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Motorist Use of Safety Equipment: Expected Benefits or Risk Incompetence?

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Abstract

Seat belts, child safety seats, and motorcycle helmets are not used all the time by all drivers, parents, or riders when they travel. Since the safety advantages of these types of equipment are well established, nonuse could be due to risk incompetence. This article starts instead with risk competence to see to what extent use can be attributed to the net benefits expected by individual motorists. Logit analysis of microdata from the Nationwide Personal Transportation Study shows that use is more likely with larger perceived net benefits for all three types of motorists. They are therefore risk competent enough to respond to changes in net benefits in ways and degrees that are qualitatively and ordinally correct.

Risky decisions can be complex. People can have great difficulty comprehending and performing well in complex situations. Yet such situations are common in organized, formal markets such as insurance and housing and in less formal settings involving individual health and safety. The dominant economic paradigm for risky decisions has been the expected utility model, a model of rational behavior. Whatever its position now, criticism of it is plentiful and research on anomalies associated with expected utility continues.

This article, in contrast to an emphasis on anomalies, starts with rationality in the form of expected utility to determine its usefulness in understanding motorist decisions about the use of safety equipment—specifically, safety belts, child safety seats, and motorcycle helmets. The thought behind this approach is captured in Sen's (1987, p. 72) review and general assessment of rationality in economics. He observes that while some authors are extremely skeptical of the expected utility model, others emphasize with some justice

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that it still can be useful in explaining behavior. The purpose of this article is to apply the expected utility model to motorist behavior as it concerns the use of protection devices. The individual net-benefit approach should be appropriate, because motorists are familiar with the safety equipment and the traffic accident risks.

We start with a description of the individual net-benefit approach to motorist use of safety equipment and a critique of the approach. Section 2 presents results of multivariate and multinominal logit analysis of national microdata of seat belt use of drivers from 7900 households. The results show what might be called ordinal competence, since motorists respond in the expected directions. For example, drivers of lighter cars use seat belts more than drivers of heavier cars. Section 3 contains results for the use of child safety equipment and motorcycle helmets, which have been studied much less than seat belts. These results also exhibit ordinal competence. Parents driving lighter cars use child safety seats or harnesses or seat belts for their children more than parents driving heavier cars. Motorcyclists who travel more wear helmets more than those who travel fewer miles. This new evidence indicates that a rational, expected utility model of risky decisions can be useful in understanding, in part, motorist behavior concerning traffic safety. At a minimum, drivers respond in ways and degrees that are qualitatively and ordinally correct according to the net-benefit approach.

1. Expected utility and traffic safety

1.1. Individual net-benefit approach

Motorists more than anyone else have a stake in decisions concerning their own safety. If they are competent in understanding traffic accident risks, then motorists can be expected to use safety equipment when it is sensible to do so. The general framework for this article is that individuals pursue safety and nonsafety goals and use their resources and arrange their activities so as to get as much overall satisfaction as humanly possible. In other words, motorists maximize their expected utility given their limited budgets, technology, and the safety environment (see Blomquist, 1986). Motorists balance goals and weigh actions that affect their own traffic safety in terms of the expected private benefits and costs. The benefits depend on the roadway users' own values of good health and others' care for and dependency on them. Benefits depend on the motorist's avoidance of medical expenses, vehicle repair costs, liability lawsuits, and increases in insurance rates. The costs depend on the time, care, and effort involved, the equipment purchased, and their values. Driving at moderate speeds, responding to changing weather conditions, and staying well rested and sober are examples of what can be done by a driver who wants more traffic safety. Roadworthy tires, toll roads, and sound vehicles can be purchased by drivers who desire more safety. Publicly provided items such as traffic rules, highway design, and vehicle regulations can affect individuals' benefits and costs.

1.2. Potential imperfections

Concern exists about the relevance of the model when motorists might have insufficient incentives, information, or competency. Third-party financing of health care and no-fault insurance could cause motorists to undervalue safety by reducing the pecuniary costs of accidents to individuals. The complexity of modern machinery may prevent understanding and information flow about safety by making it more difficult to determine how much protection safety equipment provides to individuals. However, as discussed in Blomquist (1988), the most widespread doubt is about motorist competency in making decisions involving risks.

Even if travelers fully consider all the benefits and costs of their actions and are well informed, a problem may arise if individuals cannot properly process information about risks. The individual benefit-cost approach is appropriate for people who can evaluate the target level of safety that they have chosen. People who have the ability to do so compare their subjective estimates of risk being experienced to their target level and respond to any gap between the two. The criticism of safety decisions that is taken most seriously is the challenge to individual competency.

One challenge is aimed at the ability of people to perceive risks. An example would be drivers who, believing that their own driving skills are greatly superior, perceive their risk to be so low that they would not respond to any changes in risk. Competent drivers would respond to changes in risk. When faced with driving a lighter, less crashworthy vehicle, competent drivers would use seat belts more frequently and in proportion to the lightness of the vehicle; this is ordinal competency. Drivers who are cardinally competent as well would increase their seat belt use by just the amount that would maximize expected net benefits.

