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Mary Riddel

R. Keith Schwer

MARY RIDDEL* & R. KEITH SCHWER**

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ABSTRACT

The failure of the price system when faced with public goods and externalities is cited as the rationale for government intervention in the market. When government agencies step in to guide market forces, however, they may also fail, resulting in more resources being expended than necessary to achieve the desired outcome. Implied social losses from inefficient regulation have led many policy analysts to question the desirability of command and control approaches and suggest a move toward incentive-based strategies for environmental regulation. In this article, we suggest targeting initial regulatory reform to situations in which environmental externalities are reversible. Using a case study of the Federal Aviation Agency's recent rulemaking surrounding commercial air tour limitations in the Grand Canyon National Park (GCNP), we provide an example of government failure resulting from command and control approaches to environmental regulation. We make a clear case that the costs of the proposed regulation outweigh the benefits to ground visitors to the GCNP. We suggest two different incentive-based strategies that could provide the same level of noise reduction achieved by the proposed quota system. Finally, we argue that because of the non-cumulative nature of noise externalities, the GCNP is an ideal setting in which to test the efficacy of incentive-based strategies for environmental control.

I. INTRODUCTION

Under basic tenets of economic theory, competitive free markets will efficiently allocate scarce goods amongst consumers.[1] As such, efficiency occurs when the rate of tradeoff between any two goods is the

* Associate Director and Assistant Professor of Economics, Center for Business and Economic Research, University of Nevada, Las Vegas, 4505 Maryland Parkway; Las Vegas, NV 89154-6002; email:mriddel@nevada.edu.

** Director and Professor of Economics, Center for Business and Economic Research, University of Nevada, Las Vegas, 4505 Maryland Parkway; Las Vegas, NV 89154-6002

1. A free market equilibrium will be socially optimal if the distribution of goods optimizes social welfare.

same for all economic agents.[2] When markets exist, prices provide the rate of trade-off between the two goods.[3] This result fails, however, when faced with non-market goods such as clean air or water because markets and prices don't exist for these goods. For an efficient allocation of non-market goods to occur, extra-market forces must step in and allocate goods based on implicit prices, such as willingness to pay estimates.[4] The failure of the price system under these conditions is cited as the rationale for government intervention in the market.[5]

The intercession of an extra-market force into situations where market failure is present is a necessary, but not sufficient, condition for a socially efficient allocation of public and private goods. Indeed, when government agencies step in to guide market forces, they may also fail, resulting in more resources being expended than necessary to achieve the desired outcome.[6] In some cases, a net efficiency loss may be observed because political concerns override economic efficiency. In other cases, legal directives may ignore the tradeoffs inherent in allocating economic goods.[7] More often than not, government regulation takes the form of a socially inefficient quota whereby environmental damages are mandated to not exceed some given level.[8]

Command and control approaches to regulation, such as quotas and standards, have long been recognized by economists to frequently result in inefficient allocation of non-market goods.[9] The inefficiency arises from two sources. First, once the standard is met, there is no incentive for regulated agents to further reduce damages. Second, the standards may require costly improvements that add little benefit to society.[10] In this case, the costs of the regulation exceed benefits and the final result is a net social loss.

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2. *See* WALTER NICHOLSON, MICROECONOMIC THEORY: BASIC PRINCIPLES AND EXTENSIONS 222, 512 (5th ed. 1992).

3. *See id.* at 233, 512.

4. *See id.* at 745, 751.

5. *See* BARRY C. FIELD, ENVIRONMENTAL ECONOMICS: AN INTRODUCTION 68 (2d ed. 1997); WILLIAM J. BAUMOL & WALLACE E. OATES, THE THEORY OF ENVIRONMENTAL POLICY 1-7 (1988).

6. *See* CHARLES WOLF, JR., MARKETS OR GOVERNMENTS: CHOOSING BETWEEN IMPERFECT ALTERNATIVES 35 (Rand Corp. Publ'n Series No. N-2505-SF, 1988).

7. *See id.* at 34-36.

8. *See* Kenneth J. Arrow et al., *Is There a Role for Cost-Benefit Analysis in Environmental, Health, and Safety Regulation?*, 272 SCIENCE 221 (1996).

9. For a discussion of the inefficiency of standards in dealing with environmental externalities see ALLEN V. KNEESE & CHARLES L. SCHULTZE, POLLUTION, PRICES, AND PUBLIC POLICY (1975); FIELD, *supra* note 5, at 211-24; WOLF, *supra* note 6, at 57-63; Richard B. Stewart, *Controlling Environmental Risks Through Economic Incentives*, 13 COLUM. J. ENVTL. L. 153, 153 (1988).

10. *See* KNEESE & SCHULTZE, *supra* note 9.

