Identifying Blind Spots and Optimisation Pathways in Special Insurance Terms for New Energy Vehicles: A perspective Based on Risk Grading and Dynamic Pricing

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Abstract. Because of global warming, energy shortages, and other issues, new energy vehicles have become the top choice for more and more people when buying a car. As new energy vehicle technology keeps getting better and better, and people start to see the benefits of new energy vehicles, like lower fuel costs, more comfort, and more in-car tech, the public is starting to accept the fact that new energy vehicles are replacing traditional fuel vehicles. However, purchasing complementary insurance for new energy vehicles has become a very different problem. This paper analyses the issues of high premiums and pricing difficulties in new energy vehicle insurance through a review of multiple relevant articles. It identifies the causes of high premiums, high accident rates, and high claim ratios, primarily attributed to the high maintenance costs of new energy vehicles, the rise of the ride-hailing industry, increasing claim risks, and data barriers within the insurance industry. In response to this, this paper draws on the UBI dynamic pricing model in the United States and proposes risk classification, separation of vehicles and batteries, and government policy support in response to the shortcomings of China's current insurance system. This paper can provide some reference for the development of new energy insurance in China.

Keywords: New Energy Vehicle Insurance, Dynamic Pricing, Repair Costs, Separation of Vehicle and Battery.

1 Introduction

Since 2015, China has consistently ranked first in the world in terms of new energy vehicle sales. The market is huge and has shown explosive growth, with production reaching 794,000 vehicles in 2017, bringing new opportunities for new energy vehicle insurance [1]. By the end of 2022, China's new energy vehicle ownership exceeded half of the global total, with pure electric buses accounting for more than 95% of the market share, a position of monopoly [2]. However, although the new energy vehicle industry is booming, most existing traditional insurance products lack specificity and cannot meet market demand. Furthermore, because they fail to satisfy consumers, this has led to a decline in related insurance sales and a decrease in consumer trust [3]. Consumers

A. J. Moshayedi (ed.), *Proceedings of the 2025 International Conference on Hybrid Commerce, Human Capital, and Economic Dynamics (ICHCH 2025)*, Advances in Economics, Business and Management Research 374,
https://doi.org/10.2991/978-2-38476-585-0_84

believe that premiums are too high, while insurance companies believe that underwriting loss rates are too high, making it extremely difficult to insure and underwrite new energy vehicles.

The dual credit policy was officially implemented in 2018, greatly promoting the development of new energy vehicles. It aims to promote the energy transition of the automotive industry through credit accumulation, carry-over, or trading. The policy mainly stipulates the calculation of CAFC credits and NEV credits through algorithms. These credits are used to evaluate companies' development and use of new energy sources, thereby promoting cooperation between traditional companies and new energy companies [4]. Subsequently, the General Office of the State Council issued relevant policies, mainly concerning tax and financial exemptions, transportation support, and national research programs [5]. These policies enabled new energy vehicles to rapidly capture the market and provided enormous opportunities for motor insurance companies. At the end of 2021, relevant policies established special additional terms, forming a unique pricing system for new energy vehicles. These terms clearly define and expand the scope of insurance for new energy vehicles and also add special additional insurance [6]. However, due to the technical specificity of new energy vehicles and the limited availability of data collection, there are obvious problems with related insurance. To alleviate these issues, the Financial Regulatory Administration issued guidelines emphasising the need to reasonably reduce repair costs for new energy vehicles and guide the establishment of a high-payout risk mechanism, so that prices match risks and dynamic pricing is implemented [7]. On 25 January 2025, the ‘Good Car Insurance’ platform was officially launched. Its main function is to compel insurance companies to provide coverage and prohibit them from refusing to insure. Car owners can directly purchase insurance through this platform [8]. New energy vehicle insurance faces the ‘three highs’ issues of high accident rates, high claim ratios, and high premiums. New energy vehicles, due to their low fuel costs and superior performance, have higher usage rates. Combined with specific factors, this has driven up accident rates: in 2024, new energy commercial vehicles accounted for over 10% of the total, with high usage intensity; owners are primarily under 35 years old, accounting for over 14% of the total, with short driving experience and insufficient expertise; new features such as intelligent driving assistance have also caused some drivers to feel unaccustomed [8]. High accident rates indirectly drive-up claims ratios. Key factors include a high proportion of new vehicles, high repair costs, the difficulty of repairing power batteries, closed repair authorisation models adopted by companies, and high parts and labour costs. Special designs such as Tesla's monocoque body also increase claims costs. Data from 2024 shows that the industry insured 31.05 million new energy vehicles, with premiums of 140.9 billion yuan, but incurred a loss of 5.7 billion yuan. Among 2,795 vehicle models, 137 had a claims ratio exceeding 100% [7]. High premiums stem from short-term accumulation of driving data and policy terms leading to pricing miscalculations, compounded by high accident rates and repair costs. Based on this, the main focus of this paper is to study the potential shortcomings of new energy insurance in China's current environment and explore areas for improvement. Currently, China's new energy development is booming, but there is still considerable controversy surrounding the blind

