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# A Study on the Application of InsurTech in Auto Insurance Risk Control

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**Abstract:**
With the development of new energy vehicles (NEVs) and intelligent connected vehicles (ICVs), traditional auto insurance faces a dilemma where “vehicle owners pay too much, and insurers lose money.” InsurTech, through technologies like cloud computing, big data, IoT, and AI, constructs a four-dimensional data system of “;human-vehicle-road-environment” to enable precise risk assessment, intelligent claims processing, and proactive risk intervention. Blockchain and privacy-preserving computation technologies address data credibility and privacy issues. The UBI model achieves a precise match between risk and premiums, while the Internet of Vehicles (IoV) and AI are driving the transformation of auto insurance from “post-event compensation” to “real-time risk intervention.” In the future, the deep integration of 5G+IoV and blockchain technology will promote the development of auto insurance risk control towards multi-dimensional and dynamic models, forming an ecosystem of shared responsibility among “automakers-insurers-tech companies” to achieve a win-win situation for all parties.

**Keywords:** InsurTech, Auto Insurance Risk Control, New Energy Vehicles, Advanced Driver-Assistance Systems, UBI Insurance

## 1. Research Background

China's auto insurance market, as the core segment of the property and casualty (P&C) insurance industry, holds a pivotal position. Currently, auto insurance premium income accounts for over 50% of the total P&C insurance premiums, and the national vehicle parc has exceeded 430 million[1]. This massive market base establishes its critical role. However, with the profound transformation of the automotive industry, this traditional field is facing unprecedented challenges.

New energy and intelligent connected vehicles have become the industry's development direction. In 2024, China's NEV production and sales both exceeded 12.8 million units, a year-on-year increase of over 34%, with their share of new car sales reaching 40.9%[2]. The China Association of Automobile Manufacturers (CAAM) predicts that NEV sales will reach 16 million units in 2025, with the market size expected to surpass that of fuel vehicles for the first time. Meanwhile, L2-level advanced driver-assistance systems (ADAS) have become mainstream,

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and the commercialization of L3/L4 levels is accelerating. Related regulations require high-value special liability insurance, signaling that technological change has deeply reshaped risk boundaries[3].

The adaptability crisis of the traditional auto insurance model is increasingly prominent. NEV insurance is caught in a dilemma where "owners pay too much, and insurers lose money": although premium income reached 117.7 billion yuan in 2024, a year-on-year increase of 52.93%[4], the industry's combined loss ratio was nearly 85%, resulting in an underwriting loss of 5.7 billion yuan[4]. The popularization of intelligent assistance systems has complicated liability determination, and traditional pricing models struggle to cover new types of risks. The problem is particularly severe for NEV ride-hailing vehicles. Their high-intensity usage (daily mileage is 3 times that of private cars) leads to a severe mismatch between risk and pricing, with the industry's combined loss ratio reaching as high as 142% in 2024[5]. At the same time, a large number of these vehicles being insured as private cars has led to numerous claim denial disputes[5], while automakers' monopoly on battery data and high repair costs further exacerbate pricing distortions[5].

In this context, InsurTech has become the core path to breaking the industry's predicament. Technologies such as cloud computing, big data, IoT, and AI are driving the transformation of auto insurance from "post-event compensation" to "full-process risk control." The global UBI insurance market is growing steadily, with its premium share expected to reach about 5% by 2025[6]. This study aims to focus on the application mechanism of InsurTech in auto insurance risk control, analyzing how it optimizes the risk control process and helps insurance companies achieve more precise pricing and claims handling.

# 2. Theoretical Foundations of InsurTech and Auto Insurance Risk Control

## 2.1 Key Concept Definitions

### 2.1.1 The Concept and Technological Scope of InsurTech

InsurTech refers to the system of technological innovations applied to the insurance industry. Its core lies in optimizing the entire insurance business process through cutting-edge technologies, showing significant enabling value, especially in the auto insurance sector. This system includes key technologies such as privacy-preserving computation, big data analytics, artificial intelligence, blockchain, and the Internet of Vehicles (IoV). Among them, privacy-preserving computation, through methods like multi-party secure computation and federated learning, achieves "data usability without visibility," providing a secure foundation for cross-institutional collaborative data modeling. The IoV and smart sensors form the basis for data collection, supporting the real-time acquisition of dynamic information such as driving behavior and vehicle status.