As a result of criticism from the private and academic sectors concerning the inefficiency of many environmental regulations, cost-benefit analysis has begun to play a tentative role in environmental policy decision making. Executive orders by Presidents Reagan[11] and Clinton[12] instruct the Environmental Protection Agency (EPA) to perform cost-benefit analysis when devising environmental regulation. However, using cost-benefit analysis in developing environmental regulation is not the accepted norm for federal agencies. According to the Regulatory Flexibility Act of 1980, regulatory agencies are required to prepare a regulatory flexibility analysis (RFA) unless "the head of the agency certifies that the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."[13] The Regulatory Flexibility Act also requires that regulatory agencies "endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation."[14] Thus, this directive requires regulatory agencies to consider flexible regulatory proposals and explain the rationale for their actions, though there is no mandate that the agencies use economic rationale to support their decisions.

Because agencies are not required to show that society as a whole is economically better off under proposed regulations than without them, the possibility exists that regulations may be enacted that lead to sub-optimal social improvements or even actual social losses. One study estimates that federal regulations targeted at improving public health, safety, and the environment cost $200 billion annually.[15] Yet another study points out that many current environmental and health regulations could not pass a cost-benefit test.[16] For example, Arrow et al. point out that the EPA, when assessing the efficiency of environmental regulations, uses values for a human statistical life ranging between $200,000 and $6.3 trillion.[17] One finds it hard to believe that such differences reflect careful analysis. Thus, the coupling of high regulatory costs with unreliable estimates of benefits creates a strong case for questioning the ability of the public sector to correct market failure under current regulatory conditions.

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11. *See* Exec. Order No. 12,291, 3 C.F.R. 127 (1982), *revoked by* Exec. Order No. 12,866 § 11, 3 C.F.R 638 (1994).
12. *See* Exec. Order No. 12,866 § 11, 3 C.F.R 638 (1994).
13. 5 U.S.C. § 605 (1994 & Supp. III 1997).
14. 5 U.S.C. § 601 (1994).
15. *See* Arrow et al., *supra* note 8.
16. *See id.*
17. *See id.*

Command and Control Approaches versus Incentive-Based Strategies

Implied social losses from inefficient regulation have led many policy analysts to question the desirability of command and control approaches and suggest a move toward incentive-based strategies for environmental regulation.[18] Under an incentive-based approach, benefits and costs of a regulation are compared in order to choose between competing regulations. Further, the market is allowed to work, within certain defined parameters, through transferable permits or charges on emissions fees. Supporters of incentive-based strategies point out that when market-based solutions are used, a "socially efficient" level of the externality is achieved at the lowest possible cost to society.[19]

The argument that incentive-based strategies for pollution control provide more "bang for the buck" has provided momentum for a movement to incentive-based systems. Some authors suggest that an incremental shift away from command and control toward a fee and permit-based approach be instituted. Ackerman and Stewart recommend beginning with marketable air and water pollution rights at the national level, then later allowing for regional differences in emissions.[20] Mintz suggests a more cautious approach using "a carefully limited system of transferable pollution permits, based upon existing regulatory standards."[21] In this article, we argue that a third direction for change is apparent—targeting initial regulatory reform to a situation in which environmental externalities are reversible. Using a case study of the Federal Aviation Agency's (FAA) recent rulemaking surrounding commercial air tour limitations in the Grand Canyon National Park (GCNP), we provide an example of governmental failure resulting from command and control approaches to environmental regulation. We show that the current regulatory environment supported an incomplete analysis of the costs and benefits of regulating the air tour industry in the GCNP. Further, we make a clear case that the costs of the proposed regulation outweigh the benefits to ground visitors to the GCNP. We suggest two different incentive-based

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18. *See* FIELD, *supra* note 5, at 230.

19. The "socially efficient" level of an externality is reached when the marginal benefit of reducing the externality is equal to the marginal cost of doing so. For several excellent references concerning this topic, see THOMAS H. TIETENBERG, EMISSIONS TRADING, AN EXERCISE IN REFORMING POLLUTION POLICY (1985).

20. Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171, 191-94 (1988).

21. Joel A. Mintz, *Economic Reform of Environmental Protection: A Brief Comment on a Recent Debate*, 15 HARV. ENVTL. L. REV. 149, 162 (1991). *See also* Howard Latin, *Ideal versus Real Regulatory Efficiency: Implementation of Uniform Standards and "Fine-tuning" Regulatory Reform*, 37 STAN. L. REV. 1267 (1985).

strategies that could provide the same level of noise reduction achieved by the proposed quota system. Finally, we argue that the case study of aircraft noise externalities in the GCNP is particularly compelling because several incentive-based solutions exist for controlling aircraft noise. In fact, because of the non-cumulative nature of noise externalities, the GCNP is an ideal setting in which to test the efficacy of incentive-based strategies for environmental control.

II. THE HISTORY OF THE PROPOSED REGULATION

The National Park System (NPS), a part of the Department of the Interior (DOI), currently manages a total of 378 areas.[22] Their mission is to preserve "unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations."[23] These are resources whose preservation, management, and use are likely to offer social values that exceed market values that could be gained from their development. The social values are derived from the aesthetic, recreation, ecosystem, and existence values that are impossible to purchase in a private market.

