Identifying Moral Hazard in Car Insurance Contracts[1]

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Abstract

This paper capitalizes on a unique situation in Israel where car insurance coverage is often distributed as a benefit by employers. Employer-determined coverage creates variation in accident costs that are not a function of individual choice. Using instrumental variable analysis on data provided by an insurance firm in Israel (2001-2008), we find that a $100 discount in accident costs increases the probability of an accident by 3.4-3.7 percentage points. These results can be interpreted as the effect of moral hazard on car accidents.

1 Introduction

A positive correlation between the occurrence of an accident and insurance coverage is often observed in empirical research.[1] The "moral hazard" explanation for this phenomenon is that insurance alters individuals' behavior by decreasing their motivation to prevent loss. However, an alternative explanation is that people with a higher risk of accidents self-select into insurance coverage. This "adverse selection" generates a positive correlation between accidents and insurance coverage since insured individuals are disproportionately more likely to suffer accidents in the first place. Clearly, both explanations of the observed correlation are plausible and, as much of the empirical research has emphasized, it is challenging to separately identify them in the available data.

Empirically disentangling moral hazard from adverse selection is important as it can give us insight into the effects of monetary incentives on risk-taking behavior. The presence of a moral hazard effect would suggest that increasing penalty rates applicable after involvement in a car accident would decrease accident rates. This policy recommendation will only hold true if people adjust their driving behavior to expected accident costs. Alternatively, if monetary costs do not have an effect on driving behavior, these types of policies will only result in increases in insurance costs without changing accident outcomes.

The focus of this study is examining the effect of accident costs on driving behavior in a context where car insurance coverage is included as a fringe benefit distributed by employers. This benefit reduces the cost of an accident and could result in a moral hazard effect of increased accidents. Our dataset consists of employees who worked in a large Israeli company between 2001-2008. While all of these employees drive their own private cars, workers holding contracts that are part of a collective-bargaining agreement receive insurance free of charge, while other workers holding individual contracts are not given

[1] See recent work by Abbring, Chiappori and Zavadil (2008), Ceccarini (2009), Cohen and Dehejia (2004), and Schneider (2010).

access to this benefit.[2] Those receiving the insurance benefit pay only a set deductible averaging $120 when reporting an accident, while those holding private insurance pay a higher deductible averaging $160 as well as an additional penalty ranging between $80 and $400 per accident upon policy renewal.[3]

Importantly, the selection mechanism for obtaining the insurance benefit is a function of occupation and not of individual preferences regarding insurance coverage.[4] Thus, the allocation to company coverage creates a plausibly exogenous source of variation in insurance coverage that cannot be attributed to adverse selection. This provides an opportunity to estimate the moral hazard effect of increased insurance coverage using an instrumental variables strategy. After controlling for available policy holder and car characteristics we find that a $100 discount in accident costs increases the likelihood of an accident by 3.4-3.7 percentage points. This represents a 21-23 percent increase in auto accidents as a result of moral hazard since the mean accident rate for people in our sample is 16.3 percent. We compare small and large accidents to ensure that these results are consistent with a moral hazard effect and find that increased costs have a significant effect on accidents with low versus high risks of physical harm.

To the best of our knowledge this is the first paper that attempts to identify the effect of insurance on accident outcomes when insurance costs are not determined by individual choice or driving behavior. However, there still exists the possibility for omitted variable bias as individuals employed in different occupations may have different unobserved levels of driving riskiness. To ensure that omitted variable bias is not driving our results, we also estimate a moral hazard effect using a differencing approach. We

[2]The average cost of a policy for those who purchased insurance privately was $700.

[3]The size of the penalty is dependent on the driver's accident history and annual policy price and can be as high as $400 if this is the second reported accident in a given year. This penalty is expected to remain even if the private client transfers to a different insurance firm (clients are required by law to submit an accident history from their previous insurer).

[4]While membership in a trade union is voluntary in Israel, the coverage created by a collective-bargaining agreement is applied to all relevant workers. Thus, the insurance benefit is not a matter of individual choice (Cohen et. al., 2003)

focus on drivers who are observed in the data from the start of their relationship with the insurance provider (i.e. individuals who started receiving coverage after 2000). In this first period of coverage the driving behavior of individuals allocated to company coverage may still reflect pre-benefit conduct. We can then estimate a moral hazard effect by comparing driving behavior in the first period to driving behavior in the second period and onwards within each group. The change in accident rates occurring within the group of drivers receiving company coverage provides a moral hazard effect that is separate from an occupation effect. We again find a significant moral hazard effect that increases the accident rate for those receiving company insurance. This differencing framework, which was only applied to a subset of new employees who began their insurance policies after 2000, measures a larger insurance effect of 6.6 percentage points. New employees receiving company coverage may be more susceptible to the moral hazard effect since they are likely to be younger than long-serving employees.[5]

This paper is organized as follows. In the next section we begin by reviewing relevant research on insurance and its effects on behavior. Section 3 outlines the modeling framework relating driving behavior to insurance and shows how the allocation to company coverage can be used as an instrumental variable for identifying the moral hazard effect. Section 4 describes the institutional setup and the data used in the empirical analysis while Section 5 reports the empirical results for both the instrumental variable analysis and differencing approach. While our analysis is applied to employees working at a single company it is relevant to note that over 50% of new cars in Israel were covered by company insurance plans in 2010.[6] In our concluding remarks we discuss alternative policy approaches to combat the moral hazard effect created by the widespread implementation of company coverage.

[5] Younger drivers may be less able to compensate for dangerous driving and prevent the occurrence of an accident.

[6] Statistics published by the Israel Central Bureau of Statistics (2010 Motorized Vehicles Report , Table 17).

2 Empirical Research on Moral Hazard

The problem faced by prior studies in measuring the effect of post-insurance accident costs on behavior (moral hazard) is that individuals can choose their level of coverage (adverse selection). This endogeneity in costs can result in mixed answers to the question of whether or not moral hazard exists in car insurance. Chiappori and Salanie (2000) find no evidence of moral hazard when focusing on a cross-section of young French drivers to assess whether there is unobserved information affecting both the insurance choice and the accident outcome. In an attempt to separately identify adverse selection and moral hazard, Abbring et. al. (2003) stress the importance of using a panel of individuals. They also find no evidence of moral hazard based on a model where moral hazard would imply that each accident decreases the chance of a future accident, as the additional cost of a future accident has increased.[7]

In more recent studies, Abbring et. al. (2008) using Dutch longitudinal micro data and Dionne et. al. (2012) using French longitudinal micro data do find evidence of moral hazard. Abbring et. al. compare accident timing for people with the same number of total accidents in a given year who face different costs due to their bonus-malus class.[8] Dionne et. al. (2012) identify moral hazard by examining both the effects of the previous year's insurance contract as well as the driver's bonus-malus class on car accidents.