In the auto insurance field, the application of InsurTech shows diverse characteristics:

· Usage-Based Insurance (UBI): This model uses on-board diagnostics (OBD) and smart sensors to collect driving behavior data (e.g., hard acceleration, nighttime driving duration, frequency of sharp turns). Combined with big data algorithms, it generates a safety score to achieve a "one-person, one-price" model with dynamic premium adjustments.

· ADAS Insurance: This provides differentiated coverage for L0-L5 levels of autonomous driving. The responsible party shifts from the driver to the system developer as the technology level increases. A typical example is liability insurance for L3 and above, which needs to cover accidents caused by system failures or software errors.

### 2.1.2 The Connotation and Core Links of Auto Insurance Risk Control

Auto insurance risk control is a dynamic process of identifying, assessing, and managing risks throughout the entire auto insurance business process using technological means. Its core objective is to achieve precise control and continuous optimization of the total risk volume. This system emphasizes full-process management, covering risk screening at the underwriting stage, risk quantification in pricing, loss control in claims, and risk warning during the policy period.

Three Core Links of Auto Insurance Risk Control

· Precision in Underwriting and Pricing: Relies on joint pricing technology to integrate vehicle status data and driver behavior data, building risk assessment models through AI algorithms.

· Intelligence in Claims Processing: Uses technologies like image recognition and blockchain to simplify the loss assessment process, reduce fraud risk, and achieve rapid accident liability determination through IoV data.

· Proactivity in Risk Reduction: Intervenes in the driving process through technologies like Advanced Driver-Assistance Systems (ADAS) to reduce the probability of accidents, achieving a reduction in total risk volume at the source.

## 2.2 Theoretical Support and Technological Basis

The application of InsurTech in auto insurance risk control needs to build an analytical framework based on a multidisciplinary theoretical system. Its core theories include

not only the fundamental logic of traditional risk management but also innovative paradigms of the digital economy era. Risk management theory emphasizes loss control through the closed-loop management of risk identification, assessment, and response[7]; information asymmetry theory reveals the necessity of data sharing to alleviate market failures[8]; and the technology acceptance model focuses on consumer acceptance of InsurTech products[9].

On the technical level, big data integrates driving behavior, vehicle status, and environmental data to build a four-dimensional "human-vehicle-road-environment" data system. Artificial intelligence enables risk segmentation and pricing optimization. For example, Ping An P&C uses federated learning technology to build a joint pricing model for cross-institutional data collaboration, optimizing its auto insurance combined cost ratio to 98.3% in 2024, which is 1.7 percentage points lower than the industry average[10]. IoT and IoV enable real-time data interaction through V2X technology, supporting dynamic risk warnings.

# 3. Current Status and Core Applications of InsurTech in Auto Insurance Risk Control

## 3.1 Overview of Domestic and International Development Status

### 3.1.1 Domestic Policy Drivers and Technical Practices

The development of NEV insurance in China is characterized by a deep integration of policy guidance and technological innovation. In January 2025, four departments, including the National Administration of Financial Regulation (NAFR), jointly issued guiding opinions to promote a 28.6% reduction in the average premium for NEVs in the first batch of pilot cities by opening up the parts supply chain and establishing risk-sharing platforms[11]. At the technical application level, automakers and insurers are collaborating to build end-to-end digital risk control systems: the "Jingcheng Smart Loss Assessment System" developed by BYD in cooperation with Ping An and PICC saves over 50% of the assessment time[12]; Ping An P&C's "5G+AR" survey and trusted data pricing platform has increased annualized premium income by over 1 billion yuan[12].

