An Analysis of the Determinants and Implications of the Selection of the Full versus Limited Tort Automobile Insurance Coverage in New Jersey and Pennsylvania

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Introduction

The expense of accidents, financial responsibility laws, and the widespread use of motor vehicles make automobile insurance a significant public policy issue. Automobile accident compensation schemes range from full tort to no-fault in the United States. There is a substantial body of research that examines the costs and benefits of each system, but no consensus on which is most efficient and equitable. Many studies of auto insurance regulation have focused on the difference in accident rates and loss costs between states that have a no-fault compensation system and those that rely on the tort system (see, for example, Cummins, Phillips, and Weiss, 2001; Cummins and Tennyson, 1992; Harrington, 1994, Cummins and Weiss, 1991; Detlefsen, 1998, Schwartz, 2000).

The study here takes a different approach. Several states have chosen to adopt an alternate system, called auto choice, which allows motorists to decide whether to accept limitations on the right to sue for non-economic damages or retain full tort rights. Those drivers who relinquish tort rights get a lower insurance premium in exchange. Three states, Pennsylvania, New Jersey and Kentucky are choice states and each of these states has a default provision if no choice is explicitly made. While Kentucky has a very low monetary threshold of one thousand dollars, Pennsylvania and New Jersey have strong verbal thresholds for those who choose to limit their rights to tort recovery for non-economic damages.¹

One of the reasons that the choice issue is significant is because recent efforts to introduce no-fault provisions have come in choice plans. Choice reforms succeeded in Pennsylvania in 1990, but failed in Florida in 1990 and Rhode Island in 1993. At the federal level, choice legislation was introduced twice in the late 1990's. In the current millennium, two automobile choice reform bills HR 1704 (2001) and S 2931 (2004) have been introduced. The proposed legislation specified that states would have the opportunity to accept the national choice plan or retain their current systems. Neither bill got to the point of a Congressional vote, but continued reintroduction of choice legislation signals its significance as a major issue and one of national interest.

¹ The District of Columbia adopted a no-fault system in 1982, but currently has a unique system that is a combination add-on/ tort system where a driver has a 60-day post accident window to decide whether to receive the first-party compensation or file a third-party claim.

Evaluation of the accident experience with two of the three choice states, Pennsylvania and New Jersey will be the major contribution of this work.² Both states have strong verbal thresholds combined with mandatory first-party coverage. Further, the maintenance of data on the percentage of insured drivers choosing either the full or limited tort option in those states permits empirical analysis.

Given the results of prior empirical work identifying differences in the characteristics of full and limited tort selectors (Regan, 2001, Schmit and Yeh, 2003), the intent of this study is to determine the degree and significance of differences in demographic characteristics and accident outcomes of limited and full tort selectors.

Literature Review

The literature significant to the theory and hypotheses of this work focuses on the features and outcomes of proposed and actual choice automobile accident compensation systems and their moral hazard and adverse selection potential. The potential and observed benefits of a choice system are discussed in the relevant literature on an individual policyholder and aggregate level through observations or predictions on how the limited and full tort options benefit individuals and groups.

Powers (2001) posits that only a choice system offers the insured a choice in accordance to the "rate equity principle" which is defined as premium reductions earned upon limiting an insured's tort rights (and the insurer's potential losses), and the "tort equity principle" which is defined as the ability to retain unrestricted tort rights. Powers (2001) describes the New Jersey and Pennsylvania insurance systems as "self-determining" ones where both rate and tort equity can be realized.

Other authors focus on the systemic advantages and benefits of auto choice insurance systems. Lascher (1999) argues that choice is "politically feasible" because it reduces the opposition of the powerful legal lobbies, lessens the political pressure on legislators to decide to restrict tort rights, and serves to relieve the pressure of organized opposition in the form of advocacy groups. There is also some evidence from the health care field that a state's insurance consumers may prefer a choice system. The results of a health insurance study documented by

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² Kentucky's relatively low monetary threshold, restrictions on the ability to collect "basic reparation benefits" when the full tort option is selected, and the lack of records indicating drivers' choices, are the reasons for its exclusion.

³ E.L. Lascher, <u>The Economics and Politics of Choice No-Fault Auto Insurance</u> (Boston: Kluwer, 2001) 326-328.

Gawande, Blendon, Brodie et. al. (1998) indicate that the level of the satisfaction with health insurance corresponds to the degree of choice that health plan subscribers have.

Miller (2001) states that choice systems economically benefit lower income and urban drivers by allowing them access to both insurance coverage and job opportunities that would otherwise be unattractive or unavailable. Thus, choice system implementation is predicted to result in the inclusion of drivers into an automobile accident compensation system. O'Connell and Kinzler (2001) focus on the potential benefits, in terms of more reliable but lower cost coverage, resulting from avoidance of legal costs and non-economic damage awards for most accidents.

