Economic and Non-Economic Losses Fraud Severity Estimation of Auto Bodily Injury: Evidence from China

Abstract

Despite the increasing importance of opportunistic fraud activities in liability claims to insurers, relatively little research has been done to understand the causes and impacts of these activities. General damage awards are often argued to be the primary motivating factor for this type of opportunistic fraud. We test this hypothesis using a unique sample of closed claim lawsuit cases in automobile bodily injury liability during 2007-2012 in China. Our results show that the economic and non-economic losses fraud is significant and exists universally in any injury severity, disability or death damages. Hospitalization opportunistic fraud occurs mainly in more serious injury severity, but the opportunistic fraud within the elderly group occurs mainly in less serious injury severity. Our findings provide additional insights on ex post moral hazard and have important policy implications to both insurers and regulators.

Keywords: Insurance Fraud, General damage, Strain and Sprain.

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1. Introduction

Moral hazard has long been recognized as an essential issue in the insurance markets. One particular form of moral hazard is when the insured attempts to manipulate the amount received from an insurance claim, i.e., the ex post moral hazard or insurance fraud. Fraudulent claims significantly increase the cost borne by insurance companies and ultimately create deadweight losses to the entire society[Meyer et al., 1995, Cummins and Tennyson, 1996]. The prior literature of ex post moral hazard primarily focuses on the effects of economic losses claimed on total settlements, such as medical expenses on the soft-tissue injuries [Derrig et al., 1994], sprain and wage claims from the perspective of falsification cost [Crocker and Tennyson, 2002], and medical expenses and wage losses [Doerpinghaus et al., 2008]. Although noneconomic losses are more susceptible to such ex post moral hazard, it is rarely studied because of the difficulty in separating economic and noneconomic losses in detecting these fraud scenarios.

Publicly available statistics generally are highly aggregated and presented in a form accessible only to the specialist. The previous studies often utilize and are limited by the Insurance Research Council (IRC) data or similar data from insurance companies, which lack of the noneconomic damages claims data to examine how closely the settlement amount represent the real underlying losses. This is further complicated by the fact that most of these data sets have to resort to the opinions of experts, rather than court decisions, to determine whether a claim constitutes fraud or not.

The primary objective of this paper is to fill the gap in the current literature by making use of a unique data set. This study provides new insights in ex post moral hazard by examining both the economic and noneconomic losses in automobile bodily injury liability (BIL) insurance. Automobile liability claims is one of the most common sources of individual liability and the consequences of settlement decisions are far reaching. Auto liability settlement amounts are influenced by many factors such as the claimant's degree of fault in causing the accident, the extent of the claimant's bodily injury, state negligence rules, the attorney involvement and falsified claims from both economic and noneconomic losses due to moral hazards from the claimants. Inflations in the general damage awards have been the primary motivation for liability claims opportunistic fraud [Cummins and Tennyson, 1996, Crocker and Tennyson, 2002, Loughran, 2005, Asmat and Tennyson, 2014]. Noneconomic personal injury protection coverage is most susceptible to moral hazard and has been a major source of premium inflation.

Our empirical work builds upon a unique data set of settled automobile bodily injury third-party compulsory liability (BITPCL) claims lawsuits during 2007-2012 in China. Our data set has a few advantages over what is used in previous studies. First, litigated claims provide a more objective fraud definition than expert opinions. Second, our data contains a break down of different items of claimed losses that include also noneconomic losses. Because our data provides detailed information on the claimed and settled loss amounts, we focus on studying the severity of insurance fraud, rather than the frequency. To our best knowledge, this is the first study that empirically gauges noneconomic losses fraud severity. We are able to test whether the economic and noneconomic losses have different impacts on insurance fraud severity and identify claimant demographic and other claim characteristics that affect the fraud severity.

We classify the court awarded amounts into "insurer award amount" and "insured motorist award amount", and then calculate the insurance fraud amount based on the total

claim and the awarded amount. We divide the court awarded amount into "insurer payment amount" and "insured defendant motorist payment amount", and then calculate total opportunistic fraud amount based on the total claim and award amount. Both the claim and award amount are considered spontaneously to evaluate the opportunistic fraud severity. Next, we identify opportunistic fraud from two dimensions: the opportunistic fraud exists only for the insurer if the court award amount equals the insurer payment amount; on the contrary, the opportunistic fraud exists for both the insurer and the insured defendant driver if the court awarded amount is greater than the insurer payment amount. These measures are employed to answer three questions: i) To what extent does the general damage influence opportunistic fraud severity in auto bodily injury claims? ii) Does lower opportunistic fraud probability of death or disability damage also imply lower opportunistic fraud severity? iii) Does higher opportunistic fraud probability for sprains suggest larger opportunistic fraud severity?

This paper contributes to the existing literature in the following four aspects. First, the opportunistic fraud severity of general damage is the largest claim sub-items among all economic and non-economic losses and much larger than the second largest wage loss claim consistent with our hypothesis. Mental anguish exists objectively, but claimants often neglect the auto accident injured identity, family background, accident fault, and social effects etc., leading to larger opportunistic fraud space for general damage claim. This main finding adds to the present auto claim fraud literature in which general damage claim amount is not included [Crocker and Tennyson, 2002, Loughran, 2005, Doerpinghaus et al., 2008]. Second, our research contributes to the current auto claim fraud literature in which bodily injury severity is just a dummy variable [Crocker and Tennyson, 2002, Loughran, 2005, Doerpinghaus et al., 2003, 2008]. The opportunistic fraud severity of disability or death damage is the third largest among all economic and non-economic losses claim sub-items because more severe injury severity for disability or death creates the claimants a larger opportunistic fraud space. The largest insurer payment and larger opportunistic fraud amount coexist in disability or death damage claim. Third, the opportunistic fraud severity with attorney involvement is larger than that without an attorney consistent with our hypothesis. Claimant negotiating power can be enhanced significantly when a lawyer is involved, but the lawyer may encourage the claimant to seek higher claim amount, leading to larger opportunistic fraud space. Larger insurer payment and larger opportunistic fraud amount are consistent in attorney involvement claim, enriching present single lawyer enhancing claimant negotiating power and insurance payments literature [Cummins and Tennyson, 1992, Doerpinghaus et al., 2008]. Last, the opportunistic fraud severity for sprains is not statistically significant contrary to our hypothesis because lower injury severity for sprains limits its potential for opportunistic fraud greatly, leading to a much lower claim amount. Higher opportunistic fraud possibility for sprains does not suggest larger opportunistic fraud severity[Crocker and Tennyson, 2002, Loughran, 2005].

The remainder of this article is organized as follows. Section 2 presents the literature review, the Bodily Injury Third-Party Compulsory Liability (BITPCL) Data from China, and discusses the importance and necessity of quantifying the opportunistic fraud severity and adding noneconomic losses claimed and other economic losses claim sub-items besides medical expense and lost wage by seeking an independent claims lawsuit sample beyond insurance companies. Section 3 develops specific hypotheses to be tested, measures how economic and noneconomic losses claim sub-items, RTSL, claimant demographic and other claim characteristics affect insurer payment and opportunistic fraud amount differently, and describes the actual lawsuit data on auto bodily injury third-party compulsory liability insurance claims. Section 4 presents empirical test results of the hypotheses and discusses insights. Section 5 concludes the paper and discusses limitations.

2. Literature Review and The Bodily Injury Third-Party Compulsory Liability (BITPCL) Data from China

2.1. Literature Review

The essential components of fraud are the intent to deceive and the desire to induce an insurer to pay more than it otherwise would. A great deal of research focuses on fraud frequency, assessing and ranking fraud suspiciousness of individual claims, either based on the parametric and supervised methods [Derrig and Ostaszewski, 1995, Artís et al., 2002, Viaene et al., 2002, Caudill et al., 2005], or unsupervised methods for opportunistic fraud detection [Brockett et al., 2002, Ai et al., 2009, 2013].

However, higher fraud frequency does not necessarily imply larger fraud severity. The ex post moral hazard often cause the soft insurance fraud, i.e., the opportunistic insurance fraud. It occurs when the claimant takes advantage of a situation which has already taken place and makes an inflated claim, such as exaggerating the severity of an injury and claiming injuries or pain beyond the actual damages. For example, a person being legitimately injured in a collision could pretend that the injuries received were worse and more painful than they actually were and claimed additional monies. Soft fraud is the most common form of auto insurance fraud because it is very easy to commit and difficult to detect. Especially in cases where neck and back injuries are involved, it is often difficult to determine the true extent of the damage. Due to this fact, policyholders often exaggerate their pain or disabilities to receive extra compensation. The excess of legitimate injuries received in unplanned accidents is very easy to do, even without malicious intent, which is why it is so frequent. Therefore, it is very important to analyze the severity of opportunistic fraud.

Empirical estimates of the extent of excess claim are not available. Some previous researches focus on insurance payout, which are used to imply the excess claim indirectly, but its implication is too coarse and inaccurate. Among these literatures, total damages payments include economic and noneconomic losses, but noneconomic loss is not contained in the total amount claimed. Economic loss is also called special damage in auto insurance. It refers to financial loss and damage suffered by a person resulting from medical expense and lost wage. Extent of bodily Injury includes non-disability, partial disability, total disability, and death. Fatality and permanent total disability are more severe injuries, more disputable between the claimant and the insured motorist, and more likely to be litigated. Doerpinghaus et al. [2008] find that the payout for permanent disability larger than that for temporary disability after eliminate all death claims.

The difficulty inherent in diagnosing the severity of the types of injuries typically suffered in automobile accidents—soft-tissue injuries or "sprains and strains"—makes automobile insurance fraud relatively inexpensive to perpetrate and costly to deter. Sprains are more difficult to prove than other injury types, and relatively more susceptible to opportunistic fraud. Crocker and Tennyson [2002] report that claims involved sprain injuries receive lower insurance payments than non-sprain claims, and Loughran [2005] sees that sprain injuries receive lower general damages at all levels of special damages. Viaene et al. [2002] find that auto accident audit probability is positively correlated with strain and sprain claim. Derrig et al. [1994] find that the auto accident claimant is inclined to claim general damage for strain and sprain if he can get help from a lawyer. Derrig and Weisberg [2003] find that the presence of independent medical exam (IME) corresponds to higher payout because it can prove the suffered injury more easily, meaning lower fraud probability, so the insurer is willing to give a more generous payout.

Wage loss is easier to falsify by malingering on the part of the injured party than claims for medical expense. Crocker and Tennyson [2002] eliminate all death and permanent total disability claims because the wage loss settlement amount of death or permanent total

disability is much larger than other claims. Crocker and Tennyson [2002] find that claims involving wage loss receive substantially less generous settlements than claims entailing only medical expense.

It is also of interest for economic losses claimed to extend to other claim sub-items such as subsequent treatment expenses, transportation costs etc. Doerpinghaus et al. [2008] find the payout of hospitalization larger than that of outpatient because bodily injury severity of inpatient is more severe than that of outpatient. But inpatient is involved with hospitalization care expense, which is still involved in the revenue, persons, term, and level of the nursing staff, and there exists a larger opportunistic fraud space to exaggerate the claim amount if the claimant colludes with the hospital care staff.

