İSTANBUL UNIVERSITY PRESS

Siyasal: Journal of Political Sciences, JPS 2025

https://doi.org/10.26650/siyasal.2025.34.1455265

Submitted: 19.03.2024
Revision Requested: 13.11.2024
Last Revision Received: 31.01.2025
Accepted: 27.02.2025
Published Online 21.07.2025

Siyasal: Journal of Political Sciences

Research Article

Open Access

Revisiting the Moral Hazard Problem: Evidence from Automobile Insurance Sector

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Abstract Asymmetric information, a market failure, is frequently observed in insurance markets involving risk and uncertainty. Asymmetric information arises from moral hazard, adverse selection, and the principal-agent problem. The primary purpose of this study is to test the moral hazard in the Turkish automobile insurance sector. Determining factors affecting moral hazard is also one of the study's aims. The data used in this study were obtained from a survey conducted with policyholders in Istanbul, Izmir, and Ankara, which have the most insurance policies. According to the analysis results, the car brand affects the moral hazard level of drivers. As the intercity mileage of drivers increases, the moral hazard level decreases. The moral hazard level decreases as drivers' accidents increase during the policy period. When obtaining car insurance, drivers with complete information have lower moral hazard levels. In addition, drivers who take risks while driving have higher moral hazard levels than others. Uncertainty will be reduced if insurance companies consider the factors that cause moral hazard when determining the policy price. For this purpose, the government should regulate the automobile insurance sector. Insurance companies and car owners can make more rational decisions in this case.

Keywords Asymmetric Information · Moral Hazard · Automobile Insurance Sector

Author Note We presented the summary of this study was presented at the 36th International Public Finance Conference. We have expanded this study because of feedback.

Citation: Sağbaş, İ., Saruç, N. T. & Balkı, A. (2025). Revisiting the moral hazard problem: Evidence from automobile insurance sector. *Siyasal: Journal of Political Sciences*, Advance Online Publication. https://doi.org/10.26650/siyasal.2025.34.1455265

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Insurance protects against possible risks that individuals may encounter in the future. Individuals transfer the dangers they may encounter to the insurance company with the insurance they have taken out. The insurance company distributes the losses incurred due to the realization of the risks to the insured through the policy price to be determined. The most crucial point here is determining the cost of the insurance policy, which is the price of the risk. Because the proper functioning of a market depends on its price mechanism, any situation that disrupts the functioning of any market and prevents the efficient use of resources is a market failure.

Neo-classical economic thought, which emerged in the late 1800s and is also known as marginalism, stated that efficiency can be achieved with limited government intervention in cases where markets do not work effectively (Medema, 2007: 331-332). There are three basic assumptions of neo-classical economic thought: Individuals have rational preferences, companies try to maximize their profits while individuals try to maximize their interests, and individuals can act independently in the market with complete information (Weintraub, 2002). Market failures are situations where social benefit cannot be maximized under these basic assumptions. One cause of market failures is asymmetric information. Asymmetric information, first systematically revealed by Akerlof's (1970) study, is also expressed in the literature as incomplete, imperfect, and private information. Asymmetric information, which means that one party in a market cannot have the information the other party has, affects the decisions taken and causes the markets to fail (Mishkin & Strahan, 1999: 3).

In asymmetric information that disrupts the economy's functioning, uncertainty comes to the fore. Scientists generally have different views on uncertainty, which causes economic fluctuations and affects markets' functioning. Keynes (1937) and Arrow and Debreu (1954) considered the uncertainty that causes economic fluctuations exogenous. According to Knight (1921), Hayek (1945), and Akerlof (1970), uncertainty is internal and results from imperfect and incomplete information among actors in the economy.

In his study, Akerlof (1970) stated that asymmetric information is the basis of the problems arising in the second-hand car, labor, and insurance markets. Analyzing the labor market, Spence (1973) pointed out that asymmetric information that causes market disruption can be reduced through signaling. In their insurance market analysis, Rothschild and Stiglitz (1976) stated that the market failed due to individuals hiding their risk levels. In 2001, Akerlof, Spence, and Stiglitz were awarded the Nobel Prize in Economics for their market analysis of asymmetric information. However, this is not the first Nobel Prize related to asymmetric information. Mirrlees (1971; 1974) and Vickrey (1945; 1961) received the Nobel Prize in economics in 1996 for their studies on optimal income taxes and incentives in the case of asymmetric information in the field of public economics. This situation demonstrates that asymmetric information negatively affects decisions in both the market economy and public economics.

