HIGHWAY LOSS DATA INSTITUTE

Bulletin | Vol. 30, No. 33 : December 2013

Noncrash fire safety recall losses

Vehicles with known fire-related defects have significantly higher risk of noncrash fire insurance losses compared with vehicles without such defects. After a recall has been issued, this risk decreases, but still remains higher than for vehicles without any fire safety recalls.

Introduction

The Highway Loss Data Institute (HLDI) collects and codes information on vehicle recalls from the National Highway Traffic Safety Administration (NHTSA). HLDI identifies vehicles that have been recalled for having defects that can lead to vehicle fires without being in a crash. Insurance losses from noncrash fire damage are covered under comprehensive insurance. The purpose of this study is to investigate the difference in noncrash fire insurance losses between vehicles with and without known noncrash fire-related defects. This study also investigates whether insurance losses decline after a recall has been issued and there has been an opportunity for the fire-related defect to be corrected.

Methods

Insurance data

Automobile insurance covers damages to vehicles and property as well as injuries to people involved in crashes. Different insurance coverages pay for vehicle damage versus injuries, and different coverages may apply depending on who is at fault. The current study is based on comprehensive coverage. Comprehensive coverage insures against a variety of perils. These perils include theft, animal strikes, and physical damage to insured vehicles that occurs for reasons other than crashes. A specific physical damage that is covered under comprehensive insurance is noncrash fire.

Only companies that specified noncrash fire as a cause of loss in the data they supply to HLDI over the full 2007-12 time period were included in this analysis. The exposure from those companies represents 95 percent of the comprehensive coverage exposure in the HLDI database. Loss data included calendar years 2007 through 2012. Results were based on more than 495 million insured vehicle years and almost 130,000 claims.

Insurance measures

Several insurance measures are used in this report. Exposure is expressed in insured vehicle years. One insured vehicle year may consist of one vehicle insured for 365 days or 365 vehicles insured for one day or any combination of vehicles and days that adds up to 365 days. Exposure is used as the denominator for calculating claim frequency. Claim frequency is a measure of claim risk and is calculated by dividing the number of claims by the amount of exposure. For noncrash fires, claim frequency is expressed in claims per 10,000 insured vehicle years. Claim severity is measured in dollars and is calculated by dividing the dollars spent to settle a claim by the number of claims. Overall losses are the product of the frequency and severity measures, and represent the dollars paid for claims per insured vehicle year.

Vehicles

This study includes vehicles aged -1 to 8 years old from 2007 through 2012. Vehicle age is calculated as the difference between the calendar year and model year. Many manufacturers release new models in the calendar year prior to the vehicle's model year. For example, a vehicle's 2008 model year may be released during the 2007 calendar year. For the purposes of this analysis, such a vehicle is considered to have an age of -1 in calendar year 2007, 0 in calendar year 2008, 1 in calendar year 2009, etc.

Recall information

HLDI collects and codes information on vehicle recalls from NHTSA. HLDI identifies vehicles that have been recalled for having defects that can lead to vehicle fires without being in a crash. Vehicles identified by HLDI as having a noncrash fire-related recall were used to identify the study populations. Recalled vehicles are identified only by model year, make, and series. Manufacturers are not required to report to NHTSA the vehicle identification numbers (VINs) of the vehicles involved in the recalls. Specific recall information is available on HLDI's member website, http://www.iihs-hldi.org, and from prior HLDI reports. Other possible noncrash fire-related defects still may be under investigation by NHTSA. In addition, some fire-related defects may be handled through manufacturer service bulletins. A total of 366 noncrash fire related recalls for model years 1999–2013 are included in this analysis.

Statistical methods

Regression analysis was used to quantify the difference between vehicles with known fire-related defects that have been subject to a noncrash fire recall and those that were not subject to noncrash fire recalls while controlling for calendar year, vehicle age and vehicle make and series. A binary variable was included to identify whether or not a particular vehicle had been subject to a noncrash fire recall.

