not being effectively allocated in their respective markets demands a substantially higher burden of proof.

Government actions affecting traded resources may lead to net benefits when, for some reason, the price of goods is not able to adjust in a way that sets the marginal WTP equal to the marginal cost. When this is true, price does not accurately reflect the social cost of a resource. The true social opportunity cost of the resource is called the “shadow price.”

In a labor market with unemployment, the shadow price of labor is the worker's reservation wage; that is, the wage below which the worker would choose not to work.

Economies of size and scope may result in opportunity costs that are lower than the price of increased activity. Unfortunately, there is little empirical research on these effects. Arguments based on these impacts must be carefully documented. It must also be kept in mind that this argument also works in reverse. There are resources that are subject to size diseconomies; their average costs increase as size increases. These may result in opportunity costs rising above the market price. Drinking water supplies is an example of a good possibly subject to long run increasing average costs. Expanding drinking water supplies often requires that restrictions be placed on the use of large contiguous blocks of land. As cities expand, the available land gets more expensive or further away. Either way, average costs increase.

Another reason for the divergence between the market price and the social value of a resource is the presence of "externalities." An externality arises when one individual's actions have an effect on another individual without the intervention of a market transaction. These effects result from imperfections in our ability to define property rights for some things. Without property rights, markets (in the economist's sense of the word) cannot be used to allocate resources according to willingness to pay. While we know that externalities can cause price not to accurately reflect social costs and benefits, the remaining difficulty is how to find the "true value" or shadow price of these unownable resources. This is the subject of the next section.

C. Principles for valuing resources not traded in markets

It is well understood that, for various social and technical reasons, many things that people value are not traded in markets. An individual cannot buy national defense, quality of life or a beautiful view. Probably the single greatest challenge in economic impact assessment is in making a fair determination of the value of things not traded in markets. The issue arises most frequently (but not exclusively) in assessing the value of protecting environmental assets not amenable to ownership: air, water, oceans, genetic diversity, parks.

The goal of this part of the analysis is to assign a dollar value to goods (and bads) not normally associated with explicit monetary measures. This procedure will inevitably be controversial for two reasons: First, when you state an average value for something, you can be virtually certain that everyone will disagree with you. Depending on personal preferences, any individual will see the value as too high or too low.

Second, measuring these values is extremely difficult. There will often be a reasonable range of error spanning orders of magnitude. However, the models and data used to estimate values of non-market goods are improving. The methods appear to be converging in a way that gives us some confidence that the true social value of some unpriced resource lies between our error bands. It is preferable to give a rough estimate (and to assess its accuracy based on experience and general knowledge) rather than to give no estimate at all.

Just because things are not traded in markets does not mean that people do not try to consume them. In fact, the efforts that people make to consume non-market resources can be very useful for estimating their value of consuming that resource. Often, we can observe market transactions that are properly interpreted as efforts to consume something for which there is no explicit market. The first set of valuation tools discussed here, known as indirect market methods, attempt to infer the values that people place on non-market goods (and bads) from other, observable transactions. For those resources with no observable impact on marketed goods, we are left with little choice but to ask people how much they value a resource. This survey method is known as contingent valuation (CV).

Non-market valuation techniques are expensive. In evaluating Virginia regulations, great reliance will be placed on research undertaken in other locations or in slightly different contexts from the actual situation under consideration. Great care should be taken to assess how closely the study used matches the particular circumstances of the regulation under consideration. Enough information from the study used should be included to allow the decision maker to make an independent judgment about any additional uncertainties introduced by using the study.

1. Inferring values from observable consumer choices[22]

It is a central tenet of economics that, whenever an individual places a value on consuming or using a resource, that individual will be willing to expend resources toward that end. Thus, even when a valued good is not itself available for purchase, if we can observe the resources that a consumer spends to acquire the good we can infer the consumer's value on the non-market good itself. As discussed earlier, we expect that an individual will continue to invest in acquiring a good until the cost of the last unit is equal to the benefit of that unit. So, for a small change in the quantity of the unpriced good consumed, the value of that change can be inferred from the value of the market goods spent acquiring it. For larger changes, the analysis is somewhat more complicated and requires more information. So, in general, it is easier to value small changes than it is big ones.

a) Averting behavior: If a person is exposed to something he does not like, we expect that they will, when possible, make some effort to mitigate the effects of that exposure. When exposed to high perceived risks of nuclear war, some people moved away from "targeted areas", others stocked food and water, while some built bomb shelters. At a more prosaic level, if people perceive that their water supply is not safe, they may buy bottled water. Farmers can adjust cropping patterns to adjust to hotter weather or to ozone exposure.

For small changes in exposure, we can estimate the value of the change as the cost of the "averting good" times its effectiveness in producing the desired change. If we can observe how productive the resource is at mitigating physical damage and the amount spent on that good, we have a reasonably good estimate of the value of the marginal damage itself, that is, the WTP for less exposure to the bad effect. Suppose that we observe an individual spending $100 on a prescription medication that reduces the health effects of ozone pollution for 5 days. This would imply a value of $20 for an additional day free of ozone pollution.

