Transportation Research Part A 124 (2019) 549–556

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Autonomous vehicles, risk perceptions and insurance demand: An individual survey in China

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A B S T R A C T

Based on an online survey with 1164 participants, this paper investigates the risk perceptions and anticipation of insurance demand for autonomous vehicles in the Chinese market. The findings reveal that autonomous vehicles are highly familiar and have a positive impression in China. Of the respondents, 42.35% and 45.28% expect lower risk and lower insurance premiums for autonomous vehicles, respectively. By using one-way analyses of variance, this paper further examines the statistical effects of perception of autonomous vehicles, insurance purchases and claim experiences as well as personal information on responses to risk perception and insurance anticipation. Several significant factors were found that correlate with each other. Both the understanding of autonomous vehicles and personal information affect risk perception of autonomous vehicles, all of which collectively determine the anticipation of insurance demand for autonomous vehicles.

1. Introduction

Autonomous and unmanned technologies continue to develop incrementally and become more commercially available. Technology companies such as Google, Uber, and Lyft, as well as traditional auto manufacturers such as BMW and Ford, are the main contributors of autonomous technology and the main competitors in the future autonomous vehicle (AV) market (Condliffe, 2016). Since Google began its self-driving car project in 2009, Google's self-driving vehicles have been tested across multiple locations in California, Taxes, Washington and Arizona in the US (Google, 2017). Many international auto manufactures have been publicly announcing their plans to manufacture different types of autonomous vehicles, including Ford by 2021 (Ford, 2017), BMW by 2021 (Condliffe, 2016) and Daimler trucks by 2025 (Daimler, 2014). The Victoria Transport Policy Institute projected that autonomous vehicles will be widely used by the 2040–2050s (Litman, 2018), while fully autonomous vehicles that can drive from point A to point B and encounter the entire range of on-road scenarios without any interaction from the driver could be realized as soon as early 2020 (Business-Insider, 2016; Condliffe, 2016). Indirect evidence for the rapid development of AVs shows that, there are already 33 states in the United States have already introduced legislation related to autonomous vehicles (NCSL, 2018).

The adoption and application of autonomous technology in auto manufacturing could have a major impact on the insurance industry (KMPG, 2015). On the one hand, insurance plays an important role in enabling the development and adoption of autonomous technology (Lloyd'S, 2014). Insurance could be used to mitigate new risks such as cyber risk and reputational risk of manufacturers of autonomous vehicles, helping to transfer liability risk from the driver to the machine with clear definition of liability (Lloyd'S, 2014). On the other hand, the enhanced safety of AVs (Dixit et al., 2016) requires insurance companies to adjust insurance

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https://doi.org/10.1016/j.tra.2018.04.009

Available online 10 May 2018

premiums as car accidents plummet (KPMG, 2017; Skees, 2017). The shifting of liability from the owner of the vehicle to the manufacturer (Anderson et al., 2014) could reduce the portion of the automobile insurance market in the overall property and casualty insurance market.

The impact of AVs on automobile insurance remains uncertain as understanding such impacts requires a comprehensive analysis of different influencing factors from both the demand (risk perception, income, etc.) and supply sides (product design, price, etc.). This paper attempts to investigate the risk perception of autonomous vehicles and its influence on the demand for insurance from the perspective of individual consumers. We use survey data from China, as the country is one of the largest car markets in the world. The high rate of car ownership, increasing consumption, friendly regulation framework, innovative infrastructure and highly attractive market for AVs make China a representative sample for studying the risk perception and anticipation of insurance demand for autonomous vehicles.

The remainder of this paper is organized as follows. Section 2 summarizes the key literature on AV insurance and insurance demand. Section 3 provides background on the development of AVs in China and the future importance of AV insurance for China. Section 4 describes the data and the methodology. Section 5 presents the main results and discusses the statistically significant factors. Section 6 concludes.

2. Literature review

Autonomous vehicles have drawn considerable attention in recent years. As the technology itself is developing, the Society of Automotive Engineers (SAE) has proposed a set of operational definitions for vehicle automation (SAE, 2014); these norms have been accepted by the U.S. Department of Transportation and the National Highway Transportation Safety Administration (NHTSA) (Transportation and NHTSA, 2006). SAE defines 6 levels of autonomous vehicles: levels 0–2 require human drivers to monitor the driving environment, and levels 3–5 involve an automated driving system monitoring the driving environment (SAE, 2014). Generally, completely self-driving vehicles are those autonomous vehicles characterized as Level 4 and above.