Comparing driving patterns between people who own versus lease their vehicle has also been used to identify moral hazard. Dunham (2003) examines differences in vehicle

[7]In the French system the premium level each year is determined by the premium in the previous year multiplied by a bonus-malus coefficient. Each year without an accident decreases the size of this coefficient by a factor δ (set to 0.95 in 2003), while having an accident increases it by a factor γ (set to 1.25 in 2003). Individuals who have not had an accident for at least 3 years receive a malus-deductible i.e. do not face a premium increase after their first accident. Thus, the cost of an accident is convex in the number of past accidents that occurred. Despite the decision by the European Union (1994) that bonus-malus systems reduced competition, the European Court of Justice ruled in 2004 that France and Luxemberg can keep their original systems.

[8]The bonus-malus class is determined at each annual contract renewal date and is based on accident history. This class defines the premium paid by the insured.

depreciation of corporate owned fleet and rental versus private vehicles. He estimates an upper bound for moral hazard since there remain significant differences between fleet and private vehicles that provide alternative explanations for the increased depreciation rate. Schneider (2010) investigates differences in driving behavior between taxi owners and leasers in New York City. His dataset allows him to control for a wide range of observable differences in driver characteristics of those who choose to lease versus those who choose to own taxis and examine changes in driver behavior due to moral hazard. Schneider finds that moral hazard increases the accident rate by 16 percent. In these papers the ownership decision is endogenous and the validity of the results relies on accurately controlling for adverse selection.

This brief review illustrates how in the absence of complete information on the accident risk level of each individual, alternative methods of risk classification can result in different evaluations of insurance outcomes. Ideally, to estimate a moral hazard effect we would like to eliminate the adverse selection aspect of insurance. That is, we would want to have a sample of individuals that are "as if" randomly allocated to different insurance contracts regardless of their preferences. Section 3 illustrates how employer allocated insurance provides an opportunity to move in this direction.

3 An Empirical Framework

A moral hazard estimate should capture how the "demand" for car accidents responds to a change in their post-insurance price. While this price can be calculated from an insurance contract, it is a clearly endogenous variable driven by individual choice. We demonstrate how estimation of moral hazard becomes feasible when the allocation to company coverage creates exogenous variation in accident costs. Potential objections to this method of identification as well as techniques employed to address these issues are discussed.

We assume that each individual has his/her own preferred level of driving care

which is a function of personal and car characteristics x, the financial cost of an accident C_A, and an unobserved individual factor v. The level of unobserved (latent) driving behavior maps into an observed accident indicator y. We therefore relate the probability of an accident to these observed and unobserved factors,

$$\Pr(y = 1|x, C_A, v) = x\beta_0 + \beta_1 C_A + v \tag{1}$$

Previous research has shown that personal characteristics such as age, gender, and driving experience as well as car characteristics can affect driver behavior (Cohen and Einav (2007)). Car characteristics such as speed capabilities, brake technology, commute distance, etc., can also affect driving behavior. These factors are captured by x. The unobserved individual component v refers to time-invariant unobservable personal characteristics. The zero mean residual term $\varepsilon = y - (x\beta_0 + \beta_1 C_A + v)$ reflects the randomness associated with the occurrence of an accident involving other automobiles and unexpected road hazards. Importantly, v is known by the individual while ε is not.

The critical variable in the analysis is C_A, the out-of-pocket cost of an accident. Without insurance coverage this cost is simply the expected damage resulting from an accident. With the introduction of an insurance contract this cost is predetermined at the start of the contract, and does not depend on the expected car damage. Thus, C_A is potentially known to individuals and may therefore affect their driving behavior and consequently the incidence of car accidents. This is the moral hazard effect we wish to estimate.

We examine a simple insurance contract $\{p(x), \delta, k\}$ composed of a base annual premium $p(x)$, a deductible δ and a penalty rate k (in percentage terms) in case of an accident. The base premium is calculated by the insurance provider as a function of the driver and car characteristics that are relevant for determining the probability and expected cost of an accident. In general, more dangerous drivers and drivers with more expensive cars face higher base premiums. The deductible δ is constant across individuals

and paid to the provider immediately after reporting an accident. The accident penalty k is paid upon renewal of the insurance contract and increases the annual cost of insurance by k percent.

Given an insurance contract, the cost of an accident for each individual is the deductible (δ) as well as the expected increase to their annual insurance contract resulting from a car accident,

$$C_A = p(x) \times \frac{k}{100} + \delta \tag{2}$$

The problem with estimating the effect of C_A on car accidents through equation (1) is that C_A is likely to be endogenous since the unobserved factors v are correlated with the choices of k and δ. More precisely, when drivers can choose from a menu of annual premiums, penalties and deductibles, more dangerous drivers will choose higher premiums p and lower out-of-pocket costs of accidents δ and k in order to minimize the expected cost of an accident. The implication of this adverse selection effect is that the unobserved factor v is negatively correlated with C_A, thereby biasing downwards the estimate of β_1 in equation (1). Thus, a negative estimate of β_1 may be indicative of adverse selection and not moral hazard.

This correlation between the unobserved individual effect and accident costs can exist even when p, k and δ are determined by the insurance provider, and not the individual driver. Accident costs can sometimes be selected based on individual choice but they are always subject to criteria of the insurance provider. Because drivers who are identified as more dangerous (larger v) present a higher financial risk to the insurance provider they are often assigned higher accident costs C_A. When the econometrician lacks access to all information utilized by the insurance company to assess initial accident risks this will create a positive correlation between v and C_A in equation (1). Thus, omitted variable bias in this context could hide an existing moral hazard effect by biasing the β_1 estimate towards zero.

We evaluate accident results in a company where some employees face lower accident costs (C_A) due to a salary incentive. Those drivers allocated to company coverage face no post-accident penalty ($k = 0$) and receive a 25 percent discount on the deductible ($0.75\delta = \$120$).[9] In contrast, individuals without company coverage pay the full deductible ($\delta = \$160$) as well as a penalty that is dependent on involvement in an accident in the past year ($k = 10$ percent for a first accident, $k = 30$ percent for a second accident). Thus, the individuals who receive these fringe benefits face lower out-of-pocket accident costs (C_A) than identical individuals who are privately insured.[10] Importantly, the allocation of this fringe benefit is not dependent on the extent to which the car is used for job-related purposes.[11]

Let $z = 1$ denote receiving company coverage, while $z = 0$ denotes private coverage. Accident costs can then be expressed as,

$$C_A = \begin{cases} 0.1p + 0.2p \times y_{-1} + 160 \text{ if } z = 0 \\ \\ 120 \qquad\qquad\qquad\qquad \text{if } z = 1 \end{cases} \tag{3}$$

Using information on the annual insurance premium p paid by individuals in our data over time as well as accident history y_{-1} we compute C_A at the start of each annual contract. This calculation is based on the average deductible set by the insurance provider $\delta = \$160$. While we would have preferred individual level data on deductible fees, the main cause of variation in this variable is differences in car values which are controlled for in

[9] The size of the deductible is determined when the individual first joins the insurance company as a function of driver and car characteristics. We were not given access to individual data on deductible fees and thus, can only use the information on the average deductible as provided by the insurance company.