Haynes (1895: 445), who was the first economist to mention moral hazards in the insurance sector, stated that moral hazards could occur in three different ways: In the insurance industry, individual efforts decrease. Full-coverage insurance encourages a person to act carelessly. The most significant disadvantage of insurance is that it encourages fraud. The person may falsify the insured property or render it impossible to receive compensation from the insurance company. In this case, the cost of insurance will increase for honest people. Arrow (1963), in his article on uncertainty and health insurance, considered the lack of a

market to provide insurance in economic activities where uncertainty is in question as a market failure. Health insurance states that the state should ensure that the market cannot offer insurance when it cannot. The reason for market failure in health insurance is moral hazard rather than adverse selection.

Exemptions proposed by Arrow (1963) to reduce moral hazard in health insurance are a strategy that insurance companies prefer, albeit in part. Under this exemption, insurance companies cover health expenditures above a certain amount. In contrast, individuals pay relatively small expenditures directly (Cutler & Zeckhauser, 1999: 30). In their studies, Dréze and Schokkaert (2013), Dréze et al. (2016), and Ghossoub (2017) found that the exemption theorem developed by Arrow gives positive results for optimal health insurance. On the other hand, Bardey and Lesur (2005) showed that Arrow's exemption theorem is not optimal for all health insurance policies; exemptions are successful for minor illnesses. However, full coverage insurance is optimal for terminally serious diseases. Exemptions in automobile and health insurance can reduce possible moral hazards. Dionne and Gagné (2001), Li et al. (2007), and Wang et al. (2008) obtained substantial evidence that exemptions reduce moral hazard in their studies on the automobile insurance sector.

Moral hazards arise from the individual who purchases insurance on any subject not being able to maintain the moral qualities accepted when signing the policy. Any deviation from correct human behavior that may cause problems for an insurance company is a moral hazard. The best example of a moral hazard in health insurance is the individual increasing their use of medical tests and supplies after taking out insurance. Increased medical care costs due to moral hazard increase health insurance policy prices (Pauly, 1968: 535). The reason for moral hazard is that the individual has more information about their moral attitudes and behaviors than the insurance company; in other words, asymmetric information.

Suppose insurance companies guarantee to cover almost 100% of the damage when insuring buildings owned by individuals against fire. In that case, policyholders will behave differently than they would if they were not insured. Building owners must use fire alarms and fire extinguishing systems to prevent fire. At the same time, this alarm and extinguishing system must be periodically maintained. All these require time and money; in other words, they are a cost. If the insurance policy guarantees to cover almost all of the damage that will occur, the building owner will not find it necessary to spend this time and money. Of course, the insurance company may state in its policy that it will only make payments if basic safety precautions are taken. However, it is often difficult to tell how careful the building owner is. While the building owner knows himself well, the insurance company cannot see the owner as well as he does. As a result, insurance companies face more demands for damage payments than they should. The reason for this is the moral hazard caused by asymmetric information (Krugman & Wells, 2013: 587-588).

As with fire insurance, an insurance policy purchased through health insurance affects not only the quantity and quality of health services requested by an individual when they are ill but also their quality. It can also affect the individual's efforts to stay healthy and maintain health. Because individuals do not have to pay the total cost of illness, they may not take sufficient precautions to prevent disease (Stiglitz, 1994: 365). This is also the case with full-coverage automobile insurance. A person who purchases a full-coverage insurance policy for their vehicle may drive more carelessly in traffic or park their vehicle in areas with a higher risk of an accident, a problem caused by moral hazard.

The first study to test the existence of moral hazard in the automobile insurance sector is Boyer and Dionne's (1989) study in the Canadian province of Quebec. Subsequently, Cummins and Tennyson (1996) in the American automobile insurance sector, Richaudeau (1999), Dionne et al. (2013) in the French automobile insurance sector, Li et al. (2007) in the Taiwan automobile insurance sector, Rowell et al. (2022) in the

Australian automobile insurance sector, and Zheng et al. (2021) tested the existence of moral hazard in the Chinese automobile insurance sector. The original value of this study is that no previous study has tested the existence of moral hazard in the Turkish automobile insurance sector. To our knowledge, studies have yet to analyze the factors influencing moral hazard in automobile insurance comprehensively. We examined the relevant literature in the first part of this study, whose primary purpose was to test the moral hazard in the Turkish automobile insurance sector. In the second part, we provide information about the dataset and the methods used in this study. Next, we explain the empirical findings obtained from the analysis. In conclusion, we discussed the similarities and differences between our findings and the literature.

