Will Encouraging the Return of the Driver’s Licenses of the Elderly Reduce Traffic Accidents?

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Abstract
This paper examines the effect of restricting the elderly’s driver’s licenses or encouraging elderly drivers to forfeit their licenses on reducing the number of traffic accidents. Considering the pedestrians and drivers who participate in compulsory automobile liability insurance and voluntary insurance we model a traffic accident scenario that incorporates the number of elderly, the insurance rates, population density, income, and pavement extensions by prefecture in Japan. Furthermore, we model a simultaneous equation that considers the occurrence of traffic accident and insurance participation. The study found that when strict liability is applied to a driver, drivers are not likely to avoid accidents beforehand. Notably, it is possible that elderly people possessing a driver’s license induce more traffic accidents. It is difficult to expect the effect of deterring an accident in the insurance market unless there is a mechanism to give pedestrians incentives to avoid accidents.

Keywords: Traffic accidents, strict liability, negligence liability, moral hazard, insurance contract, senior citizens
elderly drivers

1. Introduction
In recent years, the number of car accidents involving elderly people has increased. According to the “Traffic Accident Statistics” in 2014, the number of overall traffic accidents and the number of injured and deceased people have decreased since 2000, although 405,109 traffic accidents have occurred, with a total of 3,037 deaths. Among those killed, 53.7% were elderly people aged 65 years and over.

In response to this situation, the Japanese government had set a goal under the “Tenth Traffic Safety Basic Plan” of reducing traffic fatalities to 2,500 or less by 2016. Thus, there is a growing interest on how to reduce traffic fatalities of elderly people. Mass media reports are encouraging elderly people to forfeit their driver’s licenses and local governments are taking measures to implement this process. However, the reported “number of traffic accident deaths by age” used in the press represents all road traffic accident deaths, including those of pedestrians and bicycle users. In addition, encouraging elderly driver’s license return is often derived from the view that the decline in cognitive function of elderly people leads to accidents. However, limiting the means for elderly people to drive will increase the number of elderly pedestrians. According to the White Paper on Police in 2004, 87% traffic accident deaths of elderly people occur in passengers who do not have a license or people who are walking or bicycling. On the contrary, the percentage of elderly people killed in traffic accidents who have a license is remarkably low at 13%. The possibility of death by a traffic accident seems to be lower in elderly individuals with a license. There have been many policy recommendations, such as providing better road infrastructure, increasing safety equipment for automobiles, installing electronic devices such as radar to assist drivers, and providing subsidies for developing vehicles that include these modifications. However, there have been few studies to consider the latent factors behind traffic accidents from an economic point of view in conjunction with such incentives. In particular, it is important to consider whether encouragement to return one’s driver’s license contributes to reduction of traffic accidents for elderly people and whether pedestrians neglect safety attention. Nothing has been discussed regarding whether incentives to observe risk obligation are successful.

Therefore, in this paper, we examine whether drivers can obtain incentives for accident prevention. We also empirically clarify whether giving drivers an incentive for accident prevention will work.

An important feature of this research is dealing with the problem of compensation for traffic accident avoidance by elderly people, especially considering whether a program encouraging elderly drivers to forfeit their licenses contributes to the reduction of traffic accidents. Specifically, we empirically investigate whether voluntary insurance functions in terms of suppressing traffic accidents among elderly with driver’s licenses contribute to a reduction in...
traffic accidents.

Through paying attention to relationships between the voluntary insurance participation rate and the population composition of the elderly, we contribute to academic fields from the point of comparative institutional analysis.