[10] In addition, the annual cost of the insurance policy is paid by the employer. This large benefit, however, may not be relevant to moral hazard since these expenses are sunk at the beginning of the contract period.

[11] The employer also allocated company vehicles to individuals with increased job-related car usage as well as managers and senior level employees, but these individuals are not included in the sample as they were only insured by the data-provider for one year. Additionally, for these individuals it would be difficult to disentangle increased accidents resulting from moral hazard versus increased accidents resulting from differential driving patterns.

our analysis. This new variable C_A is directly affected by past accidents y_{-1} generating a positive correlation with v in equation (1) and therefore biasing the moral hazard estimate towards zero. OLS estimation will not capture the moral hazard effect in the presence of this omitted variable bias where more dangerous individuals face higher accident costs.

When the allocation of company coverage z is not correlated with car usage and driving preferences we can use it as an instrumental variable to identify β_1, the moral hazard effect of increased coverage. An instrumenting technique allows us to both estimate the moral hazard effect and gain a better understanding of the bias created by the endogeneity of cost of an accident. The first stage illustrates the exogenous variation in C_A created by allocation to company coverage and provides a basis for our identification of the moral hazard effect. Absent additional individual controls, we identify the Wald estimator as the difference in accident rates between those with and without company insurance ($E[y|z=1] - E[y|z=0]$) divided by the differential level of coverage between these 2 groups ($E[C_A|z=1] - E[C_A|z=0]$).

Consistent estimation of the moral hazard effect depends on the identification assumption that without differential coverage we would not expect those with company coverage ($z=1$) to drive more dangerously. We must still account for this possibility even when the allocation to company coverage is determined by occupation and not decided upon by the individual. Intuitively, however, we may expect the opposite to be true since workers in Israel holding positions covered under collective-bargaining agreements are generally found to be older and predominately female in comparison to workers holding private contracts. If anything, these characteristics are associated with better driving behavior and lower riskiness levels.[12] If this were the case, our estimate of β_1 would underestimate the moral hazard effect of car insurance. This can be clearly illustrated

[12]See Cohen et. al. (2003) for a comparison of characteristics of Israeli workers who do and do not hold collective-bargaining agreements. In their 2007 paper, Cohen and Einav find a negative relationship between age, gender (female) and accident claims.

using the Wald estimator. When individuals allocated to company coverage are better than average drivers in our sample $E[y|z=0]$ is higher than it's true value, resulting in a difference $(E[y|z=1]-E[y|z=0])$ that underestimates the moral hazard effect. This result should be contrasted to the usual overestimate of the moral hazard effect resulting from the presence of adverse selection in car insurance.

One may still be concerned that individuals who receive company coverage ($z=1$) work in occupations that are less likely to require a college degree (Cohen et. al. (2003)) a characteristic associated with higher riskiness levels (Cohen and Einav (2007)). In this case, the allocation of company coverage is positively correlated with (v) and our instrument will result in an overestimate of the moral hazard effect. In order to allow a causal interpretation of the moral hazard effect we include a control for unobserved heterogeneity in riskiness levels in our main specification via first period accidents. Additionally, in section 5.1 we estimate a moral hazard effect by comparing changes in driving behavior occurring within the company and private coverage groups. This differencing specification provides additional evidence of a moral hazard effect that cannot be explained by pre-existing driving differences.

We do not have detailed data on car usage (kilometers driven, speed, driving hours) to control for pre-existing driving differences between individuals receiving company coverage and individuals paying privately. But we can differentiate between different types of accidents in order to ensure that our estimate of β_1 reflects moral hazard. If individuals allocated to company coverage have different driving patterns or risk preferences than those purchasing private insurance, we would expect a constant difference in accident rates regardless of accident size or years experience with the insurance provider. Alternatively, if individuals are reacting to financial incentives we would expect a larger effect on small accidents (where the damage is only financial) than on large accidents (where the damage can also involve physical risk). In the following sections we present evidence along these lines supporting the interpretation of a moral hazard effect despite

the possible non-random allocation of company insurance coverage.

4 The Data

In Israel, all car owners are required by law to hold a minimal level of insurance coverage. Mandatory insurance covers claims on injuries incurred by people in the insured vehicle and pedestrians injured in an accident. Most drivers purchase additional coverage against damage to their vehicle and other vehicles in the case of an accident.[13] There also exist options of lower premium costs and higher deductibles or higher premium costs and no deductible. Despite these alternative options, the majority of drivers purchase a standard package insuring them against damage to their own vehicle and other vehicles.

Data for this study come from a private insurance firm and from Israel's Central Bureau of Statistics. Under a confidentiality agreement with the insurance firm we received data on 6,813 policies activated between 2001 and 2008. These policies belong to employees of a single, large Israeli company. 4,590 of the policies were paid for by the employer as a benefit, while 2,223 were paid for privately by the employees. Since we will be interested in analyzing the number of car accidents per policy it is important to maintain a uniform policy duration and to control for systematic differences, if any, in the contract duration of company and privately paid clients. We therefore combine consecutive insurance contracts for the same vehicle when the duration of one of them was under six months[14] and exclude policies that were not renewed and therefore do not

[13] This additional coverage usually includes a deductible averaging $200 if involved in an accident and using an in-policy garage. In cases where the driver is under age 24, or has his/her license for less than a year, the deductible increases by 50% at most insurance companies. There is also the opportunity to purchase additional legal and third party coverage as well as windshield damage coverage, towing, and temporary vehicle replacement. Alternatively, drivers can purchase third party insurance which covers damage to other vehicles but does not cover damages to their own vehicle.

[14] Some insurance policies lasted for a short period of time because the insurance firm attempts to set a uniform starting month (September). Thus, clients who started their policy mid-year often had short first year policy lengths. In addition, I excluded private policies with only mandatory and/or third-party insurance so that the remaining private policies are standard insurance packages against damage to the client's own vehicle and other vehicles. This ensures that private and company-paid policies are the same homogeneous product.

provide enough information to calculate C_A.[15] Details of the data cleaning process and variable definitions are in Appendix B.