In response to growing concern about the "significant adverse effect of aircraft on the natural quiet and experience of the [GCNP]," Congress enacted Public Law 100-91, popularly called the "Overflights Act."[24] The act mandated that the NPS and the FAA devise regulations that would provide a "substantial restoration of natural quiet" to the GCNP.[25] In May 1988, in response to Public Law 100-91, the FAA created a Special Flight Rules Area (SFRA) over the GCNP, prohibiting flights below 14,499 feet above mean sea level.[26] Accompanying the new SFRA was regulation SFAR (Special Flight Area Rule) No. 50-2, establishing special routes for air tours, curfews, communications requirements, and creating several flight-free zones.[27]

In 1994, the DOI submitted a final report entitled "Report to Congress on Effects of Aircraft Overflights on the National Park System,"

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22. *See The National Parks System: Caring for the American Legacy* (last modified Oct. 26, 1999) <http://www.nps.gov/legacy/mission.html>.

23. *Id.*

24. Grand Canyon Overflights Act, Pub. L. No. 100-91 § 3, 101 Stat. 674, 676-77 (codified at 16 U.S.C. § 1a (note) (1994)).

25. *Id.*

26. Special Flight Rules in the Vicinity of the Grand Canyon Nation Park, 53 Fed. Reg. 20,264 (proposed June 2, 1988) (to be codified at 14 C.F.R. pts. 91 & 135).

27. *See id.*

containing recommendations for revising the regulations.[28] This report recommended simplifying the structure of commercial sightseeing routes, expanding flight-free zones and time periods, phasing in of quiet technology aircraft, and establishing a system to monitor aviation-related noise in the GCNP.[29] In 1996, the FAA issued the final rule instituting many of the recommendations.[30] The rule also contained a ceiling on the number of sightseeing overflights that would be allowed at GCNP. The effective date for full implementation of the final rule has been delayed several times.[31]

Currently, flight routes and curfews are in force.[32] The full rule, including the ceiling on overflights, was scheduled to be implemented in January 2000.[33] However, testimony introduced into public hearings held by the FAA in Flagstaff, Arizona, and Las Vegas, Nevada, in August 1999 raised concerns about the impact of the rules on small businesses and the credibility of the cost-benefit analysis attached to the rulemaking.[34] As a result, the FAA is reviewing the proposed regulation, and implementation has been delayed further. As of January 2001, no new date had been set for implementation.

III. BENEFITS AND COSTS OF THE NOISE MANAGEMENT REGULATIONS

Do the proposed noise management regulations for the GCNP move us any closer to the socially efficient outcome? This article argues that they do not. In fact, under the proposed regulations, uncertain benefits to ground users are given priority over certain and tangible benefits to air tour consumers. The outcome of the proposed regulations will be an unequal shift of benefits from air tour consumers and operators to users on the ground resulting in a net loss of benefits from GCNP resources.

As overflights are limited, benefits to users of GCNP resources on the ground rise to the extent that the visitor experience improves with the quieter environment. However, limiting overflights below the market

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28. *See, e.g.*, Commercial Air Tour Limitation in the Grand Canyon National Park Special Flight Rules Area, 64 Fed. Reg. 37,304 (July 9, 1999) (to be codified at 14 C.F.R. pt. 93) (describing the history of the FAA's actions).

29. *See id.*

30. Special Flight Rules in the Vicinity of the Grand Canyon Nation Park, 61 Fed. Reg. 69,302 (Dec. 31, 1996) (to be codified at 14 C.F.R. pts. 91, 93, 121, and 135).

31. Commercial Air Tour Limitation in the Grand Canyon National Park Special Flight Rules Area, 64 Fed. Reg. at 37,304.

32. *See* 14 C.F.R. pt. 93, subpart U (2000).

33. *See id.*

34. Testimony of R. Keith Schwer, Center for Business and Economic Research, University of Nevada, Las Vegas.

equilibrium will cause the price of scenic air tours to rise and lead to a reduction in benefits to individuals that consume the aesthetic resources of the park from the air. Though prices rise, leading to an increase in revenues per flight for operators, quotas restrict air-tour operators from collecting the revenues from all flights demanded by consumers, leading to additional social losses.[35]

Economic efficiency instructs us to equalize the marginal benefits to each user group using the GCNP.[36] As such, some noise would be tolerated because it results in benefits to air tour consumers. On the other hand, a socially efficient outcome is likely to entail some restrictions on overflights because excess aircraft noise is perceived as detracting from the wilderness experience for some visitors. Essentially, social efficiency requires balancing the benefits to each visitor group by reducing benefits to some groups and increasing benefits to others so that the overall benefit is maximized.[37] In order to decide what the socially optimal level of noise should be, regulators need a clear idea about the benefits of the proposed regulation to ground users and the costs to air tour consumers and operators.