Noneconomic loss is also called general damage, which is intended to compensate the auto accident injured or the dead victim's dependents for pain and suffering, emotional distress, loss of consortium or companionship, and other intangible injuries. These damages involve no direct economic loss and have no precise value. It is very difficult for insurers or legal courts to assign a dollar value to these losses by their nature. As a result, these awards tend to be erratic and easy to be falsified. The main function of noneconomic loss is its appropriate symbolic atonement. Jaffe [1953] suggests that noneconomic damages may establish the plaintiff's self-confidence, wipe out his sense of outrage, or may be a consolation or solace from a psychic perspective; Ingber [1985] argues that its symbolic function is served by limiting damages to pecuniary losses that additionally result in nonmonetary harm; Radin [1993] suggests that its compensation can symbolize public respect for rights and public recognition of the transgressor's fault by requiring something important to be given up on one side and received on the other; Zavos [2009] argues that noneconomic damages symbolically affirm that the plaintiff has been wrongfully deprived of something of value, even though that value can not be expressed at its fair market equivalency. Its calculation focuses on the appropriate atonement, e.g., Blumstein et al. [1991] argue that a series of jury verdicts for similar injuries or losses will lack predictability and consistency, given the minimal guidance they customarily receive from the court; Geistfeld [1995] clarifies the potential award arbitrariness into vertical and horizontal equity, indicating horizontal equity worse than vertical equity; Bovbjerg et al. [1988] propose constructing a matrix that determines the relative ratios for noneconomic damages based on data from past jury verdicts, broken down by the nine-point severity scale (the highest severity is death, and the lowest severity is emotion only); Zavos [2009] further proposes that the jury selects a point on the severity scale to determine the noneconomic loss. Empirically Crocker and Tennyson [2002] examine the optimal claims settlement strategy for a liability insurer by regressing the total payment amount on the economic damages claimed for bodily injury liability in automobile accidents; Loughran [2005] shows that insurers use general damage awards to reduce the incentive to submit exaggerated claims for specific damages for injuries and lost wages in bodily injury claims; and Asmat and Tennyson [2014] estimate the impact of bad faith liability on the total settlement amount relative to the claimed amount of loss, and find the presence of tort liability for insurer bad faith increases settlement amounts and reduces the likelihood that a claim is underpaid. But to date no research estimates the relationship between general damage claimed amount and total insurance payments, let alone the investigation of the opportunistic fraud space for a general damage claimant to exaggerate his or her claim amount.

The second branch of related research is on compensation mechanism, which mainly falls into tort and no-fault.[1] The major difference is whether there are restrictions on the right

[1]Automobile liability accounts for more than half of all property-liability insurance premiums sold in the United States. Furthermore, the topic of sufficient concern that state legislators continue to pass laws modifying rules for compensating individuals injured in automobile accidents. Colorado, for instance, reverted to a tort liability system in 2003 after many years as a no-fault state. Minnesota is considering a similar change.

to sue and whether the policyholder's own insurer pays first-party benefits, up to the state maximum amount, regardless of who is at fault in the accident. Under the traditional tort mechanism for compensating victims of auto accidents, a driver can only be held responsible for other parties' damages if the driver is found to be negligent in the context of the accident. Tennyson and Warfel [2008, 2010] find that tort liability for first-party bad faith leads to more paid claims that contain characteristics often associated with fraud. The no-fault system is intended to compensate injuries more efficiently and lower the cost of auto insurance by taking small claims out of the courts. Each insurance company compensates its own policyholders (the first party) for the cost of minor injuries, regardless of who was at fault in the accident. No-fault liability can lead to greater levels of compensation, but variability in payment is less. Insurer liability for bad faith increases pressure on insurer to pay fraudulent or exaggerated claims. Schmit and Yeh [2003] find that New Jersey increases variability in payment after it switched to choice from no-fault. A great deal of research has been reported on various aspects of U.S. litigation patterns, such as changes in numbers of legal claims filed in various courts and jurisdictions, and the effects of various legislative modifications to the civil litigation system [Viscusi, 1991, Reimann, 2003, Browne and Schmit, 2008]. But it is too coarse only to explore the relationship between auto compensation mechanism and total payments. Browne and Schmit [2008] find that the claimant fault is positively correlated with probability of hiring attorneys and filing legal claims, where the more the claimant fault is, the larger probability the claimant hires an attorney and files a legal claim.

The third branch of related research is to investigate whether claimant demographics characteristics (namely, gender, age, marital status, and employment status etc.) also affect economic and noneconomic claim moral hazards. The prior literature provides evidence of risk aversion and negotiation differences as a function of gender and age. For instance, women and the elderly are more risk averse for a variety of pure and financial (i.e., speculative) risks [Levin et al., 1988, Powell and Ansic, 1997, Jianakoplos and Bernasek, 1998, Sunden and Surette, 1998, Schubert et al., 1999, Halek and Eisenhauer, 2001]. Study also provides evidence that women and the elderly are more conflict averse in dispute settlement with greater negotiation costs and less successful outcomes, resulting in preferences for shorter negotiations with relatively lower payoffs holding other factors constant [Gallos, 1993, Stuhlmacher and Walters, 1999, Graddy and Pistaferri, 2000]. But to date no research estimates the opportunistic fraud space for the woman or elderly claimant to exaggerate his or her claim amount. The married can make claim decisions jointly with his or her spouse. Bair et al. [2012] find the married motorist gains larger payout than the non-married controlling other factors. Unemployed claimants are more ready to hold out for higher settlements since they have little to lose by waiting. The unemployed receives more payout than the employed [Cummins and Tennyson, 1996, Doerpinghaus et al., 2008]. But to date no research estimates the opportunistic fraud space for the married or the unemployed claimant to exaggerate his or her claim amount.

The forth branch of related research is to investigate whether other claim characteristics (such as attorney, location in city, and sprains etc.) also affect economic and noneconomic claim moral hazards. Claimant bargaining power can be greatly improved when a lawyer is involved. Browne and Schmit [2008] find that claimant fault is positively correlated with probability of both hiring attorney and filing legal claims. Doerpinghaus et al. [2008] find that defendant driver fault is positively correlated with total claim payment. The larger victim fault is, the more the court reduces the award amount, and the larger the difference between total claim and award amount is. Cummins and Tennyson [1996] find that the insured motorist can gain higher award amount of pain and suffering for the slight auto accident injury when a lawyer is involved. In metropolitan locations, people are less likely to know one another and therefore are more likely to make a claim, even if potentially without

a merit. Kessler [1995] finds that more fraud occurs in metropolitan areas than in rural areas, where fraud is more likely to exist, insurers are less generous in their claim payment. Doerpinghaus et al. [2008] find that the payment in the urban area is less than that in a rural area. Tennyson and Warfel [2008, 2010] find that tort liability for first-party bad faith leads to more paid claims that contain characteristics often associated with fraud because insurer liability for bad faith increases pressure on insurer to pay opportunistic fraudulent or exaggerated claims.

We take these studies one step further to test whether economic and non-economic losses claim sub-items, compensation mechanism, claimant demographic and other claim characteristics affect opportunistic fraud severity based on our datasets on court award sample of auto bodily injury third-party compulsory liability insurance, and make a contrast between their effects on insurer payment and opportunistic fraud amount.

2.2. The Bodily Injury Third-Party Compulsory Liability (BITPCL) Data from China

Our research sample is the automobile bodily injury third-party compulsory liability (BITPCL) legal claims lawsuit data in China. We begin by providing an overview of the auto insurance system and the structure of the auto insurance market in China. China is the largest emerging auto insurance market with auto accidents increase significantly. In 2010 alone, more than 390,000 accidents occurred on local roads and highways in China, with over 254,000 injuries, and death toll of more than 65,000 (Statistical Abstract of Traffic Control Department of the People's Republic of China, 2013).

The Road Traffic Safety Law (RTSL) implemented in China since 2004. It emphasizes on protecting the auto accident victims, especially guarding the non-motor driver or pedestrian in a traffic accident more than the motorist, and urges the insurer to pay the traffic injured within the auto bodily injury third-party compulsory liability (BITPCL) limit.[2] A considerable number of auto accident claims disputes were litigated to the courts, and both economic and noneconomic losses were sought by claimants. RTSL is a mixture of tort and no-fault: if the auto accident victim is a non-motor driver or pedestrian, it mainly applies no-fault and fault is considered by the court secondly; but if the auto accident victim is a motorist, it applies fault completely. RTSL classifies victim role in auto accident into motor driver, and non-motorist or pedestrian, and protects the non-motorist or pedestrian more than the motorist, maybe leading to moral hazard that the non-motorist or pedestrian exaggerate his or her bodily injury claim amount. We expect that RTSL gives rise to moral hazards of claimants neglecting victim fault, and focuses on non-motorist or pedestrian role in auto accident and higher policy compensation. We expect that victim fault is negatively correlated with insurer payment amount, but positively correlated to opportunistic fraud severity, and that both insurer payment and opportunistic fraud amount for the non-motorist or pedestrian are larger than that for the motorist.

The claimant may recover for all bodily injuries sustained including economic and noneconomic losses from the insurer and the insured injuring motorist. If an auto accident causes the victim personal injury or death, the insurer shall pay indemnity within BITPCL threshold. The BITPCL provides the basic compensation for bodily injury that the insured has caused to another party, and its indemnity limit is the same across China, including death or disability limit, medical expense limit, and limit when the insured motorist is no-fault. Death

[2]RTSL may affect claimants and judges behavior through victim fault and role in auto accident, and BITPCL policy limit. Browne and Schmit (2008) include total disability and fatality in injury severity. The claimant is the victim while the injured is subject to temporary disability, or partial disability; but the claimant is the victim's dependents when the injured is subject to total disability or fatality. Our actual claims lawsuit sample encompasses all injury types, especially total disability and fatality, so we use victim instead of claimant in this article.

or disability expenses include funeral expenses, death damages, traffic costs for dependents of the traffic accident dead victim to deal with the funeral£¬disability damages, disability aid expenses, care expenses, restoration expenses, traffic costs, dependents expenses, accommodation expenses, and lost wages. Death and disability damages amount are calculated in similar manner and hence considered as the same category. Death damage reflects the amount that the decedent would be reasonably expected to have accumulated during the remainder of his lifetime, which is generally calculated according to 20 years. Disability damage reflects the amount that the disabled would be compensated by his or her capacity losing severity and disability level. In China, due to the large urban-rural disparity, death or disability damages amount is much different between urban and rural residents.[3] There is incentive for claimants to exaggerate claim amount with the bodily injury severity from lower grade to higher grade. In contrast, the general damages amount is a larger flexible scope, not an absolute value, and not subject to the difference across the urban and rural residents.[4] Assuming that normal life expectancy is 80 years old, if the injured victim in the auto accident is above 60 years old, the time span equals 80 minus his or her real age.[5] Assumed that a peasant and a citizen suffer the same bodily injury in an auto accident, disability or death damages awarded for the citizen is much larger than that for the peasant just because of their urban-rural identity difference, so it is more tempting to exaggerate claim amount for city claimants.

On June 19, 2006, China Insurance Regulatory Commission determined auto BITPCL indemnity limit of ¥58,000 without deductibles, including death or disability limit ¥50,000, and medical expenses limit ¥8,000. When the insured defendant motorist is no-fault in the auto accident, death or disability limit is ¥10,000, and medical expenses limit is ¥1,600. In 2008, China Insurance Regulatory Commission revised auto BITPCL indemnity limit of ¥120,000 without deductibles, including death or disability limit of ¥110,000, and medical expenses limit of ¥10,000.

There is no systematic study on auto bodily injury liability fraud detection. Empirical auto insurance fraud detection in China largely focuses on physical damage and fraud frequency. [Ye, 2010] obtains auto insurance fraud detection indicators for auto physical damage and fraud frequency based on Jiangsu, Zhejiang, and Shanghai automobile insurance claims data; **?** finds the validness of BP Neurological Networks based on the significant automobile physical damage fraud frequency factors; Zhou et al. [2014] explore how claim filing characteristics affect insurer award amount (a fraction of total award amount) based on legal claims in Beijing.

3. Basic Assumptions, Model Setting, Sample and Data

3.1. Basic Assumptions

We assume that factors related to fraud frequency and claim payments equally influence both insurer payment and opportunistic fraud amount. Both insurer payment and opportunistic fraud amount are determined by economic and non-economic losses claim sub-items, RTSL, and claimant demographic and other claim characteristics together.