Literature Review

There are many branches in the insurance sector, such as life, health, crops, natural disasters, and automobiles. Cawley and Philipson (1999), Zhu and Bauer (2013), and Choi et al. (2015) tested the existence of moral hazard in life insurance, Cameron et al. (1988), Chiappori et al. (1998), and Klick and Stratmann (2007) in health insurance. Chambers (1989), Horowitz and Lichtenberg (1993), Roberts et al. (2006) investigated the existence of moral hazard in crop insurance, and Doherty (1980), Hudson et al. (2017), Vitaliano (2021) investigated natural disaster insurance. Studies on asymmetric information in automobile insurance are more specific to adverse selection (Puelz & Snow, 1994; Chiappori & Salanie, 1997; Richaudeau, 1999; Cohen, 2005; Shi et al., 2012; Donnelly et al., 2014; Qu et al., 2018). Few studies have tested the existence of moral hazards in auto insurance.

Boyer and Dionne (1989) performed a regression analysis in the probit model using policy data of 19013 drivers from 1980-1983 in the Canadian province of Quebec. Accordingly, there is a significant difference between the number of accidents and gender, age, accident history, traffic penalty score, and driver's license class. There was no relationship between the number of accidents and the number of years of driving license. Driver characteristics must also be considered in pricing to reduce the moral hazard of auto insurance. Gaudry (1992) tested the existence of moral hazard in Canadian auto insurance using accident numbers and policy data from 1978. In this study, the number of accidents is the dependent variable; car maintenance prices, the number of licensed drivers per car, and the number of vehicles per capita are the independent variables. According to the results of the analysis, accidents increased after compulsory traffic insurance was introduced. This increase in the number of accidents indicates a moral hazard. In addition, there is a positive relationship between the number of accidents and car maintenance prices and a negative relationship between the number of licensed drivers per car.

Cummins and Tennyson (1996) conducted regression analyses using the data from their survey of 1987 insured persons in the United States automobile insurance sector. This study, in which policy costs are taken as the dependent variable, provides essential evidence of moral hazard in the United States automobile insurance sector. Tennyson (1997) measured individuals' perceptions of moral hazard in auto insurance using data from a 1987 survey conducted in the USA. According to the study, ethical values and the social environment affect individuals' perception of moral hazard. People with a negative perception of insurance companies are more tolerant of moral hazards. In addition, the natural structure of the insurance sector, which includes risk and uncertainty, also affects individuals' perceptions of moral hazard. Kerr (2021), as a result of her analysis using the Insurance Research Council's data for 1995-1998, obtained evidence for moral hazard in the US automobile insurance sector, supporting the results of Cummins and Tennyson (1996).

Richaudeau (1999) tested whether asymmetric information exists in the French automobile insurance sector using the policy and accident information of 5703 vehicles obtained from an insurance company. No evidence of adverse selection or moral hazard was found because the regression analyses were conducted using a probit model. Dionne et al. (2013) investigated whether a moral hazard exists in the French automobile insurance sector using survey data from 1995 to 1997. According to the study findings, a moral hazard exists among (inexperienced) drivers who have been driving for less than 15 years. The more risks can be identified and learned for drivers and insurance companies with less than five years of car usage, the less asymmetric information is.

Artis et al. (1999) investigated the existence of moral hazard by examining 1357 post-accident compensation claims from a Spanish insurance company from 1993 to 1996. The data used in this study include information about the driver's characteristics, the accident, and the car. This study provides substantial evidence of the moral hazard of Spanish auto insurance. The presence of police reports in accidents reduces the moral hazard. In addition, drivers with more accidents are more likely to cause moral hazards. Viaene et al. (2007) tested whether auto insurance has a moral hazard using 2403 post-accident claims from Spain in 2000. The logistic regression analysis results indicate that Spanish auto insurance has a moral hazard. In addition, moral hazard probability, insurance coverage, gender of the insured, and working time with the insurance company significantly differ in the type of car.

Li et al. (2007) conducted a logit regression analysis using insurance policy and car damage information for 2000-2001 to test whether there is a moral hazard in the Taiwanese auto insurance sector. According to the study's findings, it is a moral hazard for drivers who buy whole insurance policies without an exemption to drive carelessly in traffic. To solve this problem, it is necessary to apply for an exemption from the insurance policy depending on the accident risk of each driver. Wang et al. (2008) tested the existence of moral hazard in Taiwanese auto insurance using data from 2000 obtained from an insurance company. According to the probit regression analysis results, there is a positive relationship between insurance coverage and the occurrence of damage. A positive association indicates a moral hazard as the exemptions for automobile insurance increase and the claims for damage decrease. This result shows that exemptions can be a solution to moral hazard. Peng and Li (2024) investigated the existence of moral hazards in Taiwanese automobile insurance using policy information from nearly two million insured individuals from 2013 to 2015. According to the regression analysis results in the probit model, drivers with bundled insurance claim more compensation than those with narrow coverage insurance. This situation indicates a moral hazard to automobile insurance. In addition, the probability of a policyholder's moral hazard significantly differs according to the brand and price of the car.

