

How Are Physical Conditions and Driving Errors of Commercial Large-Truck Drivers Associated with Injury Severity in Fixed-Object Collisions?



Introduction

Overall goal: To investigate the effect of large truck drivers' physical conditions and driving errors on the severity of fixed-object crashes involving large trucks.

Data

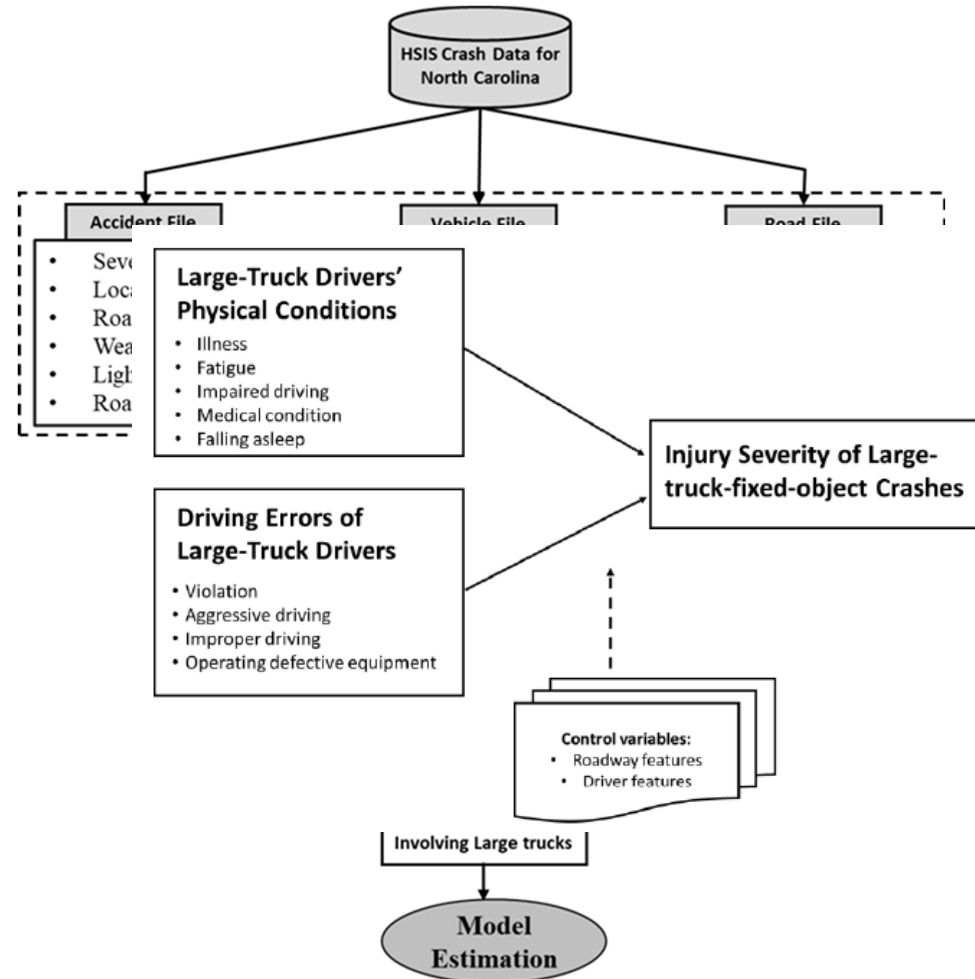
Five years (2013-2017) of crash data from North Carolina provided by Highway Safety Information System (HSIS)

Paper Contribution

- Explores the physical conditions and driving errors of large-truck drivers that correlate with severe injuries in fixed-object crashes
- Investigates the pure effect of large-truck drivers' behavior
- Applies a random parameter model to account for unobserved heterogeneity



Conceptual Framework



Estimation results

Model results for the ordered probit Model with random and fixed Parameters
Marginal effects for significant variables of the ordered probit model with random