2. Setting the Model and Hypotheses

According to data on traffic accident statistics for FY2005, the proportion of elderly people among the total pedestrian-to-vehicle accidents is 8.4%, but among fatal accidents, elderly people are 34.7% of the total. By classifying accident victims by age, there were 1,063 people between 60 and 65 years of age and 734 people over 65 years of age. Also, in the case of mutual vehicle accidents (vehicle versus vehicle) involving elderly people, 600 were between 60 and 65 years of age and 352 were over 65 years of age. Because elderly people aged 65 and older occupy about 30% of the total population, they inevitably have a high frequency of involvement in traffic accidents. Especially in rural areas, this trend is expected to be noticeable, because the proportion of elderly people is higher here than in urban areas, available transportation methods are limited, and traffic movement is difficult in the rural environment.

In addition, there have been few cases where negligence offsetting is applied to pedestrians by compulsory automobile liability insurance. If an elderly pedestrian neglects his/her duty of safety attention and a driver does not specifically make changes to avoid the danger, the number of traffic accidents will increase and insurance fees increases. As a result, the insurance market will not function and the moral hazard problem in insurance contracts may become serious ([7], [10]).

The increase in insurance premiums due to the loss of trust in driver’s safe driving cannot ignore the influence of young people reducing their reliance on cars. When an elderly person is heavily involved in an injury traffic accident, usually a driver of 64 years old or less is the cause of the accident. Drivers are regarded as perpetrators and suffer significant losses not only from criminal responsibility but also economically and professionally. In Europe and the United States, it is argued that the governance function using an insurance contract that imposes a strict liability on the driver is actually not very effective in reality ([10]). However, currently, the empirical analysis has not been fully implemented in Japan. In addition, researchers cannot apply a hypothesis derived in the United States to Japanese traffic conditions; therefore, the hypothesis must consider the special characteristics of Japanese roadways. The introduction of a system for elderly driver’s license return should be discussed considering the narrowing means of migration of elderly people. In addition, the aging phenomenon is lower in large cities due to regional bias and higher in rural areas, so a traditional traffic policy that tries to protect the elderly has its limits.

Considering the pedestrians and drivers who participate in compulsory automobile liability insurance and voluntary insurance: there is an upper limit (C) for the amount of damage guaranteed by compulsory automobile liability insurance, and voluntary insurance shall compensate for damage exceeding it. However, depending on the type of voluntary insurance, the degree of security varies.

The utility function of the driver and the pedestrian are \( U_d \) and \( U_w \), respectively; the effort levels of each are \( e_d \) and \( e_w \) (0 ≤ \( e_d \), \( e_w \) ≤ 1), respectively; the variable representing age is \( \theta \), the accident occurrence probability is \( \pi(e_d, e_w, i=d \) or \( w, \partial \pi \partial e_d < 0, \partial \pi \partial e_w > 0 \); the cost to strive to prevent an accident is \( C(e_d, e_w, \theta) \).

\[
\frac{\partial C}{\partial e_d} > 0, \frac{\partial^2 C}{\partial e_d^2} < 0, \frac{\partial C}{\partial \theta} > 0, \frac{\partial^2 C}{\partial \theta^2} > 0, \frac{\partial^2 C}{\partial e_d \partial \theta} > 0.
\]

We let \( W \) be the original wealth, \( I, L \in \{L, I\} \) be the amount of damage caused by the accident, and \( f(L) \) the probability density function of \( L \). \( P \) is the sum of the compulsory automobile liability insurance premiums and the voluntary insurance premiums. \( C(L) \) is the amount compensated by compulsory automobile liability insurance and by voluntary insurance when an accident occurs: \( C(L)=L \) if \( I<L \) and \( C(L)=C+k(L-C) \) if \( L \geq C \), guaranteed up to \( C \) by compulsory automobile liability insurance. The amount of damage exceeding the compulsory insurance is guaranteed by voluntary insurance. If \( k(0 \leq k<1) \) is larger, it indicates that the driver has subscribed to voluntary insurance with greater compensation. If \( k=0 \), the driver has not subscribed to voluntary insurance. The expected compensation amount shall be less than the damage amount \( \int_0^I L f(L) dL > \int_C^I C(L) f(L) dL \).