[3]The death or disability is divided into 10 grades from level 1 (the most severe, disability damage amount=death damage amount ×100%) to level 10 (the least serious, disability damage amount=death damage amount ×10%) according to the bodily injury severity with the multiplier is gradually reduced by 10% from level 1 to level 10.

[4]In 2012, for Beijing urban resident, death damages amount is ¥658,060 (= ¥32,093 of the urban per capita disposable income in previous financial year ×20 years) and the general damages amount is ¥50,000˜¥100,000. Similarly, for Beijing rural resident, death damages amount is ¥294,720 (= ¥14,736 of the rural per capita disposable income in previous financial year ×20 years), and the general damages amount is ¥50,000˜¥100,000.

[5]For example, if an urban victim is 75 years old, death damages amount equals ¥32,093 times 5 years.

3.1.1 Economic and Non-Economic Losses Claim Sub-items

According to BITPCL, the insurer pays the traffic accident injured economic and non-economic losses, which include medical expense, subsequent treatment expense, transportation cost, hospital care expense, disability or death damage, general damage, etc., so total amount claimed also includes non-economic loss, which means pain and suffering, loss of companionship, mental anguish, etc.

Crocker and Tennyson [2002] examine the optimal claims settlement strategy for a liability insurer by regressing the total payment amount on the economic damages claimed for bodily injury liability in automobile accidents; Loughran [2005] shows that insurers use general damage awards to reduce the incentive to submit exaggerated claims for specific damages for injuries and lost wages in bodily injury claims; and Asmat and Tennyson [2014] estimate the impact of bad faith liability on the total settlement amount relative to the claimed amount of loss, and find the presence of tort liability for insurer bad faith increases settlement amounts. Here non-economic loss claim is measured by the natural logarithm of general damage claimed. We expect that the payment coefficient for LnGeneralDamage is lower than that for LnMedExp, but the fraud coefficient for LnGeneralDamage is larger than that for LnMedExp.

Besides medical expense and wage loss, economic loss amount claimed also includes other claim sub-items such as death or disability damage, hospital care expense, subsequent treatment expense, and transportation cost etc. Medical expense means the really expended amount for the hospital to remedy the traffic accident injury, including medical fee, diagnosis fee, and face lifting fee etc. Medical expenses claim requires the receipts documentation of the specific services and the date and cost of each service received from each licensed practitioner who provides medical treatments, so there is hardly opportunistic fraud space. Lost wage means the actually reduced revenue by the traffic accident injured because of not being able to engage in his normal work from his or her suffering the auto accident injury to being completely cured. Lost wage claim must also offer the traffic accident injured revenue document before his injury and lost wage documentations, but the documentation only involves a simple form filled out by the victim's employer, which reports the dates of victim employment, absences following the accident, gross earnings, leading to a larger fraud space than medical expense. Crocker and Tennyson [2002] find that claims involving wage loss receive substantially less generous settlements than claims entailing only medical expense. Medical expense and wage loss claim is measured by the natural logarithm of their claim amount respectively. We expect that the payment coefficient for LnMedExp is larger than that for LnWageLoss, but the fraud coefficient for LnWageLoss is larger than that for LnMedExp.

Death damage means the amount that the decedent would be reasonably expected to have accumulated during the remainder of his lifetime, which is generally calculated according to 20 years. Disability damage means the amount that the disabled would be compensated by his or her capacity losing severity and disability level. We group personal injury severity into non-disability, disability and death. But death has been omitted in the present claim literature [Crocker and Tennyson, 2002, Doerpinghaus et al., 2008] because of their severe nature and rare occurrence. Disability or death claim needs disability degree or death documentations. Derrig and Weisberg [2003] find that presence of IME corresponds to higher claim payment because IME reflects lower soft fraud likelihood and the court will award a generous amount. Death is an objective fact with the death documentation offered by the traffic officer or the hospital, also with lower fraud likelihood. Death or disability is divided into 10 grades from level 1 (the most severe, disability damage amount=death damage amount 100%) to level 10 (the least serious, disability damage amount=death damage amount 10%) according to bodily injury severity with the multiplier is gradually reduced by 10% from level

1 to level 10. There is incentive for claimants to exaggerate claim amount with bodily injury severity from lower grade to higher level. Death or disability damage claim is measured by the natural logarithm of death or disability damage claim amount. We expect that the payment coefficient for LnDisa/DeathDamage is larger than that for MedExp, but the fraud coefficient for LnDisa/DeathDamage is not much larger than that for LnMedExp.

Hospital care expense means that the traffic accident injured can hardly take care of himself or herself during his or her hospital treatment, but need others'hospital care, which involves the revenue, persons, term, and level of the nursing staff. Hospital care expense requires hospitalization document and the income, persons, term, and level documentations of the nursing staff. Hospital stay means more severe injury than non-hospitalization, and even many not instant fatalities need also be hospitalized for some time in our sample. Doerpinghaus et al. [2008] find that claimants with injuries resulting in a hospital stay receive higher claim payments than those not hospitalized. But it is easier to exaggerate hospital care expense claim amount if the claimant colludes with the nursing staff, leading to a larger opportunistic fraud space. Hospital care expense claim is measured by the natural logarithm of hospital care expense claim amount. We expect that the payment coefficient for LnHospiCare is lower than that for MedExp, but the fraud coefficient for LnHospiCare is larger than that for LnMedExp.

Subsequent treatment expense means a fixed sign of dysfunction left behind after the traffic accident injured is treated medically, and the traffic accident victim is not satisfied with present medical treatment result, asking the insured injurer to continue medical treatment in the future. Namely subsequent treatment expense is not real medical expense presently, but the potential medical expense in the future. Subsequent treatment expense claim requires medical certificate or expert conclusion, which is hardly adopted by the court. Even if the court adopts the medical certificate or expert conclusion, subsequent treatment expense claim amount is easily surpassing its necessary and reasonable limit, so there is larger opportunistic fraud space. Subsequent treatment expense claim is measured by the natural logarithm of subsequent treatment expense claim amount. We expect that the payment coefficient for LnSubseTreat is lower than that for MedExp, but the fraud coefficient for LnSubseTreat is larger than that for LnMedExp.

Transportation cost means the actual bus or ship tickets for the traffic accident injured and the necessary hospital care staff to have a medical treatment or transfer to other hospitals for medical treatments, which should be consistent with the site, time, persons, and frequency of hospitalization. Transportation cost claim requires the actual bus or ship tickets for the traffic accident injured and the necessary hospital care staff to have a medical treatment or transfer to other hospitals for medical treatments. It is easier to exaggerate transportation cost claim amount if the claimant colludes with the bus or ship tickets provider, so there is also a larger opportunistic fraud space. Transportation cost claim is measured by the natural logarithm of transportation cost claim amount. We expect that the payment coefficient for LnTransportation is lower than that for MedExp, but the fraud coefficient for LnTransportation is larger than that for LnMedExp.

3.1.2 Claimant Demographic Characteristics

Claimant demographic characteristics mainly include gender, age, marital status, and employment status. These characteristics may reflect a greater availability of resources, which in turn is likely to encourage greater levels of litigation. Gender and age have been associated with differences in risk-aversion and negotiating preferences and discrimination. Halek and Eisenhauer [2001] report evidence in life insurance purchase decisions of risk aversion differences across gender, age, and marital status. Doerpinghaus et al. [2003, 2008] find gender

and age effects in both fault assignment and claim payment in automobile liability claims. Viscusi [1988] identifies gender and marital status effects in pursuing product liability claims. Men generally have higher incomes and married people may have support from the spouse both improving their bargaining power. We expect that both insurer payment and excess claim amount for male is larger than that for female, and meanwhile for the married is larger than that for the non-married.

Unemployed claimants have lower lawsuit cost because their time cost is nearly zero. There exists the "lottery effect" that unemployed claimants "hold out" for higher settlements since they have little to lose by waiting [Cummins and Tennyson, 1996, Doerpinghaus et al., 2008]. In China, the unemployed contains peasants and citizens, the peasant is potential unemployed, but the citizen is publicly not employed, both having lower time cost. We expect that both insurer payment and opportunistic fraud amount for the unemployed are larger than that for the employed.

Older people (defined as more than 65 years old) demonstrate greater financial risk aversion because the cost of risk is greater at older ages due to a shorter horizon with which to recover from adverse circumstances [Fuchs, 1980, Posner, 1995]. But there is little prior research on the effect of youthful age (defined as less than 22 years old) on financial decision making based on his or her relatively less negotiating experience. We group age into the elderly (more than or equals to 60 years old), the youthful (less than 18 years old), and the middle-aged (more than or equals to 18 years old, but less than 60 years old). According to Article 11, Chapter II, General Principles of the Civil Law (GPCL) of the People's Republic of China, a citizen who is more than or equals to 18 years old shall have full capacity for civil conduct and may independently engage in civil activities. Here we have a different definition of youthful claimant from the classical literature because there is a large body of young migrant workers who are over or equals to 18 years old in our sample. According to retirement provisions by the State Council of the People's Republic of China, male and female official who are more than or equals to 60 years old,female staff who is more than or equals to 55 years old, female worker who is more than or equals to 50 years old shall retire. We uniformly use age 60 or over as retirement for convenience. Here we have a different definition of elderly claimant from the classical literature because life and health condition in developing country is significantly different from that in developed country, namely obvious difference of economic development leads to the medical and security condition distinctive gap between developing and developed countries. We expect that both insurer payment and opportunistic fraud amount for the youthful and elderly are lower than that for the middle-aged.

3.1.3 Other Claim Characteristics

Besides the claimant demographic characteristics, there are some other claim characteristics, such as lawyer involvement, accident location, sprains, and the elderly who claims sprains.

Claimant negotiating power can be enhanced significantly if a lawyer is involved because the attorney is more expert in dealing with the legal system, which may lessen a claimant's risk estimate, and provides a buffer that may lessen negotiating costs to the claimant. Cummins and Tennyson [1992] find that the insured motorist can gain higher award amount of pain and suffering for slight auto accident bodily injury because of the lawyer involvement. But the attorney may encourage the auto accident victim to exaggerate their injuries when he or she enhances significantly claimant negotiating power. We expect that both insurer payment and opportunistic fraud amount with lawyer involvement are larger than that without a lawyer.

In metropolitan locations, people are less likely to know one another and therefore are more likely to make a claim, even if potentially without a merit. Kessler [1995] finds that

more fraud occurs in metropolitan areas than in rural areas. Where fraud is more likely to exist, insurers are less generous in their claim payment. Doerpinghaus et al. [2008] find that the payment in the urban area is less than that in a rural area. Beijing is undergoing a rapid urbanization, many local peasants become citizens, and more and more migrant workers across the country flow to Beijing city. There are more frequent population mobility and less familiarity among people in city. We classify accident location in Beijing into city and rural area and expect lower insurer payment amount in city than in rural area, but larger soft fraud amount in city than in rural area.

Sprains are more difficult to prove than other injuries, and therefore more vulnerable to fraud. Crocker and Tennyson [2002] report that claims involved sprain injuries receive lower insurance payments than non-sprain claims; Loughran [2005] finds that sprain injuries receive lower general damages at all levels of special damages. We expect lower insurer payment amount for sprains than for non-sprains, but larger opportunistic fraud amount for sprains than for non-sprains.

We still add an intersection between sprains and the elderly. The elderly has greater financial risk aversion [Fuchs, 1980, Posner, 1995], and if the elderly claims sprains, we expect that both insurer payment and soft fraud amount for the elderly who claims sprains are lower than that for the middle-aged who claims sprains.

In summary, Table 1 presents the dependent and independent variable names and definitions.

