



The Necessity and Feasibility of Usage-Based Insurance for New Energy Vehicles in China

Wang Jun ^{a*} and Ye Zhixian ^a

^a School of Accounting and Finance, Xiamen University Tan Kah Kee College, China.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: With the continuous development and growth of China's new energy automobile market, new automobile owners desire exclusive auto insurance. However, most insurance companies use traditional automobile commercial auto insurance to cover them. Under this pricing model, there is little overall difference in premiums, regardless of whether the driver's driving behavior is good or not. This paper wants to implement usage-based insurance (UBI) in China because it can add more auxiliary pricing factors, adjust according to the driver's driving behavior changes, and make auto insurance pricing more scientific and fair.

Study Design: This paper employs the literature review and market research methods to analyze the current product supply and consumer demand in the Chinese auto insurance market. Firstly, introduce the current situation of the development of the new energy automobile insurance market in China and its problems. Then, discuss the necessity and feasibility of developing UBI auto insurance for new energy vehicles in China. Finally, based on the reality of China's new energy vehicle UBI auto insurance gives some programs.

Conclusion: This paper finds that from the perspective of insurance companies, consumers, and the social level, UBI auto insurance for new energy automobiles is necessary, and it is also the

*Corresponding author: E-mail: wj19930316@126.com;

direction of future auto insurance reform and development. Subsequently, combined with China's current relevant policies and technologies, it is concluded that the development of UBI auto insurance for new energy vehicles in China is feasible.

Keywords: New energy vehicles; UBI auto insurance; necessity and feasibility; program design.

1. INTRODUCTION

As early as 2015, the China Insurance Regulatory Commission (CIRC) proposed the exploration of UBI (usage-based insurance) in the corresponding documents, but due to technical reasons, the real UBI auto insurance has not yet been fully promoted. In December 2021, the China Insurance Association issued the "New Energy Vehicle Commercial Insurance Exclusive Provisions (Trial)", which for the first time clarifies the elements that new energy automobile insurance should have, the content of the compensation, etc. Combined with the current exploration of UBI auto insurance in the insurance industry, this paper will discuss the necessity and feasibility of UBI auto insurance for new energy vehicles in China and put forward the idea of the implementation program of UBI auto insurance for new energy vehicles in combination with the current insurance operation mode.

2. BACKGROUND OF THE STUDY

2.1 Growing Market for New Energy Vehicles

Data show that as of 2021, China's new energy vehicle sales to grow from 18,000 units in 2013 to 3,521,000 units in 2021. 3,545,000 units of new energy vehicle production in China in 2021, accounting for about 13.4% of China's total automobile market, higher than in 2020 by 8 percentage points. In the future, China's new energy vehicle market has a large market development potential, China Association of Automobile Manufacturers (CAAM) predicts that by 2025 China's domestic automobile production and sales will reach 30 million, and new energy vehicles are expected to achieve a market share of 20%-30%. Therefore, in the future, new energy automobile-related industries will usher in development opportunities, including new energy automobile insurance products.

2.2 UBI Auto Insurance in the International Insurance Market

UBI is an auto insurance policy that provides personalized premium rate settings based on the

status of the driving behavior of the motor vehicle driver. In UBI auto insurance pricing, the data related to driving behavior is obtained and identified through an automated on-board diagnostic (OBD) system installed on the motor vehicle [1]. Through the OBD equipment, the insurance company can view the corresponding data information of the automobile when the automobile accident occurs when the automobile insurance claim is made, have a deeper understanding of the damage to the automobile, and read and analyze the data information of the automobile such as mileage, fuel consumption, engine speed, and breakdowns, etc., and also form the information on the condition of the automobile and the driver's behavior, which will help to determine the next automobile insurance premium rate better. The data can also be read and analyzed to form vehicle condition information and driver behavior information, which can be used to better determine the next auto insurance rate.