Large changes in exposure require knowledge of the individual's marginal value function (demand curve) for avoiding the damage. While conceptually possible, this would

[22] This section relies heavily on Cropper and Oates (1992).

be very difficult to actually accomplish. There are ways of putting some bounds on the value of large changes in exposure to undesirable effects that depend only on knowing the technology of producing the change in exposure. By making reasonable simplifying assumptions, it is often possible to reduce the problem to manageable proportions without unduly sacrificing the reliability of the results.[23]

The usefulness of the averting behavior approach is limited to cases where individuals can substitute other (measurable) goods for the damage from exposure to the undesirable effect. Crop substitution in the face of ozone pollution is a case already mentioned. Some of the minor health effects of air pollution can be relieved by medication. People can buy bottled water or filtration systems to improve the reliability of their water supply. Air conditioners can reduce the effects of outdoor air pollution.[24]

There are two difficult measurement problems in the use of the averting behavior method. First, the consumer's expected benefit from the averting behavior depends not on the actual effectiveness of the behavior but on the perceived benefit. It is the *perceived* benefits of the expenditure that the household equates to the marginal cost of the exposure. For example, if the actual benefit were smaller than the perceived benefit, the observer would underestimate the consumer's WTP for lower exposure. Second, when the averting expenditure produces other benefits besides reducing expected harm, the cost of the activity should not be attributed solely to reducing the harmful effect. Bottled water may taste better than equally safe city water. Air conditioners cool and dehumidify as well as reduce exposure to pollution. Sorting out these effects may not be possible with the resources available.

Suppose that an agency plans to promulgate a regulation imposing reliability standards for the supply of electricity from regulated power companies. An increase in reliability will be costly and the costs are reasonably easy to estimate. But what about the benefits of such a change? The averting behavior approach may be useful here. The object is to estimate a demand curve for reliability of supply. We would start by gathering data on expenditures that

[23] See Bartik (1988).

[24] For some recent applications of this method, see Smith and Devousges (1986) and Dickie and Gerking (1991).

firms and individuals make on equipment designed to smooth over service interruptions. In order to estimate a demand function, we would require information from several areas with different levels of reliability. Under the assumption that people will set the marginal value of additional reliability equal to its original cost, we could then derive an estimate for the willingness to pay for various levels of reliability. This, in turn, would allow us to calculate the value of the change in reliability proposed in the regulation.[25]

b) Weak complimentarity: For the same reasons that we would expect to see people spend money to avoid bad things, we would expect to observe them spend money to enjoy good things even though they are not traded in markets. People routinely spend substantial resources for trips to parks or other public lands. Also, we would expect that the amount people are willing to pay increases with their perception of the relative quality of the good. So, the value of a trip to a lake would increase as the quality of the water improved. As before, if we assume that people spend on the consumption of a good until its marginal benefit equals its marginal cost, then we have a way of inferring the social value of these unpriced goods that people pay to use.

This technique is often called the "travel cost method" because it infers the value of recreational sites from the travel (and other) costs people incur to use the site.[26] The travel cost method starts with a survey of actual users to find out the origin of their trip and the costs associated with the trip. This information is then used to estimate the fraction of the population from various areas who actually use the site and the WTP for various quantities of usage. This allows the researcher to construct a demand curve for the resource and, hence, the total social value of consumption of the resource.

While there are numerous technical difficulties with applying the travel cost method, a full discussion of these goes beyond the scope of this report.[27] What is important to mention here is that there is a great deal of experience with this method and the existing literature

[25] The reliability of this estimate will depend on the quality of the data and the care taken to avoid bias in the estimates.

[26] For surveys of recreation demand models, see Mendelsohn (1987) and Braden and Kolstad (1991).

[27] Freeman (1991) gives an extensive treatment of these issues.

provides a very good guide for the implementation of this type of study and what level of reliability to expect. As with all indirect methods of valuing resources, these studies, if properly implemented, can be quite expensive. Every effort should be made to use studies of analogous resources. It may be that, a sensitivity analysis of the decision being made will show that a more detailed study of the particular resource in question will be unlikely to change the outcome of the policy decision.

c) Hedonic pricing: For goods traded in markets, the price reflects consumer valuation of all of the given characteristics of the good. If you were to observe a change in just one of those characteristics, then the resulting change in price would give a measure of the value that the consumer places on that particular attribute. A value inferred in this way is known as a hedonic price. So, conceivably, we could decompose the price of marketed goods into a full set of hedonic prices. Many of the attributes of a marketed good may not themselves be traded in markets. The hedonic pricing method allows us to infer shadow prices for these non-traded goods. This method has been used primarily in the housing and labor markets to estimate the value of environmental disamenities and risks to health.

It is well known that many unpriced amenities influence the prices of urban dwellings. Among other things, public schools, proximity to parks, air pollution, views, distance form dumps all contribute to the valuation of a given piece of property. The change in property value due to a small change in one of these attributes measures may be taken as the shadow price of the attribute itself. For large changes, this measured price change will not measure the value of the attribute exactly because the individual can be expected to respond to the change in the amount of the attribute by changing his choices of other attributes as well. Thus, the price change observed when there is a large change in one attribute may be seen as an upper bound on the value of that attribute itself.

Another way of assessing the value of unpriced amenities is to measure the wage differential between areas with different levels of the amenities. If workers can migrate freely between the locations, we would expect wages to be lower in locations with higher levels of amenity value, all other things being equal. The return to non-movable assets such as land

will also reflect the differences in amenity values. Thus, we can find the value of the amenity services by adding the wage and property differentials between two locations.

Finally, we can use wages to estimate the value to workers of increases or reductions in their risks of death or injury. Safety is an attribute of a job. Wage demanded is, to some degree, a function of the attributes of a job. So by comparing jobs that are similar in most respects except that they differ in the workers' exposure to risk, we can infer the value that the workers place on accepting risk. The difficulties in estimating values from wage differentials are potentially very great. Wage differentials depend on bargaining power while workers' values of risk generally will not. Workers who are risk tolerant tend to self-select into riskier occupations; thus, it would be a mistake to assume a uniform population of workers. Also, wage differentials will depend not on actual risks but, rather, perceived risks. This gives rise to strategic behavior by employers and employees in representing the nature of the risk and the preferences regarding them, respectively.

The estimation problems in using hedonic pricing methods are formidable. There is, however, a large body of experience with these techniques, large enough so that, when the studies are properly designed, the results may be used to make a reasoned judgment about the valuation that people place on environmental amenities and about the range of uncertainty that remains. The key to successful use of this methodology is in paying close attention to the representativeness of the sample, the mobility of resources and the quality of information actually used by the individuals making the consumption choices.

