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# **Cost-Benefit Analyses of; Passive Restraints**

## Cost= Benefit Analyses of Passive Restraints

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Should passive restraints be required on all new cars in the United States? Theoretically, the answer can be determined by a comprehensive cost-benefit analysis (CBA), one which accounts for all of the social costs and benefits associated with implementation of the rule—pecuniary and nonpecuniary, tangible and intangible. In practice, however, few CBAs even approach such a complete analysis.

Nonquantifiable costs and benefits and those which are quantifiable but not readily valued are commonly mentioned and then put aside; often they are ignored altogether. In either case, they are left out of the final calculus of the CBA which arrives at a “bottom line,” an economic assessment of the worthiness of the program in question. As such, the “bottom line” is deficient. It can and should be recognized as a useful input into an overall assessment of the program, but it should not be viewed as the sole determinant of the program’s desirability (20,50). This caveat should be kept in mind when reading this chapter.

CBA is in its ascendancy as a tool of policy analysis, particularly with regard to the issue of governmental regulation. Thus, it is not surprising to see that new CBAs entered the debate over Federal Motor Vehicle Safety Standard (FMVSS) 208 prior to the October 1981 rescission. What may seem more surprising, however, is that CBAs pertaining to the restraint issue date back more than a decade.

In 1970, Lave and Weber (20) examined the costs and benefits of seatbelts from the perspective of the individual and found that benefits exceeded costs if the value of an individual’s life was at least \$10,000, a number more than a full order of magnitude below the smallest estimates of the value of life (or livelihood) (50).

Lave and Weber failed to explain why, with benefits so much larger than costs, the majority of occupants choose not to wear belts. Thaler and

Rosen (46) addressed this question in an analysis in which they compared the time costs of buckling up with the expected benefit. Thaler and Rosen estimated an annual benefit from wearing lap belts of approximately \$10 (using a value of life of \$200,000), and they argued that the individual’s opportunity cost of time involved in buckling and unbuckling the seatbelt could easily exceed this amount.

Recently, Arnould and Grabowski (3) reexamined Thaler and Rosen’s analysis (46) and undertook two CBAs: 1) the lap/shoulder belt from the perspective of the individual, and 2) from the point of view of society as a whole on passive restraint systems.

In the former, Arnould and Grabowski work with three different weighting schemes to value individuals’ willingness to pay to avoid injuries of varying severity. They conclude that the expected annual benefits from regular belt use, \$38 to \$78 (in 1975 dollars), must exceed the time opportunity costs associated with buckling up.

Subject to two qualifications which they dismiss as insufficient to reverse their conclusion, Arnould and Grabowski argue that belt nonuse is not the result of rational, informed decisionmaking, as Thaler and Rosen had suggested it might be. To the contrary, these authors interpret their findings as supporting the “insensitivity-to-low-probabilities” hypothesis, discussed in chapter 2. It was found, however, that Arnould and Grabowski dismiss too readily the possibility that people value the freedom from discomfort (physical or psychological) produced by belts at more than the expected benefits. Over hundreds of hours of driving per year, the hourly discomfort cost would have to be extraordinarily low to dismiss this factor.

Arnould and Grabowski’s passive restraint analysis is a competent, if standard, CBA of the social desirability of a system of mandated passive

restraints, either automatic belts or air bags. The analysis finds that both systems would produce substantial social benefits, with the benefits of air bags slightly exceeding those of automatic belts. However, the costs of the bags are so much higher than those of the belts that Arnould and Grabowski conclude belts are superior on the basis of net benefit (or benefit-cost ratio). Indeed, they find that only under very favorable conditions will air bags result in positive net benefits—i.e., the costs of bags quite likely would exceed the benefits.

Arnould and Grabowski's study is noteworthy for its sensitivity analysis, which tests the impact of varying assumptions on the benefit-cost conclusions. The analysis is thorough in its consideration of economic costs and benefits, but it merely mentions the costs of inconvenience and discomfort associated with belts—costs which must be considered potentially large, given all of the evidence on belt use. And, like almost all CBAs, the analysis ignores the costs of the suffering experienced by the loved ones of automobile accident victims. (This is discussed further below.)

Subject to these limitations, Arnould and Grabowski's analysis estimates that in a steady-state situation, i.e., after passive restraints were in virtually all automobiles (commonly estimated to require about 10 years), net benefits of passive belts could be as high as **\$8.5 billion** and would not be likely to be less than **\$3.4 billion**. Net benefits of air bags, by contrast, could reach **\$6.6 billion** but could also be as low as **-\$4.9 billion**. The analysis also calculates expected annual costs per life saved, which range from **\$135,000** to **\$557,000** for belts and **\$472,000** to **\$2,159,000** for bags. \* Obviously, these cost figures attribute no value to injuries avoided. Lave (19) concurs with the finding that passive belts would be more cost effective than air bags, though he does not demonstrate analytically the basis of his conclusion.