Rowell et al. (2017) tested the existence of moral hazards in the Australian automobile insurance sector using 994 traffic accident data from 1999 and probit regression. The findings of this study indicate a moral hazard in the automobile insurance sector after an accident. Rowell et al. (2022) used the same dataset to investigate the effects of moral hazard. According to the study results, moral hazards after a traffic accident increase repair costs by nearly 50%. This is because drivers request replacements for parts not damaged in the accident by adding them to the accident report. In addition, no significant relationship was found between the characteristics of the cars and drivers and repair costs.

Jeziorski et al. (2017) investigated the existence of moral hazard in the Portuguese automobile insurance sector by using the policy information of 12,576 insured individuals from a Portuguese insurance company from 2004 to 2010. According to the regression analysis results, the risk levels of individuals who purchase

whole coverage insurance policies are twice as high as those who purchase limited policies. This situation is evidence of moral hazard in the Portuguese automobile insurance sector. Annan (2022) determined the existence of moral hazard in the automobile insurance sector in Ghana using data from official institutions for the period 2013-2015. In addition, this study estimated the extent of moral hazard to be 12% of insurance companies' profits.

Saito (2006) tested whether there is moral hazard and adverse selection in the Japanese auto insurance sector by using insurance policy information obtained from an insurance company from 1999 to 2000. According to the results of the analysis, there is no positive relationship between the policy coverage amounts issued by the insurance company within the scope of the information observed and the accident risk. Car owners in regions with high accident risks do not purchase more comprehensive policies with higher coverage. These findings show that asymmetric information does not pose a problem in the Japanese auto insurance sector. In their study, Spindler et al. (2013) investigated the existence of moral hazard in the German automobile insurance sector by using the policy information of an insurance company from 2009. The results of the analysis using driver risk levels and insurance coverage do not provide any evidence of moral hazard.

Gao et al. (2017) tested asymmetric information in automobile insurance using data from 4297 insured companies in China from 2008 to 2009. In the regression analysis of the negative binomial panel model, the damage demands of the drivers are the dependent variable. In contrast, the independent variables were the driver and car characteristics. Although the results of the analysis indicate adverse selection in Chinese auto insurance, they do not provide any evidence of moral hazard. Zheng et al. (2021) analyzed data for 2013-2014 obtained from the China Insurance Information Technology Company to test whether adverse selection and moral hazards exist in the Chinese automobile insurance sector. According to the regression analysis results using Gamma and Poisson distributions, only the moral hazard of property damage is evident. This study does not provide any evidence of moral hazard in the event of bodily injury.

Methodology of Study and Empirical Findings

The automobile insurance sector, which is part of the non-life insurance branch, contains intense risk and uncertainty. Therefore, it is often subject to moral hazard and adverse selection. To test the existence of moral hazard in the Turkish automobile insurance sector, policy information is needed. We contacted insurance companies to obtain policy information but did not receive a positive response. In addition, since the data to be obtained from insurance companies only include the information included in the policy, it would be beneficial to collect data from vehicle owners that may cause asymmetric information. For these reasons, we used the survey technique, which is a quantitative research method, for data collection.

While preparing the scale of this study, we conducted a pilot study twice in the city center of Afyonkarahisar. While preparing the survey scale that we will use in the first pilot study, we benefited from the scales and variables used in studies such as Chiappori & Salanie (2000), Donnelly et al. (2014), and Geyer et al. (2020). We conducted the first pilot study with 34 car owners in Afyonkarahisar. Thanks to feedback from this study, we corrected the identified deficiencies and revised the survey scale for the second pilot study. We conducted a second pilot study with 20 insurance agencies in Afyonkarahisar. During the survey conducted with the insurance agencies, we gathered detailed information about the cars and owners' information that was considered when making the insurance policy. After receiving feedback from both pilot studies, we determined the final version of the scale to be applied to policyholders.

The research universe consists of car owners in Türkiye who have car and traffic insurance. According to the Insurance and Private Pension Regulation and Supervision Agency's (PPRSA) Report on Insurance and Private Pension Activities for 2019, the number of cars with car and traffic insurance policies was 5.9 million. We considered this number into account when calculating the sample size. Due to budget and time constraints, we carried out the study in Istanbul, Ankara, and Izmir—the three provinces where most car insurance and traffic insurance policies were issued.[1]

The 95% confidence interval and 5% margin of error were considered when calculating the sample size. According to the sample size calculation method made by Yazıcıoğlu and Erdoğan (2004), the sample size was determined as 400. When distributing 400 policyholders by province, we considered the number of car and traffic insurance policies issued in Istanbul, Ankara, and Izmir. Accordingly, we planned to survey 200 car and traffic insurance policyholders in Istanbul, 100 in Ankara, and 100 in Izmir.

