Multinomial probability assessment
of motorcycle injury severities

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Abstract

The analysis of motorcycle crashes that occurred in Florida has shown an average increase of 11.9% from 1999 to 2004. During that time period, 48.5% resulted in severe injury while 2.6% were fatal. Various studies have evaluated contributing causes of motorcycle crashes and factors determining injury severity. No specific conclusions have been reached on factors directly connected to injury severity. In view of these statistics and findings from previous researches, this study applies the Multinomial Logit (MNL) and the Multinomial Probit (MNP) models to analyze factors associated with motorcycle crash injury severities. The multinomial models are used instead of the ordered models since the latter are not flexible in quantifying the effect of the independent variables for each injury severity category. The MNL and MNP models yield the similar results in terms of the sign and magnitude of the coefficients. However the standard errors of the coefficients in MNP are tighter than those in MNL, implying that MNP is a more efficient estimator than MNL. It was found that, increase in number of lanes, alcohol and drug use, high posted speed limit, curved areas, turning movements, ramps, and driving with no adequate daylight increase probability of severe injury. Collision with truck and buses and more than two vehicles in the crash also increase the probability of severe injury.

Keywords – motorcycles, crash, injury severity, multinomial logit, multinomial probit

1. Introduction

According to the National Highway and Traffic Safety Administration [10], motorcycle crashes contribute significantly to deaths and injuries on highways. Using the NHTSA record from 1998 to 2001, motorcycle related crashes contributed to 6.5% of all vehicle crash fatalities. According to NHTSA, the motorcycle fatality rates per million vehicle miles of travel from 1998 to 2005 were 22.31, 23.46, 27.67, 33.17, 34.23, 38.78, 39.79 and 43.77 respectively. This was an increase of approximately 96% from 1998 to 2005 year. In Florida, motorcycle crashes increased at an average rate of 11.9% from 1999 to 2004. This paper evaluates factors influencing motorcycle crashes injury severity. Studies of motorcycle crashes have been conducted by various researchers. Mannering and Grodsky [3] found that most motorcyclists were generally aware of the factors that contribute to accident risk. In another study, Preusser et al. [6], analyzed ten crash types using 2,074 crash records from the Fatality Analysis Reporting System (FARS) database.