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# Designing Smarter Regulation with Improved Benefit-Cost Analysis

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# Designing Smarter Regulation with Improved Benefit-Cost Analysis

Robert Hahn

## Abstract

Benefit-cost analysis is required for many regulatory decisions in the United States and in other countries. In this paper, I examine a standard textbook model that is used in benefit-cost analysis as it is actually applied to environmental policy and other areas of regulation. My primary objective is to suggest how including some key factors in the analysis could promote the development of smarter regulation.

I begin by presenting a standard economic model for government intervention in markets, which balances benefits and a narrow definition of costs. I then introduce a richer normative theory that considers several political and economic costs that are frequently not considered in analyzing real-world applications. Examples include costs associated with rent seeking, design and implementation, and raising revenues. The richer theory suggests that the government should supply less of a good, or ask the private sector to provide less of that good, than the standard economic model suggests. The reason is that intervening in markets is often more costly than the standard model assumes. In special cases, the theory provides guidance on the setting of socially optimal taxes and subsidies. I then explore how the theory needs to be modified in the presence of biased estimates of benefits and costs. I conclude with a discussion of how the theoretical framework can be applied to the actual design of regulatory policy.

**KEYWORDS:** benefit-cost analysis, environmental economics, regulation, public choice, political economy, public finance, implementation analysis, risk management

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## Introduction

Benefit-cost analysis is required for many major regulatory decisions in the United States and many other countries. Several policy analysts and decision makers advocate the use of such analysis because they believe it can help improve the design of regulation (Crandall et al., 1997; Sunstein, 2002). In this paper, I examine a standard textbook model that is frequently used in benefit-cost analyses of environmental policy and other regulatory decisions. My primary objective is to suggest how including other key costs in the analysis could promote the development of smarter regulation.

After introducing what I call the standard economic model, which balances benefits and a narrow definition of costs, I develop a richer normative theory that includes several political and economic factors that are frequently not considered when governments analyze real-world applications.[1] Examples include costs associated with rent seeking, design and implementation, and raising revenues. I then explore how the theory needs to be modified in the presence of biased estimates of benefits and costs. I argue that the richer theory provides a useful framework for devising smarter regulation that can enhance economic efficiency or social welfare.[2]

The theory suggests that government should supply less of a good, or ask the private sector to provide less of that good, than conventional economic analysis might suggest. The reason is that intervening in markets is often more costly than the standard economic model might imply. For example, including costs associated with income redistribution, raising funds, monitoring and enforcement, or partial compliance makes many regulatory interventions look less attractive. Yet, at least some of these factors are frequently not systematically considered in analyzing the impact of law and regulation, even when they are potentially important.

A good example of how partial compliance could affect costs is provided by Nordhaus (2008) in his discussion of the benefits and costs of a climate agreement. Nordhaus provides some estimates on the net benefits of a global agreement compared with an agreement involving a smaller set of countries, so the reader can appreciate the incremental net benefits of having more countries sign on to an agreement. He finds that the cost with incomplete participation (countries responsible for about one-third of global carbon dioxide emissions in 1990) is more than seven times the cost of the same global emissions reduction

[1] The theory developed here is not meant to be comprehensive. It addresses some key defects that I have observed in the actual implementation of benefit-cost analysis over the years.

[2] An efficient outcome can be defined as the outcome that maximizes the sum of producer and consumer surplus. Social welfare can be defined more broadly depending on the policymaker's objective or welfare function.



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with full participation. Thus, if it were the case that an agreement was only feasible for a small group of countries, it would imply that less should be done on climate change.

I present a literature review in Section 2 of the paper. Section 3 presents the standard economic model and suggests how this framework can be modified to help design more efficient regulation. Section 4 concludes with a discussion of how the framework can be applied to the design of smarter regulatory policy.