Regression analysis was used to quantify the difference before and after a recall notice was given. In order to assess this effect, a categorical variable was included to classify the data into three groups: no recall, pre-recall, and post-recall. No recall includes all observations for vehicles that are not associated with any noncrash fire-safety related recall. Pre-recall includes observations for recalled vehicles where the calendar year is less than or equal to the year of the recall. Post-recall includes observations for recalled vehicles where the calendar year is after the year of the recall. Some vehicles may be associated with multiple recalls. For the purpose of this analysis, only the date of the most recently issued recall is considered.

Due to the large data size (over 1,600 different series over six years) other covariates such as garaging state, vehicle density (number of registered vehicles per square mile), rated driver age group, rated driver gender, rated driver marital status and risk were examined but not included in the final analysis. Each of these covariates was included individually in a separate regression with calendar year, vehicle age, vehicle make and series, and the categorical variable indicating whether a recall had been issued. The inclusion of any of these additional covariates had a negligible effect on the estimate for recalled vehicles. For example, the inclusion of state as a covariate shifted the estimate for recalled vehicles from 0.1463 to 0.1467.

Claim frequency was modeled using a Poisson distribution, whereas claim severity (average loss payment per claim) was modeled using a Gamma distribution. Both models used a logarithmic link function. Estimates for overall losses were derived from the claim frequency and claim severity models.

A separate regression was performed for each insurance loss measure under each scenario for a total of six regressions. For space reasons, summary results are shown on the following pages. To illustrate the analyses, however, the **Appendix** contains model results for the noncrash fire claim frequencies comparing recalled and nonrecalled vehicles. To further simplify the presentation here, the exponent of the parameter estimate was calculated, 1 was subtracted, and the result multiplied by 100. The resulting number corresponds to the effect of the parameter on that loss measure. For example, the estimate of the effect for recalled vehicles on noncrash fire claim frequency was 0.1463; thus, vehicles with known fire-related defects that have been recalled are expected to have 16 percent more noncrash fire claims than vehicles with no known fire-related defects ((exp(0.1463)-1)*100 = 15.8).

Results

Figure 1 shows the actual noncrash fire claim frequencies by vehicle age. As vehicles age, the risk of noncrash fire appears to increase for both those with and without a noncrash fire recall. Eight-year-old vehicles without any noncrash fire recalls had 2.4 times as many noncrash fire claims as the vehicles without recalls and an age of 0. Eight-year-old vehicles with a noncrash fire recall had 2.9 times as many noncrash fire claims as recalled vehicles with an age of 0.

Figure 1: Noncrash fire claim frequency by vehicle age

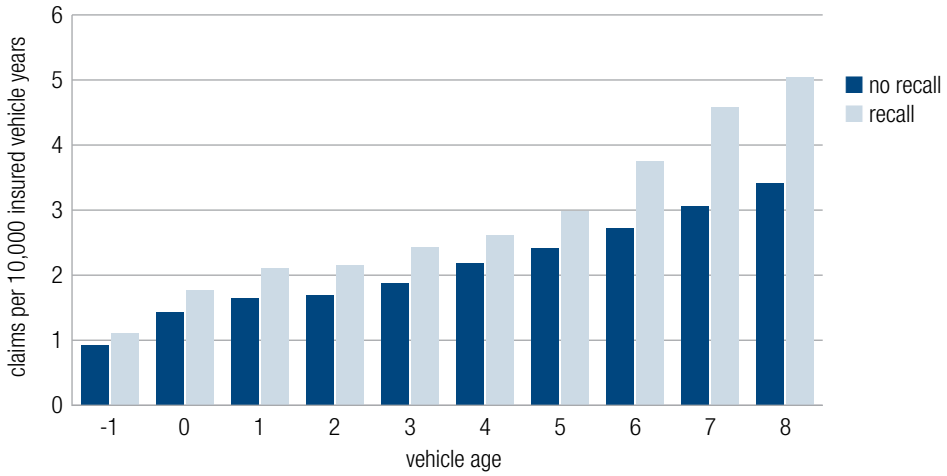


Table 1 summarizes the regression results for insurance losses, comparing vehicles with and without recalls. The upper and lower bounds represent 95 percent confidence limits of the estimates. Figure 2 illustrates the results comparing vehicles with and without a noncrash fire graphically. The vertical I-bars correspond to the range of the 95 percent confidence intervals for that estimate. Vehicles with a noncrash fire recall were found to have a 16 percent higher frequency of noncrash fire claims compared with vehicles with no noncrash fire recall. The severity per claim for these vehicles was 1 percent higher, though this was not statistically significant. As a result, overall losses for noncrash fire recalled vehicles were 17 percent higher.