The expected utility of the driver (\( EU_d \)) is expressed as follows.

\[
EU_d = (1-\pi(e_d, e_w))U(W - P) + \pi(e_d, e_w)\int_0^I (W - P - L + C(L)) f(L) dL - c(e_d, e_w, \theta)
\]

\[
= (1-\pi(e_d, e_w))U(W - P) + \pi(e_d, e_w)\int_0^C (W - P) f(L) dL
\]

\[
+ \pi(e_d, e_w)\int_C^I (W - P - L + C + k(L-C)) f(L) dL
\]

\[
- c(e_d, e_w, \theta)
\]

\[
= U(W - P) + \pi(e_d, e_w)[-U(W - P) + \int_0^I U(W - P) f(L) dL + \int_C^I (W - P - L + C + k(L-C)) f(L) dL]
\]

\[
- c(e_d, e_w, \theta)
\]
The optimal effort level \( e_d \) of the driver satisfies the first-order condition as follows.

\[
\frac{\partial \pi}{\partial e_d} \left[ -U(W - P) + \int_0^c U(W - P) f(L) dL + \int_0^c U(W - P - (1-k)(L - \overline{C})) f(L) dL \right] = 0
\]

Further, when the first-order condition is modified, it becomes as follows.

\[
U(W - P) - \int_0^c U(W - P) f(L) dL + \int_0^c U(W - P - (1-k)(L - \overline{C})) f(L) dL = \frac{\partial c}{\partial e_d} / \frac{\partial \pi}{\partial e_d}
\]

That is, as \( k \) is larger (the amount of guaranteed compensation is larger), the left side becomes smaller, and \( e_d \) decreases by the assumption of \( \pi \) and \( C \). In other words, the effort level of the driver is reduced. This is the moral hazard of the driver (Hypothesis 2). In addition, the smaller \( k \) is, the higher the effort level is.

On the other hand, the expected utility of the pedestrian (\( EU_w \)) is expressed as follows. Pedestrians are supposed to be covered by insurance, but they will suffer losses that are not represented by the amount of damage. We let this loss be \( \alpha L \) \((0 \leq \alpha \leq 1)\) with respect to the damage amount \( L \).

\[
EU_w = (1 - \pi(e_d, e_w)) U(W) + \pi(e_d, e_w) \int_0^c U(W - \alpha L) f(L) dL - c(e_d, e_w, \theta)
\]

Therefore, the pedestrian's optimal effort level, \( e_w \), satisfies the following first-order condition.

\[
\frac{\partial \pi}{\partial e_w} \left[ -U(W) + \int_0^c U(W - \alpha L) f(L) dL \right] = \frac{\partial c}{\partial e_w}
\]

Here, when looking at \( \theta \), the optimum \( e_w \) level increases as \( \theta \) increases. In other words, the probability of the occurrence of an accident reduces \( \pi(e_d, e_w) \), and an increase in the number of elderly pedestrians decreases the probability of accident occurrence.

Similarly, the same can be said for the optimization of the driver's effort level; as long as the level of participation in voluntary insurance is at the same level, the optimum level of \( e_d \) will be raised.

On the other hand, [8], [9] and [11] have shown that the increase in the number of elderly people increases society's voluntary insurance participation rate; therefore, aging increases the level of \( k \) and reduces the level of \( e_d \).

Thus, unlike the case of the pedestrian, in this case, we cannot say that an increase in the number of elderly people will raise the level of \( e_d \). The effect of rising voluntary insurance rate due to aging may outweigh the effect of decline of \( e_d \).

In this case, there is a possibility that an increase in the number of elderly people raises the probability of accident occurrence \( \pi(e_d, e_w) \) (Hypothesis 1). Therefore the resulting hypotheses are as follows:

**Hypothesis 1**: Traffic accidents decrease due to an increased number of elderly people. However, it cannot be said that the existence of elderly people possessing a driver's license contributes to the reduction of traffic accidents.