## Literature Review

This research builds on the public choice literature, implementation analysis, public finance, and contract theory (Buchanan and Tullock, 1961; Mueller, 2003; Wolf, 1988). A central insight of public choice theory is that policymakers will rarely have the interests or information to implement first-best policies (Downs, 1957; Meltzer and Richard, 1981; Riker, 1962). If policymakers are legislators, they may count benefits and costs differently from how a typical economist would because they have a different objective function. They may, for example, cater to the "median voter" or count costs of projects in their districts as benefits (Weingast, Shepsle and Johnsen, 1981). If the policymakers are bureaucrats working in agencies, they may be interested in maximizing their budget or some other utility function not related to efficiency, such as perks (Niskanen, 1971). In many cases, bureaucrats will be influenced by the interests they serve. Indeed, an agency may be "captured" by a particular interest group, such as producers, and serve that interest in a particular way (Stigler, 1971; Bernstein, 1955). More generally, politicians can be expected to serve well-organized interest groups that compete with each other (Becker, 1983; Olson 1965; Peltzman, 1976).

Early economic literature focuses on the need to compare realistic institutions, as opposed to idealized ones, in assessing policies. Coase (1964) notes that it is not surprising that actual market outcomes fall short of the economist's ideal of perfect competition, but notes that the key challenge should be to compare realistic options. "Contemplation of an optimal system may suggest ways of improving the system, it may provide techniques of analysis that would otherwise have been missed and, in certain special cases, it may go far to providing a solution. But in general its influence has been pernicious. It has directed economists' attention away from the main question, which is how alternative arrangements will actually work in practice. It has led economists to derive conclusions for economic policy from a study of an abstract of a market situation."[3] Demsetz (1969) makes a similar point. He introduces the idea of a "nirvana approach" to describe a comparison of actual markets with idealized

[3] Coase (1964), p. 195.

non-market institutions—noting why such comparisons can be misleading. Of course, the fallacy could also arise in comparing actual non-market institutions with idealized market institutions. Either way, it underscores the importance of comparing realistic alternatives, a point I shall return to below.

Another related literature analyzes how policies are implemented (Pressman and Wildavsky, 1973). Wolf (1988) examines the choice between markets and governments. He argues that "…one purpose [of implementation analysis] is simply to facilitate evaluation of the specified alternatives with respect to the ease or difficulty of implementing them—of translating 'what is good to be done' into an estimate of what actually would get done."[4] While I do not focus specifically on the choice between markets and governments, Wolf's insights can add some context to my results.

A related idea in the implementation literature is that policies frequently give rise to unintended consequences. In an attempt to make cars more fuel-efficient through imposing higher mileage standards, the government may inadvertently have increased the number of fatalities by inducing consumers to buy smaller cars (Crandall and Graham, 1989). More generally, regulation and taxation have been shown to be imperfect instruments for controlling human behavior (Becker, 1968; Peltzman, 1973; Winston, 2006). For example, if the government implements price controls to ameliorate shortages of a food staple like bread, a black market may arise in bread. Even if a black market does not arise, queues may replace the price mechanism as a way of equilibrating the market (Peltzman, 2004).

My analysis also builds on public finance. Public finance is concerned, among other things, with optimal provision of public goods (Samuelson, 1954). It also has examined the deadweight costs of taxation, and argued for including the costs of raising revenues in evaluating different policies (Feldstein, 1999; Musgrave, 1959). However, these costs are frequently not included in benefit-cost analyses (Weimer and Vining, 2008).

The analysis discussed below can also be framed in terms of contract theory. The government may not be able to achieve the first-best result because the set of contracts is incomplete (Hart, 1995). For example, it may be constrained from writing the contracts it wants for political reasons, or the contracts may involve substantial transactions costs.