The political economy model framework is applied by Regan (2001) to explain the adoption of the auto insurance compensation system in Pennsylvania. As Harrington (1994) and Devlin (2002) do on a national basis, Regan (2001) seeks to identify the determinants of the selection of the full or limited tort option in the state of Pennsylvania, and identifies demographic, income and premium data variables that potentially influence auto insurance choice in the counties of Pennsylvania. Those variables were price, income, traffic density, unemployment, age, sex and proportion of the population that travels to work by car. Of those explanatory variables, price, income, traffic density, and the proportion of people who drive to work were significant determinants at the 1% level. The proportion of unemployed and males existing in the population were also significant at the 10% level.

The outcomes of choice implementation were studied by Schmit and Yeh (2001, 2003) who compare the pre-choice and post-choice insurance regimes in Pennsylvania and New Jersey. The authors' theory in the second work (2003) can be summarized as follows. Tort systems are characterized by untimely compensation that does not always correspond with the loss level, and there is a high degree of administrative waste due in part to attorney usage. Thus, when switching from a no-fault insurance regime to a choice insurance regime, as in the case of New Jersey, the addition of full tort selectors should result in an overall increase of time to compensation, higher variability in compensation, along with more attorney involvement for suit resolution. The empirical results for New Jersey supported these predictions.

Similarly when the previous system was a tort one, as was the case in Pennsylvania, the addition of no-fault insureds should have the opposite effect. On an aggregate level, there should be less attorney involvement, more rapid settlements and more just and less variable compensation (Schmit and Yeh, 2003). However, the empirical results for the Pennsylvania

were mixed and not as highly significant as those for New Jersey. These studies indicate that results may be different for limited tort and full tort selectors in this study, and that the findings may be unanticipated.

Another stream of literature relevant to this study focuses on the potential moral hazard effect of tort liability reduction through no-fault coverage. Moral hazard results when the presence of insurance reduces incentives of insureds to limit the size or probability of a loss (Shavell, 1979; Eisenhauer, 2004), and can exist a priori, affecting the probability of an accident or claim (Dionne, Gourieroux, and Vanasse, 1999), or ex post where the moral hazard affects the size of the claim (Chiappori, 1999) However, as Chiappori (1999) posits, the operational effectiveness of a moral hazard is an intangible that must be inferred based on the incentives of the insurance contract and the outcomes of empirical research. Cohen and Dehejia (2004) explicitly state that no-fault insurance results in moral hazard and multiple studies assert that the reduction of an insured's liability due to tort right restrictions results in less careful driving (Landes, 1982; Devlin, 1992; Cummins and Weiss, 1999; Kabler, 1999; Cummins, Phillips and Weiss, 2001). The moral hazard potential of any insurance regime may be the strongest argument against its implementation, moral hazard concerns have historically been an insurance industry and public policy issue (Baker, 1996).

However, the incentives for conscientious driving in a choice system are different. Drivers in New Jersey and Pennsylvania may chose to reduce their tort options, but they share the local roads with other motorists with the tort option and both full and limited tort drivers are equally responsible for the bodily injury and property damage claims of full tort drivers. Thus, the deterrent effect of a tort recovery system should exist to some degree in a choice state, and the results of empirical testing should reflect that fact.

If selection of the limited tort option results in less care, then evidence could be found through investigating whether limited tort drivers are assessed a higher degree of fault for the accident, or are more likely to have more severe injuries. However, moral hazard is just one potential explanation. These negative accident outcomes may be due to characteristics such as age or sex that affect a driver's inclinations or limitations (Doerpinghaus, Schmit and Yeh, 2003). As Kabler (2000) states, the moral hazard issue should be addressed through empirical analysis.

The adverse selection potential of a choice system has also been debated in the literature.

Adverse selection results from an information asymmetry favoring the insured with respect to the probability or magnitude of a claim (Chiappori, 1999). Carroll and Abrahamse (2000) note that despite research into the incentive effects of no-fault, "the available data offer no reason to expect either adverse selection or moral hazard." Adverse selection is difficult to detect with the type of data currently available to researchers in the United States. It should be noted that Chiappori and Salanie (2000) could find no evidence of asymmetric information in the automobile insurance market in France.

However, Kabler (1999) argues that the adverse selection potential of choice systems may make projections of cost savings inaccurate and that selection of the limited tort option is economically advantageous to the higher risk drivers who will benefit from the subsidization by the good risks⁵. Carroll and Abrahamse (2000) in their response to Kabler (1999), state that third-party bodily insurance coverage is also experience rated, and thus the bodily injury premiums of the less careful or competent drivers should reflect their impact on other drivers. Furthermore, as Carroll and Abrahamse (2000) posit, adverse selection requires that the insureds have knowledge of their actual accident risk, and use this knowledge in making their coverage decisions.

