

Modelling public bus/minibus crash severity in Ghana

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KNOWLEDGE IN ACTION

Outline of presentation

- Introduction
- Study objective
- Method and data
- Results
- Conclusion/ The way forward

Introduction



30th ICTCT workshop, Olomouc, Czech Republic. 26th-27th October, 2017



Study objective

- Examine:
 - Factors influencing bus/minibus crash severity in Ghana
 - First study, notwithstanding bus/minibus safety concerns
- Motive?
 - Create awareness on factors with injury risk for bus/minibus

Factors influencing bus/minibus crash severity (BCS)

- Prato & Kaplan (2014): VRUs, high speed, night hours, aged 3-party drivers, drivers crossing in yellow/red light etc.
- Barua & Tay (2010): weekends, off-peak hours, 2-way lanes; traffic controls, median etc.
- Hamed et. (1998): driver's age, accident location, surface condition, time of day, time since previous accident etc.

Method and data

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Model estimation

Statistical technique: Generalised ordered logit

- Final model: significant factors from 3 parsimonious models
- Model fitted using GENLIN procedure in IBM SPSS v24; Dataset: 33,693 valid cases

 Crash outcomes: fatal; hospitalised; injured but not hospitalised; and damage only= categorical ordinal

Model estimation cont'd

 An ordered logit model can be specified in terms of the probability of injury severity j for a given crash i as (see Long, 1997; Prato & Kaplan, 2014):

$$P(y_i > j) = \frac{exp(X_i\beta - \phi_j)}{1 + exp(X_i\beta - \phi_j)} \qquad j = 1, 2, ..., M - 1$$
(1)



Model estimation cont'd

 The generalised ordered logit model expresses the probability of injury severity j for a given crash i as (see Long, 1997; Prato & Kaplan, 2014):

$$P(y_i > j) = \frac{exp(X_{1i}\beta_1 + X_{2i}\beta_{2j} - \phi_j)}{1 + exp(X_{1i}\beta_1 + X_{2i}\beta_{2j} - \phi_j)} \qquad j = 1, 2, \dots, M - 1 \quad (2)$$



Model estimation cont'd

• The probability of injury severity has a closed-form expression and the parameters $\beta_{1,} \beta_{2j}$ and φ_{j} are estimated through the maximisation of the log-likelihood function *LL*:

$$LL = \sum_{n=1}^{N} \sum_{j=1}^{J} d_{nj} ln P(y_i > j)$$
(3)

where N is the number of accidents,

and

if accident n results in severity category j

 $d_{nj} = \begin{cases} 1, & \text{if accident} \\ 0, & \text{Otherwise} \end{cases}$

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Model estimation results (Note. *p<.001; **p<.05; ***p<.01;

N=33693)			
Variable	В	Std. Error	Exp(B)
Day of week (Reference category: Sunday)			
Monday	.150	.0386	1.161*
Tuesday	.166	.0392	1.180 *
Wednesday	.152	.0393	1.164*
Thursday	.051	.0390	1.052
Friday	.082	.0379	1.085**
Saturday	.053	.0372	1.055
Road separation (Reference: No median)			
Median	.256	.0253	1.292*
Vehicle type (Reference: Minibus)			
Bus	081	.0231	0.922*
Weather condition (Reference: Clear)			
Adverse	.112	.0351	1. <u>11</u> 9***
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Model estimation results cont'd

Light condition (Reference: Night-Light ON)			
Day	.147	.0330	1.158*
Night-Light OFF	023	.0389	0.977
Road description (Reference: Curved/inclined)			
Straight and flat	.389	.0341	1.476*
Road surface (Reference: Wet)			
Dry	.097	.0374	1.102**
Shoulder condition (Reference: No shoulder)			
Good	457	.0227	0.633*
Poor	431	.0364	0.650*
Location (Reference: Intersection)			
Section	190	.0280	0.827*
Traffic control (Reference: Speed humps/rumble strips)			
None	204	.0240	0.816*
Present	.196	.0388	1.217*
Collision type (Reference: Hit pedestrian)			
Head on	.907	.0383	2.478*
Rear end	2.529	.0323	12.545*
Right angle	1.766	.0457	5.849 [*]
Sideswipe	2.425	.0359	11.307*
Overturn	1.562	.0355	4.767*
Hit object	2.173	.0442	8.781*
Drunk driving (Reference: Positive)			
Negative	.215	.0753	1.240***
Surface repair (Reference: Rough with potholes)			
Good	.108	.0469	1.114**
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Conclusion

- Day of the week, road median, adverse weather, daylight, good road terrain, traffic controls etc increase BCS
- Vehicle type, road shoulder, accident location and absence of traffic control reduce BCS
- Implications/ The way forward (3Es)
 - Education: road hazard detection and management, driver behaviour monitoring in real time
 - Enforcement: speed limits, vehicle standards, increased police surveillance
 - Engineering: road shoulders, road curves
 - Further research: traffic control, median