### 3.1.2 Overseas Corporate Explorations

Overseas NEV insurance is centered on dynamic pricing driven by user behavior data. Tesla has implemented UBI insurance in the US market through its self-developed Insurance Services platform. It generates a safety score based on real-time driving behavior data and dynamically adjusts premiums monthly, with excellent users enjoying up to a 30% premium discount[13]. This model has covered 48 US states, and in 2024, UBI premium income accounted for 62% of Tesla's total insurance business income[13]. Companies like Waymo have introduced "system liability insurance" that covers the risk of algorithm failures in L4 technology, completely transferring the liability to the technology provider.

### 3.1.3 Comparison of Domestic and International Applications

| Dimension | Domestic Practice | International Practice |
|---|---|---|
| Driving Mechanism | Policy-led risk sharing (e.g., the new policy from four departments requires automakers and insurers to share liability for system failures)[11] | Market-based pricing (Tesla's dynamic premiums, Waymo's liability insurance)[13] |
| Data Application | Focus on "vehicle-end data" (e.g., BYD's three-electric system data for loss assessment) | Deep mining of "human-end behavior" (Tesla's driving habit score)[13] |
| Cost Control | Reducing costs through economies of scale (China Pacific Insurance's NEV premium growth of 48.55%)[4] | Achieving precise risk control through user segmentation (Progressive's UBI model) |
| Responsible Party | Primarily the driver for L2-L3, with automakers providing supplementary guarantees[14] | Liability completely transferred to the automaker/technology provider for L4[15] |

## 3.2 Core Application Logic and Typical Cases

### 3.2.1 Underwriting: Risk Assessment and Precision Pricing

The core application logic of InsurTech in auto insurance underwriting is data-driven risk assessment and precision pricing optimized by AI models. By integrating traditional factors (driving experience, vehicle model) with new technological factors (sensor precision, algorithm update frequency, battery health, etc.), a multi-dimensional risk assessment system is built, breaking the limitations of traditional "vehicle-based pricing."

Typical Cases:

· BYD Battery Health Insurance: Dynamically adjusts

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premiums based on over 200 battery parameters (such as capacity decay rate, charge-discharge cycle counts), with the direct sales model reducing premiums by 20%-30%[5].

· Tesla UBI Model: Generates a "Safety Score" based on real-time ADAS usage data collected by vehicle sensors, incorporating hardware parameters like LiDAR line count and computing power configuration into the pricing model for monthly dynamic premium adjustments[13].

Multi-dimensional Pricing Factor System

· Traditional Factors: Driving experience, vehicle model, historical claims record

· Technological Factors: Sensor precision, algorithm update frequency, battery health

· Behavioral Factors: Frequency of hard braking/speeding, proportion of autonomous driving mileage, safety score

· Scenario Factors: Commuting patterns, time-of-day risk

#### 3.2.2 Claims: Intelligent Processing and Efficiency Improvement

AI-powered loss assessment technology forms the core engine of intelligent claims. Ping An Auto Insurance, relying on computer vision and deep learning algorithms, has achieved a smart loss assessment accuracy rate of 98%, compressing the traditional 1-3 day claims processing time to within 2 hours[12]. Blockchain evidence-recording technology provides "technical proof" for claims disputes: the Vehicle Data Blockchain Platform (VDBP), led by the China Association of Automobile Manufacturers, has enabled real-time on-chain recording of accident data from over 30 automakers, insurance, and testing institutions nationwide[16]. For example, an L2 ADAS accident evidence case completed by NIO and Ping An P&C through this platform took only 3 hours from data collection to liability determination, an efficiency improvement of 85%, with a 100% judicial acceptance rate for the data evidence[16]. As of June 2025, the platform has provided blockchain evidence services for 12,000 complex accidents, reducing the claims dispute rate by 62%[16].

Typical Case: Baidu Apollo reduced the claims cycle from 5 days to 2 hours using V2X technology. Its fingerprint evidence technology, jointly developed with CATARC, improved the efficiency of accident data verification by 80%[17].