Multiple researchers have investigated the possible relationship of no-fault legislation and moral hazard by comparing accident outcomes in no-fault states to those in tort states. Results have been mixed, but more evidence has been produced linking no-fault with less favorable outcomes (Kabler, 2001; Cummins, Phillips and Weiss, 2001; Devlin, 1999). A table summarizing the findings appears in the appendix of this paper. Generally, the empirical results appeared to be highly sensitive to methodology and variable selection. Secondly, comparisons of these works are between different states and time periods whose unique characteristics also seem to affect modeling results.

Given the results of prior empirical work identifying differences in the characteristics of full and limited tort selectors (Regan, 2001), and the numerous works that found differences in the characteristics of tort and no-fault states (Devlin, 2002; Harrington, 1994; Cummins and Weiss, 1991), this paper will report the findings of the tests designed to determine whether limited and full tort selectors differ significantly by accident experience and demographic

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⁴ Comment on the Case Against Auto Choice (2000) p. 410.

⁵ Subsidization would occur when insurance rates are determined on the expected losses resulting from being involved rather than causing an accident.

characteristics. First, the relationship between the frequency and severity of accidents within the counties and the full/limited tort decisions of county residents will be analyzed. Secondly, empirical results from the closed claim testing will be examined with the purpose of determining whether there is evidence that limited tort selectors are significantly more likely to have a more serious injury or to be assessed a higher level of fault.

County-Level Model of No-fault/Limited Tort Choice

While data was collected for both Pennsylvania and New Jersey, the significantly different distributions of both dependent and explanatory variables indicate that data of the two areas should not be combined. Tort selection options and a number of demographic variables were much more uniform in New Jersey, and this lack of variability in the data also suggests that findings may not be readily generalized. Owings-Edwards (2004) describes New Jersey as fundamentally a no-fault state because the overwhelming majority of drivers select the limited tort option. New Jersey differs from Pennsylvania in other characteristics. It is a more densely populated state, whose residents have higher median incomes and premium costs on average. The small number of New Jersey counties and more limited data availability resulted in the exclusion of New Jersey records for this analysis. Thus, the following two hypotheses are only tested with Pennsylvania data. U.S. Census 2000 was the source for the demographic explanatory variables of this analysis while accident frequency and severity information was provided by the Property Casualty Insurers Association of America. The full and limited tort exposure table was provided by the Pennsylvania Department of Insurance.

The purpose of this county level analysis is to measure the impact of the riskiness of the local driving experience on tort threshold choice, where riskiness is measured by the frequency and severity components of expected losses. Given that premium level (which has an expected loss component) is significantly and positively related with limited tort selection (Regan, 2001), the empirical results are expected to support the following hypotheses.

H1. Counties where accident frequency is high have more limited tort selectors.

H2. Counties where accident severity is high have more limited tort selectors.

⁶ This information is from the Insurance Information Institute website, http://www.iii.org/media/facts/statsbyissue/auto/. The rank is for the 2003 premiums.

⁷ Insurance Services Office (ISO) provided crucial territory location data for the preparation of the frequency and severity estimates for the counties of Pennsylvania.

The dependent variable is the logged-odds ratio of the proportion of exposures covered by the limited tort option in the year 2001. The functional relationships of the structural equations can be represented as follows where the dependent variable, represents the proportion of limited tort exposures in each county.

Equation 1:

CHOICE = f(RUCC, FPBFREQ, MFRATIO, LEGAL,UNEMPLOYMENT, MEDIAN INCOME)

Equation 2:

CHOICE = f(RUCC, FPBSEV, MFRATIO, LEGAL, UNEMPLOYMENT, MEDIAN INCOME)

Since available reports indicate that accident frequency and severity rates are not uniform across geographical units, it is anticipated that some of the demographic factors associated with limited tort selection may also predict accident frequency or severity levels. Therefore, it is possible that either frequency or severity is endogenous in the sense that their values can be predicted by other explanatory variables in the determinants model for the dependent variable, CHOICE. Thus, testing for endogeneity and subsequent adjustment of empirical methods will be accomplished. In the event of endogeneity, the equations for Hypotheses 1 and 2, may be represented as follows where y_2 represents either frequency or severity:

$$y_1 = \alpha_0 + \alpha_1 y_2 + \beta_1 x_1 + \beta_2 x_2 + \dots + e_1$$
 (Wooldridge, 2002).

Explanatory Variables

This study introduces frequency and severity variables based on the accident history calculated for the counties' constituent territories. The first-party benefit frequency variable, (FPBFREQ), represents a three-year average of the total claims per 100 car-years earned. First-party benefit severity, (FPBSEV), is expressed as a three-year average of total losses per claim. These quantities were selected because they best represent the risk level of the local driving environment since there are no thresholds of fault or injury level for claims.