Table 1. Variable Name and Definition

Variable Name	Variable Definition
Ln(InsurerPayment)	ln(insurer payment amount)
Ln(InsurerFraud)	ln[(total claim - total payment)*(insurer payment/total payment)]
LnMedExp	ln(medical expenses claimed)
LnSubseTreat	ln(subsequent treatment expenses claimed)
LnHospiCare	ln(hospital care expenses claimed)
LnTransportCost	ln(transportation costs claimed)
LnWageLoss	ln(lost wages claimed)
LnDisa/DeathDamage	ln(disability or death damages claimed)
LnGeneralDamage	ln(general damages claimed)
VFault	% Victim at fault in accident
Non-Motorist	1if victim is non-motorist or pedestrian, 0 else
HigherPolicy	1 if claim apply BITPCL indemnity limit of ¥120,000, 0 else
CFemale	1 if claimant female, 0 else
CYouth	1 if claimant<18 years, 0 else
CElderly	1 if claimant≥60 years, 0 else
CUnemployed	1 if claimant unemployed, 0 else
CMarried	1 if claimant married, 0 else
Attorney	1 if claimant use an attorney, 0 else
LocationCity	1 if accident occurs in city, 0 else
Sprains	1 if victim sprain, 0 else
ElderlySprains	1 if the elderly claims sprains, 0 else

3.2. Theoretical Model

Before developing the empirical model for the opportunistic fraud severity, we briefly summarize Doerpinghaus et al. [2008]'s model for insurance claim payment, which expresses

the claimant's excess demand as the difference between the claimant's and the insurer's perceived value of the claim. Specifically, the claimant's net payment after negotiation in Doerpinghaus et al. [2008] is

$$P_n = P - c(y - x)^2, \tag{1}$$

where c is the negotiating cost parameter (such that higher values of c imply higher negotiating costs), and P is the liability claim payment, which is defined as

$$P = x + G(y - x), \tag{2}$$

where x is the insurer's perceived value of the claim and y is the claimant's perceived value. The quantity $(y - x)$ reflects the claimant's excess demand beyond the insurer's valuation of the claim. The random variable, G, ranges from 0 to 1 and is the settlement multiplier, determined by social, cultural, and legal factors that are beyond the control of the claimant. The claimant's optimal claim value, y, is determined by expected utility maximization, where utility is a function of the net payment, P_n, and Doerpinghaus et al. [2008] define the claimant's expected utility as

$$EU(P_n) = EP_n - rVar(P_n) = x + \mu_G(y - x) - c(y - x)^2 - r\sigma_G^2(y - x)^2, \tag{3}$$

where r is the claimant's risk-aversion parameter, μ_G and σ_G represent the mean and variance of the settlement multiplier, respectively. By maximizing Equation (3) subjected to $y - x \geq 0$, it follows that the optimal demand for the claimant is $y^* = \frac{1}{2}\frac{\mu_G}{c + r\sigma_G^2} + x$.

Doerpinghaus et al. [2008] test empirically whether women, elderly, and youthful (as well as married) claimants receive different payments for similar injuries. Results of empirical testing are consistent with differences in settlement amounts, particularly with respect to gender. Our BITPCL closed claim litigation cases are involved with three parties: the claimant, the insurer, and the insured motorist. The claimant litigates both the insurer and the insured motor driver, not distinguishing their respective amount claimed, but total award amount often includes the insurer payment amount and the insured defendant motorist payment amount. That is to say, the insurer payment amount is a fraction of total award amount, slightly different from claimant payment [Doerpinghaus et al., 2008]. We mainly explore the relationship between economic and non-economic losses claim sub-items and insurer payment amount.

In addition, we extend the Doerpinghaus et al. [2008] study to estimate the excess claims and test it with our survey on auto bodily injury third-party compulsory liability insurance claim lawsuit data in China. Present insurance payment researches [Crocker and Tennyson, 2002, Loughran, 2005, Doerpinghaus et al., 2008] detect inflated claims subjectively based on the Insurance Research Council (IRC) data which originate from the insurers in the United States. Here we substitute the court for the insurer, fairly estimating the claimant's excess demand beyond the court's valuation of the claim. This paper detects inflated claims objectively according to the court award amount as a fair reference point. If the claim amount is larger than the award amount, it is regarded as overstated claims, where total inflated claim amount = (total claim amount − total award amount). We assume that insurer opportunistic fraud amount is in proportion to the insurer and the insured defendant motorist payments awarded by the court, then insurer opportunistic fraud amount equals total inflated claim amount times the ratio of insurer payment amount relative to total award amount. In short, overstated claim severity is determined by total claim amount and total award amount together. Given that the total award amount is comparatively stable, soft fraud severity depends mainly on total claim amount.

We develop a model to estimate insurer payment and overstated claim amount with our survey on auto bodily injury third-party compulsory liability insurance claim lawsuit data in China as

$$P_i = \beta_0 + \beta_1 * C_i + \beta_2 * L_i + \beta_3 * D_i + \beta_4 * O_i + \varepsilon_i, \quad \text{where} \tag{4}$$

P_i = natural logarithm of insurer payment amount, or opportunistic fraud amount for the ith;
β_0 = intercept term;
C_i = measures of amount claimed including economic and noneconomic losses for the ith claim;
β_1 = a vector of regression coefficients for amount claimed measures;
L_i = measures of RTSL including victim fault and role in auto accident for the ith claim;
β_2 = a vector of regression coefficients for RTSL;
D_i = measures of claimant demographic characteristics;
β_3 = a vector of regression coefficients for claimant demographic characteristics;
O_i = measures of other claim characteristics associated with the ith claim;
β_4 = a vector of regression coefficients for other claim characteristics;
ε_i = the random error term.

3.3. Sample and Data

To test the hypotheses that economic and noneconomic losses amount claimed affect insurer payment and opportunistic fraud amount, we analyze auto bodily injury third-party compulsory liability (BITPCL) closed claims lawsuit cases awarded by a Beijing district court during 2007-2012 in China.

Our actual BITPCL claims data are obtained from a district court in Beijing over the period 2007-2012. Based on Article 29 of the Civil Procedure Law of the People's Republic of China, "a lawsuit brought on a tortious act shall be under the jurisdiction of the people's court of the place where the tort is committed or where the defendant has his domicile". Therefore, the claim data is not limited to the district residents. It reflects both the accident places and the residence of the defendant in the entire city of Beijing. Recent figures released by Beijing's municipal bureau of statistics show that the capital's population grew by almost half a million residents in 2013 to 21.15 million. To put that in perspective, that's only slightly less than the entire population of Australia, or 60% of the entire population of Canada.

Our data include extensive information on each claim case which makes them uniquely suited to examining the economic and non-economic losses effects on insurer payment and opportunistic fraud amount respectively. Both the claimed amount and the amount paid by the insurer are reported in some detail, such as amount of medical expense, lost wage, disability or death damage, subsequent treatment expense, hospital care expense, and transportation costs, and also reported is the amount of general damage claimed by the claimant and paid by the insurer. Details are provided regarding the circumstances of each accident, including the location, attorney involvement, victim fault, role in auto accident, and different policy limit. The data also contain information regarding the nature of the injuries incurred by the claimant and the extent of trauma suffered. Finally, there are some data on the personal characteristics of the claimant, including age, sex, and marital and employment status.

The initial survey data set of all auto third-party liability closed award claims involving two-party accidents yields 649 cases. First, we eliminate 50 closed award claims in which auto third-party compulsory liability (TPCL) insurance is not purchased, which reduces our

sample to 599 cases. Following Doerpinghaus et al. [2008], we focus only on auto BITPCL claims, and thus omit 95 observations from complete property damage third-party compulsory liability (PDTPCL), leaving our sample to 504 cases. We further delete 40 auto bodily injury claims in which both BITPCL and voluntary bodily injury third-party liability insurance are simultaneously bought by the same injuring motorist because auto voluntary bodily injury third-party liability insurance with deductibles does not contain general damages. The many differences across non-TPCL, PDTPCL, and BITPCL add-on yield non-comparable liability claims. The reasons for deleting these 185 unsuitable auto closed award claims from the analysis stem from the desire to reduce heterogeneity in features of BITPCL award environment that will determine the award amount differently. The resulting suitable closed award data of auto BITPCL claims for analysis are 464 cases, which are very rarely received and quite valuable.[6]

Among the 464 auto bodily injury third-party compulsory liability insurance cases, there are 8 cases in which insurer payment amount is zero. Since we are interested in the performance of the economic and noneconomic losses claim sub-items in the normal insurer payment amount, here we drop the 8 samples, leaving 456 normal claims, which seems more appropriate for the evaluation of insurer payment amount. Via the outlier detection, we further drop 50 outliers, leaving 406 normal claims for our empirical regression. Among the 406 normal claims, there are 245 cases of male and 161 cases of female, 20 cases of the youthful, 62 cases of the elderly, and 324 cases of the middle-aged; 159 cases of the unemployed, and 247 cases of the employed; 331 cases of the married, and 75 cases of the unmarried; 63 cases of soft tissue injury, and 343 cases of non-soft tissue injury; 268 cases with lawyer involvement, and 138 cases without lawyer involvement; 390 cases in city, and 16 cases in rural area; 324 cases of policy limit for ¥120,000, 82 cases of policy limit for ¥58,000; 338 cases of the non-motor driver or pedestrian, and 68 cases of the motorist; 164 cases of non-disability, 208 cases of disability, and 34 cases of death. Table 2 presents the summary statistics for dependent and independent variables for the 406 normal claims, in which LnInsurerPayment mean is 10.1522 and its median is 10.7899. When the insured defendant motorist is no-fault in the auto accident, death or disability limit is ¥11,000, and medical expenses limit is ¥1,000. We classify the sample into higher policy for ¥120,000 and lower policy for ¥58,000, and anticipate that both insurer payment and opportunistic fraud amount for higher policy larger than that for lower policy. Kessler [1995] groups claimant role in accident into automobile driver, passenger in automobile, motorcycle driver, passenger on motorcycle, and pedestrian; Tennyson and Salsas-Forn [2002] group it into passenger, pedestrian, and driver. Our sample encompasses all injury severity types, especially fatality, so we use victim instead of claimant in this article. The claimant is just the victim while the auto injured is subject to non-disability and disability; but the claimant is most possibly the victim's dependents when the traffic accident injured is dead.

Our BITPCL closed award files include summary information on economic and noneconomic losses amount claimed containing total and sub-items, economic and noneconomic losses amount awarded containing total and sub-items, RTSL, the claimant, and other claim characteristics. We choose 7 representative economic and non-economic losses claim sub-items, such as medical expenses, follow-up treatment expenses, hospital care expenses, transportation costs, lost wages, disability or death damages, and general damages. Namely, bodily injury severity is changed to numerical variable for disability or death damages, and extent of treatment is changed to numerical variable for hospital care expenses. Our BITPCL total amount claimed and awarded may include noneconomic losses, and other economic losses

[6]Kessler [1995] excludes 32 litigated claims from 7385 automobile insurance bodily injury claims, collected by the Insurance Research Council in 1987, in which litigated claims account for only 0.43% of all claims.

besides medical expenses and lost wages, greatly increasing claim fraud scope. The BITPCL award data are thus well suited to hypothesis test regarding economic and noneconomic losses claim effects on insurer award and fraud amount. Victim fault and role in accident, and different policy limit are also reported, making it possible to relate insurer award and fraud amount to RTSL under which moral hazards of auto accident injured, especially the more protected group.

In our sample, BITPCL insurance provides the traffic accident injured the basic indemnity. If the traffic accident injured is more severe injury, the claimant may receive payments from the insurer and the insured motorist. This article detects BITPCL fraud objectively based on the total amount awarded by the court. A claim is legitimate if the total amount claimed equals the total amount awarded; on the contrary, it is fraudulent if the total amount claimed is greater than the total amount awarded. There are 18 honest and 446 fraudulent ones in our BITPCL sample. Our study distinguishes less serious injury from more severe one. If total award amount equals insurer award amount, the insurer pays auto injured completely; on the contrary, the insurer and the insured motorist pay auto injured jointly if total award amount is greater than insurer award amount. There are 281 complete insurer payment and 183 co-payment cases in our BITPCL sample. In a word, the co-payment subsample is more severe injury and larger liability for the insured driver than the complete insurer payment one.

