Analysis on Pricing Model of UBI Auto Insurance in China from the Perspective of Big Data

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Abstract: The auto insurance pricing model of UBI in china is a pricing model which offers special terms of premium to those drivers who have safer driving behaviour by evaluating and analyzing the behaviour of drivers and usage data of vehicles. According to document analysis method and comparative analysis method, this research compares the present UBI auto insurance pricing model in China and other countries. As a result, this study finds that pricing the vehicles by internet brings a increasing of premium income and profits, well, a decreasing of loss. Meanwhile, it is advantageous to market economy as it promotes the development of a industry chain, including car parts and services. However, pricing the vehicles by internet still depends on the developed model abroad due to the lack of domestic professionals and IT core system. Hence, comparing with traditional insurance, there is a significant advantage and a prospective future of UBI auto insurance pricing model. However, this UBI model faces challenges which requires it to justifies its development model continuously, matching up the pricing of drivers and vehicles preferably. As a consequence, the UBI model shall be more refinement in China.

Keywords: UBI Vehicle Insurance, Pricing Model, Big Data

1. Introduction

UBI auto insurance is a quantifiable insurance based on the owner's driving behavior and related data of vehicle usage. The implementation of UBI auto insurance is of great benefit to insurance companies, individual auto insurance users and the whole society, and an innovative pricing model for auto insurance that achieves a win-win situation among three parties. First of all, for insurance companies, UBI auto insurance companies analyze owners' driving behaviors through data collection and implement differentiated pricing to make the premium more fair and reasonable. Insurance companies can also clearly understand the risk status of each customer through big data analysis, and then make pricing according to the specific risk situation, so as to better control the risk; Secondly, for individuals, since their driving behaviors are included into UBI auto insurance, drivers can reduce their personal claims and obtain more benefits by improving their awareness of safe driving, which is on account of that a high driving behavior score will bring higher premium discount, while a low driving behavior rating will cause a higher premium to cover the high risk. Finally, for the whole society, on the one hand, UBI car insurance is beneficial to improve the user driving behavior and make social return to a more safe driving environment. On the other hand, because the UBI car insurance determines the premium of car insurance according to driver's actual driving time, location, range, and specific driving behavior, car owners would reduce vehicle use frequency in order to obtain greater premium discount, which in turn can reduce the emissions of greenhouse gases, and alleviate the environmental pollution problem. (Table1).[Chen Jiajun; Deng Wen; Yuan Xiaoguang; Cui Mingyu7an; Meng Yuan, in 2019] A very important part of realizing UBI auto insurance pricing model involves the collection of big data. Without big data as a reference standard, it is difficult to realize UBI auto insurance pricing. Different pricing models generate different benefits, so it is particularly important to build UBI auto insurance pricing model based on the collection of big data. At present, there are four UBI auto insurance pricing models in the market, but each has its own advantages and disadvantages. It is of great practical significance to learn from foreign UBI auto insurance pricing models to improve China's UBI auto insurance pricing model.

2. Big Data Analysis of UBI Auto Insurance

2.1 Big data theory of UBI auto insurance

With the rapid development of Internet technology, big data technology and Internet of vehicles technology, big data technology has been introduced into UBI auto insurance and became an important tool for data collection and processing. The big data platform of UBI auto insurance collects the driver's behavior data, such as driving conditions, mileage, speed, the total times of "four sharp" (brakes, sharp turn, sharp speed up, and sharp slow down) relying on internet of vehicles big data technology, OBD (on-board diagnosis system), GPS and smart phone APP, stores data through the database of cloud platform, and records, analyzes and processes the data and data quality, and generates data report. When the database is used for data classification and storage, the HDF distributed file system can be used for data classification management, hierarchical management and distributed storage. Yarn and Spark technologies can be used for cluster management of the scattered data collected (Table2).[Han Jiakun, 2017], which is not only convenient for insurance companies to manage users' vehicle-related data and users' driving behaviors, but also convenient for customers to timely understand their own relevant information, so as to timely improve bad driving habits. In addition, the companies can process the data through establishment of reasonable and scientific data models (such as Poisson model, Logistic model) and algorithms, so as to estimate the risk coefficient of drivers' driving behavior, and evaluate drivers' driving behavior, and provide relevant basis for auto insurance pricing.