Another challenge goes beyond perceptual incompetence and criticizes any expected utility approach, including the expected net-benefit approach. Simon (1955) challenged the approach by arguing that people have limited time, information, and capacity to process information and limited ability to compute outcomes. *Bounded rationality* compels people to simplify decision-making problems and focus on some aspects more than others. Presumably the tendency to seek cognitive simplification leads to the adoption of heuristics that are inconsistent with the individual benefit-cost approach considered in this article. Instead, descriptive rules of behavioral decision making are thought to be better. The representativeness rule leads people to base probability estimates on similarity, even when prior odds are different. The availability rule leads people to base probability estimates on how readily the situation can be brought to mind, even when easy recollection is misleading. Probabilities are based on the frequency of hearing about an event rather than on actual frequencies. Finally, the anchoring rule leads people to choose a reference point and make adjustments from it slowly. This gradual adjustment can cause people to be unduly conservative and underweigh new information (see Shoemaker, 1982).

One critical study is particularly relevant. Kunreuther (1976) posits a sequential model of decision making in which the loss, even if catastrophic, is ignored if it is below some threshold level. He studied consumer response to highly subsidized flood insurance and found that few individuals bought the insurance, contrary to his estimates of positive individual net benefits. He concluded that people have great difficulty and make mistakes when processing information on low-probability, high-loss events. A fatal traffic accident could be considered such an event.

1.3. Existing evidence of motorist competence

Some existing research directly addresses the proposition of behavioral decision theory that bounded rationality leads people to use heuristics that in turn cause systematic error in traffic safety decisions. Hammerton, Jones-Lee, and Abbott (1982) investigated specifically the seriousness of bounds when people are asked to deal with traffic safety. They performed psychological laboratory experiments presenting situations that tested for willingness to deal with traffic risks, ability to rank traffic risks, accuracy of subjective risk relative to objective estimates of risk, and monetary valuation of reductions in traffic risks. The results showed that people were able to answer questions about traffic safety, were coherent in that they were consistent in choices involving different bets, and were consistent over time and not mendacious. The authors reported that people seem to be poor at ranking unfamiliar activities in terms of risk and that there is evidence of anchoring. They also found, however, that people are much better at ranking risks associated with transport modes. They concluded that, on balance, in familiar activities and situations such as those inherent in traffic safety decisions, there is a basis for optimism concerning broad correspondence between subjective and objective probabilities. A consistent underlying scale for frequency of lethal events exists, even though the scale differs from that of the actual frequency for groups and individuals. The scale is not without error, but it does not indicate total incompetence either.

The survey finding of general correspondence between subjective and objective risks is consistent with patterns in automobile safety belt use. Surprisingly, given an apparent conventional wisdom that seat belt use is too low because of risk incompetence and that all people should always wear their belts, several studies yield results that indicate that people do indeed respond, and respond appropriately, to situations with different benefits and costs of seat belt use.

In an early study for a national sample of over 1800 drivers in 1972, Blomquist (1977) found that the greater the expected net private benefits of belt use are, the higher is the probability of their use. Usage is greater for drivers for whom the intrinsic safety productivity of belts is the highest, the value of injury avoidance is highest, and the costs of using belts are lowest. Two recent multivariate studies support these earlier findings. For a national sample of over 2000 drivers in 1983, McCarthy (1986) did a logit analysis of belt use giving particular attention to travel conditions under which trips are made. He found that drivers in risky vehicles and environments are more likely to use their seat belts. Through logit analysis of his own 1984 survey of drivers in two eastern cities, Winston (1987) found that belt use varies systematically with perceived benefits and costs. Winston's results show that drivers are particularly sensitive to the time it takes to fasten seat belts.

This study has several advantages over the previous studies of safety belt use. The sample size (8312 drivers) is much larger than earlier studies by Blomquist (1800), McCarthy (2000), or Winston (310). The travel and vehicle characteristics are more complete than in Blomquist's earlier study. The driver characteristics are more complete than in McCarthy's analysis. In addition, this study explores the usefulness of the individual net-benefit approach for understanding parents' use of safety seats and other protection equipment for their children. Analysis of child safety-seat use extends the model from the individual to the household. Also, this study explores the usefulness of the individual net-benefit approach for understanding the use of helmets by motorcycle riders. Some people doubt that the model is applicable to this high-risk group.

The individual net-benefit approach is applied to a new, rich data set for a fresh look at seat belt use and a first look at child safety-seat use and motorcycle helmet use. This look at motorist use of three types of safety equipment allows us to reconsider the notion that use is too low because of risk incompetence. Evidence of some degree of competence in decisions about traffic safety risks would prompt questions about the conventional wisdom.[1]

2. The NPTS data and safety belt use

2.1. *Reported reasons and tests of differences of means*

The Nationwide Personal Transportation Study (NPTS) deals with the nature and characteristics of personal travel. Information is collected on households, drivers, trips, and motor vehicles, as well as on safety behavior. The new NPTS, unlike previous NPTS surveys, has a special section on use of safety devices in household vehicles. The Bureau of Census collected the data for the Department of Transportation between February 1983 and January 1984 using a national probability sample of 7900 civilian, noninstitutionalized households in 50 states and in Washington, D.C. The final sample of 6438 households comes primarily from Current Population Survey units. The analysis that follows was accomplished with a 1983 NPTS Public Use Data Tape supplied by the Federal Highway Administration.