Table 1: Effect of noncrash-fire-related defects on noncrash fire claim frequency, severity, and overall losses

Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
14%	**16%**	17%	0%	1%	3%	15%	**17%**	20%

Figure 2: Effect of fire-related defects on noncrash fire losses

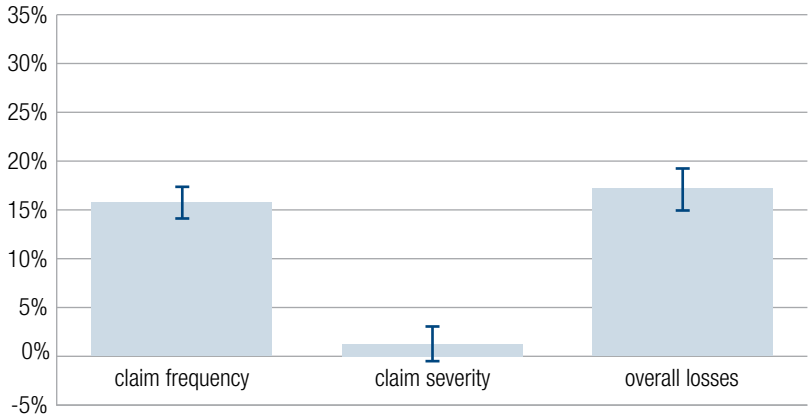
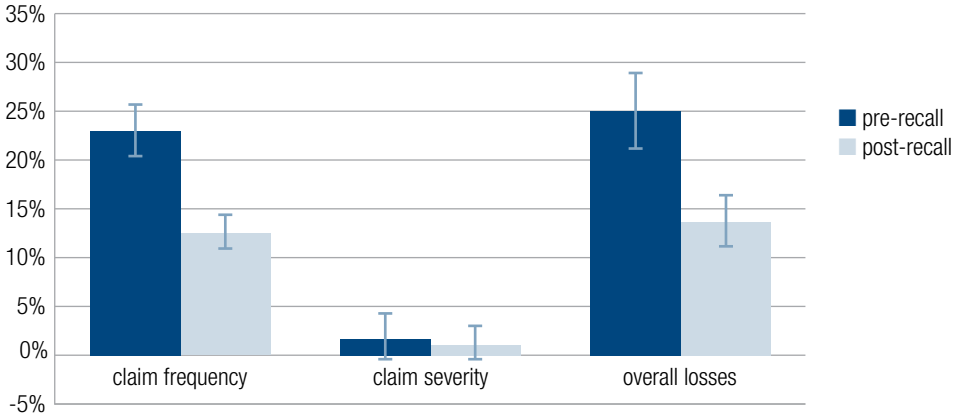


Table 2 and Figure 3 illustrate the results of the pre-recall and post-recall analysis. Vehicles with known noncrash-fire-related defects, during calendar years prior to the recall (i.e., pre-recall) had a claim frequency that was 23 percent higher than vehicles without recalls and overall losses that were 25 percent higher. These differences were statistically significant. The difference in severity was not statistically significant. During the calendar years after the recall (i.e., post-recall) the difference in claim frequency dropped to 12 percent with overall losses at 14 percent. Again, there was no statistically significant difference in severity.