2.2 Application and importance of big data in UBI auto insurance pricing

Application of big data in UBI auto insurance pricing

Under the background of the rise of "Internet + Insurance", big data plays a pivotal role in the pricing of UBI auto insurance. The insurance companies collect vehicle usage data, driving behavior, driving environment and other related pricing factors through OBD terminal system, then the big date platform retains the required information according to the relevant influencing factors of UBI auto insurance pricing, and selects the information to build the model. The purpose of building model is to build a driver user portrait system. By big data technology, the insurance companies collect the driver's static factors such as gender, age, occupation and compensation, and the dynamic factors such as driver's driving behavior of over speed, sharp turn, and fatigue driving, so as to build the user portrait system2 of drivers (Table3). [Wen Wanxu 2019]. First, the big data platform analyzes the behavior factors affecting driving safety through user portrait system and Logistic model, and ranks the factors affecting driving safety from high to low according to the degree of influence. Secondly, based on the influence degree, using the subjective weighting and objective weighting method, the big data platform determines the weight of influence degree of indexes, and prepares the driving behavior scoring model table to evaluate the customer's driving behavior(Table4).[Zhu Shuang 2015]. The big data platform calculates risk data and conducts risk assessment according to the algorithm, so as to intuitively understand the level of safe driving risk of drivers. The driver's driving risk is an important basis source influencing the pricing of UBI auto insurance, that is, the lower the risk probability, the lower the insurance premium that the owner needs to pay. Similarly, insurance companies will offer more premium incentives to premium customers with high driving behavior scores and safety ratings.

Importance of big data in UBI auto insurance pricing

The big data technology promotes differentiated and precise pricing of UBI auto insurance. Traditional auto insurance pricing is "vehicle based", which calculates mainly relying on motorcycle type and driving mileage as the main data. Because of the developed mobile Internet technology and big data technology, UBI car insurance pricing mode changes from the traditional "vehicle based" to "vehicle + people based", making the differential pricing of UBI car insurance possible(Table5). [Jin Jianfei 2018]. At present, with the maturity of communication technology and built-in technology as well as the rapid development of Beidou satellite positioning system and GPS technology, real-time vehicle positioning and real-time uploading of vehicle driving information can be realized, and drivers' driving behaviors can be more accurately collected, contributing to more reasonable, scientific and accurate pricing of UBI auto insurance.

At present, some studies have shown the feasibility of using smart phones as data collection tools for UBI insurance.

Table 1. Advantages and disadvantages of smart phone data acquisition

advantage	inferiority
Cost advantage: the scheme uses the user's existing devices (smart phones) to replace the data acquisition devices installed in the vehicle, without equipment cost.	Moral hazard: when the driver turns off the app or smart phone during the high-risk driving journey, the scheme will generate moral hazard due to the failure to collect high-risk data.
High portability: smart phones can follow the driver to collect data when driving different vehicles, unlike the second-generation OBD device built in the car, the collected data may belong to different drivers rather than the insurer Data to be collected for specific vehicles and specific drivers.	Lack of vehicle information: smart phones can only obtain vehicle speed, formation distance and other data through global positioning, but can not directly obtain internal data such as vehicle diagnosis, so they can not provide maintenance or driving suggestions to users.
Value added services: after analyzing driver data, insurance companies can push value-added services to users through software on smart phones, including data formation, safe driving suggestions, community interaction, etc.	Battery life: the use of smart phones to collect vehicle data will increase the use frequency of smart phones, reduce the service life of the collected batteries, and increase the discount for users.
Vehicle compatibility: smart phones can collect any vehicle information, and the scheme will not be unable to be implemented due to compatibility problems.	User identification: the insurer defaults that the mobile phone user is the driver, which can not effectively identify the driver.