Below, I use these literatures to underscore two key points. First, in the area of public policy, things are almost always more costly to implement than is typically assumed by modelers. Furthermore, under certain plausible conditions, it makes sense for the government to produce less or regulate less than it otherwise would based on a standard benefit-cost model. Second, with some information on

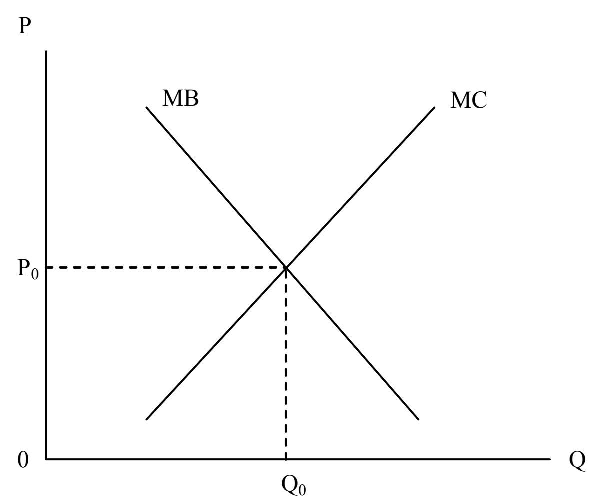
[4] Wolf (1988), p. 111.

factors not typically included in a benefit-cost analysis, and additional information on the underlying biases in the benefit and cost curves, we may be able to make quantitative or qualitative statements about how optimal prices or quantities should change relative to a stylized optimum.

## The Standard Economic Model

A classic way of teaching students about the supply of goods, and public goods in particular, is to weigh benefits and costs. The idea is typically to supply an amount where marginal benefits and marginal costs are equal, so as to maximize net benefits (the difference between benefits and costs). Figure 1 illustrates this idea using what I call the standard economic model. The marginal benefit curve, denoted by MB, is downward-sloping. This curve can be thought of as the demand for a public good, such as clean air, and thus reflects social benefits. The marginal cost curve, denoted by MC, is upward-sloping. This curve can be thought of as the direct marginal cost of producing cleaner air. The intersection of the marginal cost curve and the marginal benefit curve gives the optimal quantity, $Q_0$, and the optimal price, $P_0$. For now, I will focus on quantities, so the only point is that it is optimal to produce $Q_0$ of the public good, and that such production can be achieved by setting an optimal price or quantity.

**Figure 1: The Standard Model for Determining Optimal Price or Quantity**

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Several assumptions are embedded in this model. First, the marginal cost and marginal benefit curves are well-behaved so as to guarantee an interior maximum. Second, I will assume for now that the marginal benefit curve and the marginal cost curve are known with certainty.

I will define the standard marginal cost curve, MC, as the lowest economic cost of achieving a particular outcome, excluding a number of potentially important variables that I will consider below. The definition used here would include direct production costs, such as the costs of adding a catalytic converter, and output effects, such as the reduced demand for cars. I use this definition because it is one that is frequently taught in undergraduate economics. It is also one that is frequently used in analyzing real-world legal and regulatory issues. Indeed, in many settings, only the "end-of-pipe" costs are estimated, such as the costs of adding a scrubber to a power plant, and output effects are ignored.

Unfortunately, in the real world, the standard marginal cost curve, MC, can rarely, if ever, be achieved. There are many reasons for this, but I would like to focus on three. The first reason, and perhaps the most important one, is the politics surrounding the choice of goals and instruments. The political process encourages rent seeking, and these costs are frequently hard to measure (Krueger, 1974). In addition, politics constrains the range of instrument choices to those that may be less than optimal. For example, there may be redistributive goals of legislation and regulation that conflict with narrow efficiency goals. Consider the case of ethanol made from corn. Because of the importance of the farm lobby, ethanol made from corn has been subsidized in the U.S. for 30 years. In addition, a tariff is imposed on ethanol imports. In principle, it might have been possible for lawmakers to design a system that provided more efficient lump-sum transfer to farmers, but such efficient transfers are rarely made in practice. A related problem is that lawmakers may frequently choose to favor particular technologies, such as using scrubbers on power plants or promoting solar energy, even though there may be cheaper and better ways of achieving the same goal (Ackerman and Hassler, 1981).