The UBI market in the U.S. and some European countries is relatively mature and leads the world in innovation and development. The U.S. is the first country in the world to implement UBI auto insurance, and after three generations of product forms, it has entered a relatively mature period and has now become the world's largest UBI auto insurance market. First, PAYD (Pay-as-you-drive), which means billing based on driving mileage. The second is PHYD (Pay-how-you-drive), in which premiums are formed based on driving mileage, driving style, and road conditions. The third is MHYD (Manage-how-you-drive), which means pricing based on driving behavior [2].

PTOLEMUS's public report shows that there were about 17.4 million in-force UBI auto insurance policies worldwide in 2017, with a growth rate as high as 26%, while domestic and international industry insiders and scholars believe that UBI auto insurance will be the direction of the future development of the auto insurance industry.

2.3 Policies Related to China's auto Insurance Market

The September 2020 Guidance on the Implementation of Comprehensive Reform of Auto Insurance and the Actuarial Provisions for Model Commercial Auto Insurance issued by the China Banking and Insurance Regulatory Commission (CBIRC) unveiled a new round of comprehensive auto insurance reform. This round of reform highlights several features: first, auto insurance pricing will move from regulatory pricing and market pricing to cost pricing; second, the cost structure of auto insurance will be reshaped; and third, auto insurance services will be more user-friendly. All these features fit well with UBI auto insurance and provide policy support for the development of UBI auto insurance in China.

3. LITERATURE REVIEW AND RESEARCH

3.1 Current Status of Domestic and International Research

The concept of UBI auto insurance first originated in 1999, when Progressive Insurance Company in the United States proposed to consider drivers' driving behavior and risk characteristics in car insurance billing. UBI auto insurance uses a personalized per-person pricing model.

Butler (1989) argues that the use of mileage alone as a pricing factor for auto insurance premium determination ignores the role of driver behavior in traffic accidents and is not a relatively fair pricing model for auto insurance. He believes that the driver's driving behavior should be added to the mileage of the car as an important factor in premium setting. This is the early prototype of the UBI auto insurance premium setting model [3]. Litman (1997) proposed the PAYD (Pay-as-you-drive) auto insurance premium setting model

[4]. It was not until 2010 that Boquete L (2010) refined the PAYD auto insurance premium setting model by implementing monitoring of vehicle usage through the use of appropriate equipment as a means of assessing the risk of the vehicle and determining the cost of the insurance policy [5]. Carfora M F et al. (2019) pointed out that the PHYD auto insurance premium setting model has more advantages than the other premium setting models, arguing that the use of machine learning and cluster analysis to assess driver behavioral risk is feasible [6].

Domestic scholars' research on UBI auto insurance started late. Qiao Mu (2014) believes that the development of UBI auto insurance products in developed countries such as the United Kingdom, the United States, and Germany is relatively mature, while Asian countries such as China, Japan, Korea, and developing countries still do not have UBI auto insurance products in the real sense. Still, he is optimistic about the future development prospects of UBI auto insurance [7]. At present, domestic scholars generally believe that UBI auto insurance has a broad development prospect in China, and also pointed out that China already has the basic conditions for the implementation of UBI auto insurance, and believes that UBI auto insurance will realize jumping growth in the next few years. According to Chang Xin (2023), this "one rate for one car" mode of determining insurance premium further realizes the "principle of equilibrium" in insurance law [8].

3.2 Research Content and Innovations

To summarize, the research ideas of this paper are as follows: first, introduce the current situation of the development of the new energy automobile insurance market in China and its problems. Then, discuss the necessity and

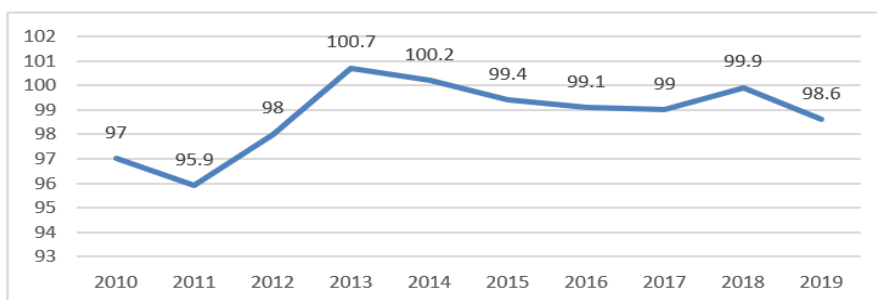


Fig. 1. Comprehensive cost ratio of China's auto insurance industry, 2010-2019

Source: China banking regulatory commission, guotai junan securities research

feasibility of developing UBI auto insurance for new energy vehicles in China. Finally, based on the reality of China's new energy vehicle UBI auto insurance gives some programs.

