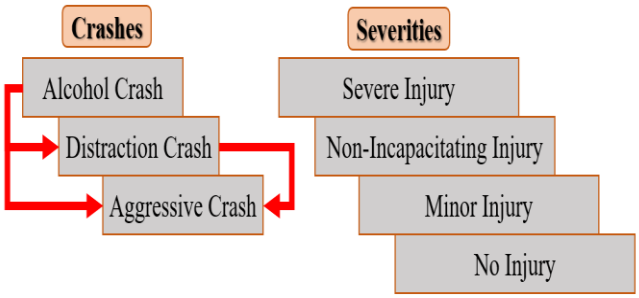
An Integrated Multivariate Econometric Model for Risky Driving Behavior Related Crashes: Evaluating Crash Risk and Severity Across Zones



Integrated Multivariate Negative Binomial – Generalized Ordered Probit Fractional Split model

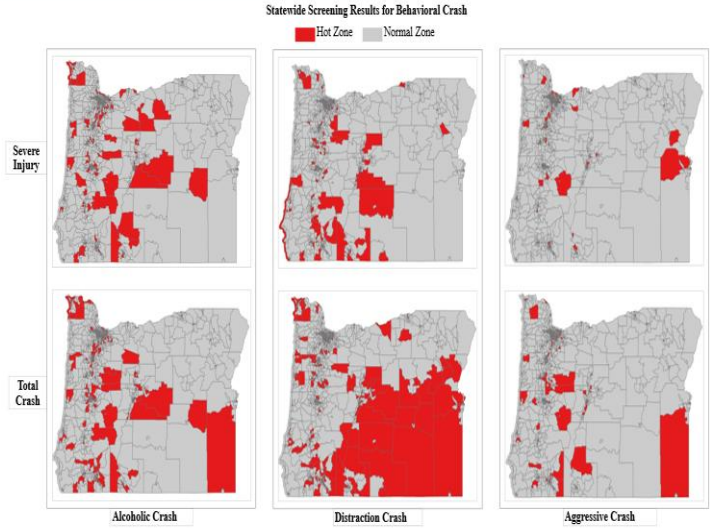
$$v_{ir} = E(c_{ir}) = exp\left(m_{ir} + \partial m_{i,r-1} + \omega m_{i,r-2} + \varrho_i \pm \eta_{ik} + \varepsilon_{ir}\right)$$

$$m_{ir} = \left((\tau_r + \Phi_{ir})x_{ir}\right)$$

Where,
i = Observation unit (census block),
r = Different crash types,
k= Injury severity categories,
m_ir = latent crash propensity for the corresponding crash type r at unit i
$m\_(i,r-1)$ and $m\_(i,r-2)$ represent the crash propensities of the preceding crash types in the behavioral sequence
$\hat{o}$ and ω are parameters to be estimated capturing the influence of these prior propensities

Methodological Advantages:
1. Addressing the dimensionality challenge
2. Incorporating the estimated crash propensities of one behavior as predictors in subsequent models
3. Flexibility of the proposed model framework allows for testing multiple correlation structures

Empirical Advantages:
1. Single Model Framework
2. Identify factors with distinct impacts
3. Pinpointing geographic area



MS Defense

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Date/Location: November 6, 2025 (03:30pm ~05:00pm), EB-202L (https://pdx.zoom.us/j/89573222168)

Short Abstract:

This study develops an integrated multivariate econometric framework that simultaneously models the frequency and severity of behavior-related crashes, specifically those involving alcohol, distraction, and aggression. Unlike traditional approaches, the framework captures multiple behavioral dimensions and their sequential linkages, recognizing that one risky behavior can intensify another. Using Oregon's 2022 crash data, the model uncovers significant behavioral interdependencies often overlooked in planning-level studies. The proposed approach improves both predictive accuracy and interpretability, identifying high-risk zones characterized by truck exposure, rural road dominance, and varying speed limits. These insights provide a data-driven foundation for targeted, behavior-specific safety strategies and proactive crash prevention.

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