

## Public opinion on usage-based motor insurance schemes: A stated preference approach



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### ABSTRACT

This paper aims to investigate which parameters affect users' willingness to pay for alternative usage-based motor insurance pricing schemes such as Pay-as-you-drive (PAYD) and Pay-as-how-you-drive (PHYD). For that reason, a dedicated questionnaire was designed and administered to 100 participants including both revealed and stated preference questions and proposed scenarios regarding current and alternative insurance schemes. In order to account for unobserved heterogeneity, a mixed logit model was applied to analyze vehicle insurance choice. Candidate variables include the effect of driving characteristics, drivers' demographics and the price of vehicle insurance premiums. Two distinct mixed logit models were developed; one mixed logit model to investigate the factors influencing the choice of present insurance policy over PAYD and one for present insurance policy over PHYD. Results indicated that women and smartphone owners are more likely to choose a new insurance schemes. Kilometers and cost reduction were also found to affect similarly the choice for both Usage-Based-Motor Insurance (UBI). Moreover, the higher the speed reduction imposed to the user, the lower the probability of the UBI scheme to choose it. It was also found that people over 40 years old are less likely to choose PHYD insurance.

### 1. Introduction

Usage-based motor insurance (UBI) schemes, such as Pay-as-you-drive (PAYD) and Pay-how-you-drive (PHYD), constitute new innovative concepts that have recently started to be globally commercialized. The core concept is based on the fact that drivers pay insurance premiums depending on their travel and driving behavior instead of a fixed price based on demographics and/or their driving experience only. In spite of having been only recently implemented, it appears to be a very promising practice with a potentially significant impact on traffic safety as well as on traffic congestion mitigation and pollution emissions reduction (Tselentis et al., 2017).

Insurance charging systems based on travel behavior are often called Pay-As-You-Drive (PAYD) Usage-Based Insurance schemes. Drivers' travel behavior can be defined as their strategic choices (whether on a real-time basis or not) concerning which type of road network they use and at what time they drive in order to fulfil their travel needs. These choices are directly linked to their exposure to crash risk through their mileage, the road network type chosen and the related traffic conditions, the period of time chosen to drive and the related weather conditions. In the primary form of PAYD, mileage was

only incorporated in the models as a travel behavior characteristic. This was concluded based on the fact that mileage and crash risk are much correlated. Indeed, many studies (Litman, 2005, Bordoff and Noel, 2008) in literature indicate a relationship between VMT (vehicle miles travelled) and crash risk. For instance, Edlin (2003) found that the elasticity of the number of crashes occurring with respect to VMT is approximately 1.7 which means that if mileage was reduced by 10%, crashes would be reduced by 17% while in other research the elasticity of crash risk was found to be around 1.2 (ICBC Research Services Data, 1998). More specifically, the authors claim that the 1981–1982 recession led to a 10% VMT and 12% insurance claims reduction in British Columbia. In support of the above, Ferreira and Minikel (2010) found that there is a high statistical significance between mileage and risk and that they are positively correlated.

Another PAYD insurance scheme is the Pay-at-the-Pump (PATP) method which was the early stage of the mileage-based insurance policy that appeared later. Considering that fuel consumption and mileage are somehow correlated, these two methods share many similar characteristics and the same conceptual basis. PATP is the second most influential method of UBI which considers fuel consumption as its main indicator instead of mileage. For example, Wenzel (1995) argued why

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insurance premiums should be estimated based on use. Claiming that VMT is a good predictor of crash costs, he proposed a travel behavior-based system which was actually a per-gallon surcharge for consumers, a method similar to the PATP method. Wenzel also suggested that premiums should be the sum of a fixed amount based on location, vehicle safety characteristics and driving record, most of which are travel behavior characteristics, plus a variable amount based on fuel consumption (per-gallon surcharge).

On the other hand, insurance charging systems based on Driving Behavior are often called Pay How You Drive (PHUD) Usage Based Insurance schemes. Driving behavior can be defined as drivers' operational choices at real time in handling the vehicle within the existing traffic conditions. These choices are directly linked to the probability of getting involved in a traffic accident, based on the way they are driving, e.g. by speeding, harsh braking, harsh accelerating, harsh cornering, being distracted by mobile phone, etc.. The main advantages of UBI schemes compared to the conventional ones so far are discussed in more details in Sugarman, (1994), Litman (2004a), Litman 2004b and Tselentis et al. (2017) and so on. For instance, Bolderdijk et al. (2011) found that speed violations of young drivers are significantly reduced with PAYD schemes. The potential financial benefits and incentives are likely to lead to reduce speeds as Toledo et al. (2008) state. Similarly, other studies found that PHYD (or pay-as-you-speed) can be very beneficial in road safety (Lahrman et al., 2012).