Some of the complications of implementing this approach can be explored in the context of the cotton dust standard previously discussed. The value of health effects are measured in terms of individual willingness to pay. One way one might measure worker WTP for safety is to examine the wage differentials demanded in other occupations with similar characteristics. Unfortunately, wage differentials may be sensitive to factors not related to worker WTP. For example, cotton mills and related facilities are often large employers in a market and have some monopoly power in the local labor market. Second, workers may face large fixed costs of relocating and may be subject to borrowing constraints.

Human capital may be highly industry-specific, contributing to the reduced mobility of the workforce. These factors may make wage differentials very poor indicators of WTP.

2. Resources with no related markets: just ask...

There are a number of circumstances where it will not be possible to estimate WTP by observing actual individual behavior in related markets or where those estimates will not capture the full value that the individual places on the resource. Often, problems in collecting and interpreting data will make these studies impractical. At other times, there may not be sufficient differences between the various opportunities available to individuals for the data to provide any information; the needed data may not be available at any price. At other times there simply may not be any mitigating strategies susceptible to measurement or any analogous markets. An especially interesting case where markets simply do not exist is the case of *non-use values*. Non-use values arise when someone does not expect to experience a good directly, but nonetheless cares about the existence or quality of the good. Examples often given for the importance of non-use values include preserving endangered species or national heirlooms. Also, a person might prefer that animals not be abused even if he will not be in a position to observe the abuse or its consequences.

The only avenue available for valuing resources with no observable market impact is to ask people about their WTP (or WTA) with respect to these goods. Surveys used to value resources not traded in markets are referred to as contingent valuation studies. Survey methods have long been disfavored in economic analysis because they are not based on the actual observed choices under a budget constraint. Consequently, it is problematic to draw a direct connection between survey responses and the choices that would be made if markets for the resources could actually exist. Survey responses are subject to numerous theoretical deficiencies: they are hypothetical, subject to strategic manipulation and sensitive to survey design.

That said, if no other avenues are available for valuing a resource, then a properly designed survey may be an acceptable possibility.[28] A great deal of effort has been applied to developing contingent valuation methods that reduce the bias to an acceptable level. A recent panel of distinguished economists performed an extensive evaluation of contingent valuation techniques.[29] Their conclusions were mixed. They suggested that CV studies could be designed to yield results reliable enough to use in making public resource allocation choices. They laid down a number of survey design criteria that should be met before the CV results could be expected to give results comparable to other methods. Unfortunately, at least at the current state of the art, satisfying the expert panel's criteria will cause CV studies to be quite expensive, prohibitively so except when larger resource allocation questions are at issue. Numerical estimates of WTP from contingent valuation studies not meeting the criteria of the expert panel should be used with very special caution, if at all.

It should be noted that, CV studies strongly reinforce the observation that WTP may diverge widely from WTA. This means that whether a policy choice is beneficial may be very sensitive to the starting point. The existing assignment of property rights may subject policy choices to a large measure of inertia. Whether this observed inertia is due to actual preferences or to the nature of CV studies is not known at this time. The presence of any significant observed differences in WTP and WTA should be reported in the economic impact assessment and its importance should be evaluated using sensitivity analysis.

3. A special case: the value of life and health

Economic impact analysis is bound by the principle of consumer sovereignty. Measuring the value of social resources depends on our ability to observe or elicit individual responses to the opportunities and constraints that they face. In this framework, it is not possible to make any inferences about the value of a given individual's life or a large, certain decline in health. There are not choices to observe and elicited values are generally seen as totally unreliable. Fortunately, regulatory actions almost never give rise to a high probability

[28] This does not necessarily imply that any number, no matter how questionable, is better than none. On this, see Hanemann (1995) and Diamond and Hausman (1995).

[29] Arrow et al. (1993).

of harm to an identifiable individual. Should such a case arise, no economic valuation can be made of the value to life or health. This decision must be left entirely up to elected representatives as a matter of public policy.

Normally, regulations do not affect an individual life but a statistical life.[30] Most individuals make daily choices about the value of **a chance** of death or **a chance** of harm. Some of these choices have directly observable market consequences that allow economists to estimate the individual's own willingness to trade health and safety off against other consumption goods. This emphasis on consumer sovereignty implies that lives should be valued in terms of individual WTP for safety (or WTA harm).

It is not appropriate to value lives in terms of lost wages or human capital. The human capital approach values lives and injury as a function of lost productivity or lost present value of earnings. Since this method is not consistent with consumer sovereignty, it is generally disfavored if alternatives exist.[31] Rather, the value of any changes to risk of life or significant risks to health should be valued by observing consumer willingness to trade consumption for safety in other analogous circumstances. A large body of literature has developed using wage differentials and consumer product choices to estimate the value that individuals place on marginal changes in risks to life and health. These studies may be used to determine a reasonable range of values for changes in risks.

A number of important issues arise in assigning these values. First, consumers base their choices on perceived risks. If value-of-life calculations are made on the basis of actual risk rather than perceived risk, the estimates will be inaccurate. Second, if people are subject to borrowing constraints or large fixed costs of moving, observed behavior may not accurately reflect the value of risk tradeoffs. Great care must be taken to control for these measurement difficulties. Third, it is well known that safety is a good that people buy more of as their income rises. Consumer sovereignty requires that the analysis respects the

[30] For a very thoughtful analysis of this issue, see Schelling (1993).

