No-Fault for Motor Vehicles: An Economic Analysis

Yu-Ping Liao, *National Cheng-chi University*, and
Michelle J. White, *University of California, San Diego*

This article compares incentives and efficiency under the pure tort system (the comparative negligence rule) to those under pure and mixed no-fault systems. Under no-fault systems, drivers are allowed to opt out of no-fault and file lawsuits if their damages exceed a certain threshold. We find that no single liability system always dominates on efficiency grounds, but the pure tort system does best when costs of care are low, and pure no-fault does best when costs of care are high. Choice systems, in which drivers choose between no-fault or pure tort systems, lead to less efficient results because drivers choose the pure tort rule too often.

1. Introduction

Fifteen states in the United States; one province in Canada; and two provinces in Australia, New Zealand, and Israel have replaced traditional tort law with no-fault systems for deciding disputes arising from traffic accidents. Under tort law, accident victims have the right to collect compensation for their damage from injurers if a court finds that injurers were negligent. The nearly universal tort liability rule is the rule of comparative negligence, which makes injurers and victims share the victim's

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Send correspondence to: Michelle J. White, Professor of Economics, University of California, San Diego, La Jolla, CA 92093-0508; Fax: (858) 534-7040; E-mail: miwhite@ucsd.edu.

damage if both are found negligent, while making injurers liable for the full amount of victims' damage if the injurer is found negligent and the victim is not. In contrast under a pure no-fault system, injurers are never liable for victims' damage. Instead, victims bear their own damage or collect compensation from their own insurance companies. The proponents of no-fault argue that it has lower administrative costs because there are fewer lawsuits and that it is more equitable because victims can collect for their damage regardless of whether injurers were negligent.[1]

There are several variants of no-fault. Under "pure" no-fault, victims must always collect damages from their own insurance companies. No compensation is paid for "pain and suffering," and there are limits on recovery for economic damage such as lost wages and medical costs. Under "mixed" no-fault, victims of accidents are allowed to opt out of no-fault and sue injurers under the tort system if their losses exceed a threshold. The incentive for victims to opt out of no-fault is that, if they sue and win under the tort system, they may receive higher compensation. Another variant of no-fault is the "choice" system. Under it, drivers choose between no-fault and the tort system at the time they purchase insurance. If they choose no-fault, then they have the right to opt out and sue under the tort system if their losses following an accident exceed the threshold. The Appendix lists which jurisdictions use which types of no-fault, together with their thresholds for opting out.[2]

Our goal here is to compare incentives and efficiency under the tort system to the various no-fault regimes used in U.S. states and other jurisdictions. An additional motivation for studying these regimes is to understand why jurisdictions have tended to adopt more and more complicated systems of liability, even though economic theorists have shown that a simple liability rule—the contributory negligence rule—leads to economically efficient incentives (see Shavell, 1987). An important reason may be that strong assumptions are necessary for the efficiency result to hold—for example, that the due care level equals the efficient care level and that courts never make errors—but these assumptions do not hold in practice. Our analysis examines these issues in the context of a model in which

1. No-fault applies only to personal injury losses, not property damage. See Keeton and O'Connell (1965) for the original no-fault proposal.

2. See O'Connell and Joost (1986) for the original choice proposal and Powers (1992) and Carroll and Kakalik (1993) for discussion.

courts make errors in evaluating care and due care standards are imprecise. Because our interest is in the liability rules themselves, we ignore issues of how insurance works in conjunction with the various liability rules.

The main results are the following: (1) The mixed no-fault system is a hybrid of the pure tort and pure no-fault rules. The mixed no-fault rule is identical to the pure tort rule if the threshold for opting out is zero, and identical to the pure no-fault rule if the threshold for opting out is infinite. In between, as the threshold for opting out under mixed no-fault increases, drivers may use either more or less care. Less care is worthwhile as the mixed no-fault rule becomes more like pure no-fault, where drivers use too little care because they ignore the damage they do to other drivers in accidents. But more care is sometimes worthwhile as the threshold increases, since it reduces other drivers' damage when accidents occur and therefore makes them less likely to opt out and sue. (2) In the simulation, we find that no single liability rule always dominates the others on efficiency grounds. The pure tort rule achieves the most efficient results when the cost of care is low, whereas pure no-fault achieves the most efficient results when the cost of care is high. When court error rates are relatively low, the mixed no-fault rule never achieves strongly more efficient results than the pure tort or pure no-fault rules, but mixed no-fault sometimes does better when error rates are high. This is because high error rates encourage drivers to substitute litigation for care under the pure tort rule, so that preventing litigation when damages are low by imposing a threshold for opt out improves efficiency. (3) We also find that the choice regime never achieves strongly more efficient results than the underlying pure tort and pure no-fault rules, because drivers tend to choose the pure tort rule too often. Because individual drivers treat other drivers' behavior as fixed, they assume that shifting from the pure tort to the pure no-fault rule will cost them the right to sue without giving them the gain from not being sued. This suggests that a justification for jurisdictions to adopt a mandatory no-fault system is that drivers do not choose it voluntarily even when it would be desirable for them to do so. (4) Our results show that the pure tort rule achieves the most efficient results at the most likely values of the parameters.