Research on autonomous vehicles is multidisciplinary and requires expertise in a number of different disciplines and aspects (Lozano-Perez, 2012). On the national level, there is a need to create a nationally recognized licensing framework for autonomous vehicles that addresses the undefined liability details, security and personal privacy (Fagnant and Kockelman, 2015). Insurance instruments have been discussed to safeguard the autonomous technology. For example, a new risk for manufacturers associated with autonomous vehicles is operating error risk, which is when system does not perform its task adequately and damage follows failure of the control system. An adequate system of mandatory insurance can be implemented to prevent car manufacturers or the control system from claiming liability (Schellekens, 2015). Insurance companies embrace autonomous technology and believe they are in a position that enables technology to have a significant positive impact on vehicle and highway safety (MunichRe, 2016). Insurance can play a role in facilitating risk transfer and encouraging high safety standards in situations where the worst-case scenario may result in injury, death and spiraling costs. Without insurance, the commercial market for autonomous vehicles is unlikely to evolve due to the high potential losses (Lloyd'S, 2014; KPMG, 2017).

However, demand for insurance for automobile vehicles will likely shrink and the allocation across different types of insurance could also change: the market for personal auto insurance could fall to 40% of its current size due to the effects of the trend toward car sharing and mobility on demand (KMPG, 2015). While a 40% reduction in market size could be controversial, an updated whitepaper released in June 2017 confirms a downtrend of the automobile insurance industry due to reduce exposure, the allocation of the business and products liability policies (KPMG, 2017). By using the Perfect Storm Scenario, KPMG indicates that total losses for the auto insurance sector could decline by 71% or 137 billion USD, by 2050 (KPMG, 2017). The impact of AV on the insurance market remains ambiguous, while some institutes are optimistic about the trends. Accenture and the Stevens Institute of Technology estimate that AV will generate at least 81 billion USD for the US auto insurance market between 2020 and 2025. However, auto insurance premiums will decrease due to the rollout of AVs after 2026 (Accenture, 2017). Insurers have recognized the safety benefits of AVs and discounted auto insurance premiums will result (Skees, 2017). Important determinants of property insurance demand by individuals include wealth, the probability of loss, the price of insurance, the value of the item exposed to risk, and the utility function of the individual considering the purchase of insurance (Smith, 1968). Specifically, Sherden (Sherden, 1984) found that for the automobile insurance demand, the key determinants are insurance premiums, income and perceived risk. The nature of risks associated with autonomous cars will differ from those of traditional vehicles. Many studies have confirmed the concerns of the public regarding owning or using AVs (Abraham et al., 2016; Schoettle and Sivak, 2014). A major factor for the future of AVs will be appropriately evaluating and mitigating these risks (Lloyd'S, 2014). In contrast to the KMPG report, this paper attempts to investigate the risk perception of insurance customers from the individual point of view with respect to autonomous vehicles and the customers' desire for insurance products.

3. Background

3.1. Autonomous vehicles in China

Chinese car production and sales reached 24.421 million and 24.377 million units in 2016, with an annual growth rate of 15.5% and 14.9%, respectively (Manufacturers, 2017). Driven by macroeconomic factors and the growth of shared mobility, the demand for Chinese vehicles is projected to increase through 2030 (McKinsey, 2016). Furthermore, China is a large car import market; approximately 1 million cars were imported into China in 2016 (Mao, 2017). New developments in autonomous driving technology by

international tech companies such as Google or by leading vehicles manufactures such as Tesla or BMW will lead to increasing demand for autonomous vehicles in China.

The Chinese automobile industry is shifting from Advance Driver-Assisted Systems (ADAS) technology to autonomous driving technology. Through "Made in China 2025", a national ten-year plan (2015–2025) aimed at transforming Chinese manufacturing released by the China's State Council in May 2015, China is planning to master the key technologies of ADAS by 2020 and master the key autonomous driving technologies by 2025 (The State Council, 2016). Since April 2017, the Chinese tech giant company Baidu has offered a free new autonomous vehicle platform with the technology and open-source code needed to help car manufacturers produce self-driving vehicles. With the technological support from Baidu, mastering the autonomous driving technology by Chinese car manufacturers is becoming more feasible.