A second reason that the standard marginal cost curve may not be achieved is that design and implementation costs are not considered.[5] These costs, which include monitoring and enforcement costs, and the costs of writing a law or regulation, may be substantial. Both regulation and taxation are imperfect mechanisms for controlling behavior (see, *e.g.*, Peltzman, 2004). If a restriction is made on selling alcohol to minors, there will be costs involved in enforcing the regulation, and enforcement is likely to be imperfect. Similar considerations arise in taxation. If the government wishes to raise taxes, the costs of enforcing particular tax regimes may be significant, and enforcement will be imperfect. In

[5] In my analyses of regulatory impact assessments done by U.S. regulators, I do not recall any attempts to quantify monitoring and enforcement costs, though there may have been a few.

such cases, the relative costs of monitoring and enforcement may be a key consideration, say, if one is choosing between a sales tax and an income tax. Although costs related to monitoring and enforcement are included in some analyses, such as those for taxation, they are rarely quantified in many settings.

A third reason that the standard marginal cost curve may not be achieved is that many policies require that the government raise revenues. Raising revenues through taxation usually leads to distortions in production and consumption decisions (see, e.g., Goulder and Williams, 2003). As noted above, the welfare costs of such distortions may be substantial. For example, the ethanol tax credit in 2006 was 51 cents per gallon of ethanol blended with gasoline. Multiplying the tax credit by the amount of ethanol blended with gasoline in 2006 by the deadweight loss per dollar of revenue raised gives a loss in welfare of approximately $0.7 billion (in 2006 dollars).[6]

How might these various omitted costs be modeled by amending the standard model presented in Figure 1?[7] I will model these costs in one of two ways, either as a shift in the marginal cost curve or a shift in the marginal benefit curve. For cases in which the costs will have a direct impact on firm response, this can be modeled as a change in the effective marginal cost curve, which is supposed to capture firm response. So, for example, if uniform standards were implemented instead of a market-based approach to environmental control, this would be thought of as an upward shift in the effective marginal cost curve. If instead, the welfare cost of funds from a subsidy is introduced, this can be modeled as a downward shift in the marginal benefit curve (since it does not directly affect firm behavior).

Let us begin by considering the impact of politics on instrument choice. Suppose politics leads to the imposition of an inefficient instrument, such as command-and-control regulation. This regulation would increase the marginal costs that are incurred by various producers, which can be modeled as an upward shift in the marginal cost curve. This shift leads to the result that the optimal price increases and optimal quantity decreases.

Another form of inefficiency resulting from politics arises in the case of climate change. Suppose that only some countries decide to limit greenhouse gas emissions, or comply with an agreement to limit greenhouse gas emissions. In this case, each firm or country's action to reduce emissions is less effective than it

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[6] Approximately 5.4 billion gallons of ethanol were produced (Energy Information Administration, 2007). I apply a deadweight loss of $0.25 per dollar of revenue raised, which the Office of Management and Budget suggests (OMB, 1992). Multiplying $0.51 per gallon x 5.4 billion gallons x .25 gives $0.69 billion.

[7] In several of the examples discussed below, there are likely to be fixed and variable costs. Fixed costs will only matter to the extent that they affect conditions on whether the intervention should be done at all. That is, they will not affect marginal decisions.

otherwise would be in terms of reducing global emissions, because emissions may increase in countries that do not actually limit such emissions. Thus partial compliance can be modeled as downward shift in the marginal benefit curve, yielding a lower optimal price and quantity.[8] At the same time, if fewer countries are participating in reducing emissions, the marginal costs of controlling emissions will increase, because low cost-emission reduction opportunities in some countries will no longer be available.[9] This upward shift in the marginal cost curve would increase the optimal price and lower the optimal quantity. Taken together, these effects will reduce the optimal quantity–in this case, of mitigation–but have an ambiguous effect on the optimal price.