The RFA[38] reports estimates of the benefits of the proposed regulation to ground users of the GCNP. Benefits to individual park users are estimated using a standard economic measure of "consumer surplus," defined as the difference between what a person is willing to pay for a good and what is actually paid for the good.[39] Total benefits are calculated using what the report terms "the benefit transfer approach," whereby data from similar sites are used to estimate consumer surplus in lieu of collecting site-specific data.[40] In the RFA, benefits are estimated for three groups: river-users, backpackers, and others, including sightseers, hikers, and campers. Visitor days for each group during 1997 are 99,137, 182,481 and 5,788,187, respectively, giving total visitation during that year of 6,069,805.[41]

Calculation of the total economic benefit of the regulation in the RFA, in terms of consumer surplus, proceeds in several steps.

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35. For a discussion of quotas, see FIELD, *supra* note 5, at 218-21.

36. *See* Nicholson, *supra* note 2, at 222-23, 512.

37. *See id.*

38. *See* OFFICE OF AVIATION POLICY & PLANS, U.S. DEP'T OF TRANSP., INITIAL REGULATORY EVALUATION, INITIAL REGULATORY FLEXIBILITY ANALYSIS, INTERNATIONAL TRADE IMPACT ASSESSMENT, AND UN-FUNDED MANDATES ASSESSMENT: NOTICE OF PROPOSED RULEMAKING—COMMERCIAL AIR TOUR LIMITATION IN THE GRAND CANYON NATIONAL PARK SPECIAL FLIGHT RULES AREA (1999).

39. *See* A. MYRICK FREEMAN III, THE MEASUREMENT OF ENVIRONMENTAL AND RESOURCE VALUES: THEORY AND METHODS 46 (1993).

40. *See* OFFICE OF AVIATION POLICY & PLANS, *supra* note 38, at 41-53.

41. *See id.* at 44.

(1) Using three different external willingness-to-pay studies, visitor-day values are multiplied by total visitation in each category and total annual willingness-to-pay for recreation in the Park, without the regulation, is calculated.[42] The marginal willingness-to-pay for the "other" category is derived from a study done for Bryce Canyon National Park.[43] The economic value of visitation for backpackers is taken from a national study of outdoor recreation.[44] The value for river users is taken from a study actually done for the GCNP.[45]

(2) Using these external studies, which provide qualitative information concerning recreationists' exposure to aircraft noise in the GCNP, varying levels of benefit reduction are applied to each category of visitor depending on their exposure to aircraft noise.[46] Due to the lack of information concerning actual reductions in willingness to pay for recreation in the GCNP, benefit reduction is chosen arbitrarily as follows: 20 percent for those slightly impacted, 40 percent for those moderately impacted, 60 percent for those impacted very much, and 80 percent for those extremely impacted. A sensitivity analysis is reported that uses one-half of the benefit-reduction levels. The estimated total lost consumer surplus from aircraft noise for 1997 using the full-benefit reduction is $34,453,000.[47]

Next, a linearized noise index is calculated for the base year.[48] Expected noise measures are calculated given that no action is taken to limit aircraft in the GCNP. For a given year, the percentage change from noise levels in the base year is applied to the lost consumer surplus. For example, the base-year linearized noise index is estimated to be 1219.23, with a noise index of 1577.47 in year 2000.[49] This is a change of 22.71 percent in noise levels, so undiscounted costs are reduced by $34.453 * .2271 = $7.82 million, the benefits attributable to the regulation in that year. Using the above

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42. The FAA uses willingness-to-pay values for the three recreation categories from the following articles: John C. Bergstrom & H. Ken Cordell, *An Analysis of the Demand for and Value of Outdoor Recreation in the United States*, 23 J. LEISURE RES., 67, 67-68 (1991); Abraham E. Haspel & F. Reed Johnson, *Multiple Destination Trip Bias in Recreation Benefit Estimation*, 58 LAND ECON., 364, 364 (1982); BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR OPERATION OF GLEN CANYON DAM: FINAL ENVIRONMENTAL IMPACT STATEMENT 164-66 (1995).

43. *See* Haspel & Johnson, *supra* note 42.

44. *See* Bergstrom & Cordell, *supra* note 42.

45. *See* BUREAU OF RECLAMATION, *supra* note 42.

46. *See* OFFICE OF AVIATION POLICY & PLANS, *supra* note 38, at 41-53.

47. *See id.* at 48.

48. *See id.* at 49.

49. *See id.*

methodology, the report concludes that the total present value of benefits to ground users, including backpackers, river users, and sightseers, over the ten-year evaluation period is $34.61 million, allowing for a discount rate of seven percent.[50]

Unfortunately, the estimates of the economic benefits of the regulation to ground users are subject to a high degree of error due to the valuation technique used and the damage relationship underlying the benefit model. The "benefits transfer method" of valuing a non-market good is subject to large amounts of error because the good in question deviates from those used in the related studies. The amount an individual is willing to pay for backpacking, for instance, may be different in the GCNP than in Bryce Canyon National Park. Because willingness-to-pay acts as an estimate of the recreational experience in benefit estimation, using an ambiguous number introduces excessive uncertainty into the final ground-user benefit estimate.