[31] See chapter 4 of Gramlich (1990) for a discussion of this point. If the human capital approach is used, it will generally be a lower bound on willingness to pay for safety.

informed choices of people to expose them-selves to somewhat elevated risk in return for higher wages or lower rents. There will be cases where the distribution of risk to health and safety may become so unequal that it will raise special concerns about fairness. (This will be especially true for children who are not considered competent to make informed choices for themselves.) This is a distributional issue that should be noted in the analysis but should not be factored into the valuation of the impact of the regulation itself.[32]

[32] As in other areas, the distribution of gains and losses will be weighed by the decision maker along side the other measurable economic effects of the regulatory change.

V. VALUING ECONOMIC IMPACTS THAT OCCUR IN THE FUTURE

All future cash flows associated with a policy change must be discounted at the appropriate discount rate to reflect the time value of money. In their text on policy analysis, Stokey and Zeckhauser state the rationale for discounting succinctly: "The key to understanding discounting and the choice of the appropriate interest rate for discounting is to remember that: funds expended for a government project are not funds that would otherwise stand idle. They are obtained by the government from the private sector...If left in the private sector, they will be put to use there, and in that use will earn a rate of return that measures the value that society places on that use of the funds."[33] In other words, discounting takes into account the opportunity cost of using resources. In the private sector, other things equal, present consumption is preferred to future consumption. Current resources are valued more highly than resources available at a later date. If the government did not discount for the opportunity cost of funds, it would end up investing in some projects that provide less value to society than had the funds been left in the private sector.

Since funds available at different times have different values, then we cannot add (or subtract) dollars that accrue in different years. We must first translate these differently-valued dollars in such a way that each dollar has the same value to people. Discounting future cash flows translates those dollars into "present value" terms. Thus, future dollars, once discounted, are valued the same as present dollars and may be added up to give the total present value of a future cash flow. The present value of a cash stream is the value of the cash stream after taking into account its opportunity cost.

Funds should be valued at their opportunity cost. The opportunity cost of the public use of resources is what those funds would have earned in the private sector. This opportunity cost is measured by the consumption benefits forgone by reallocating the funds to government activity. The appropriate interest rate to use for discounting is the rate at which individuals choose to transfer consumption between the present and the future: the social rate

[33] Stokey & Zeckhauser (1978)

of time preference (SRTP). We will discuss later actual estimates of the SRTP and hence, the appropriate rate for discounting future consumption effects of a government policy.

A. The shadow price of capital

The valuing of future benefits and costs is complicated somewhat by the observation that some of the funds used by the government program and some of the benefits flowing from the program may not affect consumption directly, rather, they may imply a change in funds available for investment in increased future consumption. As already mentioned, changes in the future consumption of resources should be valued by discounting those changes at the SRTP. Since the SRTP is a measure of how people transfer consumption across time, we must estimate what consumption stream is likely to arise from a given dollar of investment.

Investment has economic value because it provides increased consumption in the future at the expense of consumption today. The dollar value of the future consumption that we expect from a dollar of investment is called the shadow price of capital (SPC). Insofar as a government action displaces or supplements the amount of funds available for investing, the SPC is the appropriate measure of the opportunity cost of investment funds.

Once we have an estimate for the SPC, we can calculate the expected stream of consumption due to a marginal dollar of capital investment. Having translated the investment dollar into a stream of future consumption flows, we can then simply apply the SRTP to that consumption to discount it to present value terms.

It should be kept in mind that the SPC should be applied only to changes in the amount of money available for investing. Because capital is highly mobile across state (and even national) boundaries and because the amount of investment in Virginia is small relative to the total amount of capital available for investment, it will generally be appropriate to assume that a given regulatory action will have no measurable impact on the amount of investment funds available in Virginia. So, in general, the stream of costs and benefits associated with a program or regulation should not be adjusted for the SPC and should simply be discounted at the SRTP.

B. Estimates of the social rate of time preference

When capital markets are relatively efficient, as in the United States, the SRTP will be approximately equal to the before-tax rate of return to incremental private investment. A good measure of this rate is the expected real rate of return on U.S. Treasury bonds whose length corresponds to the period over which the consumption flow is expected to occur.[34] Recent estimates place this rate between 2 and 6 percent with 3 to 4 percent as the best guess.[35]

C. Other issues with respect to discounting

1. Inflation: There are several points that need to be made about the discounting of future consumption flows. First, discounting is not the same as adjusting for inflation. The appropriate procedure for accounting for inflation is to express all consumption flows and the discount rate in real (inflation adjusted) terms. For nominal consumption flows, each identifiable flow should be adjusted for inflation using the expected rate of inflation for that type of good. The real discount rate is calculated by taking the nominal interest rate on U.S. Treasury bonds and subtracting the forecast inflation rate over the same period. This procedure has the added benefit of taking into account the possibility that the relative prices of goods may change over time.

2. Risk: Especially for changes in regulations, little information is available on the correlation between the returns to the regulation and the market portfolio. Using such an adjustment is complicated by the dependence of the appropriate adjustment on the length of the stream of expected benefits, itself a highly uncertain variable.[36] Thus, unless a strong argument can be made that the returns to the project will not be highly correlated with aggregate income, the discount rate should not be adjusted to account for risk.[37] If there is

[34] Lyon (1990)

[35] See Gramlich (1990) and Zerbe and Dively (1995) for discussions of recent efforts to estimate the social rate of time preference.

[36] On this see Myers and Turnbull (1977). Introducing this significant complication into the analysis will not be of much value unless the net value of the project is quite sensitive to changes in the interest rate.

[37] This is true so long as the project in question will involve only marginal changes in the total wealth of those effected. If the change would make large changes in the level of wealth, then the program may induce significant risk for those

reason to believe that returns to the regulation are not correlated with aggregate income, it would be appropriate to include this as a consideration in the sensitivity analysis. Financial risks to individuals and firms should be taken into account in establishing the values (certainty equivalents) of the risky consumption flows attributed to the project not in setting the discount rate. This will be discussed at length later in a later section.