The analysis of climate change policy can also be explicitly extended to the choice of adaptation versus engaging in mitigation efforts. Say, for example, that local adaptation and mitigation efforts suffer from similar levels of inefficiency, but that effective mitigation efforts also require global cooperation. Then, one would prefer to do more adaptation than mitigation (relative to a first-best theoretical optimum) if the goal is to increase economic efficiency.

The precise impact of rent seeking needs to be modeled with care. One could imagine, for example, lobbying expenditures aimed at redistributing revenues to preferred groups, which reduces the size of the economic pie. To the extent that such expenditures represent social costs that vary with output, but do not directly affect firm behavior, this could be modeled as a reduction in marginal benefits. Such a reduction would imply a lower optimal price and lower optimal quantity. Alternatively, rent-seeking could actually increase the effective marginal cost curve, say, by raising rivals' costs (Salop and Scheffman, 1983). In this case, an upward shift in the marginal cost curve would yield a higher optimal price and a lower optimal quantity. Rent-seeking could lead to some combination of an increase in marginal costs and a decrease in marginal benefits, which would lead to a lower optimal quantity, but an ambiguous effect on price.

In some circumstances, one could imagine a new policy leading to an overall decline in rent seeking compared to an old policy. The introduction of market-based approaches for pollution control may provide such an example. Proponents of the allowance trading program to reduce acid rain argued that this approach could improve the environment, lower economic costs of achieving the target, and perhaps lower political costs associated with rent seeking over time. If overall rent seeking were actually reduced, the analysis could lead to the opposite

[8] For simplicity, one can think of the MB curve as representing the marginal benefits to the world's population residing in the countries agreeing to limit emissions, or the marginal benefits to the world's total population from these emission reductions.

[9] If a country allows emission-reduction projects, but does not put an overall limit on emissions, this will still lead to problems with limiting global emissions. For an insightful analysis of existing programs, see Wara and Victor (2008).

conclusion. However, I think this is likely to be the exception rather than the rule.[10]

Now consider the impact of design and implementation costs. Some of these costs are likely to be fixed, such as the resources spent writing a rule, and thus would not have an impact on the optimal price and quantity if we assume an interior solution. At the same time, some costs probably vary with the level of output. The latter costs can be thought of as reducing the marginal benefits of supplying the good. Thus the, optimal price and quantity would fall if they were included.[11]

Finally, consider the welfare costs of raising revenue that can result when the government subsidizes production of a good, such as ethanol. These costs are frequently not modeled, and by assumption, are not included in the standard model. They could be modeled as a downward shift in the marginal benefit curve resulting in a lower optimal price and quantity than the standard model suggests. In contrast, if revenues were raised, say as a result of a Pigouvian tax on carbon, the opposite result would obtain.

The results from the preceding discussion are summarized in Table 1. This table makes an important point. For the costs considered here, the optimal amount of the good that should be provided is often *lower* than suggested by the standard model. That is, it typically makes sense for the government to require that less of a good be supplied than the standard model might suggest. The reason this is important is that versions of the standard model are frequently used in the design of regulatory policy, particularly in the environmental arena.[12] Climate change provides a case in point. Mitigation is likely to be more costly and less effective than many climate models suggest. This implies that less mitigation should be done than a first-best analysis might suggest.[13]

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[10] For a recent analysis of how lobbying expenditures might affect benefit-cost calculations, which arrives at similar conclusions, see Krutilla (2008).

[11] For a more detailed analysis of how Pigouvian taxes vary with different kinds of administrative costs, see Polinsky and Shavell (1982).

[12] I emphasize that this insight depends on the accuracy of the models that are used to estimate benefits and costs. If, for example, the models tended to overstate actual costs, then this bias would push in the opposite direction. See Hahn and Tetlock (2008) for a discussion of possible biases in estimates of the costs and benefits of regulation.