Plausibility of the individual net benefit approach is indicated by the reasons respondents give for use and nonuse of seat belts. As shown in table 1, the majority of users began using safety belts for safety or safety-related reasons—in other words, benefits. The majority of nonusers report inconvenience or discomfort reasons—in other words, costs.

Plausibility is also indicated by the increase in use as the net benefits increase from one situation to another. For instance, seat belt use should be greater under riskier travel conditions. Table 2 displays the distribution and summary statistics for seat belt use under general driving conditions and under conditions of wet or snow- and ice-covered roads. Drivers report greater use under hazardous conditions, a situation in which net benefits increase: use always (all of the time) increases from 17.3% to 25.2%. The average use increases from 27.1% to 33.6%, an increase that is statistically significant at the usual levels. The expected net-benefit approach implies that seat belt use should be greater on long trips because benefits increase with faster travel and the fastening costs per mile decrease. Table 2 shows that use always (all of the time) increases from 17.7% on short trips to 27.0% on long trips. The average use increases from 23.5% to 34.5%, an increase that is statistically significant at the usual levels.

Table 1. Reasons given for use and nonuse of seat belts, 1983

"Why did you begin using seat belts?" Reason	Percent (n = 1343)
Safety	40%
Peer pressure	3
Spouse insisted	4
Media advertisement	5
Got married	1
Got older	2
Required by parent	4
Required by employer	3
To set good family example	7
Changed to new vehicle	8
Previous accident or emergency	6
Stop experience involving injury	1
Ignition interlock	1
Other	15
Total	100%

Reason	"Why don't you wear?" Percent (n = 4246)	"Why did you stop?" Percent (n = 3254)
Inconvenient	33%	33%
Don't need them	9	5
Uncomfortable	21	24
Fear of being trapped	14	10
Previous accident experience	1	2
Don't work	2	2
Other	20	25
Total	100	100

Source: Computed and calculated from U.S. Department of Transportation, Federal Highway Administration, 1983-1984 Nationwide Personal Transportation Study, Public Use Tapes. November 1985.

2.2. *Net benefits and multilogit analysis*

Generally the individual net-benefit approach suggests that drivers use seat belts whenever it is worth doing so. If we have information on factors that influence drivers' perceived benefits and costs of use, then we should be able to explain use and nonuse for individuals. Indeed, logit analysis of NPTS data shows that use can be understood in this way. Multivariate logit analysis offers an advantage over tests for differences in means, namely, that the influence of individual factors on use can be estimated separately for each factor, or variable, included in the analysis. With successful estimation, the partial effect of each factor is found to hold the other factors constant.

The household, driver, and vehicle characteristics that measure perceptions, benefits, and costs are given in table 3. Characteristics that would increase benefits and use are

Table 2. Driving conditions and seat belt use, drivers, 1983

	Seat belt use		(Percent)			
Driving Conditions (*n*)	Always (100%)	Most (61%)	Some (15%)	Never (0%)	Mean	Var.
General (13,820)	17.3%	9.7%	26.2%	46.9%	27.1%	1411
West, snow, ice (13,798)	25.2	9.7	16.2	48.9	33.6	1794
Long trips, 75 + miles (13,796)	27.0	8.9	14.1	50.0	34.5	1868
Short trips around town (13,794)	17.7	5.4	16.0	60.8	23.5	1462
Tests of differences of means						
Wet, snow, and ice > general	Z calc = 13.49					
Long trip > short trip	Z calc = 22.39					

Note: The percentage of use for drivers who use belts most of the time and sometimes is unknown. For drivers who use belts always or never, average use is 27.2%. If most-time users are grouped with drivers who always use belts and sometimes users are grouped with drivers who never use belts, average use is 27.1%. Assignment of 61% use to most-time users and 15% to sometime users yields average use of 27.15%, i.e., (.173)(100) + (.097)(61) + (.262)(15) + (.469)(0) = 27.15.

Source: Computed and calculated from U.S. Department of Transportation, Federal Highway Administration, 1983–1984 Nationwide Personal Transportation Study, Public Use Tapes. November 1985.

family income (which increases the value of risk reductions), young children and married (which increase value through greater responsibility), lap and shoulder combination belt (which gives more protection in a crash), and motor vehicle age (which may increase injury risk). Characteristics that decrease benefits are vehicle weight (which increases crashworthiness) and air bags (which also give crash protection). While vehicle weight and air bags could be used to increase safety beyond the level obtainable with safety belts alone, they are alternative ways to reduce injury risk, and can be substituted for safety belts in obtaining a target level of safety.

Characteristics that measure information and perception include education (which facilitates assimilation and processing), age (which accompanies driving experience), and miles driven last year (which indicates recent driving experience). Characteristics that measure costs of seat belt use are number of drivers in the household (which indicates how many dimensions the seat belts must accommodate), passive belts (which facilitate use), and daily fastening time costs.