Table 1

Summary Information about the Variables

Variables	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
Car-related factors				
Car brand	0.091	0.963	0	1
Car's age	2034	0.963	1	4
Ist. plate code	0.476	0.408	0	1
Cylinder vol.	2740	0.865	1	5
Car ownership	1645	0.900	1	4
Car's usage	0.020	0.139	0	1
Related insurance factors				
Insurance period	2054	1420	1	6
Life insurance	0.218	0.414	0	1
Factors related to the car's owner.				
Gender	0.017	0.130	0	1
Age	1341	0.495	1	3
Education	0.522	0.500	0	1
Profession	0.426	0.495	0	1
Factors related to driving				
Mileage per year	3373	1467	1	6
Intercity mileage	3206	1833	1	6
Winter tyre	0.721	0.449	0	1
Accident	2341	1487	1	6
Moral hazard scale				
Moral hazard1	3623	0.787	1	5
Moral hazard2	3836	0.654	1	5
Moral hazard3	2446	0.888	1	5
Adverse selection scale				

[1] Among the policies, 1,938,941 were issued in Istanbul, 708,559 in Ankara, and 378,662 in Izmir. In other words, the ratio of policies issued in the three metropolitan cities to policies issued in Türkiye is 51.2%.

Variables	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
Adverse selection1	3716	0.798	1	5
Adverse selection2	3801	0.696	1	5
Adverse selection3	3865	0.618	1	5
Insurance awareness scale				
Insurance awareness1	3081	0.999	1	5
Insurance awareness2	3831	0.686	1	5
Insurance awareness3	3740	0.749	1	5
Cause of the car insurance scale				
Causes of car insurance1	2476	0.998	1	5
Causes of car insurance2	3120	1099	1	5
Cause of car insurance3	3662	0.863	1	5
Consumer awareness scale				
Consumer awareness1	3836	0.722	1	5
Consumer awareness2	3561	0.946	1	5
Driver behavior scale				
Driver behavior1	2417	1044	1	5
Driver behavior2	2993	1078	1	5
Insurance perception scale				
Insurance perception1	2154	0.947	1	5
Insurance perception2	2132	0.931	1	5

In determining the sample, we preferred the convenience sampling method (Etikan et al., 2016) among the non-random sampling methods. The reason for preferring the convenience sampling method is that it is only possible to access some of the ends of the research universe, and it takes a long time to reach the participants after random selection. In addition, the voluntary nature of participation in the survey using the convenience sampling method will speed up the data collection process. As a result, we conducted a face-to-face survey with 202 policyholders in Istanbul, 101 in Ankara, and 107 in Izmir through a research company. Two surveys conducted in Ankara were not evaluated due to missing data. The data obtained from 408 surveys conducted with policyholders were analyzed. The most important limitation of the convenience sampling method is that the sample has a low ability to represent the universe. Therefore, it should be considered that the findings and inferences obtained from this study have limited validity in general for Türkiye. We analyzed the data obtained using the survey technique and the regression models we established. In the regression analyses, we used variables related to the car's characteristics, the car owner's demographic characteristics, and their traffic behavior. Summary information about the variables we used is in Table 1.

The dependent variable, moral hazard perception, is the following Likert-type scale statement: “When drivers have an accident, they do not report the accident to the insurance company because the insurance premium will increase.” The mean value of dependent variable is 2.29. Because the dependent variable is discrete, we conducted regression analyses in the ordered probit model. Then, we calculate the marginal fixed effect. The results obtained from the three models we established in the analysis are given in Table 2.