The possible innovation of this paper is to analyze the necessity and feasibility of the implementation of UBI auto insurance in China's new energy automobile industry by combining the current research results of the academia and the industry practice and to propose the implementation plan of UBI auto insurance for new energy automobiles based on the reality, to help the development of new energy automobile insurance market.

4. THE CURRENT SITUATION AND PROBLEMS IN THE DEVELOPMENT OF CHINA'S NEW ENERGY AUTOMOBILE INSURANCE MARKET

4.1 Current Status of China's New Energy Automobile Insurance Market Development

4.1.1 High Combined Auto Insurance Rates

Since 1980, China has experienced many rounds of insurance reforms, and the new round of comprehensive reform of auto insurance with the goal of "lowering price, increasing insurance, and improving quality" has begun to bear fruit [9]. As shown in Fig. 1, since 2010, the comprehensive cost rate of China's auto insurance industry has been higher than 95%, and even exceeded 100 %in individual years, which is near the

break-even point. The comprehensive rate of auto insurance has remained high.

4.1.2 Relatively few insurance products for new energy vehicles

A horizontal comparison of the products of China's top-ranked auto insurance companies reveals that the homogenization of products is very serious and there are relatively few new energy automobile insurance products. As of February 1, 2022, only PICC Auto Insurance, Pacific Auto Insurance, and Ping An Auto Insurance, the traditional three largest auto insurance companies in China, have commercial insurance for new energy vehicles on their official websites. As shown in Table 1, among the commercial auto insurance policies of PICC Auto Insurance on its official website, the number of new energy automobile insurance policies is also less than that of traditional automobiles.

4.1.3 The claims process is time-consuming

PICC car insurance, for example, its claims process is divided into four steps: first, call the hotline; second, after the report by the surveyor of the accident scene and vehicle survey and damage determination, and to the owner of the accident to confirm the content of the claim, the scope of the amount of repair and repair, etc., to guide the owner to fill out the relevant claim information; third, the owner of the car according to the surveyor issued by the claim instructions to submit the appropriate materials; fourth, to receive the compensation. Generally speaking, the claims process takes relatively long.

Table 1. PICC Auto Insurance Commercial Auto Insurance Products

Form	New Energy Vehicle Insurance Products	Traditional Auto Car Insurance Products
	New Energy Vehicle Damage Insurance	motor vehicle damage insurance
	Third-party liability insurance	Third-party liability insurance
	Vehicle Occupants Liability Insurance - Driver	Vehicle Occupants Liability Insurance - Driver
	Vehicle Occupants Liability Insurance - Passengers	Vehicle Occupants Liability Insurance - Passengers
	External Grid Failure Loss Insurance	Scratch Damage Insurance
	New Energy Vehicle Value-added Service Terms and Conditions	Loss of wheels alone
		Repair Period Expense Reimbursement Insurance
		Motor Vehicle Value-Added Services Waiver

Source: PICC Car Insurance website

4.2 Major Problems in China's New Energy Vehicle Insurance Market

4.2.1 Lack of exclusive insurance for new energy vehicles for a long time

In the early days, because of the relatively low market share of new energy vehicles, most insurance companies used traditional automobile commercial auto insurance to cover them. With the continuous development and growth of China's new energy automobile market, new energy automobile owners desire exclusive auto insurance. It was not until December 14, 2021, when the Insurance Association of China released the "Exclusive Terms of Commercial Insurance for New Energy Vehicles (Trial Implementation)" that new energy vehicles ushered in their exclusive insurance.