3. Pricing Model of UBI Auto Insurance

3.1 Pricing model of UBI auto insurance in China

UBI (Usage - based Insurance) means that insurance companies collect driving data such as mileage, speed, engine speed and driving route of insured vehicles through Internet of vehicles technology, conduct model verification on owners' driving behavior, and develop Internet of Vehicles insurance products on this basis(Table6). [Jin Jianfei 2018].

The insurance pricing models used by car Insurance companies are mainly divided into: pricing by models, pricing by insured amount and pricing by usage. In China, the model of pricing by insurance amount is used, that is, determining the premium according to the purchase price of a new car, auto age and seating capacity(Table7).[Han Jiaqun 2017]. Taking the insurance companies engaged in UBI business in China as an example (see Table 1), the factors determining the premium rate of the motor vehicle loss insurance of the PICC P&C are the driving area, the purpose of the vehicle, the auto age and the vehicle size., which takes the risk factors related to the vehicle as the pricing factor, but lacks the risk factors related to the driver, such as the driver's driving habits, etc., fail to realize the differentiation of drivers' premiums with different driving risks. The current UBI rules of Car Boy is that the owner who has drove less than 5000 km in a year, and has enrolled in the Safe Driving Incentive program of Car Boy, can get up to 55% of the premium incentive, in the case of safe driving with out risk occurred; there are also corresponding safe driving premium incentives corresponding to other driving ranges in Car Boy; and the owner who has unexpired insurance can also enjoy daily safe driving incentives of Car Boy only by driving safely every day, which can be fully deducted from the auto insurance premium when accumulated. The UBI representative product of GuangLianSaixuan is DidiHu, in which the premium is calculated on a daily basis, and car owners can also get cash subsidies through good driving habits. The Tencent Lubao is able to collect driving behavior data of owners but does not involve insurance marketing and claim settlement(Table8).[Tang Jiangfeng 2016].

3.2 Pricing model of UBI auto insurance in the United State

Before the real UBI came into being, foreign insurance companies found the mode of paying by mileage payd (pay as you drive). Payd collects data through GPS and other on-board equipment, then transmits data through GSM network, and finally charges premium according to the mileage recorded by GPS combined with the value of vehicle odometer. The smaller the mileage, the more discount the insurance company gives. It is an innovation of differential pricing that foreign insurance companies bring into the pricing of vehicle insurance rate, but the mileage is not an important factor for the emergence of vehicles. At the stage of big data base imperfection of payd knowledge Internet of vehicles, the innovation of insurance companies in the aspect of vehicle insurance payment is not the real UBI.

Table 2. Influencing factors of UBI auto insurance in China

Name of company	AnBang Property & Casualty Insurance Co., Ltd.
	Shenzhen Yuanzheng Technology Co., Ltd.
	Jiangsu Nanyi Dina Digital Technology Co., Ltd.
	NICIGO
	Nanjing Renrenbao Network Technology Co ., Ltd.
	Shenzhen Guangliansaixun Co.,Ltd.
	Ruisike (Shanghai) Network Technology Co., Ltd.
	Tencent Lobao
	PICC P&C
	Beijing Carsmart Technology Co., Ltd.
UBI influence factor	The APP automatically scores the driver's driving behavior and calculates the reasonable premium according to the analysis of driving behaviors recorded by Chexingbao and the UBI actuarial model
	With boxes connected to the Internet of vehicles, you can upload your mileage data, your driving behavior, and your malfunctioning data to the cloud platform for analysis.
	Customer attribute,policy attribute,target attribute,driving behavior,claim behavior.
	It includes data on the driver's behavior during driving, such as continuous driving time, brake frequency, so as to conduct corresponding auto insurance pricing according to the actual risk.
	The auto insurance premium is calculated by mileage at most one cent per kilometer. How much you drive, how much you pay, and the less you drive, the more you save. The emergency steering, emergency acceleration, emergency braking, driving range, driving duration, and other data are analyzed through the driving behavior evaluation system.
	Vehicle information and driver's habits.
	Provide driving records, driving scores, low-cost car insurance, online insurance, illegal inquiries, driving evaluation mall and other integrated online car insurance services.
	Lubao scores them based on the mileage they drove, frequency of brakes, fuel consumption, speeding and violations.
	The auto insurance products include three main motor vehicle loss insurances, namely the family insurance that are calculated according to customer types and vehicle usage, business insurance and non-business insurance
	Precise data such as driving speed, time of use and driving behavior can be obtained. In addition, the Lecheng Box also supports real-time diagnosis of running and stopping state, remote diagnosis and troubleshooting of vehicles.
Same	Factors considered in UBI pricing factor are basically divided into two aspects, one is the basic situation of the vehicle itself, the other is the driver's behavior.