Table 2

Determinants of Moral Hazard

	MODEL 1			MODEL 2			MODEL 3		
Variables	**Coeff.**	**St. Error**	**Marg.**	**Coeff.**	**St. Error**	**Marg.**	**Coeff.**	**St. Error**	Marg.
Car-related factors									
Car brand	−0.423	0.239	−0.0132	−0.443	0.240	−0.0105	−0.487*	0.241	−0.0092
Car's age	0.061	0.099	0.0034	0.080	0.100	0.0019	0.090	0.101	0.0017
Cylinder vol.	0.218*	0.099	0.0064	0.202*	0.100	0.0048	0.206*	0.100	0.0039
Car ownership	0.214	0.123	0.0066	0.229	0.123	0.0054	0.218*	0.124	0.0041
İst. Plate code:	−0.254	0.199	−0.0088	−0.283	0.200	−0.0067	−0.294	0.201	−0.0055
Car's usage	2.357***	0.508	0.0701	2.246***	0.520	0.0531	2.155***	0.525	0.0406
Related insurance factors									
Insurance period	−0.0357	0.081	−0.0011	−0.049	0.081	−0.0012	−0.0546	0.082	−0.0010
Life insurance	0.166	0.158	0.0050	0.121	0.160	0.0029	0.119	0.160	0.0022
Factors related to the car's owner.									
Gender	−0.875	0.498	−0.0089	−0.908	0.502	−0.0070	−0.860	0.502	−0.0054
Age	0.168	0.169	0.0050	0.147	0.169	0.0035	0.130	0.170	0.0025
Education	0.224	0.134	0.0067	0.232	0.134	0.0055	0.217	0.135	0.0041
Profession	−0.0965	0.140	−0.0029	−0.098	0.140	−0.0023	−0.138	0.142	−0.0026
Factors related to driving									
Mileage per year	0.0232	0.047	0.0007	0.0246	0.047	0.0006	0.0285	0.048	0.0005
Intercity mileage	−0.0857*	0.037	−0.0026	−0.0797*	0.037	−0.0019	−0.0929*	0.037	−0.0018
Winter tyre	−0.0731	0.152	−0.0023	−0.127	0.154	−0.0033	−0.122	0.154	−0.0025
Accident	−0.562***	0.130	−0.0167	−0.608***	0.132	−0.0144	−0.628***	0.131	−0.0118
Moral hazard scale									
Moral hazard1	−0.229**	0.087	−0.0068	−0.235**	0.087	−0.0056	−0.252**	0.087	−0.0048
Moral hazard2	−0.239*	0.102	−0.0071	−0.227*	0.103	−0.0054	−0.215*	0.103	−0.0041
Moral hazard3	0.200**	0.074	0.0059	0.182*	0.074	0.0023	0.181*	0.075	0.0034
Adverse selection scale									
Adverse selection1	−0.0335	0.104	−0.0010	−0.0733	0.105	−0.0017	−0.0619	0.106	−0.0012
Adverse selection2	−0.281*	0.119	−0.0084	−0.279*	0.120	−0.0066	−0.311*	0.121	−0.0059
Adverse selection3	0.0189	0.119	0.0006	0.0244	0.120	0.0006	0.0131	0.120	0.0003
Insurance awareness scale									
Insurance awareness1	0.0462	0.069	0.0014	0.0431	0.070	0.0010	0.0678	0.071	0.0013
Insurance awareness2	0.105	0.107	0.0031	0.135	0.108	0.0032	0.136	0.108	0.0026
Insurance awareness3	−0.125	0.090	−0.0037	−0.139	0.091	−0.0033	−0.185*	0.093	−0.0035
Cause of the car insurance scale									
Causes of car insurance1	0.0616	0.071	0.0018	0.0532	0.071	0.0013	0.0585	0.071	0.0011
Causes of car insurance2	0.137*	0.062	0.0041	0.137*	0.062	0.0033	0.143*	0.062	0.0027

	MODEL 1			MODEL 2			MODEL 3		
Variables	**Coeff.**	**St. Error**	**Marg.**	**Coeff.**	**St. Error**	**Marg.**	**Coeff.**	**St. Error**	Marg.
Cause of car insurance3	0.0376	0.079	0.0011	0.0401	0.080	0.0010	0.0624	0.080	0.0012
Consumer awareness scale									
Consumer awareness1	−0.0249	0.102	−0.0007	−0.0117	0.103	−0.0003	−0.0201	0.103	−0.0004
Consumer awareness2	−0.117	0.074	−0.0035	−0.144	0.075	−0.0034	−0.166*	0.075	−0.0031
Driver behavior scale									
Driver behavior1	0.139*	0.068	0.0041	0.125	0.069	0.0030	0.169*	0.071	0.0032
Driver behavior2	0.0773	0.065	0.0023	0.0570	0.065	0.0014	0.0649	0.065	0.0012
Insurance perception scale									
Insurance perception1				0.201**	0.075	0.0048	0.317***	0.086	0.0060
Insurance perception2							−0.233**	0.085	−0.0044
Observations	408			408			408		
Prob.	0.0000			0.0000			0.0000		
R-squared	0.1825			0.1912			0.2002		

Dependent Variable: Moral hazard perception.
Significance Levels: * 0.01 < p < 0.05, ** 0.001< p < 0.01, *** 0 < p < 0.001
Reference Groups: Renault, Istanbul plate code, bachelor's degree, life insurance, merchant.

According to the results of the analysis, moral hazard perception differs significantly regarding car-related factors, such as car brand, engine cylinder capacity, usage type, and car ownership duration. The moral hazard level of Renault-branded car owners is lower than that of other car owners at a 5% significance level. As the car's engine cylinder capacity increases, the moral hazard level increases (5% significance level). Similarly, as the duration of car ownership increases, the level of moral hazard also increases (5% significance level). The moral hazard level of drivers whose cars are used commercially is higher than that of drivers whose cars are used privately, at a significance level of 0.1%.