The final sample consists of 5,472 policies corresponding to 1,045 employees of a large Israeli company. The employer paid for 4,231 policies (77 percent) belonging to 755 individuals, while 1,241 policies (23 percent) were paid for privately by 290 employees who chose to be insured through the same firm as those receiving company coverage.[16]

Each individual in the sample holds an average of 6 policies since policies must be renewed yearly. These policies do not include the option of paying a higher annual premium in order to decrease deductible costs. For those holding private coverage the insurance premium is calculated annually by the insurance provider as a function of individual and car characteristics as well as accident history.

Using information on annual policy costs, penalties and deductibles we estimate cost of an accident for each individual in the data. This value is set to \$120 for those with company coverage. For those with private coverage we follow equation (3) and compute cost of an accident as \$160 plus an additional 10% or 30% of their annual premium depending on accident involvement in the previous period. We therefore cannot compute cost of an accident in the first period of insurance for individuals holding private coverage (since we do not have access to their previous accident rates).

All policies included in the data are full-coverage insurance policies (insured against damage to their vehicle and other vehicles in the case of an accident). In addition to policy price, we also have information on policy length, the gender and city of residence

[15] We find no evidence that this would create selection bias in this sample since the accident rates of those employees with private coverage who leave after 1 year are lower (though not statistically significant) than those who remain in the sample.

[16] The privately insured employees therefore constitute only a subset of the employees with private insurance. The insurance firm estimated, however, that they insure about fifty percent of the employees not covered by company insurance. The average \$160 accident deductible offered by the insurance firm to those privately insured is significantly lower than the average deductible offered by other insurance firms (\$200). Thus, I expect that most employees who were aware of the company insurance provider chose to insure through them.

of the policy holder, car characteristics, and accident characteristics. In order to allow for further controls between employees receiving company coverage and those purchasing private insurance, we expanded the dataset to include socioeconomic and geographical information corresponding to the cities where the 1,045 policy holders live. The Central Bureau of Statistics provides economic and geographical data through its GEOBASE program. We use data on average family income and percentage of students passing their matriculation exams by city in Israel. Additionally, we collected information on annual vehicle blue book values for each car model in the data from the assessor Levy Yitzhak, who publishes the Israeli "blue book" of used car prices.

We exploit the fact that all drivers work at the same location to control for different driving patterns. The 60 cities in the sample are divided into 4 groups according to their location relative to that of the employer. In addition, we calculate distances between the employees' city and both their employer's location and all reported accident locations. This allows us to better understand commute differences between those holding company and private coverage. These data will help to control for differences in the population that may be correlated with allocation to company coverage.

Table 1 provides summary statistics for key variables used in this study. The individuals in our data all commute to the same office and live in similar areas. They all drive their own private cars and do not receive any type of gasoline subsidies. Despite these similarities, people were not randomly allocated to company coverage and we expect there to be differences between the two groups and stress the importance of understanding the direction in which these differences may affect the accident outcome. One significant difference between insurance groups is that people with company coverage tend to stay with the provider for longer periods. An earlier start with the provider can be explained by the insurance firm securing all employees with the company insurance benefit directly, while needing to advertise for those purchasing private insurance. Since company insured drivers do not have the flexibility to switch to a difference insurance provider it is not

surprising that they stay in the sample for longer durations.

Company policy holders are 76 percent male while those with private insurance are 84 percent male. Because men have been shown to have a higher probability of accidents this means that we would expect more collisions from those allocated to private insurance (Cohen & Einav, 2005). While the relatively small 7.6 kilometer difference in commute distance is statistically significant, if there is any effect on car accidents we would expect those allocated to private insurance to be more collision-prone due to their longer commute to work. Additionally, we find no evidence that collisions of drivers with company insurance occur farther from their home. These findings are reassuring because they suggest that company-insured drivers may not be using their cars significantly more than privately-insured drivers (actual car usage is not observed).

Unfortunately we do not have data on drivers' age and driving experience (defined as the number of years elapsed since receipt of first driving license) except for those drivers that were involved in an accident in 2004-2005. This year of accident data shows no significant difference in age and driving experience across types of insurance.

One issue when using accident data provided by an insurance company is that this number is a fraction of the total number of accidents that occurred. Private policy holders face higher reporting costs than those holding company insurance and are therefore less likely to report smaller accidents when only their car is involved. Thus, using the difference in accident outcomes between private and company policy holders to estimate moral hazard may also pick up the effect of increased reporting. In order to mitigate this we only include collision accidents where at least two cars were involved in our analysis, as done by Chiappori & Salanie (2000). The probability of reporting is much higher in accidents involving other cars (for both types of insurance holders) and therefore restricting the analysis to this subset is less affected by selective reporting. Indeed when comparing the median damage estimates in this subset for both groups, we find no evidence that those with company coverage have a higher frequency of low-cost collisions.

Each policy contains information on the number of accidents occurring during each period of coverage. For the majority of policies (83.7 percent) there is no accident reported, 14.4 percent report having one accident, and 1.9 percent report having more than one accident per period. We assign the value $y = 1$ to those policies reporting at least one accident in the given period.

5 Empirical Results

As a first step in understanding the effect of insurance coverage on driving behavior, we examine the components of a Wald estimate of β_1 abstracting from the presence of covariates. The numerator consists of the difference in accident occurrence (y) between those with company and private insurance (z). The denominator of the Wald estimate provides information on the strength of the instrument, which in our case refers to the effect of company coverage on the cost of an accident (C_A). Table 2 displays the components of the Wald estimator for the moral hazard effect (β_1). The instrument of allocation to company coverage explains 74 percent of the variation in cost of an accident in the sample. We find that an estimated \$115 increase in C_A decreases the accident rate by 3.1 percentage points. This can be translated into a 2.7 percentage point reduction in accident occurrence as a result of a \$100 increase in C_A.

Examining the accident rate by years of coverage with the provider allows a closer look at differences between those allocated to private and company insurance. In the first year of insurance drivers with company coverage are six percent less likely than those with company coverage to be involved in an accident. This significantly lower initial accident rate of drivers' holding company coverage could reflect the negative correlation between individuals who receive the insurance benefit and unobserved characteristics resulting in more dangerous driving. Remarkably, while the collision rate remains relatively constant across periods for those with private insurance, it increases significantly between period 1 and 2 for those with company coverage, and remains relatively constant in periods

3 and onwards. One possibility is that moral hazard does not affect people's driving behavior immediately and thus the consequences of increased coverage appear with a one-year delay. We explore this issue further in Section 5.1.

Table 3 compares OLS and instrumental variables estimation of the moral hazard effect (β_1) at \$100 increments in cost of an accident. The OLS results find no effect of cost of an accident (C_A) on the probability of an accident. This is not surprising due to the presence of the unobserved individual effect v in equation (1). More dangerous drivers who hold private insurance are more likely to be involved in accidents in past periods, which will result in higher accident costs and a positive bias on the moral hazard effect (β_1) in column (i).