3. Depreciation: Depreciation is taken into account in the calculation of the consumption flow resulting from a decision. No adjustments should be made in the discount rate to account for depreciation.

4. Hard-to-value consumption flows: Some consumption flows are not easily converted to dollar values. Nevertheless, these "unmonetized" flows must be discounted to reflect the social rate of time preference. Not doing so would introduce a systematic bias in the valuation of programs. The direction of the bias would depend arbitrarily on whether the unmonetized flows were in the nature of costs or benefits.

individuals. Again, this risk to individuals should be used to calculate WTP and WTA measures of regulation benefits and costs.

VI. MEASURING VALUES UNDER RISK AND UNCERTAINTY

Every policy decision has associated with it a number of dimensions of uncertainty. At the outset, it is useful to distinguish two ways in which our lack of perfect knowledge about the world may affect the value of a given policy proposal. First, individuals (and firms) always face uncertainty about the future; different states of the world will imply different levels of well-being. Many government policies will have a significant impact on the nature and magnitude of uncertainties that individuals face. The second dimension of uncertainty confronts the policy maker who must recognize that the outcome associated with any given policy initiative is itself uncertain. This uncertainty implies that the policy maker will often be in the position of making a choice where each option has a wide range of potential outcomes. To complicate matters further, each actual policy outcome will be valued differently by consumers.[38]

The presence of uncertainty implies a choice. An individual facing a risky choice[39] can do one of three things:

1) take the gamble as presented,

2) take actions that reduce the cost of the uncertainty (buy insurance), or

3) reduce the uncertainty by buying more information about what is likely to happen.

Except in unusual circumstances, people prefer a certain outcome to a risky one. Thus, we would expect that anyone facing a risky future will make some expenditures designed to reduce the cost of the uncertainty or to learn more about what outcome will actually occur. This is true of both individuals and policy makers.

[38] The terms "risk" and "uncertainty" apply to the situation where a person does not know which of two or more possible states of the world will actually occur at some point in the future. It is traditional to speak of risk where one faces a reasonably well understood probability distribution over a well defined set of possible outcomes. Uncertainty refers to the case where less is known about the probabilities of various outcomes and even about the set of possible outcomes themselves. Clearly, these are just two parts of a spectrum of imperfect knowledge about the world. When speaking generally about our imperfect knowledge, we will often use these terms interchangeably. However, as needed, we will use these terms in their traditional senses to distinguish two levels imperfect knowledge.

[39] We will use the word "lottery" (or gamble) to describe a situation where someone faces an uncertain outcome in the future. A lottery is a set of possible outcomes and a set of probabilities that each of those outcomes may occur. We may or may not have a good idea about what probabilities to associate with what events.

In this section, we will address how risk and uncertainty affect the economic value of a given policy choice. This valuation must take into account any welfare changes due to risks that cannot be eliminated or diversified away plus the costs of obtaining new information and of adjusting behavior to reduce the costs of fundamental risk. In a later section, we will describe how the uncertainties in economic analysis will be presented so that the policy maker is fully apprised of the full range of outcomes that might result from a given policy initiative.

Since people place a premium on avoiding risk, then a risky stream of benefits or costs flowing from a policy must be adjusted to take account of this risk premium. Measuring the economic value of a policy with a risky outcome involves two distinct steps: 1) a risk assessment that characterizes the probabilities of occurrence of the various outcomes of interest, and 2) a valuation of the risks in terms of individual preferences and avoidance costs. It is important to keep in mind throughout this decision concerning what is the appropriate level of risk is a question of policy not of science. The level (and type) of risks should be chosen on the basis of the value that people place on being exposed to those risks.

A. Risk assessment

Evaluating the risk associated with some policy action raises a number of difficult scientific issues: The full range of effects of the policy may be difficult to identify. The data that is reasonably available may be incomplete, biased and subject to unknown measurement errors. Scientists may disagree over the model that specifies the key relationships in the chain of causality. Many models of physical and social phenomena cannot be fully validated. Taken together, these problems may give rise to great uncertainty about the expected outcomes. In some areas, most notably environmental and safety regulation, the scientific uncertainties may span several orders of magnitude. It is crucial that these uncertainties be incorporated into the analysis in a way that facilitates the eventual valuation of the risks in economic terms.

The fundamental principle of risk analysis for policy decision is that risk assessments should provide quantitative assessments of the central tendency of risk and measures of dispersion so that the policy maker can choose the policy that best reflects social preferences

for avoiding or accepting risk. Assumptions should be consistent with the best available scientific information. Uncertainties over the different factors in the analysis should be combined in a statistically appropriate fashion into a probability distribution reflecting the overall uncertainty about the risks. The material provided should permit the reader to replicate the analysis and quantify the effects of the key assumptions. In particular, data and assumptions should be presented in a manner that permits the explicit quantitative evaluation of their incremental effects.

One common unacceptable practice for probability assessments is to rely on studies designed to minimize false negatives. For example, many toxicity assays and epidemiological studies are designed to err on the side of finding effects where they may not exist (false positives) to avoid the possibility of not finding an effect if it is there (false negatives). If used in a risk assessment without adjustment for the experimental design, these results would tend to lead to an overstatement of actual risks. A similar problem occurs when risk assessors incorporate safety factors into parameter estimates or choose model specifications in order to account for uncertainty and unmeasured variability. Both of these practices may lead to levels of risk avoidance that are not justified by individual preferences. This is especially true because conservative assumptions made at each stage of a risk assessment are multiplied together to generate the overall probabilities. This greatly magnifies the effect of each separate conservative assumption.

To aid in effective policy choice, risk assessments must provide estimates of baseline and incremental risk on average, and the dispersion around the average. The estimates of both central tendency and dispersion should be based explicitly and solidly on the current state of scientific understanding in the field.