[13] If there is less investment in mitigation than would be optimal in a first-best case, governments should also be investing more resources in adapting to climate change than would be needed in a first-best case.

**Table 1: How Including Various Costs Affects Optimal Price and Quantity Relative to the Standard Model**

| Type of Omitted Variables | Impact on Optimal Price and Quantity | Reason |
|---|---|---|
| Politics: Inefficient Instrument | Higher Price<br>Lower Quantity | Increase in Marginal Costs |
| Politics: Partial Compliance | Ambiguous Effect on Price<br>Lower Quantity | Reduction in Marginal Benefits and Increase in Marginal Costs |
| Politics: Rent Seeking | Ambiguous Effect on Price<br>Lower Quantity Likely | Reduction in Marginal Benefits and /or Increase in Marginal Costs Likely |
| Design and Implementation Costs | Lower Price<br>Lower Quantity | Reduction in Marginal Benefits |
| Deadweight Costs of Raising Revenue | Lower Price<br>Lower Quantity | Reduction in Marginal Benefits |

A second important point relates to the setting of prices, such as taxes or subsidies, to correct an externality. Table 1 reveals that the optimal price will be higher in some cases and lower in others than suggested by the standard model, depending on whether inclusion of an activity results in a downward shift in the marginal benefit curve (yielding a lower price) or an upward shift in the marginal cost curve (yielding a higher price).

This framework can also be applied to the size of a government's budget. Suppose the government is asked to pay for a public service, but does not consider the full range of welfare losses such as those related to revenue raising (so the actual marginal benefit curve shifts down by some fraction). Suppose, further, that the government pays a subsidy determined by the intersection of the marginal cost curve and the marginal benefit curve. Then, the government should pay a smaller unit subsidy and require that less of the service be produced than the standard model might suggest, resulting in lower outlays.

The preceding analysis is presented in terms of a single marginal cost curve and a set of omitted variables that affect marginal costs and marginal benefits in certain ways. An alternative interpretation that may be useful for policy design is to think of the marginal costs and benefits of a policy as being linked to a particular policy instrument. So, for example, if a policymaker is choosing between two policies, say a tax and a subsidy, she would want to construct one marginal cost and one marginal benefit curve for the tax, repeat that exercise for the subsidy, and then compare the net benefits associated with policies under the two instruments. Such an approach would also allow for careful consideration of how different key factors affect results when considered together.

Now, consider several simplifications used in constructing this model. First, some may object to the fact that, as constructed, the marginal cost curve used in the standard model is not really feasible because it assumes away many costs, such as monitoring and enforcement costs. And if it is not feasible, then the result is not interesting because it does not really represent something that is achievable. In a sense, this criticism is valid. However, even if I were to include *all* relevant economic costs that are not typically included in the textbook model, or applied in practice, my basic point would still hold. In the real world, politics will still affect laws and regulations in ways that will likely raise the marginal cost curve or lower the marginal benefit curve.

Moreover, most policy estimates that I encounter in analyzing regulations do not provide estimates of the feasible set of economic marginal costs. Instead, they typically focus on the production costs of the firm or the government, ignoring possible costs that may result from designing and implementing policies, raising revenues, and politics more generally.[14] They also do not generally consider explicitly the fact that firms may not operate on their efficiency frontier (Leibenstein, 1966). Although firm inefficiencies may be captured in an estimate of a cost function based on real-world data, they are less likely to be accounted for in an engineering-economic analysis that focuses on production costs.

The particular marginal benefit function employed here is not critical to the analysis. Although the analysis uses a standard marginal benefit function, it can be broadened to include any definition of benefits (*i.e.*, economic or non-economic) that the decision maker wishes to compare against costs. That is, the decision maker can introduce her own measure of welfare, provided it satisfies the mathematical conditions needed for the result to hold. Moreover, the analysis can be generalized to any good, whether public, private or somewhere in between.[15]

A strong assumption in the model is that the marginal benefit curve and marginal cost curves are known. If the marginal benefit and cost curves were unknown, the same result could be obtained by substituting expected values, provided the uncertainties in the two curves were uncorrelated (Weitzman, 1975; Stavins, 1996). The policymaker would then set the expected marginal cost equal to the expected marginal benefit and choose the quantity accordingly.