**Hypothesis 2**: Because today, the driver has responsibility, the feasibility of avoiding accidents in advance is lowered and as a result, in reality, it is difficult to expect the insurance market to prevent accidents (accident suppression function hypothesis).

3. **Empirical Analysis**

In this paper, we examine the data of traffic accidents in a four-year period (2011-2015) in Japan. Data for each prefecture was obtained from the Ministry of Internal Affairs and Communications Statistics Bureau. Figures were assembled for population, prefectural inhabitant income, population density, population over 65 years old and extended pavement per car.

Regarding the number of vehicles owned, the "automobile ownership statistics data" by the Automobile Inspection and Registration Information Association, was used to provide the figures. The Traffic Accident Statistics Annual Report provided figures for the following: number of traffic accidents, number of mutual vehicle accidents and deaths, number of traffic accidents where the second party is a pedestrian described by accident type.

For example, the mutual vehicle accident rate is calculated by dividing the number of mutual vehicle accidents by the number of registered vehicles in the area, and the pedestrian versus vehicle accident rate is calculated by dividing the number of traffic accidents with a pedestrian (second party) by the population of the area.

For the insurance participation rate and average payment insurance amount of voluntary insurance, we used the automobile insurance statistics from the automobile insurance premium calculation board. The number of registered driver licenses is obtained from the driver's license statistics from the National Police Agency and is divided by the population number of each area to obtain the license rate. Table 1-1 shows the basic statistics of the variables used in this paper and Table 1-2 shows the traffic accident rate and the explanatory variables, by region.
| Variable                                  | Obs  | Mean   | Std. Dev. | Min  | Max  | vif  |
|------------------------------------------|------|--------|-----------|------|------|------|
| Vehicle mutual accident rate             | 235  | 0.00749| 0.00853   | 0.0013 | 0.0695 |
| Pedestrian vs. vehicle accident rate      | 235  | 0.00050| 0.00004   | 0.0010 | 0.00322 |
| Vehicle mutual mortality rate             | 235  | 0.00002| 0.00000   | 0.00002 | 0.0023 |
| Pedestrian vs. vehicle death rate         | 235  | 0.00002| 0.00000   | 0.00000 | 0.000008 |
| insurance participation rate (%)          | 235  | 70.46  | 7.17      | 52.30 | 82.60 | 3.72 |
| Per capita income per capita (thousand yen)| 235  | 2756.29 | 390.56   | 2018.00 | 4508.00 | 1.99 |
| Age (over 65 years old) Percentage of population (%) | 235  | 25.59 | 2.74 | 16.92 | 32.28 | 2.58 |
| Population density (1000 people / km2)   | 235  | 0.658  | 1.174     | 0.066 | 6.168 | 9.08 |
| Pavement extension rate per car (m / unit) | 235  | 2.14 | 0.82 | 0.54 | 4.50 | 9.15 |
| Health insurance policy insurance average insurance premium (thousand yen) | 235  | 56.06 | 5.30 | 35.98 | 70.01 | 1.92 |
| Average amount of personal compensation (thousand yen) | 235  | 284.88 | 41.38 | 184.22 | 386.98 | 2.53 |
| Variable/year                            | 2011 | 2012  | 2013  | 2014 | 2015 |
| Vehicle mutual accident rate             | 0.008 | 0.010 | 0.007   | 0.006 | 0.006 |
| Pedestrian vs. vehicle accident rate      | 0.0005 | 0.0005 | 0.0005   | 0.0005 | 0.0005 |
| Vehicle mutual mortality rate             | 0.00002 | 0.00003 | 0.00002   | 0.00002 | 0.00002 |
| Pedestrian vs. vehicle death rate         | 0.00002 | 0.00002 | 0.00002   | 0.00002 | 0.00002 |
| insurance participation rate (%)          | 70.16 | 69.89  | 70.73   | 70.33 | 71.12 |
| Per capita income per capita (thousand yen) | 2713 | 2733 | 2827 | 2682 | 2827 |
| Age (over 65 years old) Percentage of population (%) | 0.669 | 0.656 | 0.654 | 0.654 | 0.655 |
| Population density (1000 people / km2)   | 2.069 | 2.162 | 2.160 | 2.157 | 2.157 |
| Pavement extension rate per car (m / unit) | 53.030 | 55.459 | 55.082 | 56.532 | 60.195 |
| Health insurance policy insurance average insurance premium (thousand yen) | 254.526 | 260.955 | 283.197 | 302.018 | 323.719 |