#### 3.2.3 Full Process: Anti-Fraud and Risk Warning

InsurTech reshapes the auto insurance risk control system through a full-process digital and intelligent architecture, achieving closed-loop management from pre-underwriting risk assessment, in-policy dynamic monitoring, to post-claim loss reduction. The "data usability without visibility" fusion computing architecture built by China Automotive Data Co., Ltd. (CADC) has developed over 50 risk control data products[18], supporting more than 60 insurance companies in cross-industry data integration. The Qingdao branch of PICC P&C provides services such as fatigue driving reminders and pre-collision warnings based on IoV technology, reducing the accident rate by 18%[19]. From a macro perspective of the insurance industry, AI and big data technologies form the core engine for risk identification: a blockchain-supported industry-wide parts price database is synchronized in real-time, increasing the accuracy of fraud case identification to 98%[20].

## 4. Key Influencing Factors, Challenges, and Countermeasures in Auto Insurance Risk Control

### 4.1 Analysis of Key Influencing Factors

#### 4.1.1 Risks of NEV Three-Electric System

The risks of new energy vehicles are "technology-intensive," with challenges arising from the unique risks of the three-electric system (battery, motor, electronic control), the closed nature of the repair system, and differences in user behavior. The cost of a power battery accounts for over 30%of the entire vehicle's cost[21]. In the event of a collision or thermal runaway, repairs often require complete replacement, leading to a surge in repair costs (e.g., a Tesla Model 3 battery pack replacement is quoted at 180,000 yuan)[5]. In terms of claim frequency, NEVs are more than 10 percentage points higher than fuel vehicles, with key driving factors including a 14 percentage point higher proportion of owners under 35 and a daily mileage that is 2-3 times that of private cars[21].

#### 4.1.2 Difficulties in Liability Determination for ADAS

As ADAS technology evolves from L2 to L4, the risk distribution of vehicles undergoes a significant structural shift: risks traditionally dominated by humans are gradually transferring to system technical risks. Although L3/L4 systems significantly reduce overall risk (L4 fatal accident rate is 90% lower than human driving)[15], system failure risks become prominent, such as sensor failure (heavy rain reduces detection range by 60%)[22]and inadequate response in extreme scenarios. This risk transfer is accompanied by a restructuring of liability: for L2, the driver is the core responsible party, whereas for L3/L4, liability shifts to the automaker (e.g., L3 requires automakers to purchase no less than 5 million yuan in special liability insurance), but the division of responsibility at the moment of handover remains ambiguous[14].

**Key Data Comparison**

| Metric | Human Driving | L2 (Tesla FSD) | L4 |
|---|---|---|---|
| Accidents per 100 million miles | 2.1[23] | 1.2[13] | 0.2[15] |
| Fatality Rate (per 100 million miles) | 1.35[23] | 0.3 (est.)[13] | 0 (to date)[15] |
| Responsible Party | Driver | Driver | Automaker/Operator |

## 4.2 Core Challenges

The application of InsurTech in auto insurance risk control still faces multiple challenges, mainly in the dimensions of data governance, technology implementation, and market acceptance:

· Data Silos and Privacy Security Dilemma: Data barriers exist among automakers, insurance companies, and third-party data service providers, making it difficult to achieve effective circulation of risk data. Although privacy-preserving computation technology offers a "data usability without visibility" solution, the technical standards and legal framework for cross-institutional data collaboration are not yet complete.

· Technology Implementation Costs and Capability Gaps for Small and Medium-sized Insurers: The initial investment in technologies like AI modeling and IoV data access is substantial. Leading insurers can amortize these costs through economies of scale, while small and medium-sized insurers, limited by capital and talent, find it difficult to independently build intelligent risk control systems.

· Lack of User Trust and Market Education: Consumers have privacy concerns about the "data for service" model. Only 35% of car owners are willing to share real-time driving data in exchange for premium discounts, which is far below the 50% acceptance rate in international markets[24].