In the case of so-called fat tails, where there is a small probability of very large damages, then the problem is more complicated. If these damages can be bounded, then the same type of analysis that I am suggesting here would apply,

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[14] Production costs will typically understate economic costs because they do not take into account changes in output due to changes in prices. The MC curve presented in Figure 1 is based on economic costs. If production costs were used to define the MC curve, it strengthens my basic argument.

[15] The details of the derivation of the marginal benefit curve will typically vary depending on the type of good.

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with the proviso that these damages should be taken into account. If these damages are unbounded, the situation requires some method for bounding the damages first. These issues are taken up in Weitzman (2009) and are beyond the scope of this paper.

In the presence of uncertainty, the policymaker may want to consider a broader range of instruments (Roberts and Spence, 1976). As in earlier work, my analysis does not consider general equilibrium effects, which could lead to a more complicated formulation and a weaker result (Hazilla and Kopp, 1990). This reflects the fact that the analysis of impacts is typically more subtle in a general equilibrium setting.

Along these same lines, my analysis does not consider optimal policies in the presence of inefficiencies in other markets (the so-called theory of the second best). When one incorporates such concerns, it is not generally possible to identify the appropriate direction for policy without having a very detailed specification of how the economy works (Lipsey and Lancaster, 1957). So, for example, if one were to consider preexisting tax distortions in the labor market, it is possible that the optimal pollution tax is less than the socially optimal tax without such distortions (Bovenberg and de Mooij, 1994). The point of my analysis is not to suggest such factors are unimportant, but rather to suggest that other factors should also be considered in designing policy.

Another concern with this analysis is that it does not examine the potential biases found in estimating key constructs in this paper. It is well known that government analyses of the costs and benefits of regulation have some serious deficiencies in addition to those outlined here (Hahn and Tetlock, 2008). These include incorrect specification of economic costs–typically as production costs, incorrect estimation of costs, lack of consideration of alternatives, and inadequate estimation of benefits. There is also an ongoing debate about whether academic and government benefit-cost analyses tend to understate or overstate actual costs and benefits (Graham and Wiener, 1995; Harrington, Morgenstern and Nelson, 2000). While these factors are important, and should be considered in a particular case study, my point here goes to the general analytical framework. It says that even if there were not the kinds of empirical problems that scholars have raised, the standard model gives rise to a bias in how the optimal level of government intervention is determined.

Some scholars have argued that benefits may be systemically underestimated (e.g., Revesz and Livermore, 2008). If this is true, then the same kind of analysis used here could be applied to this issue. Table 2 illustrates how. The table considers nine cases for costs and benefits where they may be overestimated, underestimated or correctly estimated. The cells in the table show the direction of the optimal price and quantity change relative to the standard model discussed above.

**Table 2: How Bias Affects Optimal Price and Quantity Relative to the Standard Model**

| | **Benefit Underestimated** | **Benefit Correctly Estimated** | **Benefit Overestimated** |
|---|---|---|---|
| **Cost Underestimated** | Higher Price<br>Ambiguous Effect on Quantity | Higher Price<br>Lower Quantity | Ambiguous Effect on Price<br>Lower Quantity |
| **Cost Correctly Estimated** | Higher Price<br>Higher Quantity | No Change in Price<br>No Change in Quantity | Lower Price,<br>Lower Quantity |
| **Cost Overestimated** | Ambiguous Effect on Price<br>Higher Quantity | Lower Price,<br>Higher Quantity | Lower Price<br>Ambiguous Effect on Quantity |