In addition, as the technology related to new energy vehicles is still in a stage of rapid development, safety hazards, and other uncertainties have led to some insurance companies being reluctant to underwrite the policy

4.2.2 High premiums and low payouts for new energy vehicle insurance

Since the launch of the new energy vehicles, our government has provided certain concessions and subsidies to encourage the public to purchase new energy vehicles, resulting in inconsistency between the ex-factory price of the new energy vehicles and the actual purchase price after the subsidy. Some of the premiums for new energy vehicles on the market are set according to the factory price of the vehicle rather than the actual purchase price. However, when a new energy vehicle is insured, the insurance company calculates the compensation amount according to the actual purchase price after subsidy. As a result, the premiums for new energy automobile insurance are high while the payouts are low, which is detrimental to the rights and interests of consumers.

4.2.3 Disadvantages of having traditional commercial auto insurance

Over the past few years, a significant portion of new energy auto insurance has suffered from the same drawbacks as traditional auto insurance.

First, the competition in auto insurance is homogenized. The contents of auto insurance

among different insurance companies are similar, and most of them still take price as their core competitiveness rather than insurance service and insurance claims [10]. Second, the auto insurance premium pricing model is relatively single. Most of the vehicle premiums in China are based on the number of accidents, which does not reveal the driving risk in various aspects. Third, there is more fraudulent insurance behavior. At present, the main body of fraudulent insurance behavior is also more diversified, not only the moral hazard of insurance company employees but also car owners and other insurance object fraud objective factors.

5. THE NECESSITY AND FEASIBILITY OF UBI AUTO INSURANCE FOR NEW ENERGY VEHICLES

5.1 The Need for UBI Auto Insurance for New Energy Vehicles

5.1.1 Insurance company perspective

The traditional auto insurance rate setting mainly adopts the model of pricing from the vehicle, i.e., from the motor vehicle and driver risk factors to form the pricing, which is manifested in the formation of the main part of the base rate through the motor vehicle's brand, model, age, and price, etc., and the residual part of the base rate through the driver's gender, age, age, and occupation, etc., and then according to the number of times of the vehicle's insured to form a coefficient to determine the final premium [11]. Under this pricing model, there is little overall difference in premiums, regardless of whether the driver's driving behavior is good or not. But doesn't driving behavior have an impact on vehicle insurance? The answer is obvious, UBI auto insurance adds more auxiliary pricing factors, adjusts according to the driver's driving behavior changes, changes the risk pricing model, and makes car insurance pricing more scientific and fair.

Drivers who have had too many accidents this year, resulting in high premiums the following year, usually take advantage of the fact that insurance companies don't share information and switch to another insurance company. If a new energy vehicle adopts UBI auto insurance, regardless of whether the driver changes insurance companies, the OBD and other equipment on the vehicle can still objectively reflect the driver's past driving behavior and then

calculate a premium that matches his or her risk, thus reducing the insurance company's adverse selection.

5.1.2 Consumer perspective

In the traditional auto insurance pricing model, policyholders who drive the same car and are of the same gender, age, and occupation may need to pay the same premium, while UBI auto insurance combines the smart sensors of new energy vehicles, IoT technology, and big data technology to assess the risk factor of different drivers by analyzing their driving data and charging higher premiums for higher accident risks and lower premiums for lower risks. The premium is more reasonable, fairer, and more personalized for owners of vehicles with higher accident risks and those with lower accident risks.

In addition, since the level of premiums is closely related to driving habits, it will also encourage drivers to improve their driving habits and reduce the incidence of traffic accidents. According to CAAM, China's domestic production and sales of new-energy vehicles will reach 6-9 million by 2025, and by then, UBI auto insurance will realize a win-win situation for the above vehicle owners in terms of life safety and economic benefits.

5.1.3 The public social perspective

If insurance companies adopt the UBI auto insurance pricing model for new energy vehicle insurance, they can better identify drivers' risk factors and be more fair in premium pricing, which can enhance the overall welfare of society. In addition, UBI auto insurance can, to a certain extent, urge drivers to develop good driving behavior, reduce traffic accidents, and create a safer public transportation environment [12].