## 4.3 Recommended Countermeasures

Data Governance: Activate Existing Platforms and Build a Trusted Sharing Ecosystem

The core contradiction in the current data barrier lies in the insufficient industry openness of some national-level data platforms. For example, the "National Monitoring and Management Platform for New Energy Vehicles" led by the Ministry of Industry and Information Technology (MIIT) has connected to over 90% of NEVs' operational data nationwide, but its data interface mainly serves regulatory needs and has not been fully opened to the insurance industry for key risk control fields[25].

· Promote the Opening of Existing Platforms: It is recommended that the National Administration of Financial Regulation and the MIIT establish a cross-departmental coordination mechanism to study and clarify the scope and usage specifications for the orderly opening of national-level platforms to the insurance industry, while ensuring security, and to launch pilot interfaces.

· Improve Industry Collaboration Standards: Within the framework of industry platforms like China Banking and Insurance Information Technology Co., Ltd., jointly formulate standards for intelligent connected vehicle insurance data with automakers and testing institutions to unify core risk control indicators[3].

· Promote Secure Sharing Technologies: Encourage the industry to promote privacy-preserving computation technology stacks like "Federated Learning + Blockchain" to support cross-institutional joint modeling and analysis of anonymized data, thereby improving the accuracy of risk control models while ensuring data security and personal privacy[12].

Technology Optimization: Drive Innovation to Enhance Risk Control Efficiency

The focus should be on breakthroughs in explainable AI models and dynamic risk control technology. Insurers should be encouraged to develop intelligent liability determination models. For example, using industry data platforms based on blockchain and privacy-preserving computation to enable data collaboration across entities like automakers, insurers, and testing institutions to support rapid liability determination[16]. To address the technological shortcomings of small and medium-sized insurers, it is recommended to introduce special support policies, encouraging them to apply lightweight intelligent risk control modules or to share industry risk models through methods like federated learning to lower the barrier to technology adoption.

To address the risk mismatch caused by NEV ride-hailing vehicles being "registered as private cars but used for commercial operations"[26], it is recommended to build an identity recognition model that integrates multi-dimensional data, improve recognition accuracy through machine learning algorithms, and explore risk pricing models based on dynamic operational data. At the same time, it is suggested to promote the integration of insurance and ride-hailing platform interfaces through industry data platforms, supplemented by regulatory guidance and fiscal policies, to jointly solve the risk control challenges of commercial NEVs[26].

Market Education: Deepen Product and Service Innovation Driven by Demand

Increase consumer acceptance through a "basic cover-

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age + value-added services" model. On the product side, develop niche products like battery health insurance and charging pile insurance, and introduce modular insurance products for ADAS. On the service side, strengthen public education about InsurTech and help users cultivate good driving habits through tools like driving behavior analysis, thereby reducing accident risk.

## 5. Conclusion and Outlook

This study shows that InsurTech, by intervening in the entire process of the auto insurance risk control system, has significantly improved the efficiency of risk assessment, dynamic pricing, and claims handling. Its core value lies in its data-driven precision capability: blockchain and privacy-preserving computation technologies provide solutions for data credibility and privacy protection; the UBI model achieves a precise match between risk and premiums; and IoV and AI technologies are driving the transformation of auto insurance from ";post-event compensation" to "real-time risk intervention." The differences between domestic and international practices mainly stem from differences in technological maturity, market acceptance (e.g., UBI penetration rate is about 5% in China vs. 20% internationally[27]), and policy and regulatory environments, which together are pushing auto insurance risk control toward a "multi-dimensional, dynamic" evolution[6].

In the future, the industry's development will show four core trends: First, deeper technological integration, where technologies like 5G+IoV and blockchain will build a more efficient and trustworthy collaborative foundation. Second, ecosystem collaboration will be reshaped, with automakers deeply participating in auto insurance by leveraging their data access advantages, forming a new model of shared responsibility among "automakers-insurers-tech companies." Third, ADAS will reshape the form of insurance; after L4 and higher-level technologies are scaled, auto insurance products will evolve into a combination of "vehicle insurance + system liability insurance." Fourth, the "new four modernizations" trend in the automotive industry may lead to greater premium differentiation and spawn new types of insurance products and service models.