B. Risk valuation

The economic theory of how individuals value risk is very unsettled.[40] Until recently, the accepted theory, known as the expected utility hypothesis, resulted in a number of

[40] Machina (1987).

conclusions about valuing risks. This theory held that, for most relevant lotteries, individuals will be risk averse, that is they will be willing to pay to avoid (or reduce) their risks. For a given individual, the magnitude of this willingness to pay will depend on the expected outcome of the lottery and on the "riskiness" or dispersion of that lottery around its expected outcome. Recent experimental evidence has called into question the applicability of the expected utility hypothesis for certain types of lotteries. That said, there is ample reason to believe that, for many of the decisions made routinely by policy makers, the expected utility hypothesis provides a good approximation of how individuals value lotteries. For those policy choices that take us outside of the applicability of the expected utility hypothesis, the policy decision will require a more careful analysis.

It is useful to classify risks into three groups. The first group comprises small familiar risks, usually financial risks for small amounts of money relative to an individual's wealth. The second group includes lotteries with a wider dispersion of possible outcomes, risks that are still largely financial in nature or of a kind routinely faced by the individual. The third group includes lotteries with a wider dispersion of possible outcomes and where the decisions about risks of this nature are special, in the sense that they are not seen as readily comparable with other types of risk. For the first two groups, expected utility analysis is largely appropriate, the difference between them being that, in the first group individuals may be treated as valuing risks only according to their expected outcomes. In the second group, there is a significant premium for avoiding risk but risks may still be compared readily. Risks in the third group give rise to special problems because individual valuations of lotteries may depend on other things besides the lottery's expected value and dispersion of outcomes.

However risks are valued by consumers, it is not appropriate to adjust the discount rate to account for the riskiness of future benefits or costs. Most of the time, allowance for risk should be made by adjusting the monetary values of the uncertain future consumption flow. The value of risk can be incorporated into net benefits estimates by expressing the benefits and costs in terms of their certainty equivalents, or the amount of certain benefits and costs that would have an equivalent value to a risky flow of benefits and costs. The certainty equivalent of the net benefits of a regulation with uncertain net benefits is smaller than the

expected value of those benefits, because risk has an intrinsically negative value. However, the certainty equivalent of a risk-reducing regulation is larger than the expected value because the certainty equivalent includes the intrinsic value of risk reduction.

Since risk is something that individuals prefer to avoid, we would expect to observe people who face a risk to spend resources to reduce the (negative) value of the risk. These expenditures may take the form of self-protection, mitigation, buying insurance, and buying information. These risk management measures are costly and must be counted as part of the costs of uncertainty. An individual's risk premium is measured after he has adjusted his activities to manage risks. The social costs of risk, then, comprise expenditures on risk management plus any residual risk premium that remains.

a) Valuing risks: the expected utility hypothesis: If those affected by a regulatory action have diversified sources of income, if the risk affects a small share of wealth or income, or if individuals have sufficient flexibility in production methods or sources of employment, then the value of the risk will be small enough to ignore. This means that, for small risks, the risk premium vanishes under normal circumstances. In these cases, people will not spend any significant resources on risk management nor will they have any residual willingness to pay to reduce the dispersion of the risky outcomes. They will act as if they are neutral to the risk. Any policy change that will only have a small impact on individual budgets should value the stream of consumption flows from that project valued at their expected value.[41]

As the size of risks increase relative to wealth or income, or as opportunities for diversification become limiting, we will expect to observe people spending resources to manage their risk. Any remaining risks will carry a significant risk premium. The effects of a policy change may not be the same for everyone. Thus, a policy that has a small average impact on risk may fall disproportionately on a few people. In this case, those affected may have substantially increased (or decreased) costs due to changes in risk. It would then be

[41] In thinking about the budgetary consequences of a policy, except for the largest programs, the Commonwealth of Virginia should be treated as a risk neutral decision maker due to the size and diversity of its economy.

necessary to estimate the value of the changes in risk and to use the certainty equivalent for any net benefits of a policy change. Risk premia are not easy to estimate, but it will often be possible to bracket the reasonable range of values by drawing analogies with other, similar risks for which risk premia are more readily observed.[42]

b) When the expected utility model fails: There is strong evidence that, for many types of lotteries, the expected utility model gives very poor predictions of individual behavior. For the cases where this is true, it would not be appropriate to use the expected utility model to measure willingness to pay for risk reduction. It is not possible to maintain the assumption that people care only about the expected value and dispersion of the lottery. When the risks are large or they affect health or safety or some strongly held value, it is not possible to depend on some simple measure of certainty equivalents. In fact, people care about many dimensions of the lotteries they face. Is the risk voluntarily incurred? How much control does the individual maintain over the outcomes? Are the losses or gains concentrated on a few individuals with a high probability or spread over many individuals with a lower probability?

One particularly important example of the inapplicability of the expected utility measure can be found in the area of health and safety regulation. Society shows a great intolerance for sacrificing the life, health or welfare of a known individual even for a great gain to everyone else. Even if this great loss is uncertain, if the probability is high enough or the size of the loss great enough, there may be great gains to avoiding this particular risk. These considerations are often reflected in regulatory policy by fixed safety requirements or safe minimum standards (SMS). "The SMS permits trade-offs between benefits and costs but subject to a constraint which guarantees that certain types of harm are not allowed to exceed morally acceptable limits...The SMS principle applies in the context of health risks as well because the appropriateness of cost-benefit analysis is seen to break down when certain limits are reached, in this case when risks to individuals reach unacceptably high levels."[43]

[42] See the discussion of these measurement issues in the section of this document that treats the valuation of gains and losses.