Table 2. Summary Statistics for Dependent and Independent Variables based on 406 Legal Claim Samples.

Variable Name	Mean	Median	Std Dev	Min	Max
LnInsuerPayment	10.1522	10.7899	1.3789	6.4677	12.3884
LnMedExp	7.5110	8.2557	3.1622	0.0000	12.4645
LnSubseTreat	1.8237	0.0000	3.6747	0.0000	12.1498
LnHospiCare	6.3484	7.8320	3.6494	0.0000	13.3543
LnTransportation	5.2826	6.2146	2.6722	0.0000	10.2307
LnWageLoss	7.6067	8.9159	3.3376	0.0000	12.2061
LnDea/DisaDamage	6.6125	10.1903	5.4927	0.0000	13.3526
LnGeneralDamage	7.5413	9.2103	3.8027	0.0000	13.1224
VFault	0.0889	0.0000	0.1949	0.0000	1.0000
NonMotorist	0.8325	1.0000	0.3739	0.0000	1.0000
HigherPolicy	0.7980	1.0000	0.4020	0.0000	1.0000
CFemale	0.3966	0.0000	0.4898	0.0000	1.0000
CYouth	0.0493	0.0000	0.2167	0.0000	1.0000
CElderly	0.1527	0.0000	0.3602	0.0000	1.0000
CUnemployed	0.3916	0.0000	0.4887	0.0000	1.0000
CMarried	0.8153	1.0000	0.3886	0.0000	1.0000
Attorney	0.6601	1.0000	0.4743	0.0000	1.0000
LocationCity	0.9606	1.0000	0.1948	0.0000	1.0000
Sprains	0.1552	0.0000	0.3625	0.0000	1.0000
ElderlySprains	0.0271	0.0000	0.1626	0.0000	1.0000

Similarly, among the 464 auto bodily injury third-party compulsory liability insurance cases, there are 446 claims in which the claim amount is larger than the award amount, and the excess claims occupy about 96.12 percent, which seems more appropriate for the evaluation of opportunistic fraud amount. Further via outlier detection we drop another 10 cases, leaving 436 excess claims for our empirical regression. Among the 436 excess claims, there are 256 cases of male and 180 cases of female, 20 cases of the youthful, 61 cases of the elderly, and 355 cases of the middle-aged; 172 cases of the unemployed, and 264 cases of the employed; 357 cases of the married, and 79 cases of the unmarried; 78 cases of soft tissue injury, and 358 cases of non-soft tissue injury; 281 cases with lawyer involvement, and 155

cases without lawyer involvement; 418 cases in city, and 18 cases in rural area; 353 cases of policy limit for ¥120,000, 83 cases of policy limit for ¥58,000; 362 cases of the non-motor driver or pedestrian, and 74 cases of the motor driver; 194 cases of non-disability, 207 cases of disability, and 35 cases of death. Table 3 presents the summary statistics for dependent and independent variables for the 436 excess claims, in which LnInsuerFraud mean is 9.4742 and its median is 9.5051.

Table 3. Summary Statistics for Dependent and Independent Variables based on 436 Excess Claim Samples.

Variable Name	Mean	Median	Std Dev	Min	Max
LnInsuerFraud	9.4742	9.5051	1.4457	5.1985	12.9972
LnMedExp	7.3100	8.1277	3.2460	0.0000	12.4645
LnSubseTreat	1.7490	0.0000	3.6023	0.0000	12.1498
LnHospiCare	6.2142	7.7832	3.6757	0.0000	12.7915
LnTransportation	5.2443	6.2146	2.6519	0.0000	10.2307
LnWageLoss	7.5546	8.8378	3.3147	0.0000	12.2061
LnDea/DisaDamage	6.1709	10.0290	5.5687	0.0000	13.3526
LnGeneralDamage	7.3600	8.9872	3.8822	0.0000	13.1224
VFault	0.0883	0.0000	0.1997	0.0000	1.0000
NonMotorist	0.8303	1.0000	0.3758	0.0000	1.0000
HigherPolicy	0.8096	1.0000	0.3930	0.0000	1.0000
CFmale	0.4128	0.0000	0.4929	0.0000	1.0000
CYouthful	0.0459	0.0000	0.2094	0.0000	1.0000
CElderly	0.1399	0.0000	0.3473	0.0000	1.0000
CUnemployed	0.3945	0.0000	0.4893	0.0000	1.0000
CMarried	0.8188	1.0000	0.3856	0.0000	1.0000
Attorney	0.6445	1.0000	0.4792	0.0000	1.0000
LocationCity	0.9587	1.0000	0.1992	0.0000	1.0000
Sprains	0.1789	0.0000	0.3837	0.0000	1.0000
ElderlySprains	0.0252	0.0000	0.1570	0.0000	1.0000

4. Empirical Result

Based on the selected 406 insurer payment samples and 436 insurer fraud samples, we perform an ordinary least squares (OLS) regression for LnInsuerPayment in Section 4.1 or LnOpportunisticFraud in Section 4.2 using model (4), respectively. For both samples, we show the OLS regression results, the justification of the normality assumption via both graphical tools (Scatter plots and Q-Q plots) and various normality tests, and the detailed econometric explanation for the results, respectively.

4.1. Claim Effects on Insurer Payment Amount

We perform an OLS regression for LnInsuerPayment based on model (4), and Table 4 presents results of OLS regression.

As we know, normality assumption is very important for the residuals from a linear regression model. If they are not normally distributed, the residuals should not be used in Z tests or in any other tests derived from the normal distribution, such as t tests, F tests and chi-squared tests. Thus, before we demonstrate the OLS results in Table 4, we first check the normality assumption for the residuals from model (4). First we shows the visual inspection of the distribution of standardized residuals of OLS regression in Figure 1 via scatter plot and normal Q-Q (quantile-quantile) plot. From the scatter plot of the standardized residual in Figure **??**, which are randomly distributed in the strip region of -2 to $+2$, and its normal Q-Q plot in Figure **??** is distributed around a straight line, both of which imply that the normality assumption holds true for model (4). Although from Figure 1, readers can judge the normality assumption by themselves, the visual methods may seems unreliable. As

Table 4. OLS Regression of Dependent and Independent Variables based on 406 samples.

Variable	Estimate	Std. Error	t Statistic	Prob.	
Intercept	7.9804	0.1745	45.7279	0.0000	***
LnMedExp	0.0434	0.0069	6.2969	0.0000	***
LnSubseTreat	−0.0084	0.0058	−1.4587	0.1455	
LnHospiCare	0.0184	0.0065	2.8164	0.0051	***
LnTransportation	0.0254	0.0084	3.0358	0.0026	***
LnWageLoss	0.0196	0.0077	2.5296	0.0118	**
LnDea/DisaDamage	0.1756	0.0055	31.7952	0.0000	***
LnGeneralDamage	0.0232	0.0070	3.3151	0.0010	***
VFault	0.3027	0.1161	2.6072	0.0095	***
NonMotorist	0.0508	0.0603	0.8418	0.4004	
HigherPolicy	0.3245	0.0534	6.0732	0.0000	***
CFemale	−0.0999	0.0432	−2.3116	0.0213	**
CYouthful	−0.2992	0.1179	−2.5375	0.0116	**
CElderly	−0.0609	0.0726	−0.8386	0.4022	
CUnemployed	0.0002	0.0491	0.0034	0.9973	
CMarried	−0.0495	0.0599	−0.8264	0.4091	
Attorney	0.1673	0.0495	3.3771	0.0008	***
LocationCity	−0.1096	0.1073	−1.0219	0.3075	
Sprains	−0.7254	0.0714	−10.1545	0.0000	***
ElderlySprains	0.3055	0.1468	2.0804	0.0381	**
R-squared: 0.9207			Adjusted R-squared: 0.9167		
F-statistic: 235.7 on 19 and 386 DF			P-value: <2.2e-16		

***Significant at 0.01; **Significant at 0.05; *Significant at 0.1.

supplementary to the graphical assessment of normality, we perform 10 popular normality tests described in Ghasemi and Zahediasl [2012], i.e., Kolmogorov-Smirnov (KS) test, Jarque-Bera test, Shapiro-Wilk's (SW) test, D'Agostino Omnibus test, D'Agostino Skewness test, D'Agostino Kurtosis test, Cramer-von Mises test, Pearson Chi-Square test, Shapiro-Francia test, and Energy test, see tests results in the columns 2 and 3 in Table 5. All tests have a p-value far greater than 0.05, especially for the KS and SW tests with the p-value being greater than 0.20, which indicates normal distribution of data.

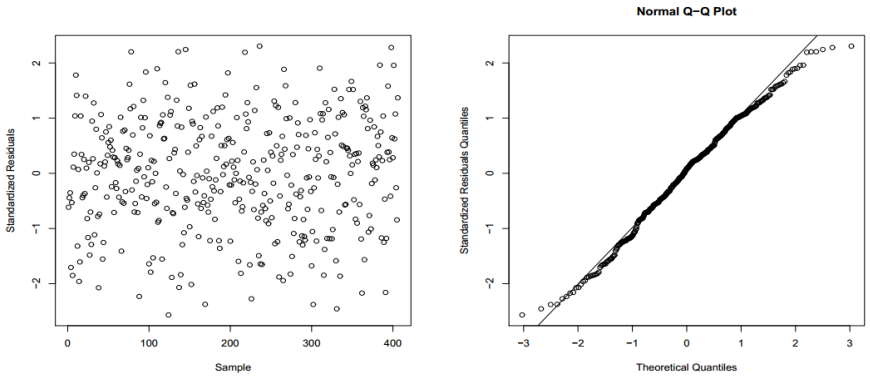

Figure 1. Scatter plot (Left) and Normal Q-Q plot (Right) for Standardized Residual of OLS regression for LnInsuerPayment.

Table 4 presents results of the OLS estimation with the dependent variable equal to the natural logarithm of insurer payment amount for 406 sample. The adjusted R^2 is 0.9167.

Here insurer payment amount is similar to insurance payout [Doerpinghaus et al., 2008], but the difference is that insurer payment amount is a fraction of total award amount in this article. The payment coefficient for LnMedExp is 0.0434 and statistically significant

Table 5. Normality Test Results for Standardized Residual of OLS regression for LnInsuerPayment or LnInsuerFraud.

Normality Test	LnInsuerPayment		LnInsuerFraud	
	Test Statistic	P-value	Test Statistic	P-value
Kolmogorov-Smirnov Test	0.0474	0.3552	0.038	0.5548
Jarque-Bera Test	4.5924	0.1006	3.8633	0.1449
Shapiro-Wilk's Test	0.9949	0.2338	0.9946	0.1247
D'Agostino Test-Omnibus	5.5710	0.0617	4.8678	0.0877
D'Agostino Test-Skewness	-1.4258	0.1539	-1.0601	0.2891
D'Agostino Test-Kurtosis	-1.8810	0.0600	-1.9350	0.0530
Cramer-von Mises Test	0.1086	0.0855	0.0901	0.1529
Pearson Chi-Square Test	27.8125	0.1455	19.8853	0.4651
Shapiro-Francia Test	0.9937	0.1020	0.9957	0.2413
Energy Test	0.7816	0.0803	0.6180	0.1381

at the 0.01 level, which is larger than other claim sub-items except Lndisa/DeathDamage consistent with our hypothesis.

The payment coefficient of LnWageLoss is 0.0196 and statistically significant at the 0.05 level, which is less than that of LnMedExp, reflecting wage loss higher opportunistic fraud probability than medical expense consistent with our hypothesis. Wage loss is easier to falsify than medical expense, leading to greater reluctance by the court to award a wage loss claim also consistent with Crocker and Tennyson [2002].