Currently, the industry still needs to focus on overcoming challenges such as data silos and lagging liability determination regulations. As the NEV insurance market size is expected to reach 380 billion yuan by 2025[28], and with the launch of specialized products like L3 autonomous driving insurance, the auto insurance industry will move from "scale competition" to "value competition," ultimately hoping to achieve an ecological win-win for vehicle owners, automakers, and insurers[28].

## References

[1] Ministry of Public Security. 2024 National Motor Vehicle Parc Data [R]. 2025.

[2] China Association of Automobile Manufacturers. 2024 New Energy Vehicle Production and Sales Data Report [R]. 2025.

[3] Ministry of Industry and Information Technology. Pilot Program for Data Security Management of Intelligent Connected Vehicles [Z]. 2025.

[4] China Banking and Insurance Regulatory Commission. 2024 Auto Insurance Market Analysis Report [R]. 2025.

[5] DiDi Chuxing. White Paper on New Energy Ride-hailing Vehicle Operations [R]. 2024.

[6] McKinsey. Research on the Current Status and Trends of Global InsurTech Development [R]. 2025.

[7] CROUHY M, GALAI D, MARK R. Risk Management[M]. New York:McGraw-Hill, 2001.

[8] AKERLOF G A. The Market for ";Lemons":Quality Uncertainty and the Market Mechanism[J]. Quarterly Journal of Economics, 1970, 84(3): 488-500.

[9] DAVIS F D. A Technology Acceptance Model for Empirically Testing New End-User Information Systems: Theory and Results[D]. Cambridge: Massachusetts Institute of Technology, 1989.

[10] Ping An P&C. 2024 Intelligent Risk Control White Paper [R]. 2024.

[11] Four departments including the National Administration of Financial Regulation. Guiding Opinions on Deepening Reform, Strengthening Supervision, and Promoting High-Quality Development of New Energy Vehicle Insurance [Z]. 2025.

[12] Ping An P&C. Case Collection on Improving the Efficiency of New Energy Vehicle Insurance Claims [R]. 2024.

[13] Tesla Inc. Insurance Services Platform Technical Whitepaper[R]. 2024.

[14] China Automotive Engineering Research Institute. White Paper on Liability Determination for Advanced Driver-Assistance Systems [R]. 2024.

[15] Waymo. Self-Driving Safety Report [R]. 2024.

[16] China Association of Automobile Manufacturers. Annual Report of the Vehicle Data Blockchain Platform (VDBP) [R]. 2025.

[17] Baidu Apollo. Intelligent Transportation White Paper [R]. 2024.

[18] China Automotive Data Co., Ltd. (CADC). White Paper on the Construction of Data Space for the Insurance Industry [R]. 2024.

[19] PICC P&C Qingdao Branch. Case Study on Risk Reduction Services via Internet of Vehicles [R]. 2024.

[20] China Automotive Data Co., Ltd. (CADC). Report on InsurTech Anti-Fraud Practices [R]. 2024.

[21] Insurance Association of China. Research Report on New Energy Vehicle Insurance Risks [R]. 2024.

[22] China Automotive Technology and Research Center (CATARC). Test Report on the Environmental Adaptability of Intelligent Driving Sensors [R]. 2024.
[23] NHTSA. 2024 Road Safety Statistical Report [R]. 2025.
[24] Tencent Research Institute. Survey Report on User Acceptance of InsurTech [R]. 2024.
[25] Ministry of Industry and Information Technology. Data Opening Specification for the National Monitoring and Management Platform for New Energy Vehicles [Z]. 2025.
[26] China Continent Property & Casualty Insurance. Pilot Report on Ride-hailing Vehicle Risk Identification Model [R]. 2024.
[27] Insurance Association of China. White Paper on the Development of UBI Auto Insurance [R]. 2024.
[28] iResearch. 2025 China New Energy Vehicle Insurance Market Forecast Report [R]. 2025.