The last variable, use cost, is the average number of trips per day for the driver multiplied by the estimated wage rate for the driver. The wage rate for each adult is estimated because no wage data is contained in the NPTS. The 1980 Census of Population and Housing Public Use Microdata Tapes were used to estimate the standard wage equations for four groups: white females, nonwhite females, white males, and nonwhite males. Variables in the wage equations include schooling, experience, experience squared, central city, suburb, and other-city location (rural is omitted). The coefficients are multiplied by the value of the variable for each individual in the NPTS to estimate a wage for each motorist.[2]

Table 3. Definition of variables

Name	Definition
Seat belt and child safety-seat use	
Income	Family income, 1983 dollars (benefit, +)
Children	Number of children under 16 (benefit, + and cost, −)
Drivers	Number of licensed drivers in household (cost, −)
Education	Years of schooling (information, + and benefit, +)
Age	Motorist age in years (information, + and benefit, ?)
Married	Marital status; married = 1, other = 0 (benefit, +)
Miles driven	Miles driven in last year (information, +)
Use cost	Number of daily trips multiplied by estimated wage rate (cost, −)
Vehicle weight	Motor vehicle weight in pounds (benefit, −)
Air bag	Air bag equipped; yes = 1, no = 0 (benefit, −)
Passive belt	Passive belt equipped; yes = 1, no = 0 (cost, +)
Combined belt	Lap and shoulder belt equipped; yes = 1, no = 0 (benefit, +)
Vehicle age	Motor vehicle age in years (benefit, +)
Child safety seat use only	
Child age	Age of child for safety seat use, years (cost, −)
Use cost	Number of daily trips for the household multiplied by mean value of adult estimated wage rates (cost, −)
Seat law	State of residence requires use of child safety seat, as of January 1983 (benefit, +) (The mean value for the household is used for personal characteristics.)
Motorcycle helmet use only	
Work trips	Motorcycle is ridden to work (information, +)
Helmet law	State of residence requires use of helmet, as of 1983, accounts for rider age (benefit, +)

Note: +, −, or ? indicates the expected sign.

Logit analysis of an NPTS sample of 8312 drivers illustrates the utility of the individual net-benefit model in understanding seat belt use. Tables 4 and 5 present three types of logit results: 1) binary for drivers who use belts always or never, 2) binary for drivers who are grouped into always-most times and sometimes-never, and 3) multilogit for the four types of use. For all three types of results, each factor influences use in a manner consistent with the individual net-benefit approach, with only one exception. The experience variable (miles driven) should have a positive sign.

The responsiveness of driver use of seat belts to the various benefit, cost, and perception factors is measured by the elasticities. The elasticities are calculated with the means and derivatives for the top half of table 4, the always-or-never sample. Because the logit coefficient gives only the estimated change in the logit index, the derivative is used. The derivative gives the change in probability of use with respect to the change in the explanatory variable. The elasticities shown in table 6 indicate that seat belt use is most sensitive to education; a 10% increase in years of schooling increases the probability of seat belt use by 18.0%. Our interpretation is that better information gathering and processing

Table 4. Logit analysis of seat belt use, 1983
Dependent variable: Seat belt use—always = 1, never = 0
1435 of 5278 drivers always use (27.2%)

Variable	Mean value	Logit coefficient	*t*-value	Derivative
Income	28,331	.1015E-4	5.33	.1823E-5
Children	.7632	.4228E-1	1.21	.7594E-2
Drivers	2.24	−.9701E-1	−2.37	−.1742E-1
Education	12.790	.2134	15.3	.3832E-1
Age	40.66	.1228E-1	5.07	.2206E-2
Married	.6633	.1125	1.43	.2021E-1
Miles driven	10,862	−.1110E-4	−3.48	−.1994E-5
Use cost	22.23	−.7572E-2	−4.56	−.1360E-2
Vehicle weight	3104	−.3449E-3	−6.75	−.6194E-4
Air bag	.4279E-2	−.8339	−1.09	−.1498
Passive belt	.1043E-1	.3320	0.95	.5963E-1
Combined belt	.7025	.7007	6.30	.1258
Vehicle age	8.639	.1499E-1	1.39	.2692E-2
Constant	1.000	−3.782	−11.8	−.6792E-5

Log likelihood value = −2799 Chi-squared = 578.8 with 13 df

Dependent variable: Seat belt use—always or most times = 1, some or never = 0
2255 of 8312 use belts (27.1%)

Variable	Mean value	Logit coefficient	*t*-value	Derivative
Income	28,620	.7920E-5	5.39	.1460E-5
Children	.7546	.4123E-1	1.52	.7602E-2
Drivers	2.237	−.1063	−3.31	−.1960E-1
Education	12.92	.1546	14.70	.2850E-1
Age	40.75	.1380E-1	7.34	.2544E-2
Married	.6682	.2391E-1	.3882	.4409E-2
Miles driven	10,816	−.2354E-5	−1.20	−.4341E-6
Use cost	22.81	−.6119E-2	−4.87	−.1128E-2
Vehicle weight	3092	−.2889E-3	−7.30	−.5326E-4
Air bag	.3449E-2	−.7221	−1.10	−.1331
Passive belt	.1062E-1	.2557	.9442	.4714E-1
Combined belt	.7233	.5846	6.68	.1078
Vehicle age	8.544	.1630E-1	1.96	.3006E-2
Constant	1.000	−3.164	−12.8	−.5834