Columns (ii), (iii) and (iv) of Table 3 provide the results of the instrumental variable analysis. Specification (ii) presents the Wald estimate calculated in Table 2 without controlling for available observed differences between individuals within the dataset. Specifications (iii) and (iv) include controls for observed differences in individual and car characteristics, as described in the table notes. After adding controls for gender, commute distance, etc. in specification (iii) we find that a \$100 increase in the cost of an accident (C_A) decreases the probability of an accident by 3.3 percentage points (s.e. 1.4 percentage points). Thus, even when controlling for observed differences in characteristics of individuals we find a significant moral hazard effect, suggesting that the Wald estimate cannot be explained by observed differences in allocation of the insurance benefit. This result is consistent with an environment where, if anything, less dangerous drivers may have been allocated to company coverage and therefore without additional individual controls we underestimate the moral hazard effect. We also find that driving in more congested areas and during winter months has a significant effect on the accident rate.

In specification (iv) we include additional controls for unobserved individual heterogeneity (v) such as accident involvement in the first period y_0 and observed charac-

teristics during the entire period of insurance summarized by their time average for each component of x.[17] Whether or not a driver had an accident in his/her first period of insurance can give us added information on his/her general level of driving care. This is especially relevant given the collision rates in Table 2 since the first period of insurance may provide information on driving behavior prior to changes invoked by differential coverage. The coefficient on accident first period is positive, as we would expect since this controls for an initial tendency towards dangerous driving. Importantly, controlling for unobserved heterogeneity via first period accidents does not alter the moral hazard effect, suggesting that the correlation between receiving company insurance and unobserved individual characteristics in v may not be that important in these data. While our analysis estimates the effect of increases to cost of an accident (C_A), the allocation of company coverage provides a discount in accident costs. We find that this $100 discount resulted in a moral hazard effect of 3.4 percentage points (s.e. 1.4 percentage points).[18] This represents a 21 percent increase in the mean probability of being involved in an accident (16.3 percent).

Our estimate of the moral hazard effect is large compared to what has been documented in previous research. The majority of the literature focuses on the existence of a moral hazard effect without measuring its size (Chiappori & Salanie (2000), Abbring et. al. (2003), Abbring et. al. (2008)). Schneider (2010) identifies what he describes as a conservative estimate of the moral hazard effect- a 16 percent increase in the accident rate for drivers who own versus lease their taxicabs. This measure may be more relevant for our dataset as both individuals receiving company coverage and drivers who lease vehicles do not pay annual insurance costs. While those with company coverage drive their

[17] Use of these types of controls for unobserved heterogeneity were introduced by Blundell (1999) and Wooldridge (2002).

[18] It is interesting to note that when including all reported accidents (as opposed to only collision accidents) we find a much larger estimate of 5.5 percentage points. This finding is consistent with the idea that including all accidents measures a reporting effect which overestimates the effect of coverage on driving behavior.

own private vehicle and are thus affected by long-term decreases in the valuation of their vehicle, they are also guaranteed coverage regardless of accident outcomes. Our moral hazard estimate may capture both the effect of a $100 discount as well as additional incentives created by group contracting.

We also estimate the specifications in Table 3 in a nonlinear Probit framework. These results are relevant since the linear model does not account for the discreteness of involvement in an accident. Importantly, the linear probability model does provides reasonable estimates for the probability of an accident (ranging between 0 and 1) for 99.9% of the sample. Table 4 provides a larger estimate of the moral hazard effect in the nonlinear framework, a 3.7 percentage points decrease in the accident rate that is significant at the one percent level.

An objection to these findings might be that they do not represent moral hazard but rather a non-random allocation mechanism where pre-existing differences in accident rates are correlated with the allocation to company coverage. We conduct a sensitivity analysis by checking these results over different definitions of accident occurrence. Small collisions are defined as those occurring within the process of parking or within parking areas, while large collisions are defined as those occurring on roads. Since small collisions have a lower risk of physical harm we would expect a stronger moral hazard effect on this outcome. We use a multinomial probit model to separately estimate the effect of accident costs on small and large collisions.

We find that accident costs have a statistically significant negative effect on small collisions at the one percent level, but find no effect on large collisions (see Table 5).[19] In order to calculate marginal effects these coefficients are multiplied by the predicted

[19] As noted by an anonymous referee it is also important to understand whether or not moral hazard has an effect specifically on severe accidents. While, we do not find evidence of a moral hazard effect for large collisions, we cannot rule out a more significant effect at higher price discounts than those available in this dataset.

probability of each type of accident.[20] Thus, although the probit coefficient on small collisions is five times larger than our estimate for large collisions, we find a lower marginal effect of accident costs on small (-0.009 (0.004)) versus large collisions (-0.017 (0.011)).[21] Importantly, despite the sensitivity of the size of the marginal effect to predicted probabilities, the story remains the same. The marginal effect of accident costs on accident outcomes is significant for small but not large collisions. These results are consistent with an effect of financial incentives (i.e., moral hazard) on driving behavior. In other words, we expect financial incentives to manifest themselves in accidents where the costs are mostly financial (such as accidents in parking areas) and not in accidents likely to involve physical injury. We further examine this issue of correctly identifying moral hazard in the following section by comparing changes in driving behavior occurring over the course of the insurance coverage.

5.1 A Driver's First Introduction to Company Coverage

Table 2 illustrates a distinct change in accident rates that occurs between the first and later periods of insurance for those with company coverage (an increase from a 9 to a 19 percent annual accident rate). This phenomenon appears only for drivers with company coverage as opposed to drivers holding private coverage who keep a fairly constant annual accident rate of 15 percent throughout all periods. Drivers receiving employer-paid insurance may not adjust their driving behavior immediately because, initially at least, they may not understand and/or internalize the changes in insurance coverage. As time elapses and information becomes available, these drivers may change their driving

[20] The marginal effect of a change in accident costs on the probability of a small accident can be calculated as: $\frac{\partial y_{small}}{\partial C_A} = p_{small}\left(\beta_{1small}\left(1-p_{small}\right) - \beta_{1\text{large}} p_{\text{large}}\right)$, where $p_{small} = \Phi\left(x\beta_0 + \beta_{1small} C_A\right)$ refers to the average predicted probability of involvement in a small collision. The same calculations are used for the corresponding estimation of $\frac{\partial y_{\text{large}}}{\partial C_A}$ and p_{large}.