The other variables are based on previous works on the determinants of no-fault selection (Harrington, 1994; Cummins and Weiss, 1999; Regan 2001). Previous findings have indicated that the most significant explanatory variables⁸ for the selection of the limited choice option have been price, income, traffic density as measured by car years earned and the proportion of persons

⁸ All of these variables were significant at the 1 percent level.

who commute by car to work (Regan, 2001). These significant variables, except the proportion of persons who commute to work by car, are retained for analysis as control variables in a modified form.

An independent variable characterizing population density is also included. Densely populated urban areas are associated with a higher demand for accident compensation (Miller, 2001). The population density in Pennsylvania and New Jersey can be proxied by "rural-urban continuum codes" that represent the degree of urbanization and distance from larger metropolitan areas. These codes, represented by the variable, RUCC, range in value from 1 to 9 and use the population characteristics obtained from the 2000 census as the basis for their calculation. Harrington's (1994) analysis shows that population density is significantly and positively related to adoption of no-fault insurance regimes, and a similar relationship between population density and limited tort selection is expected.

The log of number of legal service workers per thousand in population, designated as LEGAL, is used as a proxy for access to the legal system. In a prior analysis, the attorney ratio was negatively associated with the limited tort selection (Regan, 2001) at the 10% level.

The variables selected for representation of economic constraints are MEDIAN_INCOME and UNEMPLOYMENT. Areas with higher household median incomes should have proportionately more drivers who can more readily afford the higher priced tort option. The unemployment rate is used to represent the proportion of the population in economic distress, and areas with higher unemployment rates should have more limited tort selectors.

Regan (2001) tests whether the proportion of males is a significant factor. In this study, the male to female ratio, MFRATIO, is used to control for the effect of gender on coverage choice.

In conclusion, the choices of each of the county's population groups will be modeled as a function of premium affordability, accident experience and legal system resources.

Closed Claim Outcome Models for No-Fault/Limited Tort Selectors

The goal of this analysis is to determine whether there is evidence for the arguments against auto choice using the observed differences in the accident experience of full and limited

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⁹ These codes were originally based on the Office of Management and Budgets definitions of the rural and urban counties. These codes were obtained from the Economic Research Service of the Department of Agriculture website: http://www.ers.usda.gov/Data/RuralUrbanContinuumCodes/

tort selectors.¹⁰ This project uses the first-party personal injury protection and medical payment claim data of both full and limited tort selectors whose vehicles were registered in New Jersey or Pennsylvania. Separate analyses will be done for each state. All of the records examined will be those of the post–choice implementation eras as reported on the 1997 and 2002 closed claim surveys provided to a sample of insurers. This Insurance Research Council (IRC) supplied questionnaire data providing detailed accident information will be used for testing the remaining hypotheses.

Categorical modeling methods were selected because most of the survey responses provided by the IRC were given numerical values. Dates, counts, ages and comments are the exceptions. Preliminary analysis revealed that a number of records had missing data and this affected modeling options. Since exclusion of incomplete records could lead to biased results, a missing value code will be used for certain explanatory variables.

Opposition to no-fault adoption can be anticipated if the expected distribution of accidents and/or losses changes unfavorably. This paper cannot address this point directly because of the lack of pre-no-fault data upon which to base our analysis. Instead the empirical analysis will use a no-fault variable dummy and a number of other explanatory variables that will serve as controls for other factors influencing fault assessment, and severity of the accident. Since the accident records of limited and full tort drivers are contemporaneous, there are implicit controls for a number of factors such as quality of the roads and intersections, and vehicle age and size differentials during the sample periods.

The IRC survey includes a continuous variable representing driver fault in percentage. This is converted to a binary dependent variable, FAULT, (based on the comparative negligence standard for liability) that takes the value of 0 when the assessed fault is less than or equal to 50% and 1 when it is more than 50%.

As Devlin (1999) proposed, a greater degree of injury may be taken as evidence of less care in driving. Thus, driver fault is used as a measure for the care employed by the driver/claimant, and the goal of the test is to see whether limited tort drivers are more likely to be assessed the fault in the accident. Both Pennsylvania and New Jersey are comparative

¹¹ For example, New Jersey and Pennsylvania are identified by the numbers, 29 and 37, respectively. Furthermore, an answer of "yes" on the survey question may be coded as 1.

¹⁰ Ideally, the best way to find evidence of a shift in incentives following a change in insurance regime is to analyze any difference in accident or fatality rates by undertaking a longitudinal study of a large group of insureds in a single state and comparing their driving records for a limited observation period both before and after the change. However, this is not a possibility given currently available data.

negligence states in which the plaintiff must have less fault than the defendant in order to receive damages. Such awards are then subject to reduction by the amount of fault assessed to the plaintiff. A greater likelihood of being found at fault can be taken as evidence that the limited tort option leads to negligent driving.