Four valuation techniques are currently recognized as "state of the art" for estimating the economic value of non-market goods.[51] These are contingent valuation, hedonic studies, travel cost studies, and meta-analysis. Of these four, meta-analysis most closely approximates the benefits transfer method. With meta-analysis, the value of a non-market good is estimated using a set of past studies that value similar goods. For example, to value the recreation experience in the GCNP, we may combine estimates of the recreation value of other sites across the nation, and use these as a proxy for GCNP recreation value. A set of studies is used because the estimate, essentially an average of the values contained in the previous studies, is more precise than if only one study is used. Generally speaking, the precision increases as more studies are used.

Ironically, the meta-analysis approach has come under heavy fire from both economists and statisticians. Critics claim that the results are subject to large amounts of error due to small sample sizes and publication bias.[52] The benefits transfer method then, with only one sample point, can be seen as the worst case of a highly suspect methodology. Thus, the use of a highly criticized approach further underscores the uncertainty of the FAA estimates of benefits from the proposed regulation.

Another problem in the estimate of the benefit of the regulation to ground users arises from the assumptions made concerning the damages that ground users suffer from aircraft noise. The study reports the

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50. *See id.* at 52.

51. *See* FREEMAN III, *supra* note 39, at 486-88.

52. *See generally* Colin B. Begg & Jesse A. Berlin, *Publication Bias: A Problem in Interpreting Medical Data*, 151 J. ROYAL STAT. SOC'Y 419 (1988); Frederick Mosteller & Thomas C. Chalmers, *Some Progress and Problems in Meta-Analysis of Clinical Trials (in Meta-Analysis: Methods for Combining Independent Studies)*, 7 STAT. SCI. 227 (1992).

percentage of visitors by category that are impacted either "not at all," "slightly," "moderately," "very much," or "extremely." Ordinal categorizations such as these are not useful for valuing the impact of the noise. A simple example illustrates this point. One person may respond that they were only slightly affected by the noise, but if questioned further, may express a willingness-to-pay of $20 for the experience without noise. Another individual, experiencing the same level of noise, may be disturbed "extremely," but only willing to pay $5 for relief. As illustrated, the estimated damages are entirely determined by the values chosen by the report's authors for the benefit reductions assigned to each of the impact categories. In short, the estimated benefits of the regulation rest on arbitrarily assigned values.

To illustrate the uncertainty that arises from these assumptions, let's assume instead that the visitor-day value for those affected slightly is reduced by one percent, those affected moderately by three percent, those affected very much by eight percent, and those affected extremely by ten percent. Then the reduction in consumer surplus attributable to aircraft noise in 1997 is reduced by almost ten times from $34.6 million to $3.6 million. Unfortunately, no empirical evidence offers guidance in choosing between these two estimates of $34.6 million and $3.6 million.

Further problems exist in the study concerning the benefits to GCNP visitors from reducing aircraft noise. The calculations assume that the percentage reduction in noise results in a one-to-one percentage increase in benefits to the affected parties. Empirically, there is no reason to believe this. Indeed, economic theory posits the concept of diminishing marginal benefit, that is, additional units of a good provide less and less satisfaction for the individual.[53] Typically, environmental damages are very low or zero at low levels of an externality due to the environment's assimilative capacity.[54] Thus, as the level of damage, noise in this case, increases, economic costs increase to reflect higher damages from each additional decibel. Thus, reducing the first unit of noise will have the greatest benefit to the individual, and the added benefit from eliminating each consecutive unit of noise will be smaller.

As before, we change the assumptions of the model and recalculate the benefits assuming that the first six percent of noise reduction increases benefits by ten percent, the next 6.4 percent of noise reduction increases benefits by eight percent, the next 6.8 percent of noise reduction is paired with a benefit increase of five percent, and the final seven percent of noise reduction increases benefits by one percent. Using these illustrative assumptions, year 2000 benefits fall from $7.82 million in the FAA model to

53. *See* NICHOLSON, *supra* note 2, at 88-90.
54. *See* FIELD, *supra* note 5, at 84-87, 95.

$3.7 million in our model. Again, we find large variations in program benefits resulting from changes in model assumptions.

The benefits transfer method and the choice of the damage function together lead to a high degree of uncertainty surrounding the FAA estimates of benefits to ground users from the proposed regulation. In fact, using the data currently available, the benefit of the regulation to ground users of the GCNP cannot be estimated with any acceptable degree of certainty.