Moral hazard perception did not differ significantly regarding factors related to car ownership and insurance. However, driving-related factors, such as the intercity mileage and number of accidents, significantly differ. At the 5% level of significance, as the intercity mileage of drivers increases, moral hazard levels decrease. As the number of accident drivers increased, the moral hazard levels decreased (at the 0.1% significance level).

According to the analysis results, moral hazard perception differed significantly between the 10 statements on the Likert scale. Those who cover the damage they incur in an accident with their car traffic insurance have lower moral hazard levels than other drivers (at a significance level of 1%). Similarly, those who cover the damage they incur when they have an accident with their car from comprehensive insurance have lower moral hazard levels than other drivers (at a significance level of 5%). Drivers who believe that people with comprehensive insurance drive more carelessly in traffic have higher moral hazard levels than other drivers (at a significance level of 5%). Drivers who think the insurance agency provides complete information when getting car insurance have lower moral hazard levels than other drivers, at a significance level of 5%.

The moral hazard level of those conscious about insurance and research prices before getting car insurance is lower than that of other drivers (at a significance level of 5%). The moral hazard level of drivers

who stated that they received insurance because their car had a higher model year was higher than that of other drivers at a significance level of 5%. The moral hazard level of drivers who take risks while driving is higher than that of other drivers (at a significance level of 5%). The moral hazard level for those who believe that Türkiye's traffic insurance system is unnecessary is higher than that of other individuals (at a significance level of 0.1%). The moral hazard level of those who believe that every car owner should get insurance is lower than that of others at a significance level of 0.1%.

Conclusion

Asymmetric information, a market failure, often occurs in insurance markets that involve risk and uncertainty. This study analyzes data from 408 policyholders and tests the existence of moral hazard in the Turkish automobile insurance sector. We performed regression analysis with three different probit regression models. We also identified the factors affecting the perception of moral hazard. In this respect, this study focuses on the moral hazard literature in automobile insurance, starting with Boyer and Dionne (1989) and continuing with studies such as Cummins and Tennyson (1996), Richaudeau (1999), Saito (2006), Dionne et al. (2013), and Zheng et al. (2021).

The findings of this study largely coincide with those of many previous studies. In particular, the finding that moral hazard levels vary according to vehicle features and type of use, which was emphasized in Boyer and Dionne (1989) and Li et al. (2007), was confirmed in this study. For example, the increase in moral hazard levels with increasing engine cylinder volume can be explained by the fact that more powerful vehicles are generally associated with riskier driving behaviors. The fact that commercial vehicle drivers have higher moral hazard levels is also consistent with previous studies. Because commercial vehicle drivers travel more frequently and for longer distances due to work, they use the insurance system more often. In addition, it is significant that moral hazard levels decrease as the distance drivers travel between cities increases. Therefore, long-distance drivers tend to be more careful to minimize accident risks. This result is also consistent with Gaudry's (1992) and Peng and Li (2024) findings.

However, this study also presents findings that contradict previous studies. In particular, the inverse relationship between the number of accidents and moral hazard contradicts the findings of studies by Richaudeau (1999), Satio (2006), Spindler et al. (2013), and Gao et al. (2017) that "accidents have no significant effect on moral hazard levels." On the other hand, the fact that no significant difference was found in moral hazard perception in terms of the age and gender of the vehicle owner is not consistent with some previous studies. For example, while Viaene et al. (2007) stated significant differences in moral hazard perception between male and female drivers, this study did not detect such a distinction. This situation may be due to cultural or regional differences and differences in sample structure.

The findings of this study are broadly consistent with those of previous studies emphasizing the effect of insurance awareness and knowledge on moral hazard. For example, Tennyson (1997) found that individuals who are conscious about insurance have lower moral hazard levels. Similarly, in this study, individuals who are informed about insurance policies and consciously choose their policies have lower moral hazard levels. The main reason is that individuals who understand the insurance process better are less likely to misuse insurance. In addition, the fact that individuals whose vehicle damage is covered under traffic or comprehensive insurance have lower moral hazard levels indicates that insurance coverage can balance individuals' risk perception. This situation reveals that insured individuals are less likely to misuse the insurance system when they act consciously. The fact that drivers with a high risk-taking tendency have higher moral hazard

levels is consistent with the findings of Jeziorski et al. (2017). This indicates that individuals' driving habits can be directly related to moral hazards and that this situation is related to insurance policies and individual psychological factors.