The payment coefficient for LnHospiCare is 0.0184 and statistically significant at the 0.01 level, which is less than that of LnMedExp, reflecting hospital care higher fraud probability than medical expense consistent with our hypothesis. Injuries resulting in a hospital stay mean more severe than without hospitalization. The court will regard hospital care expense as necessary, but hospital care expense is easier to exaggerate its claim amount than medical expense if the claimant colludes with the nursing staff because hospital care expense is involved with the revenue, persons, term and level of nursing staff, leading to greater reluctance by the court to award a hospital care expense claim.

The payment coefficient for LnSubseTreat is not statistically significant, meaning the court awards subsequent treatment claim the least and much less than medical expense, reflecting its higher fraud probability than medical expense consistent with our hypothesis. Subsequent treatment expense claim should offer a medical documentation by the hospital or appraisal conclusion by the expert. Subsequent treatment expense is not real medical expense, but potential medical expense in the future, which is hard to be adopted by the court, leading to greater reluctance by the court to award a subsequent treatment expense claim.

The payment coefficient for LnTransporCost is 0.0254 and statistically significant at the 0.01 level, which is less than that of LnMedExp, reflecting transportation cost higher fraud probability than medical expense consistent with our hypothesis. Transportation cost claim should offer bus or ship ticket invoices to have a medical treatment or transfer to other hospitals for medical treatments. It is not hard for the claimant to collect bus or ship ticket invoices which are not actually involved with medical services if the claimant colludes with the bus or ship tickets provider, leading to greater reluctance by the court to award a transportation cost claim.

The payment coefficient for LnGeneralDamage is 0.0232 and statistically significant at the 0.01 level, which is less than that of LnMedExp, reflecting general damage higher fraud probability than medical expense consistent with our hypothesis. General damage claim should prove the traffic accident injured or the dependents of the dead victim to suffer mental pain and suffering, mental abnormality, or physiological and psychological damage, namely

inactive feeling. It is not hard for the claimant to prove the inactive feeling of general damage, but very difficult to prove general damage claim amount consistent with mental anguish suffered by the traffic accident injured or the dead victim'dependents, leading to larger opportunistic fraud probability for the claimant to exaggerate the mental claim amount. In China, the court still considers the area economic environment, identity, family background, accident fault, and social effects etc. of the traffic accident injured when he awards a general damage claim, leading to greater reluctance by the court to award general damage claim consistent with mental anguish not being easily documented [Crocker and Tennyson, 2002, Loughran, 2005].

The payment coefficient for Lndisa/DeathDamage is 0.1756 and statistically significant at the 0.01 level, which is the largest among all claim sub-items, reflecting more severe injury severity consistent with our hypothesis. All disability damage claimants hold IME and all death damage claimants hold death document by the traffic police officer or the hospital, and they can easily prove the suffered injury, hinting lower fraud probability and more severe injury severity, resulting in greater generosity by the court to award a disability or death damage claim, enriching present bodily injury severity literature including mainly disability and non-disability [Crocker and Tennyson, 2002, Doerpinghaus et al., 2008].

The payment coefficient of victim fault is 0.3027 and statistically significant at the 0.01 level, meaning that victim fault does not affect the court to reduce insurer payment amount significantly contrary to our hypothesis. RTSL classifies the auto accident injured into motorist and non-motorist or pedestrian subgroups, and protects non-motorist or pedestrian more than motorist. The court considers victim fault directly when the auto injured is also a motorist; but when the auto injured is a non-motorist or pedestrian, the court first considers the injury severity of the auto injured and make the insured motorist undertakes no-fault, and then thinks of victim fault secondly. In our BITPCL sample of 406 cases, there are 338 cases of non-motorist or pedestrian, namely in most conditions the insured motorist first undertakes no-fault, and then the auto injured apply at-fault indirectly, resulting in victim fault not affecting insurer payment amount negatively. This is our important finding in this paper.

The payment coefficient for higher policy is 0.3245 and statistically significant at the 0.01 level, meaning that higher policy gives the auto accident injured more economic support than lower policy consistent with our hypothesis, also consistent with Doerpinghaus et al (2003, 2008).

The payment coefficient for female is -0.0999 and statistically significant at the 0.05 level, meaning the female claimant receives less payment amount than the male consistent with our hypothesis. The female claimant has weaker bargaining power than the male, leading to greater reluctance by the court to a female claimant also corroborating the gender effect in both fault assignment and claim payment in automobile liability claims [Doerpinghaus et al., 2003, 2008] .

The payment coefficient for the youthful is -0.2992 and statistically significant at the 0.05 level, meaning the young claimant receives less payment amount than the middle-aged consistent with our hypothesis. The young claimant has less negotiating experience than the middle-aged, and more importantly, they are less than 18 years old and generally minors or students in school, not existing wage loss, leading to greater reluctance by the court to a young claimant.

The payment coefficient for attorney is 0.1673 and statistically significant at the 0.01 level, meaning the claimant receives more payment amount with the help of a lawyer than without a lawyer consistent with our hypothesis. Claimant negotiating power can be enhanced significantly if a lawyer is involved because the attorney is more expert in dealing with the legal system, which may lessen a claimant's risk estimate, and provides a buffer that

may lessen negotiating costs to the claimant, leading to greater generosity by the court to award a claim with the help of a lawyer also consistent with Cummins and Tennyson [1992].

The payment coefficient for sprains is -0.7254 and statistically significant at the 0.01 level, meaning the claimant receives less payment amount for sprains than that for non-sprains consistent with our hypothesis. Sprains are relatively more susceptible to fraud, leading to greater reluctance by the court to award a sprain claim, also consistent with Crocker and Tennyson [2002].

But the payment coefficient for elderly*sprains is 0.3055 and statistically significant at the 0.05 level, meaning the court awards the elderly who claims sprains more strongly than the middle-aged who claims sprains contrary to our hypothesis. There is higher fraud probability for sprains, and the elderly has weaker bargaining power than the middle-aged, if the elderly claims sprains, the court should award the elderly who claims sprains less than the middle-aged. But the 0.3380 payment coefficient for elderly*sprains proves that the elderly's bargaining power is not inferior but superior to the middle-aged. Modern medical condition improves significantly and life expectancy is significantly lengthened, leading to the elderly's bodily function improves greatly and his or her retiring at 60 years old seems a little earlier than ever. Sprains is lower injury severity, assuring the elderly enough time and energy on sprains claim lawsuits contrasted with the middle-aged who has to work for a living, and finally win the judge sympathy. It is our important finding in this paper, enriching present pure sprains claim and insurance payments literature [Derrig et al., 1994, Tennyson and Salsas-Forn, 2002].

In short, all payment coefficients of economic and non-economic losses claim sub-items are consistent with our hypotheses, hinting opportunistic fraud severity of other economic and non-economic losses claim sub-items except death or disability damage is larger than that of medical expense, but it is hard to sequence the excess claim severity of these claim sub-items because claim amount is not considered.

4.2. Claim Effects on Opportunistic Fraud Amount

Insurer payment amount can reflect opportunistic fraud severity indirectly, but this kind of opportunistic fraud severity estimation is inaccurate because total claim amount is not considered. Our main devotion in this paper is direct opportunistic fraud severity estimation. We consider also total claim amount and measure opportunistic fraud amount directly, further enriching present unitary insurance payout literature [Doerpinghaus et al., 2008]. We also perform OLS regression for LnInsuerFraud based on model (4), and Table 6 presents results of OLS regression. Similarly, we verify the normality assumption via graphical methods and normality tests, see the scatter plot and normal Q-Q plot in Figures **??** and **??**, respectively, and the results of normality tests in the columns 4 and 5 in Table 5. From these results, the normality assumption holds for the dataset.

The fraud coefficient for LnMedExp is -0.0304 and statistically significant at the 0.05 level, and all the fraud coefficients of other economic and non-economic losses claim sub-items are larger than that for LnMedExp. Opportunistic fraud severity sequence of these claim sub-items is as follows: general damage (0.1525) $\gg$ wage loss (0.0567) $>$ death or disability damage (0.0494) $>$ subsequent treatment expense (0.0338) $>$ hospital care expense (0.0256) $>$ transportation cost (0.0196), further the excess claim severity of these claim sub-items can be divided into three levels: General damage is the largest and much larger than the second largest wage loss claim; Wage loss, death or disability damage, and subsequent treatment expense are the second level; Hospital care expense and transportation cost are the third level with the lowest opportunistic fraud severity.

The fraud coefficient for LnGeneralDamage is 0.1525 and statistically significant at the 0.01 level, which is the largest, meaning the excess claim severity for general damage is

Table 6. OLS Regression of Dependent and Independent Variables based on 436 samples.

Variable	Estimate	Std. Error	t Statistic	Prob.	
Intercept	5.9531	0.3853	15.4520	0.0000	***
LnMedExp	−0.0304	0.0154	−1.9685	0.0497	**
LnSubseTreat	0.0338	0.0133	2.5371	0.0115	**
LnHospiCare	0.0256	0.0146	1.7502	0.0808	*
Lntransportation	0.0196	0.0186	1.0558	0.2917	
LnWageLoss	0.0567	0.0175	3.2298	0.0013	***
LnDea/DisaDamage	0.0494	0.0126	3.9362	0.0001	***
LnGeneralDamage	0.1525	0.0153	9.9598	0.0000	***
VFault	2.1089	0.2603	8.1002	0.0000	***
NonMotorist	0.3045	0.1360	2.2384	0.0257	**
HigherPolicy	0.2545	0.1213	2.0977	0.0365	**
CFemale	−0.0523	0.0970	0.5392	0.5900	
CYouthful	−0.3185	0.2701	−1.1791	0.2390	
CElderly	−0.0159	0.1704	−0.0933	0.9257	
CUemployed	0.2831	0.1096	−2.5833	0.0101	**
CMarried	0.0685	0.1347	0.5086	0.6113	
Attorney	0.2808	0.1134	2.4760	0.0137	
LocationCity	0.6266	0.2372	2.6419	0.0086	***
Sprains	0.0089	0.1515	0.0588	0.9532	
ElderlySprains	0.3444	0.3393	1.0149	0.3108	
R-squared: 0.5998			Adjusted R-squared: 0.5816		
F-statistic: 32.82 on 19 and 416 DF			P-value: <2.2e-16		

***Significant at 0.01; **Significant at 0.05; *Significant at 0.1.

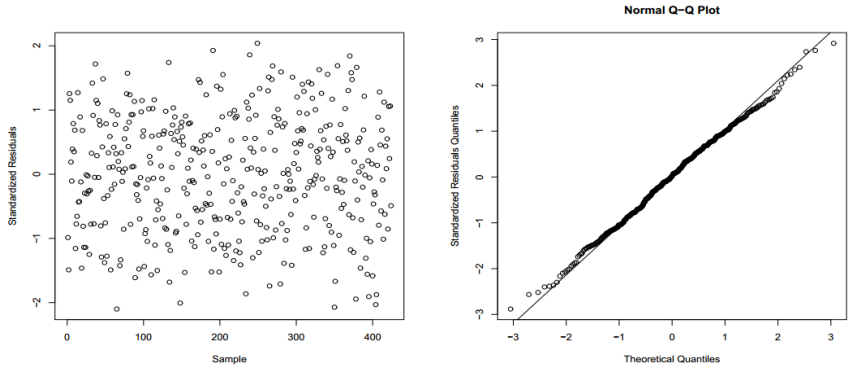

Figure 2. Scatter plot (Left) and Normal Q-Q plot (Right) for Standardized Residual of OLS regression for LnInsuerFraud.

the most severe among all economic and noneconomic claim sub-items consistent with our hypothesis. Mental anguish such as pain and suffering, losing companionship etc. exists objectively, which is hard to measure in term of money. Short of objective standards, both in death, disability, and non-disability circumstance, the claimant can claim general damage, and there is hardly fraud cost. Claimants often neglect the traffic accident injured identity, family background, accident fault, and social effects etc., but strongly focus on the auto accident victim and non-motorist or pedestrian role in auto accident, leading to claim amount larger than the court award amount naturally. In addition, mental anguish is not easily documented [Crocker and Tennyson, 2002, Loughran, 2005], and the court awards general damage less than medical expense, further enlarging the difference between total claim and award amount. The 0.0232 payment coefficient for LnGeneralDamage in Table 4 hints its opportunistic fraud severity larger than medical expense, and its 0.1525 fraud coefficient measures general damage opportunistic fraud severity the largest among all economic and

non-economic losses claim sub-items directly and more accurately, reflecting its claim amount much larger than the court award amount. There is much larger opportunistic fraud space for general damage claim, and it is our most important finding in this paper, enriching present auto claim fraud literature not including general damage amount claimed [Crocker and Tennyson, 2002, Loughran, 2005].