3.2. Automobile insurance in China

In its short history, the Chinese insurance market has experienced rapid expansion over the past decade. When China conducted its reform and opening policy in 1979, the Chinese insurance industry was revived after twenty years of stagnation. The volume of insurance premiums grew rapidly from RMB 0.46 billion in 1980 to RMB 3095.90 billion in 2016 (CICR, 2017). With USD 466 billion in insurance premiums, China is the world's third largest insurance market in terms of total premiums, after Japan (USD 471 billion) and the US (USD 1.35 trillion) and makes up 9.85% of the global market share (Swiss Re, 2017). However, China's insurance industry is still in the developing phase with respect to insurance penetration and insurance density. Insurance penetration (insurance premiums as a percentage of GDP) in China is 4.15% and ranks No. 39, and the insurance density (insurance premiums per capita) in China is USD 337.1, ranking No. 47 in the world in 2016 (Swiss Re, 2017).

According to the *Road Traffic Safety Law of the People's Republic of China*, all vehicles in China are required to carry traffic compulsory insurance (TCI), which covers third-party liability in the event of an accident causing injury or death to another person (Article 17). For those car owners or managers who do not buy the traffic compulsory insurance for motor vehicles in China, the traffic administrative authority detains the vehicle until the owner or manager has purchased the insurance in accordance with the provisions. The owner or manager is subject to a fine of twice the insurance premium payable at the minimum liability (Article 98). Traffic compulsory insurance is among the few insurance products that is required under Chinese law.

As the traffic compulsory insurance only has limited financial coverage for third-party indemnity for death, medical expenses and property damage in car accidents, automobile owners in China are encouraged to purchase commercial auto insurance (CAI) in addition to their compulsory insurance, which is generally provided by the commercial insurance companies with their traffic compulsory insurance policies. The commercial auto insurance market in China distinguishes between primary insurance and supplemental insurance; supplemental insurance can only be purchased when car owners have purchased the primary insurance. According to the Insurance Association of China, primary commercial auto insurance includes (1) third-party liability insurance, which is similar to traffic compulsory insurance in that neither the driver holding the policy nor their passengers are insured; it covers the third-party liability beyond the compulsory insurance with the option for policyholders to choose their own desired maximum rate of compensation; (2) vehicle damage insurance that in many circumstances (fire, natural disasters, falling objects, vandalism, etc.) covers all damage to a policyholder's vehicles; (3) driver and passenger insurance that covers injuries or death to the driver or passengers and is sold by the seat; and (4) theft insurance that covers theft not only of the vehicle but of all objects contained inside in the event of burglary or theft. All four types of main commercial auto insurance are subject to certain exclusion clauses such as driving while intoxicated, driving without a driver's license, and earthquakes. Insurance consumers can also add a number of extra types of additional insurance, such as auto glass insurance, vehicle damage insurance due to spontaneous combustion, quota-free insurance,[1] scratch and dent insurance, etc.

Given the volume of the car sales and car usage in China, auto insurance ranks first in the country's non-life insurance market, with an average market share of 73% from 2011 to 2015. Table 1 illustrates the auto insurance market compared to the whole non-life insurance market from 2007 to 2016 in China. The high market share indicates that any changes occurring in auto insurance could affect the entire insurance market significantly. Thus, the development of AVs would change the environment of the automobile insurance market in China and have a substantial effect on the entire Chinese insurance market (Wang et al., 2017). This possibility emphasizes the importance of studying the risk perception and potential changes to the demand for AV insurance.

4. Data

4.1. Survey design

An online survey was conducted using a web-based survey company (https://www.sojump.com/) in China. A questionnaire was developed to investigate insurance consumers' risk perception and their subjective desire to adjust their demand for automobiles (see Table 2). Participants were told the survey would take less than 10 min and only used for research purposes and that their involvement would help researchers understand the impact of autonomous vehicles on the insurance industry in China. For the target population, participants must own (or have once owned) cars and have had experience purchasing automobile insurance in China.

[1] Under traffic compulsory insurance, if the policyholders are held responsible for an accident, 20% of the compensation themselves must been paid by the policyholders.