Another recent CBA, by Nordhaus (32,33), was undertaken precisely to feed into the Department of Transportation's (DOT's) reconsideration of FMVSS 208. Sponsored by five major automobile insurance companies, this analysis also examined and compared the two passive restraint systems,

although it was focused on passive belts, the system generally expected to dominate if FMVSS 208 had gone into effect.

The analytical slant taken in Nordhaus' CBA is somewhat different from that in Arnould and Grabowski's. Nordhaus concentrates on the (net) cost of delaying or reordering implementation of FMVSS 208, rather than making an "either-or" comparison of the status quo or a fully implemented passive restraint rule. As one of DOT's options was to rescind FMVSS 208 altogether, Nordhaus' analysis of the net cost of this option is directly comparable to other analyses of the net benefit of fully implementing a passive restraint rule.

Nordhaus estimates that, in a steady state, the annual net cost of a rescission would equal **\$2.4 billion**, assuming that all cars are equipped with automatic belt systems. This number was derived from National Highway Traffic Safety Administration (NHTSA) and manufacturer data which Nordhaus believes to be in error, biased against the belt system; so he views his estimate as a lower bound on the net benefits of passive belts. Under these conservative assumptions, the benefits of the passive belt system (**\$3.6 billion**) are three times greater than the costs (**\$1.2 billion**). Nordhaus estimates the total discounted net social benefits of the passive restraint rule at **\$33 billion**. Alternatively, **\$33 billion** represents the net cost to society of a complete rescission of the rule. Under the assumptions that he believes to be more reasonable, this figure rises to **\$69 billion**. Nordhaus summarizes his findings as follows:

[T]he passive restraint rule is, from an economic point of view, as important as any environmental, health, or safety rule on the books. If the estimates of the impact on fatalities are accurate, a rescission would be equivalent to repealing a law that cuts in half the homicide rate. It is equivalent to forgoing the medical advances that allowed the virtual elimination of death from tuberculosis over the last quarter century.

Nordhaus' CBA shares with Arnould and Grabowski's an effective use of sensitivity analysis. Unlike Arnould and Grabowski, Nordhaus finds that a world of air bags would be preferable to a world of automatic belts. Despite the high cost estimate he uses to evaluate bags (**\$425**), Nord-

\*All of these figures are Arnould and Grabowski's estimates (3) inflated to 1981 dollars.

haus concludes that an all-bag system would generate total discounted net social benefits of \$47 billion. \* He does not dwell on the comparison, however, since at the time of his study belts appeared to be the wave of a 208 future.

As part of his policy analysis, Nordhaus examines the impact on the automobile manufacturers of implementing FMVSS 208. The only major organized opposition to implementation of the rule through the years, the manufacturers have expressed concern about the costs of adding passive restraints as standard equipment and what this would do to the demand for their product. The potential problem is of particular concern in 1982, with the domestic industry in a depressed condition. Nordhaus presents a case that adverse effects would be minimal. He suggests that it is even conceivable that the industry would benefit from implementation of FMVSS 208. This would occur if consumers recognized the net economic savings involved in buying a passive-restraint-equipped car, given an associated reduction in automobile insurance costs.

Nordhaus' is not the first CBA undertaken directly in connection with governmental evaluation of a passive restraint rule. In 1974, NHTSA released a CBA that demonstrated "the superiority of passive restraint systems compared to belt systems presently required" (13). The analysis was revised in response to criticisms and still came up with the same conclusion (13). Two years later, another CBA accompanied the announcement of a public hearing to be held by DOT.

At about the same time, Robertson (39) directed a survey which, though not itself a CBA, produced a finding of direct relevance to CBA: a sample of new car buyers expressed a willingness to pay an average of \$12 more per month (\$144 per year) in car payments to save 6,000 lives per year and \$17 per month (\$204 per year) to save 12,000 lives. \*\* It appears that many new car buyers might stand prepared to pay considerably more

● Recall that under the assumption he finds more realistic, Nordhaus found a greater net benefit for the belts. However, he does not apply a set of "more realistic" assumptions in the air bag case, relying instead on manufacturers' estimates of cost. Thus, this \$47 billion figure should be compared with the \$33 billion estimate for the belts.