During the last few decades traditional motor insurance has started to gradually transform into Usage-Based Insurance. The question, to what extent is this new type of motor insurance going to be widely adopted and which indicators will be fully incorporated, remains though. According to Tselentis et al. (2017), UBI will play a key role in motor insurance market in the future and as a result it will strongly influence traffic safety in total. Fig. 1 illustrates the types of insurance that currently exist in the marketplace as well as the intuition of the authors on how motor insurance future will be formed. Since the trend in innovative motor insurance revealed above is to implement schemes that progressively incorporate travel and behavioral factors the authors consider that future models will be in the form of Pay-As-How-You-Drive (PAHYD) including parameters from both PAYD and PHYD models.

In order to estimate insurance premiums, the "Willingness to Pay" (WtP) methodology is examined, which is in fact the reflection of the individual estimate on how much money an individual is willing to pay (or sacrifice) so as to obtain certain benefits or even avoid costs

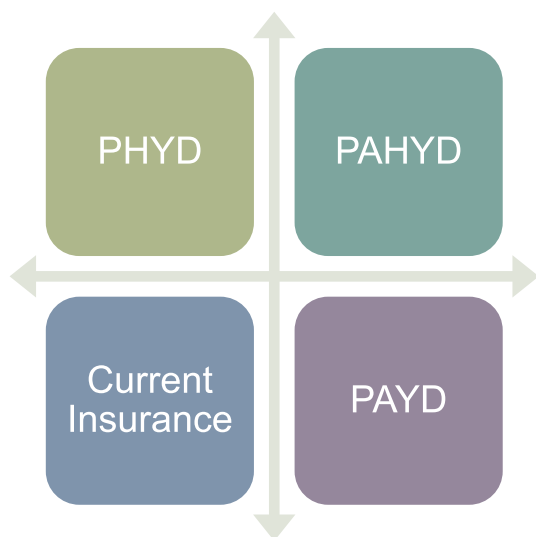


Fig. 1. UBI and current Insurance policies. Source: Tselentis, D. I., Yannis, G., & Vlahogianni, E. I. (2017). Innovative motor insurance schemes: a review of current practices and emerging challenges. *Accident Analysis & Prevention*, 98, 139–148.

(Persson and Cedervall, 1991). Apart from the opinion of each individual on the desired goods or services value in comparison to other desirable objects, the amount specified by the respondent also reflects the ability of people to pay. Individuals can judge their own wealth and therefore values and estimates derive from an oriented domination of the consumer. The existing income or wealth distribution is considered acceptable if the amount resulting from the WtP is adjusted by the individual's ability to pay (Persson, 1992).

When analyzing stated preferences in discrete choice situations, one common way is to apply (random parameters) mixed logit models (Brownstone et al., 2000). One reason for choosing this type of models is to account for unobserved heterogeneity and variations among observations. It is therefore important to apply such a methodology that allows for the influence of variables affecting users' preferences to vary across the sample. This is an important consideration raised by relatively recent research carried out by Brownstone and Train (1999), Train (1999a,b), Revelt and Train (1997, 1999), McFadden and Train (2000), and Bhat (2001). The aforementioned studies have demonstrated the effectiveness of the mixed logit model that can explicitly account for such variations. Therefore, it is suggested that mixed logit models are superior to traditional logit models. Due to the effectiveness of the mixed logit model, it is also widely applied in other fields of transport, as for example in road safety (Gkritza and Mannering, 2008; Ben-Akiva et al., 2007).

In general, relevant literature on the field is very limited since the analysis of the Usage-Based Motor insurance schemes via willingness to pay is a novel subject and has only recently been starting to be explored. Consequently, the present paper aims to add to the current knowledge by being one of the first attempts to identify the parameters that affect users' willingness to pay for usage-based motor insurance, proposing alternative pricing methods such as PAYD and PHYD. More specifically, it is aimed to investigate and provide insight on the understanding of the impact of driving characteristics (driving style and driving needs), drivers' demographics (gender, age, marital status, income, etc.) and the specific characteristics of vehicle insurance premiums on vehicle insurance choice. In order to achieve the aims of the study, a mixed logit model is implemented.

The paper is structured as follows: Section 2 provides an illustration of the sample, the experiment and the choice situations. Section 3 is dedicated to a concise theoretical background of the mixed logit model, while Section 4 illustrates and discusses the findings of the models utilized for PAYD and for PHYD. Finally, the last section provides the main conclusions of the study as well as directions for further research.

## 2. Methodology

### 2.1. Discrete choice experiment

In order to identify users' preferences and the criteria influencing their choice, the two pricing methods (PAYD-PHYD) were evaluated by respondents using multiple choice and scaled questions. For most questions, a five levels scale was used (1–5) in which the significance of individual factors was evaluated as 1 = "not at all" to 5 = "very much".

The dedicated questionnaire was designed including both revealed preference questions about current vehicle and insurance type, as well as stated preference scenarios related to current and alternative insurance schemes. To increase the number of alternative tested scenarios, two different sheets were designed with four PAYD and eight scenarios PHYD each and each of the 100 respondents answered a single sheet. The questionnaire is structured in 4 sections and questions included:

- general respondent's driving data (years since licence was obtained, vehicle make, current insurance cost etc.),
- driving behavior data
- alternative stated preference scenarios about the new insurance

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