Log likelihood value = −4581 Chi-squared = 555.2 with 13 df

Note: Variables are defined in table 3.

enhances use. Education increases productivity in nonmarket activities, such as the self-production of health and safety, in addition to increasing productivity at work. Since safety belts are highly effective in reducing injury risk, we expect people who are more efficient to use belts more, as long as other factors such as target levels of safety costs are the same. Another interpretation of the positive effect of education on safety belt use is

Table 5. Multinomial logit of safety belt use, 1983
Dependent variable: Seat belt use—always, most, some, never[a]

Variable[b]	Mean value $n = 8313$ (100%)	Always $n = 1435$ (17.3%)	Most $n = 820$ (9.9%)	Some $n = 2214$ (26.6%)
Income	2862	.9887E-5	.6617E-5	.1899E-5
		(5.39)[c]	(2.89)	(1.14)
Children	.7546	.2190E-1	.4969E-1	−.2601E-1
		(0.64)	(1.21)	(−0.93)
Drivers	2.237	−.9175E-1	−.1206	.1272E-1
		(−2.29)	(−2.40)	(0.39)
Education	12.92	.2106	.1448	.7813E-1
		(15.8)	(9.08)	(6.90)
Age	40.75	.1242E-1	.1709E-1	.1082E-2
		(5.24)	(6.02)	(0.54)
Married	.6682	.1012	.1681E-1	.1130
		(1.31)	(0.18)	(1.75)
Miles driven	10,816	−.8169E-5	.4279E-7	−.4025E-5
		(−2.77)	(0.02)	(−1.93)
Use cost	22.81	−.7678E-2	−.3238E-2	−.1058E-4
		(−4.78)	(−1.72)	(−0.01)
Vehicle weight	3092	−.3420E-3	−.2711E-3	−.6788E-4
		(−6.86)	(−4.51)	(−1.63)
Air bag	.3449E-2	−.8210	−1.696	−1.257
		(−1.08)	(−1.36)	(−1.84)
Passive belt	.1062E-1	.3563	.3340	.2463
		(1.04)	(0.80)	(0.85)
Combined belt	.7233	.7190	.8826	.5481
		(6.58)	(6.51)	(6.26)
Vehicle age	8.54	.1421E-1	.2457E-1	.5835E-2
		(1.36)	(1.95)	(0.66)
Constant	1.000	−3.778	−4.044	−1.904
		(12.1)	(10.7)	(−7.28)
Log likehood value = −9942		Chi-squared = 742.3 with 39 df		

[a]3843 or 46.2% of drivers never use safety belts.
[b]Variables are defined in table 3.
[c]*t*-values are shown below each logit coefficient.

that education may be a proxy for wealth in the current specification. Education and wealth tend to be positively correlated, and greater wealth should induce higher values of reductions in accident risks. While education may be a proxy for wealth, in Blomquist (1977), when a measure of the discounted present value of expected future labor earnings is used as an explanatory vehicle along with education, the coefficients on both were positive and significant.[3] Education has an effect beyond that of associated human capital.

After education, use is most sensitive to motor vehicle weight; a 10% increase in weight reduces the probability of seat belt use by 7.1%. Benefits are lower because heavier cars tend to be more crashworthy. The lower risk in a crash in a heavier vehicle reduces the expected benefit of safety belt use.[4]

Table 6. Responsiveness of seat belt use to net benefit factors, drivers, 1983
Dependent variable: Seat belt use, always = 1 never = 2
1435 of 5378 drivers always use (27.2%)

Net benefit factor	Mean value	Elasticity at means
Income	28331	0.19*
Children	0.763	0.02
Drivers	2.240	−0.14*
Education	12.79	1.80*
Age	40.66	0.33*
Married	0.663	0.07
Miles driven	10862	−0.08*
Use cost	22.23	−0.11*
Vehicle weight	3,104	−0.71*
Air bag	0.004	−0.55
Passive belt	0.010	0.22
Combined belt	0.703	0.46*
Vehicle age	8.639	0.09

*Elasticity is based on a coefficient with an asymptotic *t*-value of at least 2.
Note: An elasticity is the percent change in seat belt use divided by the percent change in the net-benefit factor. For example, a 10% increase in average family income increases the average probability of seat belt use by 1.9%. The "elasticities" for married, air bag, passive belt, and combined belt are for 0 to 1 changes.
Source: Based on logit analysis of NPTS data.

Taken together, the logit results for driver safety belt use show a pattern consistent with an individual net-benefit approach to traffic safety behavior. The coefficients are robust if only the drivers who use belts always or never (table 4, top) are analyzed, or if all drivers are analyzed with everyone grouped into always or never (table 4, bottom) or if all drivers are analyzed with a multinomial logit (table 5). All logits have large chi-squared values. The pattern in the coefficients in the multinomial logit make sense in that the response for a variable should decline numerically from always use to use most of the time to use some of the time. The omitted category is never use. Vehicle weight, for example, declines from (negative) .00034 to .00027 to .00007. Also interesting is the fact that a majority (4469) of the 8312 drivers use safety belts at least some of the time.