Economic Efficiency: Societal Gain versus Societal Loss under the Present Regulatory Scheme

For an economically efficient outcome to occur, the benefits to ground users from the regulation must be weighed against the lost benefits to air tour consumers from restricted flights and higher prices.[55] As demand for flights increases, the airlines will be able to raise prices to recoup the lost revenues associated with fewer flights. For each dollar increase in the flight cost, each passenger loses a dollar in consumer surplus.[56] Additional consumer surplus is lost from flights that are demanded, but cannot be flown due to quotas.[57]

To estimate the lost consumer surplus from the regulation, we must construct a demand curve for GCNP air tours. Estimates of the elasticity of demand for leisure travel indicate that the value is elastic, with an approximate value of two.[58] Using a constant elasticity of demand estimate of two and an illustrative flight cost of $100, consumer surplus losses to air tour customers exceed $25.8 million for the ten years investigated in the report if the industry were to have grown at 3.3 percent per year absent the regulation.[59, 60] The present value of this benefit, over the ten-year evaluation period, is approximately $9.9 million.[61]

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55. *See id.*

56. *See* FREEMAN III, *supra* note 39, at 50-52.

57. *See* FIELD, *supra* note 5, at 218-21.

58. Previous studies have estimated the elasticity of demand for leisure travel at approximately 2. *See* STEPHEN SHAW, AIRLINE MARKETING AND MANAGEMENT 66 (2d ed. 1988).

59. If the elasticity of demand is 2, then a 1 percent increase in the price of flights will be followed by a 2 percent drop in demand for flights.

60. The estimated industry growth rate of 3.3 percent is taken from the RFA. *See* OFFICE OF AVIATION POLICY & PLANS, *supra* note 38, at 58.

61. It is important to note that the estimated $9.9 million loss in consumer surplus to air tour customers is a lower limit. One could argue that further losses in consumer surplus result from increasing the minimum flight altitudes and thereby compromising the sightseeing experience. While this is probably true, the extent of the losses may not be determined without further study.

The air tour consumers lose value due to the higher prices resulting from the restrictions on flights. The air tour companies also lose future revenues from flights that cannot be sold. The FAA estimates that the companies stand to lose $114.6 million (discounted) over the ten-year period of the cost-benefit evaluation assuming a 3.3 percent growth rate.[62] These are monies that are not captured by any other economic agent.

Further costs are incurred due to administrative requirements of the regulation. The RFA reports that the discounted cost of monitoring compliance for the FAA is estimated to be $1 million.[63] Administrative costs for the airlines are projected to be $23,000, discounted.[64] Therefore, the estimated total economic losses over the ten years studied from the regulation, including lost consumer surplus, lost revenues, and compliance cost, exceed $125 million, assuming a discount rate of seven percent.

The $125 million estimated cost to air tour customers, airlines, and the FAA may be justified from an economic efficiency standpoint if, in fact, the gain to ground users exceeds the loss. Comparing the costs of the program to the estimated benefit to ground users of $34.7 million we see that, from an efficiency perspective, the regulation should not be instituted. In essence, the regulation may be viewed as a transfer of consumer surplus revenues from the air tour market to the ground visitors of the GCNP.

Further, when one considers the high degree of uncertainty that surrounds the FAA estimate of benefits to ground users of the GCNP, then the regulation entails even larger economic losses to society. Depending on the alternative assumptions that we propose, which are more consistent with economic theory than the FAA's estimates, benefits to ground visitors may be less than one-tenth of the FAA estimate. In essence, society would be paying $125 million to receive $3.6 million in benefits.

IV. QUOTAS AND ECONOMIC EFFICIENCY

The large economic losses resulting from the regulation follow from the statutory requirement for noise reduction. Public Law 100-91 mandates a "substantial restoration of the natural quiet" and does not direct the NPS or the FAA to balance benefits and costs to different user groups of the GCNP.[65] What the economic analysis tells us is that the standard requiring "substantial restoration of quiet" is not socially beneficial. This is not to say that some reduction in aircraft noise is not necessary to reach a socially

62. *See* OFFICE OF AVIATION POLICY & PLANS, *supra* note 38, at 58.

63. *See id.* at 54.

64. *See id.*

65. Grand Canyon Overflights Act, Pub. L. No. 100-91 § 3(b)(1), 101 Stat. 674, 676 (codified at 16 U.S.C. § 1a (note) (1994)).

efficient outcome. Rather, the claim is made that the reduction mandated by the statute restricts noise too much because it ignores the inherent trade-offs that exist in constraining the use of National Park resources. Using quotas to allocate non-market goods usually results in a socially inefficient allocation of natural resources, especially with the passage of time and changes in demand and supply conditions because, once the noise quota is reached, no more noise reduction will take place.[66]

V. ECONOMIC EFFICIENCY AND INCENTIVE-BASED RULEMAKING

A large body of literature supports the use of incentive-based strategies for managing environmental externalities rather than command and control approaches.[67] One example of incentive-based strategies includes imposing fees on units of noise emitted based on the type of aircraft flown. Another potential incentive-based strategy would be to allow air-tour operators a "noise budget."[68] The operator would be allocated a noise budget and allowed to fly as many flights as they chose as long as the budget was not exceeded.