[43] Harper & Zilberman (1992)

Whenever a person faces unfamiliar types of risk, or risks of great magnitude relative to income and wealth, or risks with unusually large or small probabilities, we cannot simply calculate certainty equivalent adjustments to the stream of policy outputs. A qualitative balance will be required, taking into account the various dimensions of risk mentioned above. One effective tool in these circumstances is to compare the policy choice in question to other choices involving similar types of risk. If an analogous choice can be found, it may help bracket the range of values that should be associated with the policy choice under consideration. It is clearly not appropriate to assume that dissimilar lotteries may be ranked purely in terms of the expected value and variance of the outcomes.

VII. REGULATORY CHOICES UNDER UNCERTAINTY

For all of the reasons discussed in the previous section, the outcomes of policy choices will always be subject to some degree of uncertainty. It is important, then, to report the results of the economic analysis in a way that avoids giving misleading impressions about the precision of the analysis. Results should always be reported as a range of possible outcomes. The report should include the author's judgment about the most likely outcome and a measure, possibly quite informal, of the likely dispersion of outcomes around the most likely one. In addition, it would be useful for the policy maker to know how costly it would be to reduce the uncertainty of the outcome by buying information or taking mitigating actions. Numerous techniques are available for making a quantitative judgment about the uncertainties present: sensitivity analysis, Monte Carlo simulation and decision analysis. Each of these techniques has strengths and weaknesses, so it is important to select the one most valuable for the given problem.

The first step in any analysis of policy uncertainty is the identification of the important variables in the analysis. It is important to consider any variable that the analysts believe might have a significant impact on the actual outcome of the policy choice, especially those that might switch the qualitative conclusions of the analysis. For example, whenever a recommendation for or against a given policy would be changed given two different but reasonable values of a variable, then the variable deserves special attention. The analysis should not be so exhaustive that the reporting of the results actually obscures the important uncertainties confronting the policy maker.

A. Sensitivity analysis

Sensitivity analysis is appropriate when there is great uncertainty about which probability distribution governs the behavior of the variables being examined. This technique is suggestive rather than exact. Nonetheless, it is a powerful tool for exploring how the variability of each variable contributes to the variability of the policy outcome. It has the added advantage of being relatively inexpensive.

Once the key variables are specified, the analyst must identify a likely range of values for each of these variables. Generally it will suffice to select "optimistic," "pessimistic," and "most likely" estimates for each variable. The extreme values should range about one standard deviation above and below the likely estimate so that the range covers about 90% of the probability distribution for the variable; that is, the analyst should be about 90% sure that the actual outcome will be between the high and low estimates. Such precision may be unrealistic. Even so, the analyst should communicate as much information as possible about the likelihood of occurrence of the different values of the variables. Setting of the range of values involves a great deal of judgment but should be consistent with current scientific opinion and previous experience

The most likely outcome of the policy choice is calculated by using the most likely value of all of the variables.[44] The next step is take each variable in turn and calculate the outcome that would be observed if that variable took on its high and low values while holding all other variables constant at their most likely value. So each variable will have associated with it a high, middle, and low value for the outcome.

One complication that often arises is that some of the variables may move (more or less) together. For example, if the price of a good rises, we expect the quantity sold to fall, other things being equal. So, one would expect that when we observe a high price, then quantity sold will not take on its most likely value but rather its low value. It is very important to take into account possible connections between variable values in carrying out sensitivity analysis. When two or more variables are grouped because their movements are coordinated, sensitivity analysis is often called "scenario analysis." Variable values are grouped into scenarios that are consistent with our best understanding their relationships. Again, the analyst should make an effort to specify the relative likelihood of the various scenarios.

The lack of an explicit model of the relationships between the variables involved is one of the important limitations of sensitivity analysis. The other weakness is that this type of

[44] This value has likely been calculated and presented earlier in the economic impact analysis.

analysis explores the effect of only one variable at a time. A truly pessimistic analyst might ask what would happen if all or several of the (independently determined) variables hit their pessimistic values at one time. Then the actual outcome would presumably be much worse than if only one of the variables hit a big value while the others were average. The opposite is true for multiple optimistic realizations. Thus, the overall variability of the outcome could be much greater than sensitivity analysis would indicate. These weaknesses can be addressed by using simulations.

B. Simulation

Simulation analysis improves on sensitivity analysis in two ways: 1) by specifying more carefully the relationships between the variables in the analysis, and 2) by describing more completely the probability distributions of the random variables. The first step in a simulation is to build a computerized model of the important economic relationships under consideration. This model must be based on a mathematical description of the economic relationships that is consistent with (and no more precise than) current scientific understanding. It is necessarily true that such a model must make explicit assumptions about what elements of the model are subject to uncertainty. The second step in constructing a simulation is to fully specify the probability distributions of the random components of the mathematical model. Third, a computer will be used to take many random draws from the probability distributions and calculate the resulting values of all of the non-random components of the model. The result is a probability distribution over policy outcomes that accounts both for known economic relationships and residual uncertainties.

The sophistication, and hence cost, of simulation analysis is itself a policy choice. The greater the potential gain from the analysis, the more resources can be used to add more variables and interrelationships, to use more complex probability distributions and to allow for more variability over time. Since the cost of simulation exercises tend to rise very fast as complications are added, this technique is subject to rapidly diminishing returns. The resources invested in reducing the forecasting errors should clearly be related to the potential for gains in efficiencies in policy design.

C. Decision analysis

Decision analysis is an effective technique for analyzing the effect of uncertainty on a policy decision when the number of random variables is small and when the policy choice can be made in stages at different points in time. It is particularly useful for identifying opportunities to build flexibility into a policy choice by delaying some decisions until more information is available. The potential gain from this increased flexibility is often called quasi-option value and its value can be large. The drawback of decision analysis is that for more than a few decisions and a few random variables, the analysis can become very cumbersome.