Different	The influencing factors of each company's pricing are different. Some companies charge according to the mileage. The more they drive, the more money they save. Some charge after scoring the driver's behavior in all aspects. The higher the score, the lower the charge.

Table 3. Data search methods of enterprises in different countries

enterprise	country	Data collection methods	Data transmission method
Pregressive Auto Insurance	U.S.A	GPS	GSM network
Norwich Union	britain	GPS	GSM network
Aioi	Japan	On board equipment	radio station &GSM
Toyota	Japan	On board equipment	radio station& Wireless media
Holland Insurance	South Africa	GPS	GSM network
Polis Direct	Netherlands	Annual odometer readings	Manual meter reading
iPAID	Canada	On board equipment	USB Bluetnooth GPS
MAPERE	Spain	GPS	GSM network
STOK	Australia	GPS	GSM network

At present, the Internet of vehicles products overseas are mainly used for the calculation of discount rate, without rise of premium in general. The pricing of Internet of vehicles in foreign countries can be divided into two categories, namely the mile-based pricing, such as Metromile in the United States, and the discount calculated based on the original, such as Progressive in America.

The auto insurance provided by Metromile in America consists of two parts: base cost and mileage variable cost. The calculation formula is: total monthly premium = monthly base premium × monthly mileage × unit mileage premium. In which, the basic premium and unit mileage premium varies according to different conditions of owners (such as age, car type, driving history, etc.). The basic premium is generally between USD 15 and 40, and the part charged by mileage is generally USD 2-6 cents per mile. Metromile also has set a premium upper limit, requiring no additional premium for the day's mileage exceeding 150 miles (250 miles in the Washington area).

The owners can calculate miles per trip by installing an Metromile Puls, an OBD device provided free of charge by Metromile, combined with mobile APP, which can also provide more intelligent services for auto owners, such as optimal navigation route, fuel consumption check, car health test, automobile positioning and other services, and summarize relevant data of auto owners through SMS or email every month to realize the digitization of mileage calculation.

StateFarm company uses the model of cooperation with Internet of vehicles manufacturers. Its Internet of vehicles insurance attracts customers to take out insurance by reducing premiums for the first-time insurance slip, and retains customers by adjusting the discount in the later period. In terms of data acquisition, StateFarms obtains the driving behavior data through an on-board diagnostic system by cooperation with the provider of Internet of vehicles devices. The customer can enjoy a premium discount of 5% for the first time. In the later period, the insurance company regularly collects and analyzes the collected data, re-evaluates the risk exposure level of the driver, and then adjusts the premium, which reaches a 50% premium discount in maximum. StateFarm company also offers a free device that connects to the Internet of vehicles in the first year of insurance. According to the company's annual report, the company's loss ratio has declined by 5% and is still falling after its UBI auto insurance program has been launched. The reason is that it is beneficial to insurance risk control through the differential pricing according to the driving behavior of insurant.

At the same time, there are serious cost problems in UBI auto insurance in America, such as the cost of Internet of vehicles devices, data value-added and maintenance services. In order to reduce costs, the Internet of vehicles devices in America mostly are in renting mode and recycling mode, the devices installed for auto owners will be recycled to the next customer after 6 months, so as to reduce costs.