3. Use of safety equipment for children

In addition to seat belt use, adult use of child safety seats for young children can be understood using the expected net-benefit approach. For the most part, the factors affecting driver seat belt use should affect child safety-seat use in the same way. Here the average of parent characteristics is used rather than characteristics of one driver, and the use cost variable is defined as household trips per day instead of trips for a single driver. The variable for the number of children under 16 years of age now measures costs also.

As drivers contend with more children while placing and keeping a child in a restraint, the cost of seat use increases for any one child. The variables for air bags and seat belt equipment are omitted because they should not affect child restraint use. For example, the presence of a driver-side-only air bag probably has little effect on parent use of safety seats for children.

Additional factors that explain child seat use are given in table 3 (above). For children under the age of five years, use costs increase as children grow from infants to "terrible" two-year-olds who resist confinement. Another new factor is state laws that require child safety seat use. Since some states have made mandatory the use of child safety seats, considerable effort was made to obtain a use-law variable. The problem is that state of residence is not given in the NPTS. After negotiations with the Bureau of Census, we were allowed to supply the Bureau with the information that would define the use-law variable if the state of residence were known and then run the logits using a special, augmented NPTS data set. Only the printout of results was taken from Census. In this way Census was able to ensure that the confidentiality of the NPTS was preserved. Fifteen states had child safety-seat use laws as of January 1983: Alabama, California, Connecticut, Delaware, Kansas, Kentucky, Massachusetts, Michigan, New York, North Carolina, Rhode Island, Tennessee, Vermont, West Virginia, and Wisconsin (see NHTSA, 1986).

Two child safety-equipment use variables are analyzed. The first is analysis of use of child safety seats. The second is analysis of use of safety equipment including harnesses or seat belts or child safety seats. Logit analyses are reported in table 7, which shows both to have chi-squared values that indicate a high level of significance.

The elasticities, or responsiveness, of use of child safety seats with reference to the benefit, cost, and perception factors are shown in table 8. Use is most sensitive to child age; a 10% increase in age leads to a 10.2% decrease in the probability of child seat use. The increased independence and size of two- to four-year-olds deters use. Use of child safety seats is next most sensitive to parent education; a 10% increase in average years of parent schooling increases the probability of child seat use by 8.9%. Better information and processing enhances use. Child safety-seat laws increase the probability of use by .426, an increase of 42.3%. Again with the exception of the experience variable (miles driven), each factor influences child safety-seat use in a way consistent with an individual net-benefit approach.

More inclusive analysis of the same sample, but for use of seat belts *or* child harness *or* child safety seat compared to nonuse of any of the three devices, yields results that are similar to those for child safety seats only. The most striking difference is that use is less sensitive to child age; the elasticity with respect to age of the child declines (numerically) from -1.02 to -0.19. Some big three- and four-year-olds are likely to be traveling in safety belts instead of child safety seats. The effect of child safety-seat use laws falls from a 42.3% increase for safety seats to a 24.6% increase for all three safety devices.

Overall, this new evidence on seat belt use and child safety-seat use complements the variety of existing evidence on motorist competency in making traffic safety decisions. Drivers and driving parents tend to use safety equipment when the expected benefits are the greatest. The qualitative response to situational changes is notable.

Table 7. Logit analysis of child safety-seat use
Dependent variable: Child travels in safety seat = 1, child does not = 0
527 of 934 children travel in seats (56.4%)

Variable	Mean value	Logit coefficient	t-value	Derivative
Income	26,276	.1027E-4	1.68	.2469E-5
Children	2.160	−.2532	−3.27	−.0609
Education	13.13	.1590	4.23	0.382
Age	32.09	.0015	0.12	.3544E-3
Married	.8929	.7218	2.58	.1736
Miles driven	11,053	−.4856E-5	−0.50	−.1168E-5
Use cost	44.06	−.2697E-2	−0.97	−.6486E-3
Vehicle weight	3066	−.7120	−0.58	−.1712E-4
Vehicle age	8.784	.0121	0.73	.2613E-2
Child age	2.127	−1.1263	−14.66	−.2709
Seat law	.3854	1.0003	5.52	.2406
Constant	1.000	.1343	0.16	.0323
Log likelihood value = −439.21		Chi-squared = 400.91 with 11 df		

Dependent variable: Child travels in safety seat, harness or seat belt = 1,
child travels without safety equipment = 0
720 of 934 children travel with equipment (77.1%)

Variable	Mean value	Logit coefficient	t-value	Derivative
Income	26,276	.4049E-5	.612	.0597E-5
Children	2.160	−.1927	−2.570	−.0284
Education	13.13	.1136	3.012	0.168
Age	32.09	−.2272E-3	−0.02	−0.335E-3
Married	.8929	.8887	3.424	.1308
Miles driven	11.053	.2993E-5	.320	.0441E-5
Use cost	44.06	−.5589E-2	−1.995	−.8244E-3
Vehicle weight	3066	−.4387E-3	−3.408	−.6471E-4
Vehicle age	8.784	−.3272E-2	−.130	−.4826E-3
Child age	2.127	−.4701	−6.727	−.0693
Seat law	.3854	1.2836	6.311	.1893
Constant	1.000	1.6442	1.94	.2425
Log likelihood value = −422.46		Chi-squared = 160.46 with 11 df		