The fraud coefficient for LnWageLoss is 0.0567 and statistically significant at the 0.01 level, which is the second largest among all economic and noneconomic losses claim sub-items , reflecting opportunistic fraud severity of wage loss larger than that of medical expense consistent with our hypothesis. Wage loss is easier to falsify than medical expense, resulting in claim amount for wage loss much larger than that for medical expense [Crocker and Tennyson, 2002]; the 0.0567 fraud coefficient for LnWageLoss reflects wage loss opportunistic fraud severity more accurately than its 0.0196 payment coefficient, enriching present auto claim fraud literature including only insurance payment [Crocker and Tennyson, 2002, Doerpinghaus et al., 2008].

The fraud coefficient for Lndisa/DeathDamage is 0.0494 and statistically significant at the 0.01 level, which is the third largest among all economic and non-economic losses claim sub-items, reflecting disability or death damage opportunistic fraud severity much larger than medical expense contrary to our hypothesis. The 0.1756 payment coefficient for Lndisa/DeathDamage reflects its lower opportunistic fraud probability and hints its lower opportunistic fraud severity because of the more severe injury extent for disability or death, but its more severe injury severity creates the claimants more convincing and reasonable excuses to exaggerate the claim amount, and there exists a larger opportunistic fraud space. Disability is divided into ten levels from the least to the most severe disability extent, and disability damage amount is gradually reduced with the multiplier by 10 percent from level 1 to level 10 according to its bodily injury severity. The 0.0494 fraud coefficient for Lndisa/DeathDamage reflects its larger opportunistic fraud space more accurately than its 0.1756 payment coefficient, which may emphasize its more severe injury extent but conceal its larger opportunistic fraud space. In a word, the largest payment amount and larger opportunistic fraud amount coexist for disability or death damage claim both because of its more severe injury extent. That is to say, more severe injury extent gives rise to larger opportunistic fraud space, and it is our another important finding in this paper, enriching present auto claim fraud literature in which bodily injury severity is only dummy variable [Doerpinghaus et al., 2003].

The fraud coefficient for LnSubseTreat is 0.0338 and statistically significant at the 0.05 level, which is the fourth largest among all economic and non-economic losses claim sub-items, reflecting opportunistic fraud severity of subsequent treatment expense is larger than that of medical expense consistent with our hypothesis. Subsequent treatment expense claim requires medical certificate or expert conclusion, which is hard to be adopted by the court, and even if the court adopts the medical certificate or expert conclusion, there is larger opportunistic fraud space for the claimant to claim subsequent treatment expense because it is not present real medical expense, but potential medical expense in the future. The statistically insignificant payment coefficient for LnSubseTreat reflects its higher opportunistic fraud probability and hints its larger fraud severity than medical expense, and its 0.0338 fraud coefficient measures its opportunistic fraud severity more accurately, enriching present economic loss claim fraud literature including mainly medical expense and wage loss [Crocker and Tennyson, 2002, Doerpinghaus et al., 2003].

The fraud coefficient for LnHospiCare is 0.0256 and statistically significant at the 0.10 level, which is the fifth largest among all economic and non-economic losses claim sub-items, reflecting opportunistic fraud severity of hospital care expense is larger than that of medical expense consistent with our hypothesis. Hospital stay means more severe injury than outpatient, and the court will regard hospital care as necessary. But hospital care expense creates

the claimant more reasonable excuse to enlarge its claim amount, and there exists larger opportunistic fraud space because it is easier to falsify the revenue, persons, term and level of nursing staff if the claimant colludes with the nursing staff. The 0.0256 fraud coefficient for LnHospiCare reflects hospital care expense opportunistic fraud severity more accurately than its 0.0484 payment coefficient, enriching present claim fraud literature in which extent of treatment is only dummy variable [Crocker and Tennyson, 2002, Doerpinghaus et al., 2003].

The fraud coefficient for LnTransporCost is not statistically significant, but its opportunistic fraud severity is still larger than that for medical expense because the fraud coefficient for LnMedExp is -0.0304 and statistically significant at the 0.05 level consistent with our hypothesis. If the claimant colludes with the bus or ship receipts provider, it is easier for the claimant to falsify transportation cost than medical expense, resulting in larger opportunistic fraud space for the claimant to claim transportation cost. The 0.0254 payment coefficient for LnTransporCost reflects its higher opportunistic fraud probability and hints its larger opportunistic fraud severity than medical expense, and its statistically insignificant fraud coefficient measures opportunistic fraud severity of transportation cost more accurately than its 0.0327 payment coefficient, enriching present economic loss claim fraud literature including mainly medical expense and wage loss [Crocker and Tennyson, 2002, Doerpinghaus et al., 2008].

The fraud coefficient for victim fault is 2.1089 and statistically significant at the 0.01 level, reflecting victim fault is positively related with its opportunistic fraud severity consistent with our hypothesis. RTSL protects the auto accident injured, maybe leading to the moral hazard that the claimant focuses on the victim injury severity, but neglects victim fault, seeking higher claim amount with larger fault. The 0.3027 payment coefficient for victim fault can not reflect the negative relationship between victim fault and the court reducing insurer payment amount because the non-motorist and pedestrian accounts for a much larger portion in our sample and the court mainly consider the victim injury extent and then victim fault secondly. But the 2.1089 fraud coefficient measures the moral hazard that the claimant neglects victim fault more accurately, enriching present only defendant driver fault and insurance payments literature [Doerpinghaus et al., 2003, 2008], or victim fault and probability of hiring a lawyer and filing a legal claim (Browne and Schmit, 2008).

The fraud coefficient for the non-motorist or pedestrian is 0.3045 and statistically significant at the 0.05 level, reflecting opportunistic fraud severity for the non-motorist or pedestrian larger than that for the motorist consistent with our hypothesis. RTSL protects the non-motor driver or pedestrian more than the motorist, maybe inducing the non-motor driver or pedestrian to claim higher amount than the motorist and there exists a larger opportunistic fraud space for the non-motor driver or pedestrian. The statistically insignificant payment coefficient for the non-motorist or pedestrian hints there is no radical difference for insurer payment amount between the non-motor driver or pedestrian and motorist, but its 0.3045 fraud coefficient reflects that its larger opportunistic fraud space is mainly because of its higher claim amount, enriching present unitary auto accident victim claim fraud literature, which does not differentiate victim role in auto accident [Tennyson and Warfel, 2010, Asmat and Tennyson, 2014].

The fraud coefficient for higher policy is 0.2545 and statistically significant at the 0.05 level, reflecting opportunistic fraud severity for higher policy larger than that for lower policy consistent with our hypothesis. In 2008, CIRC increased bodily injury compensation limit ¥120,000 from ¥58,000, maybe leading to the claimant to claim higher amount for the same or similar injury. In Table 4 the payment coefficient for higher policy is 0.3245 and statistically significant at the 0.01 level, and in Table 6 the fraud coefficient for higher policy is 0.2545 and statistically significant at the 0.05 level. In a word, larger payment amount

and larger opportunistic fraud amount coexist for higher policy. Higher policy leads to larger opportunistic fraud space, enriching present unitary law system reform and insurance payments literature [Doerpinghaus et al., 2003, 2008].

The fraud coefficient for the unemployed is 0.2831 and statistically significant at the 0.05 level, reflecting opportunistic fraud severity for the unemployed larger than that for the employed consistent with our hypothesis. Unemployed claimants have less opportunity cost, being more ready to spend more time on claim lawsuits for the uncertain award amount because they have little to lose by waiting also consistent with Cummins and Tennyson [1996].

The fraud coefficient for attorney is 0.2808 and statistically significant at the 0.05 level, reflecting opportunistic fraud severity with attorney larger than that without attorney consistent with our hypothesis. Claimant negotiating power can be enhanced significantly if a lawyer is involved because the attorney is more expert in dealing with the legal system, but the lawyer may also encourage the claimant to seek the insurer higher claim amount, and there exists the moral hazard of larger opportunistic fraud space. In a word higher payment amount and larger opportunistic fraud amount coexist for attorney involvement, it is also our important finding in this paper, enriching present single lawyer enhancing claimant negotiating power and insurance payments literature [Cummins and Tennyson, 1992, Doerpinghaus et al., 2008].

The fraud coefficient for location in city is 0.6266 and statistically significant at the 0.01 level, reflecting opportunistic fraud severity in city is larger than that in rural area consistent with our hypothesis. There is larger population mobility in city than in rural area, and people in city know each other less than that in rural area, leading to larger opportunistic fraud space in city than in rural area, also consistent with but more accurate than current claim literature on fraud probability [Kessler, 1995] and insurance payout claim [Doerpinghaus et al., 2008].

The fraud coefficient for sprains is not statistically significant contrary to our hypothesis, but its payment coefficient is -0.7254 and statistically significant at the 0.01 level, meaning that higher opportunistic fraud possibility for sprains does not hint larger opportunistic fraud severity because lower injury severity for sprains limits its opportunistic fraud space greatly, leading to its claim amount much lower than non-sprains. It is our important finding in this paper, enriching present sprains claim and insurance payout literature [Derrig et al., 1994, Tennyson and Salsas-Forn, 2002].

The fraud coefficient for elderly*sprains is not statistically significant consistent with our hypothesis, but its payment coefficient is 0.3055 and statistically significant at the 0.05 level, meaning that higher bargaining power for the elderly who claims sprains does not hint larger opportunistic fraud severity because lower injury severity for sprains restricts the elderly opportunistic fraud space greatly.

In a word, excess claim amount reflects opportunistic fraud severity more accurately than insurer payment amount, all other economic and non-economic losses claim sub-items except medical expense are the distinct factors to estimate opportunistic fraud severity, and we still find that general damage and death or disability damage are the most obvious opportunistic fraud severity detection factors besides wage loss. RTSL gives rise to moral hazards of neglecting victim fault, focusing on non-motorist or pedestrian role in auto accident because RTSL emphasizes to protect the auto accident injured, especially the non-motorist or pedestrian. An attorney can enhance the claimant bargaining power greatly, meanwhile leading to larger opportunistic fraud space. Opportunistic fraud severity for sprains is not obvious because lower injury severity for sprains restricts its opportunistic fraud space greatly.

5. Conclusion and Further Research

We propose an empirical model for insurer payment and opportunistic fraud amount, and conduct the OLS regression based on our survey on the selected 406 normal and 436 excess claim lawsuit cases respectively for auto bodily injury third-party compulsory liability insurance from a Beijing district court in China during 2007-2012. Results of our study suggest that all other economic and non-economic losses claim sub-items except medical expense are the most significant opportunistic fraud severity detection factors, yet OLS regression result for the opportunistic fraud amount is more accurate than the OLS results for insurer payment amount.

