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Auto Insurers and the Airbag: Comment

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ABSTRACT

In an earlier volume of this Journal, Kneuper and Yandle (1994) proffer that auto insurers lobbied extensively for the automotive airbag, expecting to trade increased dollar property damage claims for lower bodily injury claims. Using annual data published by the Highway Loss Data Institute, this article finds that, upon airbag adoption, not only do average collision loss payments increase, but so do the relative frequencies of collision claims and injury claims for a vehicle line.

INTRODUCTION

In an earlier volume of this Journal, Kneuper and Yandle (1994) profer that auto insurers' intense legislative lobbying efforts for the automotive airbag should be viewed as an industry attempt to reduce uncertainty. With respect to uncertainty, two airbag attributes were said to be particularly attractive to insurers: their passivity and the reduced likelihood of severe injuries to the upper parts of the body, particularly facial areas, which insurers have found expensive to settle. Kneuper and Yandle forward that insurers have been willing to trade off increased property claims for lower bodily injury claims. Implicitly, this willingness to trade off is predicated on the assumption that there would be no significant increases in the relative claim frequencies of airbag equipped cars.

This comment analyzes insurance industry loss experiences on a vehicle line basis upon airbag adoption. Contrary to what insurers reasonably might have expected, we find that relative personal injury and collision claim frequencies increase significantly for newly–airbag-equipped models. The next section discusses the data sets. After developing the models and analyzing the results, we conclude with several observations.

DATA DESCRIPTION

As auto manufacturers increasingly incorporate airbags on a model-line basis, data on insurer experiences with airbag-equipped autos have become available. For

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over 20 years, the privately-funded Highway Loss Data Institute (HLDI) has published data on insurer loss experiences by vehicle model year(s), model line, and body type (e.g., 1992 Buick LeSabre, 4-door sedan). In recent years, loss experiences published include relative claim frequency under personal injury protection coverages and claims experiences under collision coverage. The latter losses are published in terms of relative claim frequency, relative average loss payment per claim, and relative average loss payment per insured vehicle year.[1] Financial support for HLDI is provided by the Insurance Institute for Highway Safety (IIHS), which, in turn, is funded by auto insurers directly or through their trade associations.

As noted, the HLDI reports compare the frequencies of occupant personal injury claims under personal injury protection coverages for specific models by model year(s) and body style. The personal injury results are presented annually in relative terms, with 100 representing the average for all cars.[2] The HLDI results are standardized to reflect differences in the age groups of drivers by vehicle line.[3] However, other nonvehicle factors—such as annual mileage or other socioeconomic characteristics—that may differ by vehicle line have not been accounted for necessarily.

HLDI has found that relative injury claims experiences of particular vehicle lines change only when a model has been redesigned significantly or has incorporated a major safety feature (such as an airbag). Thus, to increase the number of observations on each model for statistical purposes, HLDI combines data for the three most recent model years unless there has been a major redesign or an airbag has been incorporated (HLDI, 1993b).

The HLDI relative claim frequency data under personal injury protection coverages are presented by category of size claim, with the highest category having a minimum threshold of only $1,000.[4] We chose to use the "all claims" category because the number of claims in this group is more than twice the size of the

[1] HLDI also publishes data on vehicle thefts by model line.

[2] Over the 1991–1993 model years, relative claim frequencies ranged from a low of 28 for the Mercedes SL convertible series to a high of 214 for the Hyundai Scoupe. The score of 28 indicates that the average frequency of personal injury claims filed from 1991 through 1993 model Mercedes was 82 percent better than the average model. The score for the Hyundai indicates that the average number of claims filed against Scoupes was 114 percent higher than the population average.

[3] For each vehicle line, HLDI standardizes the injury results to the distribution as if 10 percent of the drivers for each model were youthful drivers. The collision results are standardized to the distribution assuming 5 percent of drivers are youthful operators regardless of deductible size. Collision deductibles less than $200 are standardized for 50 percent nonyouthful operator, and policies with greater than $200 deductibles are standardized for 40 percent nonyouthful operator.

[4] Under PIP coverage, minimum exposure requirements for reporting statistically significant results are 5,000 vehicle years per model. This exposure increases to 25,000 vehicle years per model on claims of over $1,000. Because of the manner in which the data are collected in the several states, the most severe category has a threshold of $1,000. This low threshold effectively precludes discriminating between severe and minimal injuries. For instance, in many localities the summoning of an ambulance, whether needed or not, represents a minimum $500 charge against the PIP coverages portion of the policy.

$1,000 threshold group (HLDI 1993b) with a consequent increase in the number of vehicle lines for which HLDI could present statistically significant results.