\*\*The dollar figures have not been adjusted for inflation, so they understate current value.

than the amount passive belt systems would require. Whether answers to a hypothetical question would translate into equivalent action in the marketplace remains to be seen.

Graham, Henrion, and Morgan (9) have identified half a dozen other CBAs on the occupant restraint issue and have produced a detailed analysis of their own, one which compares passive restraint systems with other methods of encouraging restraint. Their analysis ranks FMVSS 208 below other alternatives in terms of both net benefits and benefit-cost ratio, with a compulsory belt usage law having the highest ratio (in large part because its measurable costs are so low) and a combined air-bag/mandatory-belt usage law producing the greatest net benefits (and saving the most lives). All of the alternatives these authors examine produce positive net benefits—i.e., each alternative is preferable to the complete absence of occupant restraints (and superior to the current system of merely requiring belts in cars). In particular, they estimate that the benefits of FMVSS 208 would have exceeded the costs by 95 percent.

Thus, CBAs have served as inputs, the importance of which is difficult to assess, throughout the long debate on a Federal passive restraint rule. Each of the analyses differs from the others in certain important ways: some adopt a human capital approach to valuing life (or livelihood), while others use willingness-to-pay (50); basic data sources, and hence magnitudes, often vary significantly; restraint alternatives studied differ from one analysis to the next; some analyses incorporate concerns like the effect of restraint systems on insurance costs, while others ignore them, and so on.

Almost all of the studies can be faulted for their failure to treat analytically the inconvenience and discomfort costs which, though nonpecuniary, seem to play a significant role in many people's decisions about using manual belts. It maybe difficult or unreasonable to place a dollar value on such costs directly. However, there are sensitivity analysis techniques that would permit an evaluation of the potential significance of these costs. For example, one might employ break-even analysis to determine how highly people would have to value the inconvenience and discomfort in

order to make passive belts appear to be socially undesirable (so).

Despite their idiosyncrasies and their individual and collective flaws, as a body the passive restraint CBAs present an impressive case that society would benefit more than it would lose from a compulsory passive restraint rule. The findings are reasonably consistent and robust. In general, the studies rank air bags ahead of passive belts as life-saving devices, in large part reflecting the ability (and desire) of many passive-belt vehicle owners to disconnect their belts. With some notable exceptions, the analyses rank belts higher than bags on cost-effectiveness and cost-benefit grounds, primarily reflecting the much lower cost of the passive belt option. While all of the studies find passive belts to produce positive net benefits, several note that the positive net benefit of air bags is sensitive to assumptions.

Despite the uniformity of these studies' findings, the analyses have articulate critics who challenge basic assumptions of the models. In particular, while industry critics argue that belt cost estimates in the analyses are too low, most of the criticism is focused on estimates of passive seatbelt use. The automobile industry seems convinced that incremental belt-usage rates would be extremely low, assuming passive belts that could be easily disconnected (a condition that they believe would be demanded by the public). Thus, the industry views passive belts as increasing vehicle costs without significantly increasing effective passenger restraint. Current (manual) belt users would thereby be "punished" by an unnecessary additional charge, while confirmed nonusers would have to bear the same additional burden but would realize no additional protection (23).

In closing this glimpse at occupant restraint CBAs, several caveats should be mentioned. The

first, illustrated by the work of Graham, Henrion, and Morgan (9), is that a finding that a mandatory passive restraint rule would be cost-beneficial does not necessarily mean that it would be the most cost-beneficial approach to saving lives through occupant restraint. Other alternatives should be compared in order to seek the approach that would maximize net social benefits.

Use of the phrase "net social benefits" suggests an important aspect, and limitation, of using CBA in a policy framework: as was noted at the outset of this discussion, reasonable costs and benefits are not the only, nor necessarily the most important, variables in policy decisionmaking. Above, studies were faulted for their failure to value discomfort and inconvenience; but other unmeasured variables may be of much greater consequence. For example, CBAs generally do not adequately address the issue of who benefits and who loses—not everyone realizes a net gain from implementation of a passive restraint rule—and it is this distinction that has made a (slow) horse race out of what appears to be a socially desirable objective (22). The distributional issue—winners and losers—constitutes one of the themes of the next and concluding chapters.

Finally, it should be noted that none of the CBAs attempts to directly value avoidance of the pain and suffering of accident victims and their loved ones. \* As a result, the CBA's findings of positive net economic benefit support the noneconomic desire to minimize human suffering.

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● This is considered indirectly in willingness-to-pay valuations, though these generally cover only the victims themselves and not the suffering of people close to them. Furthermore, willingness-to-pay estimates suffer from people's inability to fully comprehend and contemplate their own deaths or serious disabilities (50).