The primary benefit of these economic-based reforms is that, under most situations, they encourage continued investment in environmental technology as emitters seek to minimize their costs of compliance.[69] Incentive-based strategies force producers to consider the damage inflicted on others, including the environment, in their production decisions because they impose costs for each level of pollutant, in our case noise, emitted. In the fee-based system, each unit of noise carries a fee. As fees raise the costs of operating noisy aircraft, prices rise and the equilibrium number of flights will fall.[70] In the "noise budget" approach, the cost of flying noisy aircraft is the reduction of the number of flights that can be flown in quiet aircraft. For instance, if Aircraft A is twice as quiet as Aircraft B, twice as many flights may be flown in A as B. Choosing to employ aircraft B means losing the additional revenue from flights flown in A. Thus, a socially preferred option (in terms of maximizing social welfare) is one that encourages air-

66. *See* Arrow et al., *supra* note 8, at 222.

67. *See* FREDERICK R. ANDERSON ET AL., ENVIRONMENTAL IMPROVEMENT THROUGH ECONOMIC INCENTIVES (1977). Also, for a comprehensive list of citations concerning the social optimality of incentive-based strategies see Mintz, *supra* note 21, at 151-64.

68. The concept of a noise budget as a means of improving the efficiency of noise control in the Grand Canyon was proposed by Gary Becker at the Federal Aviation Administration, Office of Aviation Policy and Plans, Operations Regulatory Analysis Branch, APO-310 at the Western Economics Association Annual Meeting in Vancouver, B.C., on July 2, 2000.

69. *See* FIELD, *supra* note 5, at 230-33.

70. *See id.*

tour operators to switch to quiet technology aircraft. If quieter aircraft were used, then the number of overflights for a given level of noise damage could increase, while still allowing for benefits to ground users.

One may question a fee-based or "noise budget" approach to noise regulation and suggest that any new regulation specify the types of aircraft that may be flown, thus avoiding the use of noisier aircraft. The difficulty with moving to a standard of "quiet aircraft" is that it is still a command and control approach, albeit a rather more thoughtful one than flight quotas. The problem here is that once the technology standard is met, there is no incentive to further reduce aircraft noise.[71] As the number of flights increases with the projected increase in demand for air tours, aircraft noise might re-emerge as a problem unless regulators encourage the industry to "set the bar higher" by using increasingly quieter aircraft. It is conceivable that, eventually, an extremely quiet aircraft could be designed that would largely eliminate the problem of aircraft noise in the GCNP altogether.

A more efficient approach to flight quotas or a technology standard would be to enact a fee schedule for noise generation over the GCNP for commercial and general aviation flights.[72] A fee program would require operators to register aircraft and report the number of flight hours, over some specified time period, to the FAA. Fees would be based on the noise reduction technology on the aircraft and the number of flight hours over the Canyon. This raises the cost of flying noisier planes and forces air-tour operators to consider the social cost of aircraft noise when deciding which planes to operate.

Fees will automatically cause prices to rise, making flights more expensive. As the price rises, demand falls and the number of flights flown falls. Assuming an elasticity of demand of two, indicating that a one percent increase in the price of flights will be followed by a two percent drop in demand, fees would move the market toward a socially efficient equilibrium immediately. Further, fees have an additional impact on new investment in the air-tour industry. Because noisy planes would be effectively more expensive, a move toward quiet aircraft would naturally result. Early adopters would be able to lower prices and capture market share.[73] Recognizing this, operators would make the shift to quiet aircraft quickly to avoid losing market share.[74]

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71. *See id.* at 221.

72. *See id.* at 230-33.

73. *See id.* There is also a benefit to air-tour customers from reduced aircraft noise which will tend to draw consumers away from the noisier aircraft.

74. In anticipation of noise-based regulation, several operators have already invested in quieter aircraft. Interview with Jim Petty, President, Grand Canyon Air-Tour Council, in Las Vegas, Nev. (July, 1999).

The noise budget approach would have a similar impact on the investment choices as a fee program, and would immediately limit the number of flights flown. Noise budgets would act as a noise quota, allowing operators to fly as many flights as they choose, so long as their noise allocation is not exceeded. Operators would have to switch to quieter aircraft to increase the number of flights and, therefore, revenues. In this way, the industry is regulated, but is allowed to expand if it does not impose additional costs on society in the form of aircraft noise.

VI. CONFLICTING LAWS AND EFFICIENT ALLOCATION

Given the variety of incentive-based alternatives to controlling noise in the GCNP, we must question why so many resources have been devoted to devising a regulation where, by the FAA's own estimates, costs of the regulation clearly exceed the benefits. We posit that the answer is the institutional framework in which the regulations are made. Though the Regulatory Flexibility Act requires cost-benefit analysis to be performed, it does not convey strict scientific standards for the analysis, nor does it require regulators to abide by the implications with respect to social efficiency.[75] If cost-benefit analysis is performed only to fulfill mandates rather than to assess the ranking of different regulatory schemes, then cost-conscious agencies are given an incentive to perform incomplete analyses.