Table 1
Auto insurance premiums in China's non-life insurance market, 2007–2016.
Source: Author's calculation from CIRC (China Insurance Regulatory Commission) data.

Unit: billion RMB

Year	Non-life market	Auto insurance	Market share (%)	TCI	Market share (%)	CAI	Market share (%)
2007	199.777	148.428	74.30	53.669	26.86	94.7.59	47.43
2008	233.671	170.252	72.86	55.340	23.68	114.912	49.18
2009	287.583	215.561	74.96	66.800	23.23	148.761	51.73
2010	389.564	300.415	77.12	84.050	21.58	216.365	55.54
2011	461.782	350.456	75.89	98.342	21.30	252.114	54.60
2012	533.093	400.517	75.13	111.413	20.90	289.104	54.23
2013	621.226	472.079	75.99	125.886	20.26	346.193	55.73
2014	720.338	551.607	76.58	141.858	19.69	409.749	56.88
2015	799.497	619.896	77.54	157.098	19.65	462.798	57.89
2016	872.450	683.455	78.34	169.958	19.48	513.497	58.86

Table 2
Questions on perception of autonomous vehicles (AVs), risk and the adjustment of the insurance decision.

Questions	Purpose of the question	
Autonomous vehicle		
Before filling out this questionnaire, had you ever heard of AVs?	Familiarity with AVs	Q1
What is your overall impression of autonomous driving technology?	AVs perception	Q2
How do you assess your trust in the production of AVs by traditional car manufacturers (Mercedes-Benz, Ford, Honda, etc.)?	Trust to car manufacturers	Q3
How do you assess your trust in the production of AVs by tech companies (Google, Baidu, etc.)?	Trust to Tech Companies	Q4
Insurance purchasing experience		
Do you have third-party liability insurance for your current vehicle?	Liability risk transfer	Q15a
Do you have driver and passenger insurance for your current vehicle?	Personal risk transfer	Q15b
Do you have vehicle damage insurance for your current vehicle?	Damage risk transfer	Q15c
Do you have theft insurance for your current vehicle?	Loss risk transfer	Q15d
Do you have other commercial supplemental insurance for your current vehicle?	Other risk transfer	Q15e
Through which channel (telephone, direct sales, etc.) did you purchase vehicle insurance?	Distribution channel	Q16a
In the past year, the number of car insurance claims you have filed.	Claims filed	Q16b
Personal information		
What is your gender?	Gender	Q22
Which age group do you belong to?	Age	Q23
What is your highest education?	Education	Q24
What is your current job?	Employment	Q25a
How do you assess your own risk preference?	Risk preferences	Q28
Determinants of insurance expectations for autonomous vehicles		
Assuming you own and have started using an AV, how do you assess the overall risk (road safety, personal safety, car safety, etc.) of your car compared to driving a car manually?	Risk anticipation	Q5
Do you think that an advantage of using AVs is that it will lead to reduced insurance premiums?	Price expectation	Q6g
Assuming there was technology that could upgrade your car to a driverless car, how much would you likely to pay to insure it?	Willingness to pay	Q20
If you are required to buy liability insurance, what adjustments would you make to your liability insurance for driverless vehicles?	Coverage to AVs	Q21

To generate more reliable results, the questionnaire adopted the automobile vehicle classification of SAE with six levels of driving automation, spanning from no automation to full automation (SAE, 2014). While not specifically indicated in the questionnaire, autonomous vehicles generally refer to L1–L5 cars and the terminology "driverless vehicles" is used for high-automation (L4) and full-automation (L5) autonomous vehicles. The features of all levels autonomous vehicles are described at the front of the survey website, followed by the questionnaire, which is divided into three main topics. The first part concerns familiarity with and concerns about autonomous vehicles; the second part concerns participants' experience purchasing insurance and the adjustment of autonomous vehicle insurance on the market. The third part of the questionnaire concerns the personal information of the participants. Table 3 summarizes the key questions focusing on the perception of autonomous vehicles, experience purchasing insurance, personal insurance and adjustment to the individual autonomous vehicle insurance decision.

4.2. Data description

The survey yielded useable responses from 1164 individuals aged 18 years and older within one week. The advantage of an online survey is that participants' IP addresses can be traced without questioning them about where they live. Participants came from

Table 3
Demographic breakdown of sample.

