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Short Communication

Factors associated with crashes involving taxi owners and non-owners: A case of moral hazard and adverse selection?

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ABSTRACT

Taxis experience a higher risk of a motor vehicle crash partly because of their much higher levels of exposure on the roads. Although several studies have been conducted to examine the factors associated with the frequency and severity of taxi collisions, little research has been conducted to examine the differences in the factors associated with owner taxis and non-owner taxis. This study finds that collisions involving non-owners are more likely to be associated with poor or risky driving behaviors than collisions involving taxi vehicle owners. This result is consistent with the economic principles of moral hazard and adverse selection. Hence, policy makers responsible for traffic safety, taxi regulation or taxi operations should consider measures to reduce these market inefficiencies and improve the safety of not only taxi drivers but all road users.

1. Introduction

1.1. Background and rationale

Among the different driver groups, professional drivers, such as taxi drivers, are particularly at risk of motor vehicle crashes and crash-related injuries due to their high occupational exposure to hazardous conditions on the road. Hence, many studies have been conducted to examine the factors associated with the frequency and severity of taxi collisions as well as risky behaviors of taxi drivers (Chung and Chang, 2015; Tseng, 2013; Chin and Huang, 2009; Lam, 2004; Sagberg et al., 1997; Peltzer and Renner, 2003; Dalziel and Job, 1997; Passmore and Ozanne-Smith, 2006).

However, little research has been conducted to examine the differences in the factors associated with owner taxis and lessee or employee driven taxis. Are the factors associated with crashes involving taxi owners and non-owners different? In particular, are there behavioral differences in the factors associated with crashes involving taxi owners and non-owners? Are risky driving behaviors more likely to be associated with crashes involving taxi owners or non-owners? Also, can the behavioral differences found be explained by established behavioral models? The answers to these interesting research questions will provide new insight into the high crash risks associated with taxis and other professional drivers as well as open new avenues to develop countermeasures to improve the safety of taxi and other professional drivers.

Some potential theories and models that may be used to explain any observed differences in the behavioral factors associated with crashes involving taxi owners and non-owners include the concepts of moral hazard and adverse selection in the field of economics. These economic principles have been used to analyze a variety of economic behaviors, contracts and transactions, including the relationship between asset ownership and risky behaviors, buying and selling of insurance, and the provision and purchase of automobile warranties, particularly in the used car markets.

1.2. Moral hazard and adverse selection

Moral hazard is assumed to exist when one of the parties to an agreement or transaction has an incentive, after the agreement is made, to act in a manner that brings additional benefits to him-

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self or herself at the expense of the other party (Parkin, 1994). For example, according to this hypothesis, all other factors being equal, consumers who purchased auto insurance will have a lower incentive (relative to those who do not) to take the appropriate level of care to prevent car thief because they can recover most of the cost from the insurance company (Varian, 1992). Similarly, relative to a driver who owns the vehicle driven, a driver who does not own the taxi, truck or courier vehicle that he or she is driving, may have a lower incentive to drive more cautiously, all other factors being equal, because part of the cost of a crash is not incurred by him or her.

Adverse selection is the tendency for the people who accept certain contracts or transactions to be those with private information that they plan to use to their own advantage and to the disadvantage of the less informed party (Parkin, 1994). For example, some insurance companies tend to attract relatively more high risk people rather than low risk people, all other factors being constant (Parkin, 1994). Also, some low risk people or companies tend to self-insure or not purchase insurance. Similarly, all else being constant, some drivers who are risk takers, may prefer to operate a company taxi or lease a taxi rather than buy and own the taxi that they operate because they would not have to bear the full cost of their risky driving behaviors.

1.3. Literature on moral hazard in the taxi industry

In general, when economic agents do not bear the full cost of their actions, a moral hazard situation may arise in which the agents, by doing what are in their best interests, behave in ways that are not optimal from a social standpoint (Jackson and Schneider, 2010, 2011). For example, in the taxi leasing market, lessee drivers do not pay many of the costs associated with maintenance, repair, replacement and insurance, and hence, have the incentive to choose inefficient levels of usage, care and risk. As a result, Schneider (2010) finds higher rates of motor vehicle collisions and driving violations for lessee drivers versus drivers who own their taxis (Jackson and Schneider, 2010, 2011; Schneider, 2010).