Table 1-2A Descriptive Statistics of Variables Used by Prefecture (2011-2015)

| Variable                                      | Min            | 25%            | Median          | 75%            | Max            |
|-----------------------------------------------|----------------|----------------|-----------------|----------------|----------------|
| Min                                           | 1.01           | 21.22          | 31.56           | 43.07          | 75.83          |
| 25%                                           | 70.34          | 25.52          | 55.69           | 282.06         | 0.6548         |
| Median                                        | 70.34          | 25.52          | 55.69           | 282.06         | 0.6548         |
| 75%                                           | 70.34          | 25.52          | 55.69           | 282.06         | 0.6548         |
| Max                                           | 70.34          | 25.52          | 55.69           | 282.06         | 0.6548         |

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The following can be inferred from these tables. The accident rates and mortality rates of vehicle versus vehicle (mutual vehicle accidents) and pedestrian versus vehicle are decreasing year by year. Fukui prefecture has statistically significantly higher accident rates and death rates. Kumamoto and Kagoshima prefectures are statistically insignificant for mutual vehicles. On the other hand, the candidates for explanatory variables include insurance participation rates, drivers over 65 years old, insurance participation rate, and the arbitrary insurance participation rate. Therefore, we estimate the effect of the policy on reducing the number of traffic accidents. Furthermore, we model a simultaneous equation that considers the occurrence of traffic accident and insurance participation.

\[ y_{ij,t} = \alpha_i z_{ij,t} + \beta_i x_{ij,t} + a_{ij,t} + u_{ij,t} \]

\[ z_{ij,t} = \gamma_1 Income + \gamma_2 Premium + \gamma_3 Payment + a_{ij,t} + u_{ij,t} \]

The variables to be explained are as follows. The explanatory variable \( z_{ij,t} \) is the participation rate of voluntary personal liability insurance. The explanatory variable \( x_{ij,t} \) is a variable that affects traffic accidents, which includes the average payment amount of interpersonal compensation insurance, the population density, the proportion of the population age 65 or over, and the extension of pavement per car, each logarithmically transformed. Income (income per prefecture), premium (the average insurance fee), payment (the average paid amount of personal compensation insurance) are exogenous.
variables that affect the insurance participation rate. The error term is the prefecture-specific unobserved effect, or idiosyncratic errors. The estimation results are shown in Table 2-1 and Table 2-2. In addition, VIF tests were performed and there is not a serious problem of multicollinearity.

What is most interesting is the impact of the number of elderly people on the accident rate. In the case of pedestrian versus vehicle, in an aging region, the accident rate is statistically significantly negative and the mortality rate also tends to be lower, which is different from Hypothesis 1. Also, in the case of vehicle versus vehicle, similarly, a statistically significant negative coefficient is obtained. It is difficult to interpret that traffic accidents are occurring because there are many elderly people. In other words, elderly people are paying enough attention to avoid getting caught up in traffic accidents. Instead, we infer that older people avoid working hours and move when there is little traffic.

However, we have a statistically significant positive value in areas with a larger population of age 65 or older and areas with high licensing rates. This means that the elderly holding driver’s licenses may be conversely involved in traffic accidents or may contribute to an increase in traffic accidents. Therefore, by enforcing a policy to urge the elderly to forfeit their licenses it may be possible to decrease the number of accidents in the future (Hypothesis 1 is adopted).