Measures of the severity of injury will be taken from the database codes for the most severe injury reported which range from no injury to fatality. Injuries are classified and represented by a numerical value based on injury type and location, and for this analysis, a binary valued dependent variable, HIGHEST_INJURY will take the value 1 when the highest reported injury, as recorded on the surveys, is a verifiable medical injury such as a burn, laceration or broken limb. In a manner similar to that of Schmit and Yeh, (2001), sprains and strains are combined in a category, and HIGHEST_INJURY takes the value 0 when the highest injury is reported to be a sprain or strain. Psychological injuries and unknown injuries are excluded from this analysis.

The moral hazard claims tests will use the personal injury protection (PIP) and medical payments (MP) insurance records. In New Jersey, PIP insurance covers the driver, resident relatives not covered by another policy, pedestrians, passengers and other drivers who obtained the policyholder's permission to operate the vehicle. In Pennsylvania, the first-party medical benefit coverage applies to the policyholder, relatives residing in the same household and other drivers included in the policy. The interests and coverage preferences of all potential household first-party claimants should be reflected in the tort option chosen.

Some of the factors associated with the outcome variables representing the degree of fault and the severity of injury may also be predictors of limited tort choice. Thus, the possibility that these outcomes could be considered jointly determined must be considered.

The limitations of the data and the binary nature of the two endogenous variables, led to the adoption of the bivariate probit model for examining the relationship of the endogenous variables to each other, and to presumably exogenous variables.

The bivariate probit is useful in modeling a binary outcome that is expected to be influenced by another binary outcome where there is also the additional complication of unobserved factors or omitted variables that manifest as correlated error variables (Greene, 2003, 2006). This model supports the presence of an endogenous dummy variable representing threshold choice as an explanatory variable in another equation.

The bivariate probit model is appropriate when the system of equations can be represented as follows and the dependent variables are both endogenous binary variables.¹²

$$y_1 = x_1^{\ /} \beta_1 + e_1$$

 $y_2 = \alpha y_1 + x_2^{\ /} \beta_2 + e_2$

The actual model with assumptions is as follows (Greene, 2003).

$$y_1 = 1$$
 if $y_1^* > 0$, but =0 otherwise where $y_{1}^* = x_1^{\ /} \beta_1 + e_1^{\ /} \beta_2$
 $y_2 = 1$ if $y_2^* > 0$, but =0 otherwise where $y_2^* + x_2^{\ /} \beta_2 + e_2$

$$E[e_1| x_1 x_2] = 0$$
, $E[e_2| x_1 x_2] = 0$

$$Var[e_1|x_1x_2] = 0$$
, $Var[e_2|x_1x_2] = 1$

 $Cov[e_1e_2|x_1, x_2] = \rho.$

When the result of the likelihood ratio test determines that ρ is significantly different from zero, then the hypothesis of no correlation between the error terms of each equation should be rejected. Equation System (1) of this paper is designed to test error correlation. Moreover, when ρ is significantly different than zero, then the hypothesis of exogeneity of the variable, y_1 , of the model should also be rejected. This model where the dependent variable on one equation appears in the other, is characteristic of Equation System (2) found below.

Results are sought for the following equations of this study:

- (1): Single equation probit regression models
- a. Outcome¹⁴ = f(STATE¹⁵, CHOICE, MALE, AGE, VOLUNTARY, SEATBELT, ACCTIME)
- b. Threshold = f(STATE¹⁶, MALE, AGE, VOLUNTARY, SEATBELT, ACCTIME)

Equation System (1): Bivariate probit model with same regressors, but different dependent variables.

1) Outcome = f(STATE, MALE, AGE, VOLUNTARY, SEATBELT, ACCTIME, LOCATION)

¹² The seemingly unrelated bivariate probit system of equations that will be analyzed in this study is a case where α =0 and vector of variables $x_2 = x_1$.

¹³ This line also represents the single probit model equation.

¹⁴ The outcomes are driver fault level and level of accident severity.

¹⁵ This variable is removed for single state parameter estimates.

¹⁶ This variable is removed for single state parameter estimates.

2) Threshold = f(STATE, MALE, AGE, VOLUNTARY, SEATBELT, ACCTIME, LOCATION)

Equation System (2): Bivariate probit model with a threshold choice determinant equation and an accident outcome determinant equation. Note that threshold is modeled as a potential endogenous explanatory variable in the outcome equation.

3) Threshold = f(STATE, MALE, AGE, VOLUNTARY, LOCATION)

Outcome = f(STATE, THRESHOLD, MALE, AGE, LOCATION, SEATBELT, ACCTIME).