spots of new energy insurance and the formulation of plans and pricing schemes. This article can provide some references on pricing methods and ways to optimise insurance.

2 Differences between Special Terms for New Energy Vehicle Insurance and Traditional Vehicle Insurance

New energy vehicles differ structurally from traditional vehicles, and traditional vehicle insurance cannot meet their needs. Core technologies such as motors, batteries, and charging facilities are more complex and costly than those of traditional vehicles. Furthermore, due to insufficient insurance data, the risks associated with battery ageing are uncertain, and national policies are constantly changing, making insurance pricing more difficult [9]. However, compared to traditional insurance, new energy vehicle insurance has roughly the same types of coverage, but includes specific clauses. Traditional fuel vehicle insurance policies include 14 types of coverage, while new energy vehicle insurance policies include 16 types. The basic coverage is largely the same, but new energy vehicle insurance retains 9 of the additional coverage options from traditional vehicle insurance, removes one, and adds three new additional coverage options: network failure loss insurance, self-use charging station loss insurance, and self-use charging station liability insurance, thereby reducing the risk of losses for new energy vehicles [6]. According to the relevant provisions issued by the China Insurance Association in December 2021, these provisions have established comprehensive coverage for the 'three-electric' system (i.e., 'battery and energy storage system, motor and drive system, and other control systems'), as well as the body of new energy vehicles and their associated charging stations. They explicitly include accidents caused by 'fire and combustion,' and have added the "charging" process to the definition of usage, as well as defined technical terms such as 'battery degradation' and delineated the scope of responsibility [10]. Battery degradation" and other technical terms and scope of liability during the use of new energy vehicles [10].

3 Deep Blind Spot Empirical Evidence

3.1 Hybrid Technology

There is a type of plug-in hybrid vehicle among new energy vehicles that combine two major systems: an internal combustion engine and an electric system. Compared to conventional pure electric vehicles and fuel cell vehicles, plug-in hybrid vehicles are characterised by complex structures, high maintenance costs, and difficult repairs. Additionally, plug-in hybrid vehicles typically have large battery packs and high-voltage electrical systems. In the event of an accident-causing battery damage, there is a significant safety risk [11]. Therefore, the adoption of dual technologies poses greater obstacles to determining insurance rates. Insurance companies need to collect more data, drawing on traditional insurance methods while also developing targeted insurance products based on the unique characteristics of new energy vehicles.

3.2 Ride-Hailing Scenario

Ride-hailing services are widely popular in China, but due to insufficient regulatory oversight and low entry barriers for drivers, there are significant safety risks in this industry. Additionally, China has a high proportion of operational vehicles, leading to increased usage time, higher accident rates, and elevated insurance premiums. According to statistics from the National Big Data Alliance for New Energy Vehicles, the average mileage of new energy vehicles is approximately twice that of traditional vehicles [9]. Furthermore, some ride-hailing vehicles operate on a non-commercial basis. The insurance premiums and compensation costs for commercial and non-commercial new energy vehicles differ, indirectly affecting the determination of insurance premiums [11].

4 Analysis of the Reasonableness of High Premiums: Quantitative Attribution of Repair Costs, Claims Ratios, and Data Barriers

Whether the high insurance premiums for new energy vehicles are unreasonable is open to debate. According to data from China Insurance Information Technology Co., Ltd., insurance costs for traditional petrol vehicles are on average 21% higher than those for new energy vehicles. In terms of average insurance premiums per vehicle, new energy vehicles are approximately 2,000 yuan higher than other types of vehicles [9]. The high cost of insurance for new energy vehicles can be attributed to three factors. First, the repair costs for new energy vehicles are excessively high, and repairs are more difficult compared to traditional vehicles. Key components of new energy vehicles, such as batteries and drive motors, account for more than half of the total vehicle cost. Due to their highly integrated design and the immaturity of component technology, in the event of a collision or natural disaster, repairs often require the replacement of entire components, thereby increasing the cost of minor accidents [12].