Table 2: Effect of fire-related defects on noncrash fire losses, before and after recall date

	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Pre-recall	20%	**23%**	26%	0%	2%	4%	21%	**25%**	29%
Post-recall	11%	**12%**	14%	-1%	1%	3%	11%	**14%**	16%

Figure 3: Effect of fire-related defects on noncrash fire losses



Discussion

Vehicles with known fire-defects have a significantly increased risk of noncrash-fire-related loss compared to vehicles without. This risk decreases after the defects have been identified and a recall is issued but still remains significantly higher than for vehicles with no known fire defects. One possible explanation is that owners are not getting their vehicles repaired after a recall. For example, the completion rate for a 2008 and 2009 fire safety recall by General Motors was less than 53 percent as of December 2011 (O'Dell 2013). Similarly, a series of recalls since 1999 by Ford that affected over 16.6 million cars and trucks had only a 48 percent completion rate. In a press release, NHTSA noted that only about half of the 10 million recalled Ford, Lincoln and Mercury vehicles were repaired for a noncrash fire-related recall (NHTSA, 2008). The National Highway Traffic Safety Administration noted in a 2004 press release that "72 percent of the owners of vehicles with safety problems have the recall work performed" (NHTSA, 2004). Additionally, a recent study by Carfax found that nearly 2.1 million recalled cars that had not had the necessary repairs went on sale online in 2012 (Carfax 2013). Although that number is down from the 2.7 million in 2011, it only accounts for cars sold online. The claim frequency for vehicles with noncrash fire-related recalls was estimated in this report to be 23 percent higher than those without associated noncrash fire recalls during the same time period. After the recall period, the claim frequency for vehicles with noncrash fire-related recalls was estimated to be 12 percent. This change in effect is 46 percent. If we assume that the reason for the change in effect is due to the correction of the vehicle defect then this 46 percent is comparable to the repair rates seen by Edmunds, Carfax and NHTSA.

Limitations

Recalled vehicles are identified only by model year, make, and series because manufacturers are not required to report to NHTSA the VINs of the vehicles involved in the recalls. A particular recall may not apply to every vehicle with the same model year, make, and series. Therefore, it is possible that some vehicles are incorrectly being classified as having a known fire-related defect. If a significant number of vehicles are being incorrectly classified, any reported increases may actually be underestimates of the true effect of fire-related defects.

It is also possible that some fire-related defects have not yet been detected and therefore a recall has not yet been issued. This is more likely for newer models but also possible for older models as well. For example, in 2009 General Motors issued a recall that affected model years as far back as 1997. This would also cause any reported increases to be underestimates of the true effect of fire-related defects.

Appendix

Appendix: Illustrative regression results — noncrash fire claim frequency

Parameter		Degrees of freedom	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Intercept		1	-18.0581	81.9212	-178.621	142.5045	0.05	0.8255
Calendar year	2007	1	0.3634	0.0107	0.3424	0.3844	1153.02	<0.0001
	2008	1	0.3227	0.0105	0.3020	0.3433	935.90	<0.0001
	2009	1	0.1998	0.0106	0.1790	0.2206	354.17	<0.0001
	2010	1	0.1385	0.0106	0.1177	0.1594	169.69	<0.0001
	2011	1	0.0851	0.0107	0.0642	0.1061	63.47	<0.0001
	2012	0	0	0	0	0		
Vehicle age	0	1	0.3879	0.0633	0.2638	0.5119	37.56	<0.0001
	1	1	0.4858	0.0626	0.3632	0.6084	60.30	<0.0001
	2	1	0.4891	0.0625	0.3666	0.6116	61.24	<0.0001
	3	1	0.5809	0.0624	0.4586	0.7032	86.63	<0.0001
	4	1	0.6920	0.0623	0.5698	0.8142	123.20	<0.0001
	5	1	0.8027	0.0623	0.6805	0.9248	165.85	<0.0001
	6	1	0.9668	0.0623	0.8447	1.0889	240.71	<0.0001
	7	1	1.1196	0.0623	0.9975	1.2418	322.78	<0.0001
	8	1	1.2297	0.0624	1.1075	1.3520	388.59	<0.0001
	-1	0	0	0	0	0		
Make and series	Make and series information not shown due to over 1600 make and series							
Recall		1	0.1463	0.0073	0.132	0.1606	400.06	<0.0001

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The Highway Loss Data Institute is a nonprofit public service organization that gathers, processes, and publishes insurance data on the human and economic losses associated with owning and operating motor vehicles.