These equations will be used to test the following hypotheses:

- H3. The claims of the limited and full tort selecting drivers/first-party claimants do not differ in terms of accident severity.
- H4: The claims of the limited and full tort selecting drivers/first-party claimants do not differ in terms of driver fault assignment.

Explanatory Variables

The independent variables were selected to control for the effect of the driver or accident characteristics such as age, sex, location and time of accident. The relationship of interest is that of the selected tort threshold on the outcome represented by the dependent variable.

All explanatory variables used, except driver age, had categorical values assigned originally by the IRC. In this study, the driver ages are grouped in ranges and AGE becomes a categorical variable for three age groups: 15-24 year olds, 25-65 year olds and persons aged 65 and older. The variable, MALE, is used to represent the driver's sex. Doerpinghaus, Schmit and Yeh, (2003) found evidence that younger, older and female drivers were assessed a higher level of fault during the claims process than warranted.

VOLUNTARY is the variable used to record whether the policy under which the claim is filed is a voluntary market or an assigned risk one. Since assigned risk drivers are those who cannot obtain a policy in the voluntary market because of their driving record or location in a high risk area, it is expected that assigned risk policies are associated with more frequent and higher cost accidents. Additionally, many drivers with assigned risk policies may have a greater likelihood of being found at fault for an accident.

SEATBELT is the variable that records the answer on the claims survey about whether the claimant was wearing a seatbelt. Seatbelt usage can be expected to reduce the severity of an

accident, and for this reason it is included as control variable. Secondarily, seatbelt use reflects the conscientiousness of a driver. Thus, lack of seatbelt usage should also be a significant predictor of the propensity to be at fault for an accident.

ACCTIME is the variable which records whether the accident occurred during daytime hours, which have been defined as 6:00 a.m. to 6:00 p.m. The majority of accidents reported in the database occurred during the day, when traffic volume is expected to be higher. It is anticipated that ACCTIME will be associated with less severe accidents, but the relationship to driver fault is more ambiguous.

The accident location variable, LOCATION, identifies where the accident occurred. It is expected that more densely populated areas are associated with more frequent but less severe accidents. The threshold variable, THRESHOLD, is a dummy variable that indicates whether the driver is insured under a limited or full tort contract.

The variable, STATE, is used to indicate whether the record is one of a Pennsylvania or New Jersey registered driver.

Exhibit 1
IRC CLOSED CLAIM TESTING

DEPENDENT	VARIABLE DEFINITION
VARIABLE NAME	
FAULT	'1' if the driver's assessed percentage of
	fault for the accident was greater than
	50%, '0' if the assessed fault percentage
	was less than or equal to 50%
HIGHEST_INJURY	'1' if the highest injury is a verifiable
	medical injury and '0' if the highest
	injury is a less verifiable injury such as a
	sprain or strain.
INDEPENDENT	VARIABLE DEFINITION
VARIABLES	
AGE	'0' if the driver age is less than or equal
	to 24, '1' if the driver age was 25-65 and
	'2' if the driver age was greater than 65
	years old.
VOLUNTARY	'1' if a voluntary policy, '0' if assigned
	risk
SEATBELT	'2' if a seatbelt is used, '1' if seatbelt
	usage is unknown and '0' if one is not
	used.

ACCTIME	'1' if the accident occurred in day, '0'			
	otherwise			
LOCATION	'1' if the accident location was in a non-			
	rural area, '0' otherwise.			
STATE	'1' if the state was Pennsylvania, '0' if			
	the state was New Jersey			
MALE	'1' if a male and '0' if a female			
THRESHOLD	'1' if limited tort (verbal threshold) and			
	'0' (full tort)			

Results

The evidence of joint determination of first-party benefit and the proportion of limited tort exposures and accident frequency required the use of instrumental variables estimation. However, no such relationship was supported for first-party benefit severity and the dependent variable.

Exhibit 2

Dependent	Coefficient	S.E.	Dependent	Coefficient	Robust
Variable= CHOICE			Variable= CHOICE		S.E.
	(IV			(OLS)	
	Estimation)				
Intercept	-1.491***	.375	Intercept	808**	.376
MFRATIO	5.221E-	.001	MFRATIO	.005**	.002
	3***				
RUCC	.054***	.013	RUCC	.045***	.009
MEDIAN_INCOME	3.31E-6	5.779E-6	MEDIAN_INCOME	3.42E-6	6.174E-
					6*
LEGAL	013	.021	LEGAL	.010	.022
UNEMPLOYMENT	.061	.039	UNEMPLOYMENT	.093	.050
FREQUENCY	.221*	.129*	SEVERITY	-1.498E-	5.962E-5
				4**	
	Adj. $R^2 = .27$			Adj. R^2	
				=.30	

^{***}Significant at the 1% level

The county-level analysis results indicate that first-party benefit frequency is significantly and endogenously related to the proportion of limited tort selectors, while first-party benefit severity is a significant but non-endogenous predictor. Furthermore, first-party benefit frequency is associated with the selection of limited tort coverage while first-party benefit

^{**} Significant at the 5% level

^{*} Significant at the 10% level

severity is associated with the selection of the full tort option. Further analysis with a simultaneous equation model will be used to determine whether the proportion of limited tort selectors also affects the accident rate, as measured by first-party benefit frequency rates.