Many have argued that calculating the benefits and costs of environmental regulations is difficult, if not impossible.[76] They reason that cost-benefit analysis often does not include the costs of devising and implementing incentive-based strategies. Further, they argue that with the typically high uncertainty concerning environmental damages, socially efficient outcomes are unlikely and may often lead to net social harm. Finally, they argue correctly that incentive-based strategies often lead to more environmental damage than command and control approaches to regulation.[77]

While criticisms of incentive-based approaches have some merit in certain contexts, it may be argued that reducing noise in the GCNP is an excellent place to begin investigating the potential of incentive-based strategies. Because noise is a non-cumulative externality, time-related uncertainty concerning noise damages does not complicate cost-benefit analyses. Though implementation and enforcement costs for either a technology or fee-based approach will be considerable, there is no reason

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75. *See* ANDERSON ET AL., supra note 67, at 35-37, 148, 155.

76. *See* Mintz, *supra* note 21; Latin, *supra* note 21.

77. This is a reasonable assertion because incentive strategies typically tolerate some "socially efficient level of damage." *See* FIELD, *supra* note 5, at 95.

to believe that they would be any lower than implementing and enforcing a quota system. Finally, transferring visitors from the ground to the air in the GCNP will help mitigate some cumulative environmental degradation and actually *reduce* the uncertainty surrounding management of GCNP resources.

Because of the non-cumulative impact of noise on GCNP resources, we are faced with an ideal setting in which to test incentive-based strategies for controlling externalities. Others have suggested an incremental move toward incentive-based regulation.[78] We suggest the place to start this reform is in situations where uncertainty surrounding benefits and costs are low and environmental damage is non-cumulative and reversible. Clearly, aircraft noise does not cause permanent damage to GCNP resources, making it an ideal environment in which to test incentive-based regulatory strategies.

Using "trial runs" for testing the efficacy of incentive-based mechanisms for environmental protection was suggested by Mintz (1991), though he did not provide any details concerning regulations to target.[79] We suggest that collecting information concerning market-based strategies through reversible regulations with transitory environmental impacts can give needed insight into the regulatory costs, efficacy, and implementation pitfalls that may be encountered in a movement toward permits and fees for controlling environmental externalities. The data would provide information about how producers change emissions levels, prices, quality, and quantity of goods when faced with environmental fees. Because air-tour operators will alter their mix of aircraft in order to minimize costs when faced with fees, the data will also provide a case study of fleet-mix response to regulation.

Information gleaned from fee-based regulation in the GCNP would be helpful in devising efficient environmental regulations for other industries that are associated with either cumulative or non-cumulative emissions. In essence, data concerning producer response to environmental regulation may be gathered under low-risk circumstances where environmental costs are transitory and the knowledge gained may be applied to situations where impacts are perhaps more permanent. For example, producer response data could also be useful in devising fee-based regulation for improving air quality from corporate vehicle fleet emissions. And because technology investment enables firms to avoid fees, the data would also be useful in cases where incentives for environmental technological investment is called for, such as controlling emissions from coal-fired electric-generation plants.

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78. *See generally* Ackerman & Stewart, *supra* note 20.
79. *See* Mintz, *supra* note 21.

VII. CONCLUSION

Though governmental attempts to allocate scarce environmental resources in our National Parks are a response to market failures, there is no guarantee that the regulations created by regulatory agencies will result in beneficial outcomes to society as a whole. In order for beneficial outcomes to result, lawmakers and regulators alike must begin to take a broader and more economically based view of the allocation of these resources and require that incentive-based approaches be instituted in future rulemaking. We will find that in many cases, such as the noise regulation over the GCNP, environmental damages may be mitigated at a smaller cost to economic agents than when standard command and control approaches are taken.

We have argued that due to the unique characteristics of the aircraft impacts on GCNP resources, less uncertainty surrounds the socially efficient level of noise in the Canyon, making it an ideal testing ground for incentive-based approaches. However, it remains to be seen whether the institutional movement toward incentive-based strategies for environmental protection will actually take place. To date, very few incentive-based programs are in place in the United States. Currently, sulfur dioxide emissions from power plants are regulated by an experimental tradable permits approach.[80] Prior to the implementation of the tradable permits, economists estimated that expenditures for electrical generation at coal-fired electric plants were 47 percent higher than cost-minimizing levels.[81] Another program allows for tradable permits to improve water quality.[82] If instituted, a fee-based program to regulate noise in the GCNP would be the first of its kind and a valuable opportunity for collecting needed data on incentive-based programs.

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80. *See* FIELD, *supra* note 5, at 311.

81. *See* Frank M. Gollop & Mark J. Roberts, *Cost-Minimizing Regulation of Sulfur Emissions: Regional Gains in Electric Power*, 67 REV. ECON. & STAT. 81, 82 (1985).

82. *See generally* Dana L. Hoag & Jennie S. Hughes-Popp, *The Theory and Practice of Pollution Credit Trading in Water Quality Management*, 19 REV. AGRIC. ECON. 252 (1997).