Demographic aspect	Classification criteria	Number of responses	Response percentage (%)	Official percentage[1] (%)
Gender	Female	515	44.24	48.78
	Male	649	55.76	51.22
Age group	18–24	89	7.65	7.30
	25–29	226	19.42	9.35
	30–34	220	18.90	7.38
	35–39	268	23.02	7.07
	40–44	146	12.54	8.56
	45–49	118	10.14	9.01
	50–54	66	5.67	7.58
	55–59	22	1.89	5.60
	60–64	5	0.43	5.68
	65–69	2	0.17	3.99
	70 and above	2	0.17	–

[1] This percentage is calculated based on the entire population, while in the sample, all respondents were required to be aged 18 and above.

different provinces in China, with the top 5 provinces or municipalities being Shanghai (175 responses, 15.03%), Beijing (124 responses, 10.65%), Guangdong (90 responses, 7.73%), Jiangsu (76 responses, 6.53%) and Zhejiang (70 responses, 6.01%). All of these provinces and municipalities are pioneer economic development areas in China with per capita GDP exceeding USD 10,000.

Demographic breakdowns of the sample are presented in Table 3. The last column in Table 3 presents official statistics provided by the National Bureau of Statistics of China (NBSC, 2016). For example, China's male population is 704.14 million, accounting for 51.22% of the total population, while the female population is 670.48 million, accounting for 48.78% of the total population in 2015. In terms of its gender and age structure, the sample is roughly representative of the Chinese population. Note that current car ownership is primarily made up of drivers over 35 years old,[2] while 61.34% of participants are between 25 and 39 years. As autonomous vehicles discussed in this paper are mostly level 4 and above, their broad-based transformation could begin as early as 2025 and be realized as the new normal by 2040 (KMPG, 2015; Litman, 2018). The current sample still remains representative during the investigation of risk perception on autonomous vehicle insurance.

5. Results and discussion

5.1. Preliminary results

Of the respondents, 84.88% had heard of autonomous vehicles but did not have experience driving AVs, 6.96% had heard of AVs and had experience driving Level 1 AVs, and 2.84% had heard of AVs and had experience driving Level 2 and above AVs. Only 5.33% of the respondents had never heard about AVs. A total of 52.75% of the respondents had neutral impressions regarding AVs, and 43.04% of respondents had a positive impression of AVs; only 4.21% had a negative impression of AVs. Overall, most individuals in China are familiar with AVs and have positive impressions of autonomous technology. The majority of respondents trust both traditional automobile manufacturers (11.77% do not trust, 28.26% are neutral, and 59.97% trust) and new technology companies (23.54% do not trust, 25.34% are neutral, and 51.32% trust) in developing autonomous vehicles. Traditional automobile manufacturing still has an advantage in AVs compared to new technology companies.

Respondents were asked about their general perception of AVs' risk (Q5); 16.02% of the respondents consider AVs to represent a substantial increase in the risk, 27.84% view them has creating a small increase in risk, and 12.89% view them as presenting the same level of risk. Many of the respondents believe that AVs have slightly reduced risk (32.04%) or substantially reduced risk (10.31%). Interestingly, although approximately 42.35% of the respondents have a positive assessment of AVs' risk, 48.28% of participants chose to increase coverage by the third-party liability insurance when they were asked to purchase the insurance (Q21). Only 22.08% of respondents chose to reduce coverage, with the remaining 29.64% being unchanged.

The majority of respondents expect lower insurance premiums for AVs (Q6g). A total of 45.28% think that lower insurance premiums are an advantage of using driverless cars, while 31.44% do not think that there is a difference in insurance premiums between AVs and manually driven automobiles. The remaining 23.28% believe that the insurance premiums for AVs could be higher than before. Respondents were asked "How much extra would you be willing to pay for insurance if your current vehicle would be upgraded to an AV?" (Q20). They were required to give the percentage based on their current insurance premium. A total of 30.76% of the respondents were not willing to pay extra premiums, while 24.48%, 20.27%, 11.6%, 3.26% and 6.53% of respondents would pay 10%, 20%, 30%, 40%, and 50% extra for AV insurance based on their current insurance premiums, respectively. Only 3.07% of respondents would agree to pay above 50% more for AV insurance premiums.

