



Analysis of Driver Critical Reason and Years of Driving Experience in Large Truck Crashes

OVERVIEW

The 2005 Large Truck Crash Causation Study (LTCCS)¹ was the first-ever national study to attempt to determine the critical reasons and associated factors that contribute to serious large truck crashes. The LTCCS defines “critical reason” as the reason for the event that immediately led to the crash. Utilizing data from the LTCCS, this analysis examines the association between a driver’s years of professional truck driving experience and the critical reason assigned to the large truck driver (“driver critical reason”) in a crash.

Through interviews conducted with drivers, co-drivers, surrogate drivers, and passengers, the LTCCS collected data on driver attributes (e.g., years of experience driving a truck) for large truck drivers involved in the analyzed crashes. The LTCCS database includes data for 1,123 drivers. Of these, there is complete information on the drivers’ number of years driving a large truck (in general) for 943 drivers, and complete information on the drivers’ number of years driving the particular class of truck involved in the crash for 944 drivers.

This analysis compares the odds and risk of being assigned the driver critical reason for a crash for groups of drivers with varying years of driving experience. The odds ratio approximates the relative risk (risk ratio) when the outcome of interest is rare (occurs less than 10 percent of the time). In this case, this would imply that the assignment of the driver critical reason for the crash occurs less than 10 percent of the time for each comparison group. An initial examination of the data shows that this is not the case for most of the comparison driver

groups. As such, risk ratios are presented separately in addition to the odds ratios.

METHODOLOGY

A logit function with a binary response variable and a single binary explanatory variable was utilized to estimate the parameters of the model and generate the odds ratio for each comparison group of drivers. A chi-squared test was used to test strength of the association and to estimate the relative risk of being assigned the driver critical reason for the crash, by years of driving experience. The logit model used in this analysis is shown in Figure 1.

Logit Model: $logit(\pi_i) = \log\left(\frac{\pi_i}{1-\pi_i}\right) = \alpha + \beta x_i$

Where $\pi_i = \text{probability that } y_i = 1 \text{ for a given value of } x_i$

y_i is a binary dependent variable (driver critical reason assignment); {yes = 1|no = 0}

x_i is a binary independent variable (years driving a truck); e.g. { $x_i \geq 5 = 1|x_i < 5 = 0$ }

α and β are the regression parameters

$H_0: \beta = 0$: The null hypothesis states that the probability of being assigned the driver critical reason for the crash is the same irrespective of the number of years of driving experience

$H_1: \beta \neq 0$

Figure 1. Equation. Logit model used to estimate model parameters and generate odds ratios for comparison groups.

¹ Data and summary reports from the LTCCS are available at: <https://ai.fmcsa.dot.gov/ltccs/default.asp>.

Table 1. Estimated odds ratio and relative risk by years of truck driving experience.

Years Driving a Truck	Parameter Estimate (β)	p-value (0.05)	Odds Ratio	Odds Ratio Lower Confidence Limit (LCL)	Odds Ratio Higher Confidence Limit (HCL)	Relative Risk
< 3 (rel. to ≥ 3)	0.38	0.02	1.47	1.059	2.028	1.19
< 5 (rel. to ≥ 5)	0.34	0.03	1.41	1.041	1.901	1.17
≥ 5 (rel. to < 5)	-0.34	0.03	0.71	0.526	0.961	0.83
≥ 10 (rel. to < 10)	-0.35	0.01	0.71	0.542	0.915	0.86
≥ 15 (rel. to < 15)	-0.36	0.01	0.70	0.532	0.908	0.86
≥ 20 (rel. to < 20)	-0.45	0.00	0.64	0.477	0.855	0.83
≥ 25 (rel. to < 25)	-0.46	0.01	0.63	0.452	0.873	0.83
≥ 30 (rel. to < 30)	*-0.31	0.12	*0.74	0.503	1.080	*0.88

* Not statistically significant.

RESULTS AND FINDINGS

For each estimated logit model, Table 1 shows the parameter estimate, p-value, odds ratio, confidence interval for the odds ratio, and the risk ratio (relative risk) for each comparison group.

The parameter estimate (β) of each estimated model had the expected sign. A negative sign indicates an inverse relationship between the probability of being assigned the driver critical reason for the crash and years of experience driving a truck. As years of experience increase, the probability of being assigned the driver critical reason for the crash diminishes. This analysis relies on the estimated odds and risk ratios to interpret the findings.

For drivers with less than 5 years of experience driving a truck, the estimated odds of being assigned the critical reason for the crash is 1.41 times (or 41 percent higher than) the estimated odds for drivers with 5 or more years of experience. Compared to drivers with more years of experience driving a truck, the risk of being assigned the critical reason for the crash is 1.17 times or 17 percent higher for drivers with less than 5 years of experience driving a truck. The estimated odds and risk ratios decline markedly after 5 years of driving. For example, drivers with 10 or more years of driving experience have estimated odds of being assigned the critical reason for the crash that are 0.71 times the estimated odds for drivers with fewer

than 10 years of driving experience. The risk of being assigned the critical reason for the crash is 0.86 times (or 14 percent) lower for drivers with 10 or more years of experience driving a truck.