4. Motorcycle helmet use

Motorcyclists are a special group who face unusually high accident risks. Some authors question whether motorcyclists are at all competent in making good traffic safety decisions. To date, the expected net-benefit approach has not been used to analyze their behavior. Yet we would expect that use of protective helmets should be greater when the net benefits perceived by the individual are greater. As with the analysis of child safety-seat use, a specially augmented data set from the NPTS is used. A new variable is created that indicates whether or not the rider is covered by a state law that requires the use of a

Table 8. Responsiveness of child safety-seat use to net benefits, children less than 5 years, 1983

	Elasticity at means	
Net benefit factor	Safety seats	Safety equipment
Income	0.115	0.020
Children	−0.233*	−0.080*
Education	0.890*	0.285*
Age	0.020	−0.001
Married	0.308*	0.170*
Miles driven	−0.023	0.006
Use cost	−0.051	−0.047*
Vehicle weight	−0.093	−0.257*
Vehicle age	0.041	−0.005
Child age	−1.021*	−0.191*
Seat law	0.426*	0.246*

*Elasticity is based on a coefficient with an asymptotic *t*-value of at least 2.
Note: The "elasticities" for married and state law are for 0 to 1 changes.
Source: Based on logit analysis of NPTS data reported in table 7.

helmet. The variable is defined as of April 1983, based on Motorcycle Industry Council data. Twenty of the states required helmet use for all motorcyclists, and 20 more required use for riders under 18, 19, or 21 years of age. The helmet-law variable is constructed based on the state of residence and the age of the rider. The share of riders required by law to wear helmets in the sample is 39%. Most of the other variables are the same as those for safety belt use. Variables that measure car characteristics are omitted. An additional variable measures rider experience (whether or not the cyclist rides to work), which is expected to increase helmet use. All variables are defined in table 3 above.

The results of logit analysis of motorcycle helmet use are given in table 9. The dependent variable is 1 if the rider wears a helmet always or most of the time and 0 if wear is sometimes or never. Table 10 reports multilogit results where nonuse is the omitted category. Overall, both equations are significant with large chi-squareds and reasonable coefficients. For the multinominal logit results, we expect the effect of greater benefits as measured by family income to decrease from use always to use sometimes, and use does in fact decrease from 0.000044 to 0.000021 to 0.000020. The effect of miles driven unexpectedly increases somewhat—from always use to use most of the time—but the coefficient declines for use sometimes. The helmet law has a strong positive effect on use always and virtually no effect on either of the remaining categories. Nearly 84% of the motorcycle riders in the sample use helmets at least sometimes; only 39% were covered by helmet laws.

The elasticities of helmet use with respect to the various factors are shown in table 11. The most important factor explaining helmet use is state law. Mandatory-use laws increase the probability of use by .406, an increase of 54.3%. The next two most important factors are family income and miles driven per year. A 10% increase in either leads to a 1.13% increase in helmet use. The next two most important factors are the experience

Table 9. Logit analysis of motorcycle helmet use
Dependent variable: Rider uses helmet always or most times = 1,
rider uses helmet sometimes or never = 0
133 of 178 riders use helmets always or most times (74.7%)

Variable	Mean value	Logit coefficient	t-value	Derivative
Income	27,124	.3267E-4	2.27	.0310E-4
Children	0.764	−.0558	−0.24	−.0053
Education	12.39	−.0481	−0.45	−.4561E-2
Age	32.37	−.4539E-2	−0.20	−.4308E-3
Married	0.590	.0254	0.04	.2415E-2
Miles driven	15,923	.5608E-4	2.37	.0532E-4
Use cost	24.65	−.0145	−1.27	−.1372E-2
Work trips	0.118	.6914	1.02	.0656
Helmet law	0.393	4.278	4.08	.4061
Constant	1.000	−.2864	−0.19	—
Log likelihood value = −69.93		Chi-squared = 61.4 with 9 df		

Table 10. Multilogit analysis of motorcycle helmet use
Dependent variable: Helmet use—always, most, some, never[a]

Variable[b]	Mean value n = 178 (100%)	Always n = 116 (65.2%)	Most n = 17 (9.6%)	Some n = 16 (9.0%)
Income	27.124	.4359E-4	.2092E-4	.2036E-4
		(2.44)[c]	(0.94)	(0.85)
Children	0.764	.1576	.1315	.6461
		(0.54)	(0.38)	(1.65)
Education	12.39	.1083	−.2032	.2278
		(0.74)	(−1.02)	(1.27)
Age	32.37	.4953E-1	−.6679E-1	.9445E-1
		(1.60)	(−1.43)	(2.35)
Married	0.590	−1.023	.1760	−2.40
		(−1.40)	(0.20)	(−2.29)
Miles driven	15,923	.5261E-4	.7464E-4	.3587E-5
		(1.79)	(2.38)	(0.09)
Use cost	24.65	−.1678E-1	.1720E-2	−.5765E-3
		(−1.14)	(0.09)	(0.03)
Work trips	.1180	.5910	.7814	−.1019
		(0.67)	(0.74)	(0.09)
Helmet law	.3933	4.281	1.222	−14.16
		(3.96)	(0.90)	(0.01)
Constant	1.000	−3.470	1.834	−6.175
		(−1.64)	(0.66)	(−2.30)
Log likelihood value = −130.44		Chi-squared = 100.7 with 27 df		

[a]29 or 16.3% of riders never use helmets.
[b]Variables are defined in table 3.
[c]t-values are shown below each logit coefficient.