[2] Thank you to the referee for pointing this out.

Table 4
Statistically significant effects of autonomous vehicles.

	Q1 Familiarity with AVs	Q2 AVs perception	Q3 Trust in car manufacturers	Q4 Trust in tech companies
Risk anticipation	0.0003***	0.0000***	0.0000***	0.0000***
	(6.291)	(39.062)	(11.406)	(17.125)
Price expectation	0.6106	0.0000***	0.0000***	0.0000***
	(0.607)	(21.694)	(7.632)	(13.502)
Willingness to pay	0.1728	0.0052**	0.1174	0.0032**
	(1.665)	(3.713)	(1.547)	(2.661)
Coverage of AVs	0.0801	0.2886	0.8114	0.8950
	(2.257)	(1.248)	(0.604)	(0.493)

Note: Columns report the p value of one-way ANOVA. The F values are in parentheses.
* Significant at $p \leq .05$.
** Significant at $p \leq .01$.
*** Significant at $p \leq .001$.

5.2. Statistical effects

This paper applies a series of one-way analysis of variances (ANOVAs) to examine the effects of risk perception and autonomous vehicle insurance expectation on respondents' perception of autonomous vehicles, insurance purchase experiences and individual information. One-way ANOVA is a technique used to compare the means of two or more unrelated groups and examine the impact factors of risk and AVs (Ho et al., 2008; Schoettle and Sivak, 2014). Ho et al. (2008) used an one-way ANOVA to examine whether riskiness ratings differed among six different hazard events in Taiwan, as well as how disaster characteristics influence risk perception. More relevant to this paper, Schoettle and Sivak (2014) used ANOVAs to examine the statistically significant effects of individual demographic variables on responses to individual questions regarding autonomous and self-driving vehicles in the U.S., the U.K., and Australia. They found that higher education levels were associated with higher expectations that AVs will result in fewer accidents and lower insurance rates (Schoettle and Sivak, 2014). Table 4 presents a summary p value from the series of ANOVAs, indicating statistically significant effects of individuals' understanding about autonomous vehicles on risk perception and insurance expectation.

Respondents who had previously heard of autonomous vehicles, who have a positive impression of autonomous driving technology and who trust either automobile manufacturers or technology companies are likely to expect reduced risk associated with AVs. Individuals who have positive impressions of autonomous technology and trust in developers expect lower insurance rates. A better perception of AVs and trust in tech companies is positively correlated with the willingness to pay for the autonomous vehicle insurance. Interestingly, an individual's view on autonomous vehicles has no impact on the insurance coverage that he or she may purchase.

Table 5 presents the results showing whether individual insurance experiences affect individuals' insurance expectations for autonomous vehicles. Those individuals who have third-party liability insurance see a positive correlation with their willingness to pay. Respondents who carry driver and passenger insurance seem to be more risk averse and are likely to increase their insurance coverage for AVs. Vehicle damage insurance is purchased by individuals seeking to transfer their property loss and protect themselves from uncertainty and financial volatility. This group correlates with the risk anticipation of AVs. They are not only more willing to

Table 5
Statistically significant effects of insurance purchase experience.

	Q15a Liability risk	Q15b Personal risk	Q15c Damage risk	Q15d Loss risk	Q15e Other risks	Q16a Distribution	Q16b Claim
Risk anticipation	0.0508	0.1130	0.0406*	0.5236	0.5933	0.3866	0.7429
	(3.822)	(2.516)	(4.203)	(0.407)	(0.285)	(1.050)	(0.544)
Price expectation	0.2035	0.7419	0.1409	0.4145	0.6498	0.8555	0.3972
	(1.619)	(0.108)	(2.171)	(0.666)	(0.206)	(0.391)	(1.032)
Willingness to pay	0.0129**	0.3888	0.0085**	0.1989	0.3140	0.0012**	0.0000***
	(6.205)	(0.743)	(6.958)	(1.652)	(1.015)	(4.047)	(9.491)
Coverage to AVs	0.0688	0.0308*	0.0007***	0.1052	0.0614	0.2337	0.3175
	(3.319)	(4.673)	(11.525)	(2.628)	(3.506)	(1.368)	(1.179)

Note: Columns report the p value of one-way ANOVA. The F values are in parentheses.
* Significant at $p \leq .05$.
** Significant at $p \leq .01$.
*** Significant at $p \leq .001$.