Although the majority of violations are related to driver behaviors, the factors associated with motor vehicle collisions are various, including a multitude of road, driver, vehicle, and environmental influences. Therefore, it is important to explicitly examine the driver behavior related factors that contribute to motor vehicle collisions involving a taxi driver, while controlling for other confounding factors, to determine if lessees or non-owners are more likely to engage in risky and poor driving behaviors that result in a collision.

In addition, Schneider (2010) examined the ownership of taxi license, also known as taxi medallions in New York City, instead of vehicle ownership. Besides driver related costs, most of the other costs incurred in a motor vehicle collision were associated with the vehicle and not the license to operate a taxi. Schneider (2010) assumed that the fraction of drivers who owned the license but not the vehicle, was modest (<40%). Since such drivers clearly faced limited moral hazard (Schneider, 2010), it would be beneficial to explicitly examine the effect of vehicle ownership on risky and poor driving behaviors that were associated with a motor vehicle collision involving a taxi.

1.4. Objective and scope of study

The objective of this study is to examine the differences in the factors associated with crashes involving taxi owners and non-owners. More specifically, it will determine if the crashes involving taxi lessees (non-owners) are more likely to be associated with poor or risky driving behaviors compared to crashes involving taxi owners.

It will extend the existing literature by examining taxi vehicle ownership instead of taxi license ownership. Also, since the factors contributing to accidents are varied and complex (McCarthy and Tay, 2005), it is important to explicitly examine the role of driver behavior in traffic collisions, while controlling for other vehicle, road and environmental factors.

In addition, this study will also control for the age and gender of the drivers involved because these demographic characteristics have been found to be significant factors in influencing poor and risky driving behaviors in taxi drivers and the general driving population (La et al., 2013; Tay, 2001, 2005; Koh et al., 1987; Newnam et al., 2014). Moreover, since age and gender are also significant factors in influencing vehicle ownership in the taxi industry, this confounding relationship may produce spurious correlations if not properly accounted for in the model. For example, if younger drivers are less likely to be vehicle owners than older drivers, and younger drivers are more likely to take risks, then a negative correlation will exist between vehicle ownership and risky driving behavior that is due to the confounding effect of age and not simply a direct relationship between ownership and risky driving.

2. Methodology

2.1. Binary logistic model

Similar to many traffic collision studies (Yasmin et al., 2014a,b; Huang and Abdel-Aty, 2010; Anowar et al., 2013; Rifaat et al., 2011, 2012), this study uses a retrospective approach to identify the differences in the factors associated with crashes involving taxi owners and non-owners, with a special focus on the role of risky driving behavior as a risk factor. The dependent variable in this approach is simply the two types of crashes: crashes involving taxi owners and crashes involving non-owners. Since this variable is clearly binary, the logistic regression is a suitable technique to use because it is developed to predict a binary dependent variable as a function of predictor variables. The logistic regression model is widely used in road safety studies where the dependent variable is binary (Johnson et al., 2011; Haleem and Abdel-Aty, 2010; Tay et al., 2008, 2009, 2014; Anowar et al., 2013; Rifaat and Tay, 2009; Obeng, 2007). The independent variables in the model are the crash risk factors, including risky behaviors, age and gender, as well as environmental, roadway and vehicle factors.

Note that some researchers have chosen to use the random coefficient logit or probit model to allow for heterogeneous effects and correlations in unobserved factors (Milton et al., 2008; Kim et al., 2010; Tay, 2015; Anastasopoulos and Mannering, 2011). Random parameters models, especially the random parameter logit or mixed logit model, have increasingly been used in traffic safety studies to analyze both crash frequency and severity (Lord and Mannering, 2010; Savolainen et al., 2011). However, preliminary analyses using the random parameters binary logistic model found no statistically significant estimate of the variance for any of the coefficients, indicating that the fixed coefficient binary logistic model was appropriate.

2.2. Data

The motor vehicle crash data used in this study was provided by the Korean National Police Agency. In 2010, there were 47,182 crashes involving at least one taxi and a total of 51,494 taxi drivers were involved. Of the 51,494 drivers involved in crashes, 12,868 (24.99%) were taxi owners and 38,626 (75.01%) were non-owners (lessees or employees). As shown in Table 1, the majority of taxi drivers involved in crashes were male and middle-aged (36–65