Table 11. Responsiveness of motorcycle helmet use to net-benefit factors
Dependent variable: Helmet use, always or most times = 1, sometimes or never = 0
74.7% of riders use helmets always or most times

Variable	Elasticity at Means
Income	0.113*
Children	−0.003
Education	−0.076
Age	−0.019
Married	0.003
Miles driven	0.113*
Use cost	−0.045
Work trips	0.088
Helmet law	0.543*

*Elasticity is based on a coefficient that has an asymptotic *t*-value of at least 2.
Note: The "elasticities" for married, work travel, and helmet law are for 0 to 1 changes.

variable (ride to work), which has the expected positive sign, and the cost variable (use cost), which has the expected negative sign. Neither, however, is significant at conventional levels. The imprecision may be due to the small number of riders (178) in the sample. The importance of experience is in contrast with the lack of significant, positive effects of the experience variable (miles driven) on safety belt use or child safety-seat use. The difference could be attributed to the crucial learning that takes place during the first year of cycle riding when the risks are much greater than in later years. The difference could be attributed also to the lack of alternative ways of getting more protection. A driver can choose a heavier car and get more crash protection, but a heavier motorcycle does not have the same effect.

5. Conclusions

Considerable concern exists about the competency of people facing accident risks. One position implies that individuals are risk incompetent. This article takes the opposite position as a working hypothesis for motorists. An expected utility, individual expected net-benefit model is applied to motorist use of safety equipment using a large microdata sample from the 1983 Nationwide Personal Transportation Study. These data are particularly attractive because of the trip and vehicle characteristics for seat belt use. They are attractive also because the information on child safety-seat use and motorcycle helmet use has not been thoroughly analyzed before.

Reported reasons, tests of differences of means, and multilogit analysis of the NPTS data reveal at least partial motorist competency in dealing with traffic safety risks. Use of safety equipment is greater in situations where expected net benefits are greater. Seat belt use is more likely the more educated the driver and the lighter the vehicle. Parents are likely to use child safety seats the more educated they are and the younger the child is. Motorcycle riders are more likely to wear helmets the higher their income and the more miles they travel. Both child safety-seat use and helmet use are more likely for motorists who reside in states with mandatory use laws. This new evidence does not support the contention that motorists are risk incompetent. Motorists reveal a detectable degree of competence in that they appropriately respond to changes in net benefits in risky situations. This new evidence complements existing evidence of at least ordinal competence in making traffic safety decisions.

In light of this evidence, caution is warranted in accepting the conventional wisdom that motorist safety belt use is too low because of risk incompetence and that all people should use safety belts always. Caution is also warranted in interpreting this evidence so as to conclude that motorists are completely competent and whatever use of safety belts, child safety seats, and motorcycle helmets people choose is socially desirable. Motorists' qualitative responses appear to be appropriate, but the degree of response might be questioned. To determine the reasonableness of the degree of response requires more information. To determine, for example, the reasonableness of the estimated 7% for the elasticity of the probability of safety belt use with respect to vehicle weight requires estimates of the effect of weight on the risk of injury and the individual (and social) value of the reduction in risk. The results of this article exhibit a rational response that is ordinally correct. The response reflects movement in the appropriate direction and appropriate amount relative to other responses; this is ordinal risk competence. The results do not necessarily exhibit the appropriate degree of response, which is cardinal risk competence. If external information can be introduced to show that the degree of response to changes in net-benefit factors is too small, then use of safety equipment may be too low.[5] Nonetheless, caution is warranted before disregarding information about the behavior of somewhat competent motorists and concluding that everyone should use safety belts, child safety seats, and motorcycle helmets all the time.

Notes

1. Rothe and Cooper (1988) approach safety belt use in British Columbia, Canada from the perspective of the individual motorist also. They attempt to identify principles that guide people's thinking and behavior concerning safety belt use. Their study is similar to this one in that they too challenge the notion that good drivers always use belts and bad drivers do not.
2. The estimated wage equations are available upon request.
3. Another interpretation for the education variable is that it is a proxy for risk aversion or a proxy for low rate of time preference (future orientation). Greater aversion to risk implies higher levels of target safety and more safety belt use. Lower rate of time preference implies greater investments in health and safety with the expectation of enjoying more consumption in the future.
4. If education is not a proxy for risk aversion, then the elasticity of the probability of safety belt use with respect to vehicle weight is underestimated. If vehicle weight and risk aversion are positively correlated, then risk-averse motorists will drive heavier cars and use safety belts less. If less risk-averse drivers who tolerate more risk are put in heavier cars, then they would use safety belts even less. We can expect that the coefficients for vehicle age and air bags are underestimated also.

5. Brookshire et al. (1985) analyze California housing markets and estimate premiums for houses in locations with lower risks of earthquake damage. With other information, for example, about the dollar damages that would be associated with earthquakes, they check the estimates from their expected utility model. They find that these estimates are reasonable.

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