However, the findings resulting from the closed claim testing indicate that threshold choice is endogenous and significant predictor of the accident outcomes. The negative sign of the coefficients is surprising and will be the focus of continued inquiry. The results tables are in Appendix 2.

These findings at present only equivocally support a moral hazard argument. If limited tort drivers are significantly more likely to use less care they should be found at fault more often or have more severe injuries.

Appendix # 1
Summary of Empirical Findings of Moral Hazard/ Deterrence Research - No-fault
Automobile Insurance Implementation

		ce Implementation	G	T . 10 .0	D. 1
Authors	Year	Title	Significant results supporting moral hazard/reduced deterrence	Jurisdiction	Period of Study
Landes	1982	Insurance, Liability, And Accidents: A Theoretical and Empirical Investigation of the Effect of No Fault Accidents	Yes	Tort and No-fault States of the U.S.	1967- 1976
Medoff and Magaddino	1982	An Empirical Analysis of No-Fault Insurance	Yes	Tort and No-fault States of the U.S	1970 and 1977
Swan	1984	The Economics of Law: Economic Imperialism in Negligence Law, No-Fault Insurance, Occupational Licensing and Criminology?	Yes	States and Territories of Australia and New Zealand	1960- 1981
Kochanowski and Young	1985	Deterrent Aspects of No- Fault Automobile Insurance: Some Empirical Findings	No	Tort and No-fault States of the U.S	1975- 1977
Gallo	1984	Assessment of the Effect of No-Fault Insurance on Fatal and Injury Accident Rates. Final Report No. DOT-TSC-OST-84-1.	No	Tort and No-fault States of the U.S	1967- 1981
Zador and Lund	1986	Re-Analyses of the Effects of No Fault Auto Insurance on Fatal Crashes	No	Tort and No-fault States of the U.S	1967- 1980
McEwin	1989	No-Fault and Road Accidents: Some Australasian Evidence	Yes	States and Territories of Australia and New Zealand	1970- 1981

Devlin	1992	Liability Versus No-Fault Automobile Insurance Regimes: An Analysis of the Experience in Quebec	Yes	Quebec, Canada	Quebec 1971- 1984 Ontario 1967- 1984
Gaudry	1992	Measuring the Effects of The No-Fault 1978 Quebec Automobile Insurance Act with the Drag Model	No	Quebec, Canada	1973- 1984
Sloan et al.	1994	Tort Liability versus Other Approaches for Deterring Careless Driving	Yes	Tort and No-fault States of the U.S	1982- 1990
Sloan et.al	1995	Effects of Tort Liability and Insurance on Heavy Driving and Drinking and Driving	Yes	Tort and No-fault States of the U.S	1984 -1990
Cummins and Weiss	1999	The Incentive Effects of No-Fault Automobile Insurance	Yes	Tort and No-fault States of the U.S	1982- 1991
Devlin	1999	No-Fault Automobile Insurance and Accident Severity: Lessons Still To Be Learned	Yes	Tort and No-fault States of the U.S	1987
Cummins, Phillips and Weiss	2001	The Incentive Effects of No-Fault Automobile Insurance	Yes	Tort and No-fault States of the U.S	1968 -1994
Loughran	2001	The Effect of No-Fault Auto Insurance on Driver Behavior	No	Tort and No-fault States of the U.S	1967- 1970 & 1977- 1980
Kabler	2001	The Case Against Auto Choice	Yes	Tort and No-fault States of the U.S	Not stated
Cohen and Dehejia	2004	The Effect of Automobile Insurance and Accident Liability Laws on Traffic Fatalities	Yes	Tort and No-fault States of the U.S	1970- 1998

Appendix #2

Estimation Results: 2002

Dependent Variable: DRIVER FAULT (N=2660)

Predictor Coefficient Robust Coefficient Robust Coefficient Robust Variable S.E. S.E. S.E. Threshold Equation 1a Equation Equation 2 Equation Equation Equation System 1 System 2 System 2 1b 1.766*** 1.764*** 1.767*** .321 .301 Intercept .321 -1.334*** -1.333*** -1.320*** State .072 .072 .072 Seatbelt .045 .042 .046 .042 Voluntary -.281 .283 -.281 .283 -.268 .271 Male .062 .056 .062 .056 .061 .055 -.069 .061 .042 Acctime -.068 .161 .100 .100 .161 .152 .102 Location -.167*** -.166*** -.168*** .052 .052 .054 Age Predictor Coefficient Robust Coefficient Robust Coefficient Robust Variable S.E. S.E. S.E. Equation Equation **Driver Fault** Equation 1a Equation Equation Equation System 1 System 1 System 2 System 2 1b Intercept -.386 .236 -.319 .229 .352 .255 .305*** .281*** .060 .056 State Threshold .069 .061 -.668*** .140