Again, as noted, the data on collision losses by vehicle line are presented by HLDI in three forms: relative claim frequency, relative average loss payment per claim, and relative average loss payment per insured vehicle year (IIHS, 1993b). Here, we use the relative claim frequency and the relative loss payment per insured vehicle year. As with the relative personal injury data, the three most recent model years are included in any given year's result unless the vehicle line was discontinued or significantly redesigned (IIHS, 1993a).[5] The relative claim frequency measures how often paid collision coverage claims are made, while the relative loss payment per insured vehicle year measure combines the claim frequency and the average loss payment per claim (IIHS, 1993a). The latter is calculated by taking the total dollar collision loss payments for a vehicle line and dividing by total exposure for that line.[6]

ANALYSIS

Upon airbag adoption, one would expect no change in the relative collision claim frequency, an increase in the relative average collision loss payment per insured vehicle year, and no change or a slight decrease in the relative claim frequency under personal injury protection coverages.[7]

To test these hypotheses, we examine the mean differences between airbag- and nonairbag-equipped cars for changes in relative collision claim frequency, relative personal injury claim frequency, and relative average collision loss payment per insured vehicle year. The null hypothesis is that, although collision losses may increase with airbag adoption, relative collision and personal injury claim frequencies will, at worst, not change. Personal injury claim frequency may actually decline slightly due to the safety enhancement qualities associated with the airbag.[8]

Changes in each of these three measures were calculated for each model over the four periods for which data were available: 1989–1990, 1990–1991, 1991–1992, and 1992–1993. Recall that airbags first became widely available when Chrysler adopted them for the 1990 model year. Our data set consisted of five

[5] HLDI published collision results for 1990 and 1989 model year vehicles separately.

[6] For 1991–1993 model vehicles, relative collision loss results for automobiles in our population ranged from a low of 65 for the Chevrolet Lumina 4-door to a high of 234 for the BMW, 3-series convertible. The Lumina score is interpreted as insurer losses averaged 35 percent better than the average model insured over the period. At the other extreme, insurer collision claims on the BMW 3-series convertibles averaged 134 percent worse than the average.

[7] A priori, one might forward that the adoption of an airbag system may increase also the frequency of claims under collision coverage. This result assumes that airbag deployment would increase the likelihood of breaching the collision deductible. However, a collision deductible threshold of even $500 would have been breached by a much less severe accident. For instance, the Insurance Institute for Highway Safety (1993b) found that, even in its most simple, five mile per hour front barrier impact test, every vehicle tested sustained damage beyond the bumper.

[8] See IIHS (1993a) for a discussion of the safety enhancement qualities of the automotive airbag.

years of observations on 87 models, the entire automotive, non-van/wagon set on which data were reported in 1990 (HLDI, 1990c).[9] Since HLDI reports results only when there are enough observations for statistical purposes and for models which have not been discontinued, the reported sample size may vary across tests (relative to the maximum of $87 \times 4 = 348$ if data were available on each model for all four time periods). We pooled the data for estimation and testing purposes, assuming that changes in claim frequencies are independent across time and models. Independence follows from the assumption that, under the null hypothesis, innovations in relative claim frequencies for one vehicle should not depend on innovations for other vehicles. We also assume that innovations for a given vehicle are randomly distributed (uncorrelated) through time. Estimation consisted of comparing the mean changes in the above quantities after controlling for vehicle upsizing (changes in relative collision claim frequencies, however, were assumed to be unaffected by upsizing). In the first model, we regressed the change in relative personal injury on an intercept (the conditional mean) and two categorical variables (dummy variables). The first dummy variable D_1 indicates whether the vehicle adopted an airbag during the period, and D_2 indicates whether the vehicle was subject to a restyling that significantly increased its size.[10] We estimated

$$\Delta PIP = \alpha + \beta_1 D_1 + \beta_2 D_2 + \mu, \quad (1)$$

where PIP refers to the relative personal injury, and D_1 and D_2 control for the presence of a newly-adopted airbag and upsizing, respectively. Replacing the dependent variable in the equation with the change in relative collision claim frequency (COL) and relative average loss payment per insured vehicle year (ALP) permits estimation of the second and third parts of the hypothesis, respectively:

$$\Delta COL = \alpha + \beta_1 D_1 + \mu, \quad (2)$$

$$\Delta ALP = \alpha + \beta_1 D_1 + \beta_2 D_2 + \mu, \quad (3)$$

For each equation, the intercept measures the change in the dependent variable for all vehicles that did not receive an airbag in the current model year and were not upsized. Coefficients on the dummy variables measure the differential in the dependent variable relative to this control group which are due to the presence of the particular treatment variable.