Opportunistic fraud severity of general damage is the largest among all economic and non-economic losses claim sub-items and much larger than the second largest wage loss claim consistent with our hypothesis. Mental anguish exists objectively, both for death or disability, and non-disability, the claimant can claim general damage, but claimants often neglect the auto accident injured identity, family background, accident fault, and social effects etc., leading to claim amount larger naturally than the court award amount. Mental anguish is not easily documented [Crocker and Tennyson, 2002, Loughran, 2005], and the court awards general damage less than medical expense, further enlarging the difference between total claim and award amount. Opportunistic fraud space for general damage is the largest, and it is our most important finding in this paper, enriching present auto claim fraud literature in which general damage amount claimed is not included [Crocker and Tennyson, 2002, Loughran, 2005, Doerpinghaus et al., 2008].

Opportunistic fraud severity of disability or death damage is the third largest among all economic and non-economic losses claim sub-items contrary to our hypothesis. More severe injury severity for disability or death creates the claimants more convincing and reasonable excuses to exaggerate the claim amount, and there exists a larger opportunistic fraud space. The largest insurer payment and larger opportunistic fraud amount coexist in disability or death damage claim, and it is our another important finding in this paper, enriching present auto claim fraud literature in which bodily injury severity is just dummy variable [Crocker and Tennyson, 2002, Doerpinghaus et al., 2008].

RTSL gives rise to moral hazards of neglecting victim fault, and focuses on non-motorist or pedestrian role in auto accident because RTSL emphasizes to protect the auto accident injured, especially to protect the non-motorist and pedestrian more than the motorist, enriching current single law system reform and insurance payments literature [Tennyson and Warfel, 2010, Asmat and Tennyson, 2014].

Opportunistic fraud severity with attorney involvement is larger than that without an attorney consistent with our hypothesis. Claimant negotiating power can be enhanced significantly when a lawyer is involved, but the lawyer can encourage the claimant to seek higher claim amount, leading to larger opportunistic fraud space. Both larger insurer payment and larger opportunistic fraud amount coexist in attorney involvement claim, it is also our important finding in this paper, enriching present single lawyer enhancing claimant negotiating power and insurance payments literature [Cummins and Tennyson, 1992, Doerpinghaus et al., 2008].

Opportunistic fraud severity for sprains is not significant statistically contrary to our hypothesis. Lower injury severity for sprains limits its opportunistic fraud space greatly, leading to its claim amount much lower than non-sprains. Higher opportunistic fraud possibility for sprains does not hint larger opportunistic fraud severity, enriching existing single sprains claim and insurance payments literature [Crocker and Tennyson, 2002, Loughran, 2005].

Our findings have important policy implications because of present concerns about lost wages and sprains claim fraud (e.g., Crocker and Tennyson, 2002; Loughran, 2005).Other

economic and non-economic losses claim sub-items should also be heeded seriously, especially the most outstanding general damage as well as death or disability damage claim. In addition, the moral hazards of neglecting victim fault and focusing on non-motorist or pedestrian role in auto accident possibly are the unintended results of RTSL designer. We still should pay attention to the moral hazard of attorney involvement, namely the lawyer can encourage the claimant to seek higher claim amount.

However, we must be careful in interpreting these results, as the empirical analysis of the opportunistic fraud severity here utilizes a relatively small sample size, which comes from auto bodily injury third-party compulsory liability insurance in China during 2007-2012 instead from a worldwide population. The geographical location may be important, and different results may be found in the different areas. The available data, however, cause us to pause in making too much analysis, we encourage further researchers to seek out the similar data from different areas, i.e, Asia, European, or American countries, etc. If such data could be collected, which can be viewed as cluster data, maybe a mixture model will be appropriate and this deserves our further study. In addition, excess claims also exist in other insurances besides auto bodily injury third-party compulsory liability insurance. In the future, we will continue to survey much more lawsuit data of auto bodily injury third-party compulsory liability insurance and extend the opportunistic fraud severity evaluation to other insurances such as personal accident or health insurance.

References

J. Ai, P. L. Brockett, and L. L. Golden. Assessing consumer fraud risk in insurance claims: An unsupervised learning technique using discrete and continuous predictor variables. *North American Actuarial Journal*, 13(4):438–458, 2009.

J. Ai, P. L. Brockett, L. L. Golden, and M. Guillén. A robust unsupervised method for fraud rate estimation. *Journal of Risk and Insurance*, 80(1):121–143, 2013.

M. Artís, M. Ayuso, and M. Guillén. Detection of automobile insurance fraud with discrete choice models and misclassified claims. *Journal of Risk and Insurance*, 69(3):325–340, 2002.

D. P. Asmat and S. Tennyson. Does the threat of insurer liability for âbad faithâ? affect insurance settlements? *Journal of Risk and Insurance*, 81(1):1–26, 2014.

S.-T. Bair, R. J. Huang, and K. C. Wang. Can vehicle maintenance records predict automobile accidents? *Journal of Risk and Insurance*, 79(2):567–584, 2012.

J. F. Blumstein, R. R. Bovbjerg, and F. A. Sloan. Beyond tort reform: Developing better tools for assessing damages for personal injury. *Yale J. on Reg.*, 8:171, 1991.

R. R. Bovbjerg, F. A. Sloan, and J. F. Blumstein. Valuing life and limb in tort: Scheduling pain and suffering. *Nw. UL Rev.*, 83:908, 1988.

P. L. Brockett, R. A. Derrig, L. L. Golden, A. Levine, and M. Alpert. Fraud classification using principal component analysis of ridits. *Journal of Risk and Insurance*, 69(3):341–371, 2002.

M. J. Browne and J. T. Schmit. Litigation patterns in automobile bodily injury claims 1977–1997: Effects of time and tort reforms. *Journal of Risk and Insurance*, 75(1):83–100, 2008.

S. B. Caudill, M. Ayuso, and M. Guillén. Fraud detection using a multinomial logit model with missing information. *Journal of Risk and Insurance*, 72(4):539–550, 2005.

K. J. Crocker and S. Tennyson. Insurance fraud and optimal claims settlement strategies. *JL & Econ.*, 45:469, 2002.

J. D. Cummins and S. Tennyson. Controlling automobile insurance costs. *The Journal of economic perspectives*, pages 95–115, 1992.

J. D. Cummins and S. Tennyson. Moral hazard in insurance claiming: evidence from automobile insurance. *Journal of Risk and Uncertainty*, 12(1):29–50, 1996.

R. Derrig and H. Weisberg. Auto bodily injury claim settlement in massachusetts. *Document, Automobile Insurers Bureau of Massachusetts*, 2003.

R. A. Derrig and K. M. Ostaszewski. Fuzzy techniques of pattern recognition in risk and claim classification. *Journal of Risk and Insurance*, pages 447–482, 1995.

R. A. Derrig, H. I. Weisberg, and X. Chen. Behavioral factors and lotteries under no-fault with a monetary threshold: a study of massachusetts automobile claims. *Journal of Risk and Insurance*, pages 245–275, 1994.

H. Doerpinghaus, J. Schmit, and J. J.-H. Yeh. Personal bias in automobile claims settlement. *Journal of Risk and Insurance*, 70(2):185–205, 2003.

H. I. Doerpinghaus, J. T. Schmit, and J. J.-H. Yeh. Age and gender effects on auto liability insurance payouts. *Journal of Risk and Insurance*, 75(3):527–550, 2008.

V. R. Fuchs. Time preference and health: an exploratory study, 1980.

J. V. Gallos. Women's experiences and ways of knowing: Implications for teaching and learning in the organizational behavior classroom. *Journal of Management Education*, 17 (1):7–26, 1993.

M. Geistfeld. Placing a price on pain and suffering: A method for helping juries determine tort damages for nonmonetary injuries. *California Law Review*, 83(3):773–852, 1995.

A. Ghasemi and S. Zahediasl. Normality tests for statistical analysis: a guide for non-statisticians. *International journal of endocrinology and metabolism*, 10(2):486–489, 2012.

K. Graddy and L. Pistaferri. Wage differences by gender: evidence from recently graduated mbas. *Oxford Bulletin of Economics and Statistics*, 62(s1):837–854, 2000.

M. Halek and J. G. Eisenhauer. Demography of risk aversion. *Journal of Risk and Insurance*, pages 1–24, 2001.

S. Ingber. Rethinking intangible injuries: A focus on remedy. *California Law Review*, pages 772–856, 1985.

L. L. Jaffe. Damages for personal injury: The impact of insurance. *Law and Contemporary Problems*, pages 219–240, 1953.

N. A. Jianakoplos and A. Bernasek. Are women more risk averse? *Economic inquiry*, 36(4): 620, 1998.

D. Kessler. Fault, settlement, and negligence law. *The Rand Journal of Economics*, pages 296–313, 1995.

I. P. Levin, M. A. Snyder, and D. P. Chapman. The interaction of experiential and situational factors and gender in a simulated risky decision-making task. *The Journal of Psychology*, 122(2):173–181, 1988.

D. S. Loughran. Deterring fraud: the role of general damage awards in automobile insurance settlements. *Journal of Risk and Insurance*, 72(4):551–575, 2005.

B. D. Meyer, W. K. Viscusi, and D. L. Durbin. Workers' compensation and injury duration: evidence from a natural experiment. *The American economic review*, pages 322–340, 1995.

R. A. Posner. *Aging and old age*. University of Chicago Press, 1995.

M. Powell and D. Ansic. Gender differences in risk behaviour in financial decision-making: An experimental analysis. *Journal of economic psychology*, 18(6):605–628, 1997.

M. J. Radin. Compensation and commensurability. *Duke Law Journal*, pages 56–86, 1993.

M. Reimann. Liability for defective products at the beginning of the twenty-first century: Emergence of a worldwide standard? *The American Journal of Comparative Law*, pages 751–838, 2003.

J. T. Schmit and J.-H. Yeh. An economic analysis of auto compensation systems: Choice experiences from new jersey and pennsylvania. *Journal of Risk and Insurance*, 70(4): 601–628, 2003.

R. Schubert, M. Brown, M. Gysler, and H. W. Brachinger. Financial decision-making: are women really more risk-averse? *American Economic Review*, pages 381–385, 1999.

A. F. Stuhlmacher and A. E. Walters. Gender differences in negotiation outcome: a meta-analysis. *Personnel Psychology*, (52):653–677, 1999.

A. E. Sunden and B. J. Surette. Gender differences in the allocation of assets in retirement savings plans. *American Economic Review*, pages 207–211, 1998.

S. Tennyson and P. Salsas-Forn. Claims auditing in automobile insurance: fraud detection and deterrence objectives. *Journal of Risk and Insurance*, 69(3):289–308, 2002.

S. Tennyson and W. J. Warfel. The emergence and potential consequences of first party insurance bad faith liability. *Journal of Insurance Regulation*, 28(2):3–20, 2008.

S. Tennyson and W. J. Warfel. The law and economics of first-party insurance bad faith liability. *Connecticut Insurance Law Journal*, 15:203–242, 2010.

S. Viaene, R. A. Derrig, B. Baesens, and G. Dedene. A comparison of state-of-the-art classification techniques for expert automobile insurance claim fraud detection. *Journal of Risk and Insurance*, 69(3):373–421, 2002.

W. K. Viscusi. Pain and suffering in product liability cases: systematic compensation or capricious awards? *International Review of Law and Economics*, 8(2):203–220, 1988.

W. K. Viscusi. *Reforming products liability*. Harvard University Press, 1991.

M. Ye. Research on auto insurance fraud detection indicators based on jiangsu, zhejiang and shanghai auto insurance claim data. *Insurance Studies*, 4:83–87, 2010.

J. Zavos. Negotiating multiculturalism: religion and the organisation of hindu identity in contemporary britain. *Journal of Ethnic and Migration Studies*, 35(6):881–900, 2009.

J. Zhou, J. Zhou, B. Qin, and Y. Xu. Is the insurant fraud or the insurance company underpaid? *Journal of Hebei University of Economics and Business*, 35(2):115–120, 2014.