However, some study results do not fully coincide with those of other studies in the literature. First, the fact that drivers with traffic or comprehensive insurance have lower moral hazard levels contradicts the hypotheses put forward in some studies that insurance coverage can increase moral hazard. In particular, although broad insurance coverage can cause individuals to exhibit riskier behaviors in some cases, the opposite relationship is found in this study. This difference may be due to the functioning of the insurance system in Türkiye, regulations regarding damage payments, and cultural differences in individuals' perceptions of insurance. In addition, although this study found a negative relationship between insurance awareness and moral hazard, some studies have stated that this relationship is weaker or varies depending on different variables. Therefore, more comprehensive and other studies on the effect of insurance awareness on moral hazard are needed. For this purpose, PPRSA must prepare informative content for vehicle owners and share it in written and visual media.

Results

This study, the first on the moral hazard of Turkish automobile insurance, identifies the factors that constitute a moral hazard. If insurance companies consider the factors that cause moral hazard while calculating the policy price, they can determine fairer prices for policyholders. If this information is requested from the vehicle owner, he/she can declare it and even provide a document to prove the declaration. Therefore, taking these elements into account when determining the policy price allows insurance companies to apply special prices according to the situation of the vehicle owners instead of the average price. Thus, problems arising from moral hazard in the automobile insurance sector will be reduced.

The government reduces the factors that cause moral hazard and asymmetric information through its regulations in the sector. In terms of traffic insurance, entered tariff regulations were put into force in 2007. This regulation introduces a seven-step bonus-malus system. The government has changed its tariff regulations 20 times since the date of its first publication. Therefore, traffic insurance is a sector suitable for regulation. However, car insurance is subject to a free tariff regime. Therefore, regulating car insurance is relatively more difficult and challenging.

One of the regulations that can be made to minimize the elements that cause moral hazard in automobile insurance is to share the current information at vehicle inspection stations with insurance companies. Commercial vehicles are subject to mandatory annual inspections, and private cars are subject to inspection every two years. In addition to periodic inspections, vehicles must undergo a modification inspection when any modification is made to them. At vehicle inspection stations, the mileage information of the vehicles is recorded. In the models created in this study, we determined that the mileage of cars in a year affects the moral hazard level. If the mileage information of the vehicles is shared with insurance companies and considered in the policy price calculation, one of the elements that cause moral hazard will be eliminated.

In the inspections performed at vehicle inspection stations, defects that may affect the vehicle's traffic flow and cause loss of life and property due to accidents are classified as minor and major defects and recorded in the system. Cars cannot pass the inspection without having their major defects fixed. Vehicles with minor defects are subject to inspection. Considering that minor defects can also affect the risk of an accident, it is expected that the insurance or traffic insurance policy price of a vehicle that passes

the inspection without faults will be lower than the policy price of a car that passes the inspection with minor flaws. Therefore, if the information recorded at vehicle inspection stations is shared with insurance companies, which take this information into account when calculating the policy price, the moral hazard levels of drivers will decrease. This situation will reduce uncertainties in the automobile insurance sector and contribute to both insurance companies and vehicle owners making more rational decisions.

The limitations of this study create certain restrictions on the reliability and generalizability of the results. First, due to the inability to obtain data from insurance companies, collecting policy information belonging to the insured through a survey introduces the possibility of missing information or bias based on the statements of the individuals who respond. Participants may consciously or unconsciously provide incomplete or incorrect information about their policies, which may affect the accuracy of the data and the reliability of the analysis results. A study using official policy information from insurance companies may produce more precise and verifiable results. In addition, the inability to access detailed data on the insured's claim history and insurance usage habits makes it difficult to conduct a more in-depth analysis of moral hazard.

In addition, using the convenience sampling method in sample selection reduces the sample's representativeness. This situation limits the generalizability of the results obtained from the study to all insured people in Türkiye. Another limitation of this study is that it does not cover other dimensions of asymmetric information, especially adverse selection and principal-agent problems. These elements are factors that can directly affect the risk-taking tendencies of insured people and the risk management strategies of insurance companies.

In future studies, another important aspect of asymmetric information—adverse selection—can be examined in the Turkish automobile insurance sector. Similar surveys can be conducted using larger and randomly selected samples and compared with the results of this study. All aspects of asymmetric information (moral hazard, adverse selection, principal-agent problem) can be investigated in different insurance branches. The behavioral consequences of moral hazard can be evaluated in different applications, such as insurance awareness campaigns.

Peer Review: Externally peer-reviewed.
Conflict of Interest: The authors have no conflict of interest to declare.
Grant Support: The authors declared that this study has received no financial support
Author Contributions: Conception/Design of study: İ.S., N.T.S., A.B.; Data Acquisition: İ.S., N.T.S., A.B.; Drafting Manuscript: İ.S., N.T.S., A.B.; Critical Revision of Manuscript: İ.S., N.T.S., A.B.; Final Approval and Accountability: İ.S., N.T.S., A.B.

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