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[9] Virtually all new car lines introduced since the 1990 model year—such as the Lexus LS400, Infiniti Q45, Buick Roadmaster, and Oldsmobile Aurora, to name just four models—have had at least a driver's side airbag since introduction. This factor precludes analyzing the impact of airbag adoption on insurer claims.

[10] We assigned a value of unity to the upsizing dummy variable if vehicle length increased by at least two inches and/or vehicle width increased by at least one inch. Since Crandall and Graham (1989) and HLDI (1994b) have determined vehicle size to be a significant determinant of insurer loss experience under personal injury protection coverages, we anticipate that the estimated coefficient for D_2 will be negative.

Estimation and test results are presented in Table 1. Summary statistics for each of these variables follow in Table 2. The results presented in Table 1 clearly reject the hypothesis that relative personal injury claims remain unchanged, or fall, for newly-equipped airbag vehicles. Changes in relative personal injury claims are significantly higher (at the 95 percent level of confidence) for vehicles with newly-adopted airbags relative to all other vehicles ($\beta_1 = 3.232$, $t = 2.018$). Note as well the magnitude of this change compared to the statistically insignificant change for all other vehicles ($\alpha = 0.580$, $t = 1.068$). As a priori expected, models that underwent restyling and upsizing experienced negative changes in personal injury claims ($\beta_2 = -4.452$, $t = -2.541$). We conclude that, after controlling for upsizing, relative personal injury claims do not decrease for vehicles that are newly equipped with airbags. To the contrary, they increase, and, on this evidence, we must reject the null hypothesis.

Table 1
Changes in Relative Personal Injury Protection Claim Frequencies, Relative Collision Claim Frequencies, and Relative Average Loss Payment Per Insured Vehicle Year after Controlling for Newly-Equipped Airbag Models (β_1) and Upsized Models (β_2)

	Personal Injury Protection		Collision		Average Loss Payment	
	Change	t-Statistic	Change	t-Statistic	Change	t-Statistic
α	0.580	1.068	0.098	0.215	0.035	0.051
β_1	3.232	2.018*	6.798	5.145*	7.642	3.771*
β_2	−4.452	−2.541*			5.405	2.440*
Observations	314		323		314	

* Significant at the 5 percent level (critical value is 1.96).

Changes in relative collision claim frequencies (COL) were also significantly higher for newly-equipped airbag vehicles ($\beta_1 = 6.798$, $t = 5.145$) but remained unchanged for all other vehicles ($\alpha = 0.0985$, $t = 0.215$).[11]

As anticipated by Kneuper and Yandle, relative average collision loss payments (ALP) also increase significantly for newly-equipped airbag vehicles relative to all others ($\beta_1 = 7.642$, $t = 3.771$). This result was expected, as collision repairs must cover the additional cost of the airbag.

Additional tests examine the robustness of these results. The first test focuses on the perceived differences in the positive mean changes in PIP coverage and ALP outlays for airbag-equipped cars. It is clear from the data presented in Table 1 that, although both measures increase significantly for cars newly equipped with

[11] We also find a particularly interesting fact which is not reported in Table 1: When the change in relative collision claim frequency is regressed on an intercept and dummy representing *all* airbag-equipped vehicles, new and old, the change in the collision claim frequency is significantly higher for airbag-equipped vehicles ($\beta = 3.327$, $t = 3.518$) but does not change for non–airbag-equipped vehicles ($\alpha = -0.131$, $t = -0.247$).

Table 2
Summary Statistics
Changes in Relative Personal Injury Protection Claim Frequencies, Relative Collision Claim Frequencies, and Relative Average Loss Payment Per Insured Vehicle Year (Measured Relative to Base Level = 100)

	Observations	Mean	Standard Deviation	Minimum	Maximum
New Airbag					
Personal Injury Protection	38	2.289	13.512	–24	32
Collision	38	7.131	12.043	–11	36
Average Loss Payment	38	9.526	14.139	–20	54
All Airbags					
Personal Injury Protection	102	0.470	9.644	–24	32
Collision	102	3.196	8.647	–11	36
Average Loss Payment	102	4.080	11.743	–20	54
No Airbag					
Personal Injury Protection	178	0.393	8.664	–31	34
Collision	184	0.103	6.638	–18	32
Average Loss Payment	178	–0.174	11.001	–44	65

airbags, the increase in ALP is larger than the increase in PIP (β_1 = 7.642 and 3.232, respectively). One might surmise, therefore, that there is indeed a tradeoff from personal injury claims to property damage claims.[12] If such a tradeoff has occurred, then, *ceteris paribus,* one might consider the hypothesis that the ratio of the changes in relative average loss payment per insured vehicle year (ALP) to relative personal injury protection claim frequencies (PIP) should be significantly greater than zero for the newly–airbag-equipped models.[13] We uncover no such relationship. In fact, the coefficient β_1 on the airbag dummy variable in the regression

$$\Delta ALP/\Delta PIP = \alpha + \beta_1 D_1 + \beta_2 D_2 + \mu \quad (4)$$

has a negative sign ($\beta_1 = -0.345$, $t = -0.687$). Furthermore, both the intercept as well as the coefficient on the upsizing dummy variable are not significantly differ-