4. Future Direction of UBI Auto Insurance Pricing Model in China

Table 4. Factors involved in UBI auto insurance pricing

Aspects involved	Factors involved
Vehicle trajectory	Vehicle history, mileage, ignition times, etc
Vehicle fuel consumption	Vehicle fuel consumption, 100 km fuel consumption, etc
driving behavior	Rapid acceleration, rapid deceleration, sharp turning, long idle speed
Owner behavior	Overload, red light running and other violations
Driving environment	Whether the surrounding environment is bad and whether the environment will increase the loss of the car

The pricing of UBI auto insurance will be affected by many factors, which is also a difficult problem leading to the development of UBI auto insurance.UBI auto insurances have been relatively developed in many developed countries worldwide, but for China's auto insurance industry, the pricing model of UBI auto insurance is still a new thing that faces many problems, such as: the big data analysis system has not been improved, the relevant technical level is not yet developed and a series of problems need to be solved urgently. On the basis of drawing lessons from foreign developed countries' development models, the pricing model in China is also in continuous development and improvement:

4.1 From the "vehicle based" pricing to the "vehicle + people + region based" pricing

At present, the auto insurance pricing model in China has changed from "vehicle based" pricing to the "vehicle + people based" pricing, which emphasizes collecting drivers' driving habits and vehicle condition data to determine the premium. Drivers with good driving habits have less premium to pay, which arouses drivers' enthusiasm to some extent 9. UBI auto insurance pricing model will trend towards the "vehicle + people + region based " pricing in the future, emphasizing not only the collection of driver's driving behavior data, but also the collection of road information of vehicle traffic section and the overall terrain data such as the sharp turn number, the road wear to the tires of vehicle region area for data analysis and premium determination, which is conducive to better implement of differential and accurate auto insurance pricing.

4.2 Contact closely with government departments

The pricing of UBI auto insurance involves different government departments. In addition to relevant policies to be released by regulatory departments, the cooperation with insurance companies are also required so that data collection can be supported by related departments on the terminals and to the later stage. An independent third-party data platform should also be established with the support of relevant departments, so as to collect and integrate the data such as driving distance, time and vehicle acceleration. In this way, independent data collection by the third-party platform will not only help to protect the privacy of customers but also reduce the operating costs of small and medium-sized enterprises.

4.3 Promote the industry to develop in the direction of technical service type

At present China's vehicle-mounted information system is still not fully able to apply to vehicles, also relies on relatively developed foreign models for localization operation, lack of actuarial talent who can establish precise and objective customer data model and claim settlement talents who can provide customers with more accurate service. However, after a few years of UBI research in China, the terminal carriers is changed from vehicle-mounted box to the phone. Meanwhile, China's 5G era is coming, which plays a significant role in realizing the real-time transmission of vehicle information, and makes it possible to further develop differentiated UBI products. The insurance industry is also gradually

integrating with the Internet of vehicles technology to become a technology service type industry.

4.4 Uniform industry standards

There is no unified standard of driving in UBI industry at present, so establishing a unified industry norms and standards can ensure the better use of UBI auto insurance pricing model in practice. Identify good driving behavior can reduce the driving behaviors that are insured, and the standard of dangerous driving behavior and other issues will be completed in the development in the future.

5. Conclusion

UBI auto insurance plays a huge role for individuals, insurance companies, auto insurance users and the whole society, and can also create a better driving environment for the society. The pricing model of UBI auto insurance is also of great practical significance. For example, the pricing model of UBI auto insurance launched by American companies can improve the ability of insurance companies to manage and control risks through differential pricing of insured driving behaviors, so as to reduce the cost of insurance companies. In terms of other countries, such as Ingenie of Britain, has a pricing model of UBI auto insurance for young drivers, which could help them save on premiums. At present, with the development of communication technology and vehicle-mounted technology, as well as the rapid development of Beidou satellite positioning system and GPS technology, real-time vehicle positioning, real-time uploading of vehicle driving information, and acquisition of driver driving behavior are more accurate. Big data plays a more important role in UBI auto insurance pricing. Although it has been more developed than auto insurance pricing model in different countries, but there are still many problems in China, such as unclear role division, and imperfect large data analysis system, which should be adjusted and improved in all aspects, to complete the UBI auto insurance pricing model in China.

Acknowledgments

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