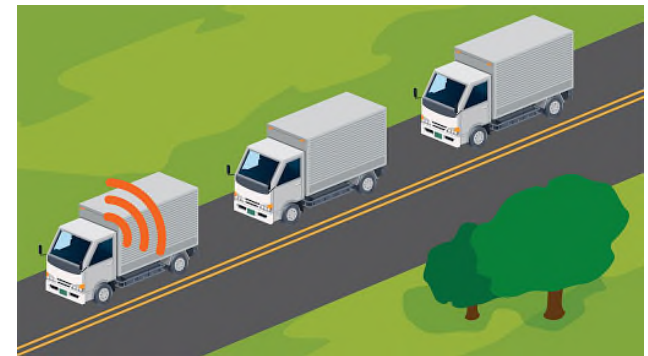
Variable		Marginal Effects							
		Fatal	Severe injury	Moderate injury	Minor injury	No injury			
Physical Condition of the Driver (Base: Normal)	Illness	-1.313	2.929%	2.90%	-0.123	1.4569	10.33%	-27.69%	
	Fatigue	-0.928	1.854%	1.85%	-0.563	0.524	2.52%	7.55%	-17.66%
	Falling Asleep or Loss of Consciousness	-1.039	0.412	-7.58	-0.646	0.549	-5.28	8.56%	-20.51%
	Impaired driving (Medications, Drugs, Alcohol)	0.887	0.134	3.68	0.599	0.274	2.6	7.98%	-18.98%
	Alcohol Condition	-2.010	0.780	-9.59	-1.294	0.848	-6.96		
Driving Error (Base: Normal)	Medical Condition and signals	-0.249	6.603%	6.37%	-0.265	0.9626	12.49%	-46.04%	
	Disregarding signs and signals	-0.717	0.248	3.12	-0.469	0.504	2.28%	1.85%	-4.46%
	Speeding	-0.204	0.695	-0.89	-0.115	0.820	0.61	6.34%	-14.25%
	Improper lane change	-0.364	0.517	-1.07	-0.198	0.644	0.7	1.54%	-3.05%
	Failure to reduce speed	-0.660	0.465	3.71	-0.440	0.618	2.78	2.78%	-5.47%
	Wrong-way driving	-0.765	0.642%	0.38%	-4.818	0.579	5.39	2.68%	-13.22%
	Oversteering	-0.853	0.707%	1.07%	-0.546	0.833	5.97%	2.77%	-14.31%
Road Lighting (Base: Daylight)	Operating defective equipment	-0.292	0.755%	1.14%	-0.183	1.229	6.52%	4.24%	-14.31%
	Dusk	0.281	0.665%	1.46%	0.265	0.703	7.35%	7.35%	-16.70%
	Operating defective equipment	-0.55	0.101	0.34%	-3.33	0.045	2.77%	2.77%	-4.99%
Road Lighting (Base: Daylight)	Dawn	0.095	0.919	0.21	0.044	0.940	0.24	2.56%	4.69%
	Dark with Lighting	-	-0.142	-1.9%	-0.062	1.192	-2.09%	-2.09%	4.69%
	Dark Without Lighting	-	-1.199	-7.9%	-0.627	1.192	-2.09%	-2.09%	4.69%
Road Surface (Base: Dry)	Dark with Lighting	0.084	0.50%	0.78%	4.20%	4.80%	-10.28%	-10.28%	
	Dark Without Lighting	0.258	0.04%	0.07%	0.105	4.22%	5.14	-0.58%	1.10%
Road Surface (Base: Dry)	Dark Without Lighting	1.408	0.06%	0.10%	0.902	2.814	0.83%	0.83%	-1.61%
	Wet	---	-0.14%	-0.25%	-1.60%	1.056	2.63%	2.63%	4.24%
Road Alignment (Base: Straight)	Snow	---	-0.30%	-0.62%	0.054	0.814	8.68%	8.68%	14.43%
	Curve	---	0.21%	0.36%	-0.204	0.439	2.75%	2.75%	-5.47%
Road Alignment (Base: Straight)	Curve	---	0.21%	0.36%	-0.204	0.439	2.75%	2.75%	-5.47%
	Curve	---	0.21%	0.36%	-0.204	0.439	2.75%	2.75%	-5.47%
Ln (AADT)	Curve	0.126	0.053%	0.09%	-0.53%	-0.71%	1.37%	1.37%	1.37%
	Curve	0.126	0.053%	0.09%	-0.53%	-0.71%	1.37%	1.37%	1.37%
Speed Limit (Base: < 45)	Curve	0.0039	0.39%	0.74%	5.18%	8.22%	8.22%	8.22%	8.22%
	Curve	0.0039	0.39%	0.74%	5.18%	8.22%	8.22%	8.22%	8.22%
Ln (AADT)	Curve	-0.303	0.739	-4.18	---	---	---	---	---
	Curve	-0.303	0.739	-4.18	---	---	---	---	---
Speed Limit (Base: < 45)	Curve	-0.628	0.534	-5.39	---	---	---	---	---
	Curve	-0.628	0.534	-5.39	---	---	---	---	---
Goodness of fit		N= 3037		N= 3037					
		AIC = 3866.3		AIC = 3873.8					
		LL = -1903.14		LL = -1909.91					

Key results form marginal effects

- Large truck drivers with a **medical condition** are **12.97%** more likely to be involved in a fatal or severe injury crash.
- Large truck drivers who have an **illness** are **5.22%** more likely to be involved in fatal or severe injury crashes.
- **Fatigue driving** increases the risk of fatal and severe crashes by **2.7%**.
- Risk of fatal or severe crashes is increased by **2.9%** having **impaired driving**.
- **Speeding** and **aggressive driving** increase the risk of a fatal or severe injury crash by **1.97%** and **2.7%**, respectively.

Implications of the results

- Periodic medical monitoring of truck drivers
 - Truck drivers take the DOT's medical exam every 24 months
 - Shorter intervals for better monitoring the drivers
- Regulations for shorter hours of service can prevent fatigue driving
- Using biometric driver monitoring systems to detect the signs of drowsy driving
- Traffic violations can be trackable using advanced technologies such as connected trucks and truck platooning





Thank you!



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