[12] Some caution should be exercised in interpreting these coefficients in this fashion. First, PIP is a frequency measure, and ALP is a dollar outlay. Second, these values measure discrete changes, not growth rates, and as such do not suggest that the rate of change to collision payments in some way exceeds that for personal injury coverage. Furthermore, while the presence of the airbag will tend to attenuate PIP, it will simultaneously aggravate ALP because the airbag itself represents additional cost.

[13] This test was conducted at the suggestion of the Editor.

ent from zero ($\alpha = 0.315$, $t = 1.764$; $\beta_2 = -0.524$, $t = -0.902$). Statistically speaking, the ratio of changes in ALP to PIP is a mean zero random variable. This result holds as well when we isolate just the airbag dummy variable, eliminating the upsizing dummy variable from the regression.

The same test then forms the ratio of changes in relative collision claim frequencies (COL) to changes in PIP. Again, regressing this variable on the right-hand side of equation (4) results in a zero intercept ($\alpha = 0.099$, $t = 0.760$) and a not significant coefficient on the airbag dummy variable ($\beta_1 = -0.0033$, $t = -0.009$). But in this case, the coefficient on the upsizing variable is significantly negative ($\beta_2 = -1.070$, $t = -2.514$). Therefore, vehicles that are upsized have a significantly lower ratio of changes in relative collision claim frequencies to changes in relative personal injury claim frequencies. In sum, the frequencies for relative collision claims and relative personal injury claims both rise immediately upon adoption of the airbag and, although the changes in relative loss payment per insured vehicle year also rise significantly upon airbag adoption, that increase is not significantly greater relative to the increase in relative personal injury protection claim frequencies.

Conclusion

Two a priori expectations concerning the impact of airbag adoption by an automobile line on insurer claims are counter-intuitive. First, the relative collision claim frequency rises significantly faster for models newly equipped with an airbag. Second, changes in the relative claim frequency under personal injury protection coverages are also significantly higher for the same newly-equipped airbag models. However, as expected, the change in the relative average collision loss payment per insured vehicle year is significantly higher for models newly equipped with airbags. The data set does not permit testing for the impact of airbag adoption on relative severe injury loss claims.

Although it is beyond the scope of this comment to explain these findings, two hypotheses can be forwarded. First, these findings are consistent with offsetting behavior, under which the beneficial impact of mandated automotive safety devices may be at least partially negated by driver behavioral changes. Although some researchers adamantly challenge this explanation (see Lund and Hazelbaker, 1993), a number of others find results supportive of offsetting behavior (see Peterson, Hoffer, and Millner, 1995; Keeler, 1994; Peterson and Hoffer, 1994; Chirinko and Harper, 1993; IIHS, 1994a; Garbacz, 1992; and Adams, 1994. Peltzman, 1975, 1976, 1977, first formally anticipated such possible behavior).

A second explanation is based on the existence of a real consumer demand for "safer" cars. Automotive buyers who consider themselves at risk may seek out autos perceived to be safer. In the early 1990s, such vehicles would have been those equipped with airbags. Therefore, "at risk" consumers may have purchased airbag-equipped cars in disproportionately higher numbers. Thus, the relative poorer collision and injury claims performance of newly–airbag-equipped autos may reflect an adverse selection. If this hypothesis is correct, as more models become airbag equipped, the differential should narrow. However, Peterson, Hoffer, and Millner (1995) do not confirm a narrowing differential. Furthermore, the relative frequency of collision claims for newly-equipped airbag car lines (as reported in Table 1) has increased over the most recent periods, a result which is inconsistent with a driver self-selection hypothesis. Nonetheless, the adverse selection hypothesis remains a possible explanation of our findings.

We emphasize that our findings do not question the inherent safety enhancement attributes of the automotive airbag. Nonetheless, an explanation of why the relative frequencies of collision and personal injury claims have increased for models newly equipped with airbags should be of interest to researchers within and outside of the insurance industry.

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