Furthermore, China will completely phase out subsidies for new energy vehicles after 2020. If a large number of batteries degrade or become damaged, this could lead to an increase rather than a decrease in battery prices [13]. In addition, due to rising prices for raw materials used in power batteries, shortages of lithium-ion batteries and chip-related components could indirectly lead to an increase in insurance premiums [2]. Additionally, in terms of standardisation for new energy vehicles, processes such as battery cycle life assessment and software risk management have not yet been established uniform standards, and the claims settlement process remains relatively complex and lacks standardisation [9]. Moreover, electronics, vehicle bodies, and engines remain key areas of patent focus, with technical barriers and insufficient component supply existing between different manufacturers [10]. The authorised repair model is adopted by most new energy vehicle companies and power battery companies, with relatively closed repair systems between different companies and third-party stores yet to develop, leading to relatively high overall repair costs [5]. Secondly, high claims ratios also lead to high premiums. Industry research data shows that the current claims ratio

for new energy vehicles in China is around 85%, and the ride-hailing sector is relatively ambiguous. Many vehicle owners ensure their vehicles as non-commercial vehicles, but in reality, use them for commercial purposes, with claims ratios as high as 170% for such vehicles [12]. In addition, BYD is the only new energy vehicle manufacturer in China that wholly owns a property and casualty insurance company. However, in 2024, BYD Property and Casualty Insurance's combined ratio reached 308.81%, and its combined claims ratio reached 233.92%, far exceeding the average level [11]. Third, there are data barriers in the new energy vehicle insurance industry. New energy vehicles and traditional vehicles differ greatly in terms of risk due to differences in technology and components used. Therefore, traditional vehicle data cannot be fully applied. Although a data foundation for new energy vehicle-specific insurance products has been developed in recent years, it has not yet reached a systematic standard [12]. At the same time, there are obstacles to the sharing of new energy vehicle insurance data. This is because the user driving data and claims data of new energy vehicles involve customer privacy, making it impossible for insurance companies to accumulate comprehensive data. In addition, due to industry competition, it is difficult to achieve complete sharing of customer data [12].

5 International Experience

Usage-Based Insurance (UBI) is a new dynamic pricing model used by car insurance companies to collect driver data and accurately reflect the risk level of drivers based on their driving behaviour and habits in order to assess premiums [14]. This pricing model differs from traditional insurance, which determines car insurance premiums based on past damage rates. It addresses the shortcomings of current pricing difficulties caused by insufficient data and the special nature of new energy vehicle technology. The model uses digital technology to develop personalised pricing for car insurance, providing another option for new energy vehicle insurance [15]. This technology is widely used in the US insurance industry, and its advantages are obvious. For drivers, owners of new energy vehicles can identify driving errors and improve their driving habits, thereby obtaining lower premiums than before (based on the traditional pricing model) [16]. This technology is widely used in the US insurance industry, and its advantages are obvious. For drivers, owners of new energy vehicles can identify driving errors and improve their driving habits, thereby obtaining lower premiums than before (based on the traditional pricing model) [16]. Currently, China has not fully implemented differentiated insurance rates, which limits the profitability of the UBI car insurance model. Furthermore, as there is no legal requirement to install in-vehicle devices in China, this creates obstacles to data sharing [14]. However, as China's vehicle-to-everything (V2X) technology continues to mature, the application of usage-based insurance (UBI) technology has gained significant attention. Leading V2X companies such as Beidou Star Navigation and Gaode are conducting research on high-precision map positioning, laying the groundwork for accurate location services required for UBI implementation [15]. Existing UBI products, such as the ‘LuBi’ UBI product launched by Dingran Technology's Li Xin, have a profound understanding of China's current motor insurance

landscape. Their pricing is based on data collected via the OBD (On-Board Diagnostic System) and analysed to provide precise pricing tailored to the insured's driving behaviour [15]. However, the UBI model still has some drawbacks and challenges, such as the potential misuse of user privacy data for other purposes, and the fact that users may be tempted to engage in dangerous driving in order to achieve a higher score due to the difficulty in defining scoring criteria [16]. Additionally, developing UBI is costly because insurance companies lack the necessary technology for new energy vehicles, which may attract investment and research from new energy vehicle development companies. This could place insurance companies at the bottom of the UBI supply chain, diluting profits [15], and may not align with the expectation of cost reduction. In reality, costs may not differ significantly from the original model.