Table 6
Statistically significant effects of personal information.

	Q22 Gender	Q23 Age	Q24 Education	Q25a Employment	Q28 Risk preferences
Risk anticipation	0.0197*	0.0228*	0.7988	0.4441	0.1107
	(5.451)	(2.516)	(0.513)	(0.970)	(1.885)
Price expectation	0.2957	0.2892	0.5128	0.4986	0.1307
	(1.095)	(1.196)	(0.875)	(0.94)	(1.779)
Willingness to pay	0.0430*	0.6631	0.0003***	0.0518	0.0012**
	(4.105)	(0.765)	(4.297)	(2.09)	(4.530)
Coverage to AVs	0.2808	0.2733	0.8529	0.4054	0.0020**
	(1.164)	(1.220)	(0.439)	(1.028)	(4.250)

Note: Columns report the p value of one-way ANOVA. The F values are in parentheses.
* Significant at $p \leq .05$.
** Significant at $p \leq .01$.
*** Significant at $p \leq .001$.

pay for insurance, but they also want to increase their insurance coverage. How respondents have purchased vehicle insurance (through the internet, brokers, over the telephone, etc.) and whether they have claim experiences also influence their willingness to pay for AV insurance.

Personal information could also affect an individual's risk perception and insurance expectation. As shown in Table 6, gender and age correlate with the risk anticipation of AVs. None of the personal information affects price expectations. Risk preferences could lead to the adjustment of insurance coverage for autonomous vehicles. Gender, education and risk preferences have a statistically significant effect on responses to willingness to pay. In summary, personal information is more correlated with whether or not to purchase AV insurance. Additionally, those who have higher risk preferences tend to increase their insurance coverage on AVs.

6. Conclusion

This paper examines public opinion regarding risk perception and expectations of autonomous vehicle insurance on the demand side. The data used in this paper were obtained through a web-based survey in China, and 1164 useable responses were gathered within one week. In terms of its gender and age structure, the sample is roughly representative of the Chinese population.

A high percentage of Chinese respondents stated that they had previously heard of autonomous vehicles and had a positive impression of autonomous technology. Only Of the respondents, 5.33% had never heard of AVs and 4.21% had a negative impression of AVs. Chinese consumers generally trust autonomous driving technology developed by both traditional automobile manufacturers and by technology companies. Many respondents believe that AVs could lead to reduced risk (42.35%) and lower insurance rates (45.28%). Nevertheless, 48.28% of participants said that they would increase coverage of the third-party liability insurance. A total of 69.24% were willing to pay more for AV insurance.

Respondents' good understanding of autonomous vehicles resulted in an expectation of AVs' low risk. Respondents with a positive impression of AVs believe the AVs would lead to lower insurance premiums; this has a positive correlation with their willingness to pay. An individual's insurance experiences also affect the risk perception and insurance expectations. For example, individuals who currently possess vehicle damage insurance are not only more willing to pay for insurance but also want to increase their insurance coverage. Additionally, the insurance distribution and claim experiences could influence willingness to pay. The character of certain individuals also affects their risk perception and insurance expectations. Differences in gender and age cause different risk anticipation as it relates to AVs. Preferences based on gender, education and risk are statistically significant with respect to responses to willingness to pay for the insurance.

With China's population of 1.38 billion, 0.29 billion vehicles[3] and USD 102.08 billion in vehicle insurance premiums in 2016, the preliminary results shown in this paper are important not only for the Chinese market but also in the fact that these trends could determine the future landscape of the global autonomous vehicles market and lead to changes in how these vehicles are covered by insurance. However, given the nature of online surveys, individuals without internet access are excluded from the sample. Additionally, this paper only presents the preliminary results of the risk perception and the insurance demand for autonomous vehicles based on individuals' expectations. There may be other factors that impact insurance demand. One is the lifestyle of younger generations that prefer car and bike sharing rather than car ownership, which could reduce the demand for cars and thus the insurance demand. Other factors are the emerging risks associated with AVs (such as cyber risks, nano tech, climate change, etc.) and risk accumulation.

[3] 66.9% of the vehicles (0.194 billion vehicles) are cars, while the rest is made up by trucks, motorcycles, etc.

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