The emphasis in decision analysis is not on variables but on decisions. The first step in the analysis is to identify all of the decision points in a project. Care is taken to identify decisions that are made sequentially, because whenever this is true, there may be an opportunity to adjust future decisions on information that becomes available between the two decision nodes. Next, each decision will have associated with it a set of possible outcomes. Some of the choices will lead to uncertain outcomes. Each of these uncertain outcomes should have assigned to it a probability that the event will occur.[45] Once this is done, one can construct a tree diagram that shows the expected value of each possible decision.

It is possible that there may be significant value in the information that may become available between two decision nodes. Thus, there may be an advantage to designing a program so that some choices will be made at a later point in time. Decision analysis can be used to calculate the value of keeping options open. This is done by calculating the value of the choice with and without the extra flexibility. If the value of the option is great enough, it may be worthwhile designing more flexibility into the implementation of a regulation or project even at some additional cost. When appropriate, the economic impact assessment will include an analysis of the value of building extra flexibility into regulatory choices.

[45] The sum of the probabilities of all of the outcomes from a given decision must sum to zero.

D. Avenues for reducing policy risk

As noted earlier, people do not simply accept that risk exists and choose from among the risky options. It is usually possible either to reduce the cost of uncertainty about the future or to reduce the uncertainty itself by obtaining more information. These options are available at some cost. One must ask whether the cost of mitigation or of information is justified by the gain in reduced risk or uncertainty. This decision depends on the value that the policy maker places on avoiding risk. While the analysis can suggest the costs of the risk reducing options, economic analysis cannot determine whether a given option should be undertaken. It is properly left to the political process to ensure that policy decisions about risk are consistent with individual preferences.

VIII. SUMMARIZING THE IMPACT OF PROPOSED REGULATIONS

In summarizing the economic impact of a proposed regulation, a careful balance must be drawn between completeness and usefulness. While all of the components of the assessment should be available for public scrutiny, as a practical matter, decision makers require a more compact statement of results. Unlike the traditional practice in benefit/cost analysis, it is not the function of the impact assessment to provide a single number on which a decision would be based. It is, rather, a presentation of the key analytical results in a way that makes clear both the best estimate of impact and the range of uncertainty. The policy maker needs to see not just the final result but the main components that make up the result.

A. Economic efficiency and cost effectiveness

1. Range of values for the likely net economic impact

The estimated net economic impact of a regulation will depend on the trace of physical flows and price changes induced by the regulation. Any changes in wages, number or quality of jobs, property values, and business profits must be noted and examined for its effect on the net economic effect of the regulation. These effects must be valued using standard economic principles and expressed, where possible, in dollar terms. Things not reasonably measurable in dollars should be reported in physical terms alongside the monetized effects. All values should be presented as a range of values including, at least, a central estimate and error bands indication the level of uncertainty.

2. Potential for efficiency enhancing alternatives

The assessment should examine the potential for changes in the regulatory design that would improve efficiency. This will include a judgment about whether the promulgating agency made a proper evaluation of strategies for increasing the flexibility of the rules by focusing on outcomes rather than on command and control policies.

B. Distribution of the gains and losses

It is within the competence of economic analysis to estimate the approximate distribution of gains and losses among individuals, firms, and localities. The distributional

consequences of a regulation are an essential part of a report of economic impact. It is not proper for an economic impact analysis to make any statements about whether a particular distribution is better or worse than another. This is uniquely the province of elected officials. It is possible for the analyst to suggest possible compensation mechanisms to ameliorate any distributional consequences that may be seen as objectionable to policy makers.

GLOSSARY OF TERMS

Consumer sovereignty. The principle that the preferences of individuals are the sole basis of the economic valuation of resources.

Consumer surplus. The net benefit that consumers obtain from consumption. It is the difference between the willingness to pay for goods and the price actually paid.

Contingent valuation (CV). A survey technique for eliciting individual valuations of resources.

Demand curve. The schedule of quantity demanded for a good as a function of the price charged. The demand curve measures the willingness to pay for an additional unit of the good.

Discounting. The process of adjusting the value of future costs and benefits of a regulation to account for the preference of current consumption over future consumption.

Externality. When one person's actions impose uncompensated benefits or costs on another without a voluntary trade in a market.

General equilibrium (GE) model. A model of the economy that includes a complete (if simplified) specification of preferences, technology, resource endowments, and market structure.

Input-output (IO) models. A partial model of the economy based on a set of estimated fixed relationships between outputs and the inputs needed to produce them.

Non-use values. When individuals value resources for reasons other than their direct consumption value.

Opportunity cost. The value of a resource in its next best alternative use. That which is forgone in order to use a resource is the correct economic measure of the cost of its use.

Partial equilibrium model. A model of supply and demand in a limited set of markets used to assess the impact of a regulation; not a full model of the economy but a model of the markets most affected by the regulation.

Present value. The total value in the present of a discounted stream of costs or income that accrues over time. The value has been adjusted to account for the preference of present consumption over future consumption.

Profit. The difference between total costs and revenues. Profit is a measure of the producer's net benefit from production

Sensitivity analysis. A process for showing how the results of an analysis change when some of the assumptions on which the analysis are based change.

Shadow price. The correct measure of the social value of a unit of a good when market prices are unavailable or do not correctly indicate social valuation.

Social rate of time preference. A measure of the strength of the preference for present consumption over future consumption. How much of tomorrow's income one would be willing to give up in order to have the income today.

Social surplus (social welfare). The difference in the social cost of producing some good and the value that people place on having it.

Supply curve. The schedule of the quantity of a good supplied to the market as a function of the good's price. The supply curve measures the cost of bringing an additional unit of the good to market.

Willingness to accept (WTA). The minimum amount of money that would induce an individual to part with his or her current right to control some resource.

Willingness to pay (WTP). The maximum amount of money that an individual would pay to gain control over a resource that he or she does not already own.

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