6 Optimisation Path

6.1 Risk Classification System Design

New energy vehicles have unique technical characteristics, data barriers, non-standardised parts models, and supply monopolies, making it difficult to assess their risk rates. A risk grading system can effectively divide risk levels, insurance premium rates, and compensation amounts into clear categories, reducing conflicts caused by vague insurance pricing boundaries. To accurately identify risk levels, insurance companies can strengthen their data detection systems and establish data sharing platforms, utilising artificial intelligence and big data models to perform accurate pricing analyses on data. This will enable them to better address risk issues caused by differences and obtain more accurate decision support [17]. Simultaneously, to establish a three-dimensional pricing system, it is necessary to supplement data such as new energy vehicle models and policyholder information, as well as vehicle usage frequency and driver behaviour data, to conduct a three-dimensional risk assessment and grading [9].

6.2 Vehicle-Battery Separation Insurance Model

'Separation of vehicle and battery' is a separate insurance method for new energy vehicles. When purchasing a vehicle, owners do not need to pay for the battery price, but instead obtain battery usage rights through a leasing model. Battery ownership belongs to the vehicle manufacturer or a third-party operator. This model can effectively alleviate issues such as battery degradation and inability to upgrade and can reduce consumer vehicle purchase costs [5]. For example, NIO offers a battery leasing service where customers do not purchase battery when buying a car but lease it on a monthly basis and enjoy free charging and replacement services [3]. Additionally, since this situation may lead to ambiguity regarding the ownership of the vehicle body and battery, insurance companies may consider offering battery insurance as a separate add-on policy. This would help clarify liability, provide more flexible insurance options for both vehicle owners and insurance companies, and reduce issues such as pricing ambiguity caused by treating the two as a single entity [9].

6.3 Government Policy Support

Since the insurance industry involves a lot of sensitive user data, the government needs to establish effective market supervision mechanisms. Insurance regulatory authorities can formulate more detailed and targeted protection regulations based on laws such as the Cybersecurity Law to supervise the entire process of data information, control the scope of data use, prevent data leakage and abuse, and utilise blockchain technology to prevent data tampering or theft, thereby enhancing user trust in insurance companies [9]. Secondly, the government can provide fiscal policies in the early stages to reduce taxes, alleviate the operational pressure on insurance companies, enhance their operational enthusiasm, and provide subsidies to consumers to increase their demand for new energy insurance products [9]. Thirdly, the government should also encourage technological innovation, provide financial support for related insurance technologies, strengthen cooperation between different institutions, and build an open platform for free communication [18]. Finally, the government should prevent unfair competition, provide policy guidance to small and medium-sized insurance companies, adopt differentiated competition strategies, enable them to underwrite specific vehicle models in niche markets, and screen customer groups, thereby enabling targeted product development [12].

7 Conclusion

This paper conducts a comparative analysis of the shortcomings of China's current new energy vehicle insurance system and its differences from traditional insurance. It specifically summarises that the new energy vehicle insurance industry in China faces issues such as high premiums, high claim rates, and high payout ratios. These issues are primarily attributed to the high maintenance costs of new energy vehicles, the lack of standardised parts specifications, the high proportion of operational vehicles, limited data collection by companies, and the adoption of innovative technologies in new energy vehicles that drivers struggle to adapt to, leading to higher accident rates. To address these shortcomings, this paper mentions the widely adopted UBI dynamic pricing model within the industry, which can be applied to domestic insurance products and fully incorporates the characteristics of new energy vehicles. Additionally, the paper discusses risk grading models and vehicle-battery separation models, which can help resolve the challenges of pricing in the insurance industry. For future in-depth research, it is essential to focus on how to construct the specific structure and elements of risk grading models, while considering the applicability of UBI model theories based on domestic conditions.

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