Next, to explicitly grasp the causal relationship, we decided to estimate by using instrumental variables. We look at the coefficient $\alpha_1$, which is the influence of the insurance participation rate on the accident rate. If the traffic accident rate decreases due to an increase in insurance participation rate, the coefficient value should be negative.

The results of the analysis are as follows. It is worth

| Table 2-1: GMM estimation | Table 2-2: GMM estimation with IV |
|---------------------------|----------------------------------|
| dependent variable: pedestrian vs. vehicle accident rate | dependent variable: pedestrian vs. vehicle mortality rate |
| Coef. | Std. Err. | z | P>|z| | Coef. | Std. Err. | z | P>|z| |
| Population 65 years old or over × License rate | 0.0006 | 0.0034 | 1.75 | 0.079 | 0.0076 | 0.0046 | 1.65 | 0.099 |
| Insurance participation rate | 0.0002 | 0.0011 | 1.45 | 0.148 | 0.0002 | 0.0008 | 1 | 0.316 |
| Population density | 0.0008 | 0.0001 | 1.66 | 0.097 | 0.0106 | 0.0113 | 1.19 | 0.234 |
| Population over 65 years old | -0.0112 | 0.0046 | -2.45 | -0.014 | -0.0137 | -0.0062 | -2.22 | 0.027 |
| Personal average premium | 0.0042 | 0.0076 | 0.55 | 0.582 | 0.0017 | 0.0097 | 0.17 | 0.862 |
| Pavement extension rate | 0.0037 | 0.0022 | 1.69 | 0.092 | 0.0042 | 0.0023 | 1.83 | 0.067 |
| Payment for compensation insurance | -0.0121 | 0.0064 | -1.9 | -0.0057 | -0.0096 | 0.0067 | -1.43 | 0.154 |
| Constant term | 0.0659 | 0.0227 | 2.9 | 0.004 | 0.0657 | 0.0285 | 2.31 | 0.021 |
| Number of samples | 235 | 235 |
| Modified coefficient of determination | 0.0425 | 0.0404 |

| dependent variable: vehicle mutual mortality rate | dependent variable: pedestrian vs. vehicle accident rate |
|---------------------------|----------------------------------|
| Coef. | Std. Err. | z | P>|z| | Coef. | Std. Err. | z | P>|z| |
| Population 65 years old or over × License rate | 0.0000 | 0.0000 | 4.25 | 0 | 0.0000 | 0.0000 | 1.99 | 0.05 |
| Insurance participation rate | 0.0000 | 0.0000 | 1.44 | 0.15 | 0.0000 | 0.0000 | 3.02 | 0 |
| Population density | 0.0000 | 0.0000 | 1.07 | 0.285 | 0.0000 | 0.0000 | -0.69 | 0.49 |
| Population over 65 years old | 0.0000 | 0.0000 | -2.92 | 0.004 | 0.0000 | 0.0000 | -1.06 | 0.29 |
| Personal average premium | 0.0000 | 0.0000 | -0.98 | 0.326 | 0.0000 | 0.0000 | -2.35 | 0.02 |
| Pavement extension rate | 0.0000 | 0.0000 | 3.37 | 0.001 | 0.0000 | 0.0000 | 2.32 | 0.02 |
| Payment for compensation insurance | 0.0000 | 0.0000 | -1.83 | 0.067 | 0.0000 | 0.0000 | -2.59 | 0.01 |
| Constant term | 0.0000 | 0.0000 | 3.16 | 0.002 | 0.0000 | 0.0002 | 3.87 | 0 |
| Number of samples | 235 | 235 |
| Modified coefficient of determination | 0.1776 | 0.0796 |