[21] This relative difference in marginal effects reverses when using the average probability (instead of the predicted probability) of small and large collisions in the data (respectively 4 and 11 percent) which results in an estimate of a 1.6 percentage point decrease in small collisions versus a 0.05 percentage point decrease in large collisions.

behavior with the knowledge that they face a constant and relatively low accident cost (C_A). If we take the first year of insurance as the initial period when moral hazard does not yet play a role, we can then estimate the insurance effect by contrasting the change in accident rates between the first year of insurance and later years for those holding private and company coverage.

Using a subset of 447 newly insured employees holding 1,829 policies, we estimate the following model,[22]

$$y_{it} = x_{it}\psi_0 + \psi_1 z_i + \psi_2 post_{it} + \beta_1 (z_i \times post_{it}) + u_{it} \tag{4}$$

where $post_{it}$ takes the value of 0 for the first year of insurance and 1 for later years. This specification requires less assumptions regarding the zero mean error term u_{it} than equation (1) as only characteristics that differentially effect those with private and company coverage over time would bias our estimate of moral hazard (β_1).

The differencing framework provides an additional understanding of pre-treatment differences between those allocated to private and company coverage. The coefficient $\psi_1 = E(y|z = 1, x, post = 0) - E(y|z = 0, x, post = 0)$ estimates unobserved heterogeneity between individuals in these 2 insurance groups. We expect $\psi_1$to be negative when those receiving company coverage are also better drivers.

The coefficient on the interaction term $\beta_1 = E(y_{post} - y_{pre}|z = 1, x) - E(y_{post} - y_{pre}|z = 0, x)$ estimates the moral hazard effect. In essence, we compare the change in accidents between the first period of insurance – when, by assumption, there is no moral hazard – and future periods for individuals with company coverage – $E(y_{post} - y_{pre}|z = 1, x) = \psi_2 + \beta_1$– and for individuals with private insurance coverage –$E(y_{post} - y_{pre}|z = 0, x) = \psi_2$.

[22]If some of these drivers are new to the company as well as to the insurance provider they may have received higher level insurance coverage at their previous company. In this case they may have already altered their driving behavior due to moral hazard and a differencing technique will underestimate the moral hazard effect.

Table 6 presents estimates of the moral hazard effect of company provided insurance on accidents using this approach. Under the assumption in equation (4) that treatment occurs from period 2 onwards, we find that providing company insurance (an estimated $115 discount in accidents costs) increases the accident rate for those employees new to company coverage by 7.6 percentage points, with a s.e. of 4.3 (see column (i)). Thus, a $100 discount in coverage is expected to increase the accident rate by 6.6 percentage points. As mentioned above, the coefficient on receiving company coverage (ψ_1) estimates the level of unobserved heterogeneity in accident outcomes between those receiving company insurance and those who do not. We estimate that without differential coverage, if anything, employees allocated to company insurance were less likely than those in the private group to be involved in an accident.

In specifications (ii)-(iv) we look at alternative period cutoffs at which individuals with private or company coverage could be adjusting their driving behavior. We find no evidence of significant changes in accident probabilities occurring after the second period (columns (ii)-(iv)). This is consistent with our explanation that drivers adjust their behavior according to incentives created by moral hazard only in the second period. It would seem unlikely for a change in driving behavior to occur after two or more years of high coverage insurance.

This 6.6 percentage points moral hazard estimate is double the effect estimated by the instrumental variables approach (3.4-3.7 percentage points). Taking into account that the average accident rate in the data is 16.3 percent, a 6.6 percentage point estimate indicates a 41 percent increase in the accident rate for those receiving company coverage. A possible explanation for this large effect is that the drivers in this subsample are likely to be new to the company and therefore tend to be younger than the employees already insured at the beginning of the sample period. Since younger drivers have been found to be more prone to accidents these results may overestimate the moral hazard effect in the population.

6 Conclusion

For over 50 years economists have been analyzing the existence of moral hazard and the role it plays in human behavior. There is much debate today over whether our basic assumptions on rational decision making hold true in reality. Ultimately when dealing with car accidents and the physical harm connected with risky driving behavior, it is especially important to understand if moral hazard has a significant effect. This paper addresses the question: do changes in financial incentives affect behavior even when physical injury could result?

In order to analyze whether moral hazard exists in car insurance contracts it is essential to control for the confounding effect of adverse selection. In prior research this has been a constant obstacle, since car insurance is selected by the policy owner and thus personal preferences play a direct role in coverage. The allocation of company insurance creates variation in accident costs regardless of individual preferences. Using an instrumental variables approach, we find that a $100 discount in the cost of an accident increases the probability of an accident by 3.4-3.7 percentage points. Our results are consistent with the idea that people take accident costs into consideration when choosing their driving behavior.

The use of company insurance packages is widespread throughout Israel due to their direct inclusion in company vehicles. During 2010 there were 2,053,248 private cars in Israel, and 316,844 of these vehicles were registered as company leased or owned cars. Thus, approximately 15.5 percent of vehicles in Israel are not privately owned. This percentage increases three-fold when considering new cars of which 52 percent of those purchased in 2010 were company cars.[23] The prevalence of company cars in Israel is attributed to the significant tax benefit provided for these cars, and is often used as an additional salary incentive (or fringe benefit) for employees. The analysis in this paper

[23]The Israel Central Bureau of Statistics (2010 Motorized Vehicles Report , Table 17).

applies directly to these groups who are receiving high insurance coverage at low costs. Our findings show that increasing rates of car accidents are an unintended consequence of increasing implementation of this type of salary incentive scheme.

This paper emphasizes the general implications of moral hazard but also holds an important contribution to policy. Car accidents are an issue of concern for countries around the world. Motor vehicle related injuries are the leading cause of death for people aged 1 to 34 in the United States.[24] The estimated cost of these accidents in the US alone amounted to over 230 billion dollars in the year 2000. Israel faces a similar relative cost estimated to be about 2% of GNP. While the largest monetary benefit of company coverage for employees in this dataset was employer coverage of their policy cost (averaging $700), we believe that the smaller differential cost of an accident (averaging $115) was the cause of the moral hazard effect. Our analysis suggests that both government and car insurance providers can play a significant role in reducing accidents at the relatively low cost of redesigning insurance contracts that will ensure drivers bear sufficient consequences after involvement in an accident.

However, competition between insurance firms to cover large pools of drivers creates a reality where experience ratings and individual driver behavior are no longer relevant for individual accident costs. The use of government enforced insurance penalties may distort market outcomes. Indeed, in 1994 "the European Union decreed that all its member countries had to drop their mandatory bonus-malus systems, claiming that such systems reduced competition between insurers" (Pitrebois et. al., 2006). One solution to this market problem is increasing enforcement or traffic penalties for unsafe driving behavior. This approach has begun implementation in Israel with a 40 million dollar investment into 300 high-end speed monitoring cameras to record and penalize unsafe driving behavior. Thus, overcoming moral hazard effects can be achieved both within

[24]CDC Centers for Disease Control and Prevention: Motor Vehicle Safety http://www.cdc.gov/Motorvehiclesafety/index.html

and outside of an insurance framework.