Seatbelt	185***	.041	184***	.041	177***	.04
Voluntary	.215	.190	.211	.190	.197	.189
Male	.022	.052	.023	.052	.032	.051
Acctime	206***	.055	208***	.055	200***	.053
Location	090	.102	086	.102	056	.106
Age	124**	.052	0127**	.052	156***	.051
Rho			.036	.036	.428***	.088

^{***}Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Estimation Results: 1997

Dependent Variable: Threshold (N=1038)

Robust
S.E.
Equation System 2
.295
.087
-
.216
.087
-
.187
.083
Robust S.E.
Equation System 2
.291
-
.153
.069
S.l. Ecc Syy .29

Voluntary	.419	.186	.412	.186	.280	.185	
Male	069	.086	.071	.085	.100	.084	
Acctime	361***	.092	360***	.092	342***	.086	
Location	935***	.192	933***	.192	850***	.193	
Age	155*	.085	160*	.084	217*	.083	
Rho			.028	.058	.467***	.099	

^{***}Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Estimation Results: 2002

Dependent Variable: HIGHEST INJURY (N=2591)

Predictor	Coefficient	Robust	Coefficient	Robust	Coefficient	Robust
Variable		S.E.		S.E.		S.E.
Threshold	Equation 1a	Equation 1b	Equation System 1	Equation System 1	Equation System 2	Equation System 2
Intercept	1.758***	.323	1.759***	.323	1.818***	.326
State	-1.356***	.073	-1.360***	.073	-1.339***	.073
Seatbelt	.075*	.043	.075*	.043	-	-
Voluntary	277	.284	281	.285	320	.297
Male	.058	.056	.058	.057	.064	.056
Acctime	105*	.062	104*	.062	-	-
Location	.141	.053	.141	.101	.138	.102
Age	139***	.05	138***	.055	133**	.054
Predictor Variable	Coefficient	Robust S.E.	Coefficient	Robust S.E.	Coefficient	Robust S.E.
Highest Injury	Equation 1a	Equation 1b	Equation System 1	Equation System 1	Equation System 2	Equation System 2
Intercept	260	.228	213*	.220	.449*	.241
State	.272	.057	.255	.054	-	-
Threshold	.049	.059	-	-	673***	.135
Seatbelt	053	.040	055	.040	055	.038

Voluntary	.165	.180	.162	.180	.131	.177
Male	037	.051	036	.051	025	.050
Acctime	145***	.055	147***	.055	140***	.052
Location	206**	.101	203**	.101	159	.102
Age	.071	.048	.069	.048	.037	.048
Rho			.031	.035	.432***	.086

^{***}Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Estimation Results: 1997

Dependent Variable: HIGHEST INJURY (N=1165)

Predictor	Coefficient	Robust	Coefficient	Robust	Coefficient	Robust
Variable		S.E.		S.E.		S.E.
Threshold	Equation 1a	Equation 1b	Equation System 1	Equation System 1	Equation System 2	Equation System 2
Intercept	1.421***	.30	1.427***	.296	1.446***	.269
State	-1.309***	.083	-1.308***	.083	-1.309***	.083
Seatbelt	026	.071	029	.071	-	-
Voluntary	428**	.199	426**	.198	400**	.195
Male	.189**	.083	.190	.083	.179**	.082
Acctime	.112	.091	.114	.092	-	-
Location	.076	.171	.072	.171	.058	.169
Age	294***	.077	294	.078	279	.077
Predictor Variable	Coefficient	Robust S.E.	Coefficient	Robust S.E.	Coefficient	Robust S.E.
Highest Injury	Equation 1a	Equation 1b	Equation System 1	Equation System 1	Equation System 2	Equation System 2
Intercept	458*	.277	156	.267	.530**	.267
State	.509***	.090	.363***	.078	-	-
Threshold	.313***	.093	-	-	688***	.134
Seatbelt	077	.068	078	.068	065	.063

Voluntary	.439***	.165	.393**	.167	•	.18
Male	.026	.079	.044	.079	.10	.08
Acctime	275***	.086	262***	.085	253	.078
Location	652***	.171	638***	.170	568	.168
Age	.059	.077	031	.076	22	.08
Rho			.185*** ¹⁷	.053	.185***	.053

^{***}Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level

¹⁷ This case is an anomaly where it appears that the errors are correlated and threshold is also an endogenous predictor of the highest injury level.

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