The advantage derived from driving experience appears to peak above the 25-year mark. For drivers with 25 or more years of truck driving experience, the estimated odds of being assigned the critical reason for the crash are 0.63 times the estimated odds for less experienced drivers, while the risk of being assigned the driver critical reason for the crash is 17 percent lower than that of drivers with fewer than 25 years of experience driving a truck.

At 30 or more years of experience driving a truck, the odds and risk ratios show an uptick. While the ratios are still less than 1, they are higher than levels observed at the 20- and 25-year marks. However, it is important to note that the estimated odds and risk ratios are not statistically significant, indicating that for this comparison group, there is no association between the critical reason for the crash and the number of years driving the truck. The estimated odds and risk of drivers with 30 or more years of experience being assigned the critical reason for the crash is not significantly different from the estimated odds and risk of drivers with fewer years of truck driving experience. Figure 2 depicts the trend in the estimated odds and risk ratios for the comparison groups.

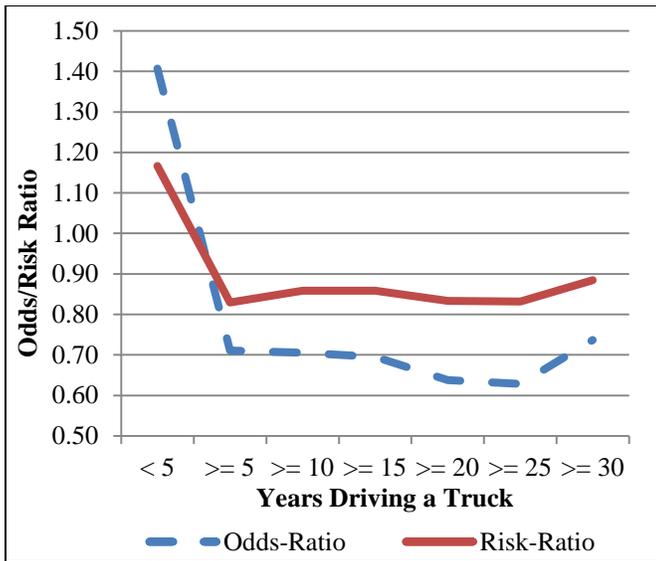


Figure 2. Line graph. Estimated odds and risk ratios by years of experience driving a truck.

The next section of the analysis examines the association between the drivers' number of years driving the specific class of truck involved in the crash and the driver critical reason for the crash. Again, for each estimated logit model, Table 2 shows the parameter estimate, p-value, odds ratio, confidence interval for the odds-ratio, and the risk ratio (relative risk) for the comparison groups.

Table 2 displays a trend similar to that observed in Table 1. Not surprisingly, a Pearson's correlation test shows a strong positive linear correlation between the years of experience driving a truck and the years of experience driving the particular class of truck involved in the crash. For drivers with less than 5 years of experience driving the class of truck involved in the crash, the estimated odds of being assigned the critical reason for the crash are 1.6 times

(or 60 percent higher than) the estimated odds for drivers with more years of experience driving the class of truck involved in the crash. The risk of being assigned the critical reason for the crash is 1.23 times (or 23 percent) higher for this group of drivers.

For drivers with 15 or more years of experience driving the class of truck involved in the crash, the estimated odds of being assigned the driver critical reason are 0.67 times the estimated odds for drivers with fewer than 15 years of experience. The risk of being assigned the critical reason for the crash is 15 percent lower than that of drivers with less experience driving the class of truck involved in the crash. As observed with the total number of years driving a truck in general, beyond the 30-year mark, the benefits of many years of experience driving the class of truck involved in the crash appears to diminish. Note that for this group of drivers, the parameter estimates, odds ratios, and risk ratios are not statistically significant.

CONCLUSION

In conclusion, based on a limited sample of 943 large truck drivers who were all involved in fatal or injury crashes of varying severities, the risk of being assigned the critical reason for the crash diminishes both with more years of experience driving a truck and more years of experience driving the class of truck involved in the crash. In particular, for large truck drivers with fewer than 5 years of truck driving experience, the risk of being assigned the critical reason for the crash is 17 percent higher than that of drivers with 5 or more years of experience driving a truck.

Table 2. Estimated odds ratio and relative risk by years of experience driving the class of truck involved in the crash.

Years Driving a Truck	Parameter Estimate (β)	p-value (0.05)	Odds Ratio	Odds Ratio Confidence Interval LCL	Odds Ratio Confidence Interval HCL	Relative Risk
< 3 (rel. to ≥ 3)	0.48	0.00	1.61	1.200	2.156	1.24
< 5 (rel. to ≥ 5)	0.46	0.00	1.59	1.204	2.104	1.23
≥ 5 (rel. to < 5)	-0.46	0.00	0.63	0.475	0.831	0.77
≥ 10 (rel. to < 10)	-0.38	0.00	0.68	0.525	0.884	0.85
≥ 15 (rel. to < 15)	-0.40	0.01	0.67	0.509	0.889	0.85
≥ 20 (rel. to < 20)	-0.49	0.00	0.61	0.448	0.838	0.82
≥ 25 (rel. to < 25)	-0.41	0.02	0.66	0.463	0.946	0.85
≥ 30 (rel. to < 30)	*-0.30	0.17	*0.74	0.477	1.144	*0.89

*Not statistically significant.