5.2 Feasibility of UBI Auto Insurance for New Energy Vehicles

5.2.1 Policy aspects

China's auto insurance business has been developed for decades, from the early government unified pricing to the subsequent rounds of commercial auto insurance rate market reform, the insurance company now has more independent pricing power.²⁰²⁰ In September 2020, the China Banking and Insurance Regulatory Commission (CBIRC) issued the Guiding Opinions on the Implementation of

Comprehensive Reform of Automobile Insurance and Actuarial Provisions for Demonstration Commercial Automobile Insurance, which formally unveiled the prelude to a new round of comprehensive reform of auto insurance. Against the backdrop of the commercial auto insurance reform, new energy vehicles have also finally welcomed their exclusive insurance.²⁰²¹ On December 14, 2021, the China Insurance Association issued the Exclusive Provisions for Commercial Insurance of New Energy Vehicles (for Trial Implementation), which provides a more suitable scope of coverage and insurance liabilities for new energy vehicles.²⁰²² The per-person pricing model highlighted in the UBI auto insurance policy not only complies with the requirements of the comprehensive reform of auto insurance but also applies to new energy vehicles in a better way. It can be seen that it is feasible in terms of policy. The UBI auto insurance model is not only in line with the requirements of comprehensive auto insurance reform but also can be better applied to new energy vehicles.

5.2.2 Technical aspects

Unlike traditional auto commercial insurance, UBI auto insurance introduces a quantitative evaluation of driving behavior when setting rates. To achieve this, it is necessary to improve the accuracy of data collection and the efficiency of data transmission and analysis. In terms of driving data collection, a mature foreign practice is to connect an external OBD device to obtain driving behavior-related data. China's ZTE is one of the world's leading OBD device manufacturers. In addition, new energy vehicle manufacturers also provide other possibilities to acquire driving behavior data, for example, large new energy vehicle companies, mainly Tesla, can read the driver's driving behavior data through the recognition of the background data of the vehicle system [13]. In terms of transmitting and analyzing driving behavior data, China's mature 5G network system and Telematics construction can provide the necessary support and guarantee for data transmission and analysis.

6. CHINA'S NEW ENERGY VEHICLE UBI AUTO INSURANCE PROGRAM SCENARIO

6.1 Pricing Models

New energy vehicle UBI auto insurance pricing can refer to three areas: the risk of the vehicle,

the risk of the driver, and the risk of driving behavior. The first two are risk factors currently considered in traditional car insurance. UBI auto insurance for new energy vehicles introduces the risk factors of driving behavior (e.g., frequency of speeding in urban areas, fatigue driving conditions, harsh braking, sharp acceleration, sharp turns, etc.) on this basis [14]. Based on the above three aspects, we construct a vehicle accident risk assessment model to give a suitable UBI auto insurance quote for new energy vehicles.

6.2 Purchase Channels

A sales model combining offline and online is adopted. Offline is dominated by 4S stores and insurance companies and their agents and dealers, while online can be insured through the official website of insurance companies and the relevant platforms of their agents. Of course, in the future, if China issues insurance business licenses to automakers, then perhaps in the future, like Tesla, the car itself comes with UBI auto insurance.

6.3 Claims Process

Based on manual claims settlement after an accident, it gradually transitions to online reporting, surveying damage determination, and submission of materials. The insured's relevant information and driving behavior are stored on the platform and can be called up by one key when the insurance claim is made, and the claim efficiency can be greatly improved by intelligent claim settlement.

7. CONCLUSION

By studying China's new energy automobile insurance market, this paper finds that from the perspective of insurance companies, consumers, and the social level, UBI auto insurance for new energy automobiles is necessary, and it is also the direction of future auto insurance reform and development. Subsequently, combined with China's current relevant policies and technologies, it is concluded that the development of UBI auto insurance for new energy vehicles in China is feasible. Finally, it tries to conceptualize the implementation plan of UBI auto insurance for new energy vehicles in China, to contribute to the development of new energy auto insurance in China. If China can also issue corresponding insurance licenses to new energy vehicle enterprises in the future, then

China's new energy vehicle insurance market may be able to realize the integration of resources of the whole chain of vehicle enterprises, insurance companies, maintenance sites, etc., thus opening up a new era of auto insurance.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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