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7 Data

7.1 Variable Definitions

1. *Time Period* in this dataset is defined as a chronological ordering of insurance policies from the point that the client joins the insurance firm. This allows us to utilize all of the available data using differencing techniques while controlling for the years in which the policy was active.

2. *Policy Length* denotes the length of time between the start date and end date of a given policy. Most policies last for about a year, but in cases where the insured switched a car mid-policy or began an insurance policy mid-year the length can be significantly shorter. In order to allow comparison of policies with similar lengths, when a policy length is less than six months and the adjacent policy insures the same car they are combined into one policy (see Data Cleaning).

3. *Policy Price* is defined as the annual premium (adjusted for policy length) paid for the given insurance policy in US dollars. After computing its value in 2001 NIS it was converted to dollars using the average exchange rate between 2001-2008 of \$1=4.41 NIS. The conversion rate during this period varied between 3.38 shekel to the dollar and 4.99 shekel to the dollar.

4. *Client Identifier* is a unique number that classifies the owner of a policy. There exist cases in the raw data where the same client holds policies for different cars that overlap (see Data Cleaning: Dealing with Overlap).

5. *Matriculation Exam Completion* is defined as the percent of 12th graders in the client's city of residence who completed their matriculation exams in the year the current policy ended.

6. *Average Family Income* is defined as average family income in the client's city of residence in US dollars in the year the current policy ended. After computing its value in 2001 NIS it was converted to dollars using the average exchange rate between 2001-2008 of \$1=4.41 NIS. The conversion rate during this period varied between 3.38 shekel to the dollar and 4.99 shekel to the dollar.

7. *Winter Months* are defined as November through March.

8. *Distance from Work* is defined using a mapping program as the kilometers between the client's city of employment and city of residence.

9. *Accident Distance* is defined using a mapping program as the kilometers between the client's accident location and city of residence.

7.2 Data Cleaning

7.2.1 I. Privately Insured

1. 2,223 Observations - Base Data.

2. 1,517 Observations holding full coverage insurance.

3. 1,487 Observations deleting expanded policies.

4. 1,450 Observations deleting observations where one car is insured separately from others.

5. 1,363 Observations combining policies under 6 months.

6. 1,359 Observations deleting observations that do not have information on city of residence or car model.

7. 1,241 Observations including only clients insured for over 1 period.

7.2.2 II. Company Insured

1. 4,590 Observations - Base Data.

2. 4,557 Observations deleting expanded policies.

3. 4,372 Observations combining policies under 6 months.

4. 4,352 Observations deleting observations that do not have information on city of residence or car model.

5. 4,344 Observations deleting observations where one car is insured separately from others.

6. 4,231 Observations including only clients insured for over 1 period.

7.2.3 III. Dealing with Overlap

1. In cases where the overlap is under one year - the end date of the earlier policy is set to one day prior to the start date of the overlapping policy.

2. In cases where the overlap is over one year - we assume multiple drivers are insured under the same client (i.e. he/she can be insuring both his/her car and that of a spouse or child). We therefore create a separate client identifier for the overlap and treat those observations as a separate client.

Table 1: Summary Statistics

		Private Insurance[a]	Company Insurance[a]	Difference[b]
Policy Holder Characteristics:	Male	0.838	0.760	0.078*
		(0.369)	(0.427)	(2.73)
	Years Insured	5.417	6.464	-1.046*
		(2.018)	(1.943)	(-7.71)
	Policy Price ($)[c]	707.01	0	707.01*
		(187.71)		(103.58)
	Policy Start Year	2002.1	2001.9	0.204
		(1.629)	(1.616)	(1.82)
	Policy End Year	2006.6	2007.4	-0.843*
		(1.752)	(1.307)	(-8.45)
Policy Holder Residence:	Distance from Workplace (km)	24.40	16.81	7.560*
		(27.92)	(27.51)	(2.53)
	Distance from Collision (km)	17.97	14.05	3.921
		(30.76)	(31.49)	(1.39)
	Reside in City of Workplace	0.241	0.270	-0.029
		(0.429)	(0.444)	(-0.95)
	Reside NE of Workplace	0.155	0.0927	0.062*
		(0.363)	(0.290)	(2.90)
	Reside NW of Workplace	0.414	0.434	-0.021
		(0.493)	(0.496)	(-0.60)
	Reside SE of Workplace	0.079	0.0675	0.012
		(0.271)	(0.251)	(0.66)
	Reside SW of Workplace	0.110	0.135	-0.025
		(0.314)	(0.342)	(-1.07)
	Average Monthly Family Income ($)[c]	3568.35	3409.64	158.70*
		(600.42)	(599.8)	(3.83)
	Matriculation Exam Completion	62.37	61.10	1.269*
		(6.390)	(6.206)	(2.93)
Car Characteristics:	Blue Book Value ($)[c]	10093.44	10808.80	-715.37
		(5139.49)	(5430.65)	(-1.93)
	Engine Size	1598.8	1680.3	-81.51*
		(353.8)	(346.2)	(-7.26)
	Year	1998.4	1998.0	0.416*
		(3.610)	(4.505)	(2.98)
N:	Number of Clients	290	755	
	Number of Policies	1,241	4,231	

[a] Standard deviation in parenthesis.
[b] *t* statistics in parenthesis , * $\rho < 0.05$
[c] This price was converted from NIS to dollars using the average exchange rate in this period $1=4.41 NIS. The conversion rate during this period varied between 3.38 shekel to the dollar and 4.99 shekel to the dollar.

Table 2: Wald Estimates

		Private Insurance[a]	Company Insurance[a]	Difference[b]
1st Stage:	Cost of an Accident ($)[c]	235.15	120	115.15*
		(61.653)	(0)	(110.15)
		[951]	[3,476]	
Reduced Form[d]:	Involved in Collision (0/1)	0.152	0.184	-0.031*
		(0.360)	(0.387)	(-2.23)
		[951]	[3,476]	
	Involved in Collision (0/1) By Period:			
	Collision (0/1) 1st Period	0.152	0.089	0.063*
		(0.359)	(0.285)	(2.97)
		[290]	[755]	
	Collision (0/1) 2nd Period	0.121	0.195	-0.074*
		(0.326)	(0.396)	(-2.83)
		[290]	[755]	
	Collision (0/1) 3rd Period	0.164	0.187	-0.023
		(0.371)	(0.390)	(-0.78)
		[220]	[679]	
	Collision (0/1) 4th Period	0.151	0.179	-0.027
		(0.360)	(0.384)	(-0.83)
		[165]	[592]	
	Collision (0/1) 5th Period	0.151	0.189	-0.039
		(0.359)	(0.392)	(-1.01)
		[126]	[512]	
	Collision (0/1) 6th Period	0.215	0.193	0.022
		(0.413)	(0.395)	(0.48)
		[93]	[466]	
	Collision (0/1) 7th Period	0.167	0.154	0.013
		(0.376)	(0.361)	(0.25)
		[54]	[423]	
	Collision (0/1) 8th Period	0.333	0.122	0.211
		(0.577)	(0.331)	(1.03)