| dependent variables: vehicle mutual mortality rate | dependent variable: pedestrian vs. vehicle accident rate |
|---------------------------|----------------------------------|
| Coef. | Std. Err. | z | P>|z| | Coef. | Std. Err. | z | P>|z| |
| Population 65 years old or over × License rate | 0.0000 | 0.0000 | 1.52 | 0.129 | 0.0000 | 0.0000 | 0.16 | 0.87 |
| Insurance participation rate | 0.0000 | 0.0000 | 1.13 | 0.259 | 0.0000 | 0.0000 | 2.8 | 0.01 |
| Population density | 0.0000 | 0.0000 | 0.73 | 0.467 | 0.0000 | 0.0000 | -0.71 | 0.48 |
| Population over 65 years old | 0.0000 | 0.0000 | -1.66 | 0.098 | 0.0000 | 0.0000 | -0.17 | 0.87 |
| Personal average premium | 0.0000 | 0.0000 | 0.62 | 0.533 | 0.0000 | 0.0000 | 0.65 | 0.52 |
| Pavement extension rate | 0.0000 | 0.0000 | 2.57 | 0.01 | 0.0000 | 0.0003 | 2.08 | 0.04 |
| Payment for compensation insurance | 0.0000 | 0.0000 | -1.32 | 0.188 | 0.0000 | 0.0000 | -2.27 | 0.02 |
| Constant term | 0.0001 | 0.0000 | 2.1 | 0.036 | 0.0002 | 0.0001 | 3.05 | 0 |
| Number of samples | 235 | 235 |
| Modified coefficient of determination | 0.0496 | 0.0402 |
noting that, contrary to anticipated signs, there is also a statistically significant positive value. In other words, if the insurance participation rate is high, the number of driver accidents and the number of injured or injured people tends to increase. When strict liability is applied to drivers, they are treated as perpetrators. As a result, it is interpreted that the driver does not pay attention and the incentives to prevent accident are not working on the driver side (Hypothesis 2 is adopted).

Moreover, the average payment amount for interpersonal compensation insurance has an effect on traffic accidents. This is a result of supporting the above interpretation. Especially when the insurance payment to the victim is large, the number of casualties also decreases. However, in the case of an accident without death, it is not statistically significant.

Furthermore, the pavement extension rate is statistically significant, and an area with a higher pavement extension rate has more driver accident casualties and injured people. The pavement extension rate is considered to be a proxy variable indicating that the cars speed is higher. In other words, due to the speed of the car, pedestrians increase the possibility of encountering traffic accidents in an area with many paved roads.

4. Conclusion

The main results of this paper are as follows. Although elderly people pay enough attention to avoid traffic accidents, elderly people who possess a driver's license have increased driving opportunities, and thereby are more likely to be involved in a traffic accident or contribute to an increase in traffic accidents. Therefore, it is considered that taking a policy to urge elderly to return driver's license is sufficiently effective for reducing accidents.

Also, under the circumstances where the Road Traffic Act imposes strict liability on drivers, it is highly expected that a driver is less concerned about accidents and pays less attention. As a result, the possibility that a driver avoids accidents beforehand is low. In other words, unless the pedestrian has incentives to avoid accidents, we cannot expect the insurance market to reduce accidents. From the viewpoint of social efficiency, not putting the entire burden of responsibility on the driver is desirable because young people not only increase the opportunity drive or be passengers but also give incentives for accident prevention.

Therefore, we would like to propose to include negligence liability in automobile damages liability insurance contracts so that pedestrians have incentives to prevent accidents. However, the problem of omitted variables remains a problem in a traffic accident model. There are many factors that affect traffic accidents. The occurrence of traffic accidents can be affected by institutional changes like as changes in the road environment; vehicle performance; damage compensation amounts; holding of a driver's license; the frequency of police traffic violations and weather conditions. However, due to data constraints, it is impossible to incorporate all of these variables into the model. As a result, there may be a bias in the estimate. It is necessary to analyze the traffic behavior of elderly people to grasp the actual conditions of traffic accidents and to reflect the result in traffic safety policy as a future subject.

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