A final point about this analysis relates to the choice of a benchmark for comparison. The benchmark for comparison is important for accurately assessing the net benefits of a policy. Many analyses compare policies against a first-best benchmark that is unlikely to be achievable. Doing so will tend to understate the net benefits of a particular policy relative to what is actually achievable, assuming the policies are modeled correctly.[16]

Where possible, it would be more useful to compare various policy designs against a design that is achievable. The state of economic modeling does not generally permit this, in part, because what is achievable can be a fuzzy concept that changes over time. Nonetheless, economists and policy analysts can make reasonable approximations and should do so where possible. Furthermore, economists may want to consider how to move closer to the first-best by improving policy tools and institutions (Weimer and Vining, 2008). One way of framing this issue is to think about improving the quality of a law or a regulation (MacLeod, 2007).

## Concluding Remarks

This paper has focused on some key costs that are not considered in many applications of benefit-cost analysis to regulatory issues. For the purpose of

[16] In a more general setting, one would want to take at least two sources of error into account. One is the benchmark issue discussed here. The second is the measurement of the actual impact of the policy, and possible biases associated with that measurement. I am grateful to a referee for pointing this out.

analysis, I have generally assumed that estimates of the marginal cost and benefit curves defined in the text were unbiased. This, of course, is a highly stylized assumption. Other sources of bias can lead to the many outcomes presented in Table 2, whether the effect is on the benefit or the cost side.

Much has been written about potential biases due to measurement error and omission of important factors. For example, some scholars have suggested that important benefits are frequently not considered, such as ecosystem services. To the extent these factors are important, and left out of the analysis, they could lead to conclusions that are in sharp contrast to the theory developed here.

One implication of the theory presented here is that the optimal level of a good that the government wishes to provide may be smaller than the standard benefit-cost model would suggest. For example, it may make sense to provide less environmental quality or national defense than the amount suggested by the standard model. But how much less? This depends on the actual cost and benefit curves. Policymakers will generally want to try to estimate cost curves that include relevant factors, such as the impact of partial compliance, redistribution costs, and monitoring and enforcement costs. They will also want to estimate the relevant uncertainties in doing realistic comparisons of different policy instruments and policy alternatives.

A second implication of this theory relates to the setting of optimal quantities and prices. In general, the optimal quantity will be lower than the standard model suggests. However, if one were setting an optimal price, say a tax or a subsidy, that price could be set higher or lower than it otherwise would be, depending on the specific application. Furthermore, as noted above, the optimal quantity or price is likely to be affected by the choice of a particular instrument.

If benefit-cost analysis were done correctly, then it should give the right answer. Doing it correctly, however, implies a number of considerations that are often ignored in practice. A key problem is that it is nearly impossible to include all relevant factors because they are poorly understood or it is costly to do so. A solution to this problem is to estimate a reasonable set of factors based on a weighing of the benefits and costs of doing additional analysis. However, one should also be aware of the likely normative implications of leaving key factors out of the analysis. In particular, where one cannot do a quantitative analysis of key factors affecting the likely marginal cost, a qualitative discussion of these factors may be useful (Arrow et al., 1996). Including key quantitative and qualitative factors in a decision is likely to lead to smarter regulation.

The analysis presented here should not be construed as an endorsement of the status quo when it comes to government policies. Economists have an important role to play in shaping those policies by identifying efficient solutions, even when those solutions are not necessarily feasible. They also have an important role to play, however, in assessing the likely economic impact of policies that are implemented in the real world.

Although economists have been in the forefront of comparing the costs and benefits of various policy instruments in theory and practice, they frequently leave out important parts of the equation, such as politics. This situation needs to be addressed more carefully. For example, climate change policy is likely to be influenced in a significant way by politics, just as energy policy is in most countries. Thus, we can expect climate policies to have significant inefficiencies that respond to the demands of domestic politics. One such example is the support for biofuels, and another is the opposition to nuclear power. To exclude such considerations from an analysis of optimal policy choice could produce misleading results.

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