[a] Standard deviation in parenthesis, Number of policies in brackets.
[b] *t* statistics in parenthesis, * $\rho < 0.05$
[c] This variable is only available between period 2 and period 8. This price was converted from NIS to dollars using the average e
during this period varied between 3.38 shekel to the dollar and 4.99 shekel to the dollar.
[d] The dependent variables are summarized between period 2 and period 8 as this is the relevant group for whom we can calculate
[e] We define a small collision as one that occurred between 2 vehicles in the process of parking as well as entering or exiting a pa

Table 3: OLS and 2SLS Estimates of the Moral Hazard Effect

Variables	(i) Linear RE	(ii) IV	(iii) IV 2SLS	(iv) IV 2SLS
Cost of an Accident (C_A)[a]	-0.009	-0.027**	-0.033**	-0.034**
	(0.014)	(0.014)	(0.014)	(0.014)
Male	-0.001		0.001	0.001
	(0.016)		(0.016)	(0.016)
High Traffic Density Commute	0.068**		0.072**	0.071**
	(0.029)		(0.029)	(0.029)
Policy Length	-0.074		-0.057	-0.087
	(0.063)		(0.063)	(0.068)
Insured During Winter Months	0.120*		0.109*	0.123*
	(0.066)		(0.068)	(0.070)
Accident 1st Period				0.039*
				(0.023)
Additional Individual Controls[b]	Yes	No	Yes	Yes
Time Averaged Controls[c]	No	No	No	Yes
Observations	4427	4427	4427	4427

Standard errors account for clustering at the individual level as well as autocorrelation.
[a]Measured in hundreds of US dollars.
[b]Additional individual controls: commute distance, policy year, blue-book car value, car year, engine size, matriculation completion, and average income.
[c]Time averaged controls: mean car value, mean car year, mean engine type, mean matriculation completion, and mean average income.

* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$

Table 4: Estimated Marginal Effects of Accident Costs on Collisions

Variables	(i) Probit RE	(ii) Probit IV	(iii) Probit IV	(iv) Probit IV
Cost of an Accident (C_A)[a]	-0.014	-0.030***	-0.036***	-0.037***
	(0.012)	(0.014)	(0.015)	(0.015)
Male	-0.000		0.000	-0.000
	(0.016)		(0.016)	(0.016)
High Traffic Density Commute	0.070**		0.077***	0.075***
	(0.032)		(0.032)	(0.032)
Policy Length	-0.040		-0.041	-0.068
	(0.048)		(0.057)	(0.059)
Insured During Winter Months	0.094**		0.099*	0.106**
	(0.041)		(0.052)	(0.049)
Accident 1st Period				0.040*
				(0.023)
Additional Individual Controls[b]	Yes	No	Yes	Yes
Time Averaged Controls[c]	No	No	No	Yes
Observations	4427	4427	4427	4427

Standard errors account for clustering at the individual level.
[a]Measured in hundreds of US dollars.
[b]Additional individual controls: commute distance, policy year, blue-book car value, car year, engine size, matriculation completion, and average income.
[c]Time averaged controls: mean car value, mean car year, mean engine type, mean matriculation completion, and mean average income.

* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$

Table 5: The Effect of Accident Costs on Small and Large Collisions

	Small Collisions		**Large Collisions**	
Variables[a]	(i) Probit	(ii) Probit Marginal Effects [b]	(iii) Probit	(iv) Probit Marginal Effects [b]
Cost of an Accident (C_A)[c]	-0.428***	-0.009***	-0.061	-0.017
	(0.133)	(0.004)	(0.041)	(0.011)
Male	-0.149	-0.004	0.027	0.007
	(0.108)	(0.003)	(0.045)	(0.012)
High Traffic Density Commute	-0.087	-0.002	0.237***	0.071***
	(0.211)	(0.004)	(0.079)	(0.025)
Policy Length	0.828*	0.018	-0.382**	-0.107**
	(0.481)	(0.011)	(0.151)	(0.042)
Accident 1st Period	0.044	0.001	0.075	0.022
	(0.150)	(0.004)	(0.061)	(0.018)
Additional Individual Controls[d]	Yes	Yes	Yes	Yes
Time Averaged Controls[e]	Yes	Yes	Yes	Yes
Observations	4427	4427	4427	4427

Standard errors account for clustering at the individual level.
[a]We were unable to control for coverage over winter months in this specification due to its strong correlation with policy length (as all individuals insured for a full year are insured over winter months).
[b]Calculated for cost of an accident C_A=\$120 .
[c]Measured in hundreds of US dollars.
[d]Additional individual controls: policy year, blue-book car value, car year, engine size, commute distance, matriculation completion, and average income.
[e]Time averaged controls: mean car value, mean car year, mean engine type, mean matriculation completion, and mean average income.

* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$

Table 6: The Effect of Company Provided Car Insurance on Accidents: DID Approach

Variables	(i) Post= Period>1	(ii) Post= Period>2[a]	(iii) Post= Period>3[b]	(iv) Post= Period>4[c]
Company×Post	0.076*	-0.049	0.021	0.041
	(0.043)	(0.042)	(0.061)	(0.059)
Company	-0.047	0.065*	0.016	0.001
	(0.036)	(0.035)	(0.049)	(0.054)
Post	-0.023	0.067*	-0.019	-0.015
	(0.039)	(0.037)	(0.057)	(0.051)
Male	0.037*	0.035	0.047	0.033
	(0.020)	(0.024)	(0.030)	(0.035)
High Traffic Density Commute	0.033	0.039	0.045	0.086
	(0.038)	(0.046)	(0.055)	(0.067)
Policy Length	-0.077	0.003	0.180	0.171
	(0.059)	(0.117)	(0.145)	(0.201)
Insured During Winter Months	0.003	0.079	0.037	0.046
	(0.060)	(0.108)	(0.090)	(0.112)
Observations	1829	1382	935	593

Standard errors account for clustering at the individual level.
Additional individual controls: commute distance, policy year, blue-book car value, car year, engine size, matriculation completion, average income, mean car value, mean car year, mean engine type, mean matriculation completion, and mean average income.
[a] Does not include the first period of insurance.
[b] Does not include the first two periods of insurance.
[a] Does not include the first three periods of insurance.

* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$