Section 2 of the paper reviews the literature on no-fault. Section 3 is our theoretical model. Section 4 discusses the simulation and the results. Section 5 concludes.

2. Literature Review

2.1. Theory

Several authors have modeled the comparative negligence rule and argued that it gives potential injurers an incentive to behave efficiently (see Orr, 1991; Rubinfeld, 1987; and Shavell, 1987, p. 40). However, this result may disappear when uncertainty or errors in the litigation process are taken into account. Calfee and Craswell (1986) and Shavell (1987, pp. 83, 97–100) analyzed the effect of errors made by courts in determining whether injurers and victims behave negligently under various liability rules. Both show that errors may cause injurers to take either too much or too little care. White (1989) analyzed a model of the comparative negligence rule in which uncertainty concerning the due care level can cause injurers and victims to take either too much or too little care. Edlin (1994) analyzes a model in which legal decision makers make errors when they evaluate injurers' and victims' care levels. He explores the possibility of varying the due care level as a means of offsetting drivers' inefficient incentives under the comparative negligence rule.

There has been little formal modeling of no-fault rules. Kornhauser (1985), Trebilcock (1989) and Arlen (1990, 1993) all note that no-fault gives injurers an incentive to undersupply care, because they ignore the benefit of additional care to victims. But no one appears to have modeled the mixed no-fault and choice rules actually used by U.S. states and other jurisdictions.[3]

3. Sappington (1994) provides a formal model of a no-fault system, but it is specialized to the context of medical malpractice. The no-fault system that he analyzes provides compensation to parents of infants born with serious birth defects that might have resulted from malpractice during birth. Sappington assumes that compensation for damage is a fixed dollar amount raised from a combination of insurance premia paid by doctors and public subsidies. His main focus is to determine the optimal shares of compensation from each of the two sources. Arlen (1990, 1993) also considers the effect of no-fault rules on risk-bearing and activity levels. Epstein (1980) discusses the incentive effects of no-fault versus other liability rules in the motor vehicle context, but argues that incentives vary little under the various rules, because other systems, such as speed limits, also provide sanctions for careless behavior. Schwartz (2000) discusses the pros and cons of U.S. no-fault rules for automobile accidents. He notes that adoption of no-fault gives drivers in no-fault states incentives to buy automobiles that provide higher levels of protection for their own drivers.

2.2. Empirical Work

In contrast to most areas of law and economics, there has been quite a bit of empirical research on the effects of no-fault. The research typically takes the form of regressions explaining the number of accidents involving fatalities in jurisdiction i in year t as a function of whether the state uses the no-fault system versus the tort system and other control variables. In the earliest article, Landes (1982) used this technique on a data set of U.S. states over the period 1971–1976. Her main explanatory variables were whether states had adopted no-fault, and the dollar value of the threshold for opting out of the tort system. She found that states which adopted no-fault had more fatal accidents and that the higher the threshold value for opting out, the larger the increase in fatalities when no-fault was adopted. In particular, states that adopted no-fault systems with a low ($500) threshold for opting out had 4% more fatal accidents than non-no-fault states, whereas states that adopted no-fault with a high ($1,500) threshold had 10% more fatal accidents. Thus Landes' results suggested that adopting no-fault is associated with an increase in the number of fatal accidents.

More recent studies have found mixed results. Zador and Lund (1986) re-ran Landes' regressions with data covering the longer period 1967–1980 and found the opposite result: adoption of no-fault led to a small *decrease* in the number of fatal accidents. Kochanowski and Young (1985) used U.S. data for 1975–1977 and found no significant relationship. But McEwin (1989) used data from New Zealand and the Australian states for 1970–1981 and found that the adoption of no-fault was associated with a 16% increase in the number of fatal accidents. More recently, Sloan, Reilly, and Schenzler (1994) estimated separate models explaining the number of fatal accidents caused by 18- to 20-year-olds, 21- to 24-year-olds, and 25- to 65-year-olds, using data for U.S. states from 1982–1990. A strength of their study is that they included many legal and insurance-related explanatory variables as controls. They found that adoption of no-fault is associated with an increase in the number of fatal accidents caused by 21- to 24-year-old and 25- to 64-year-old drivers, but has no effect on accidents caused by 18-to 20-year-old drivers.[4]

4. Their tests actually measure the effect of no-fault compared to the contributory negligence rule, rather than the comparative negligence rule, but they also found no

Other studies have examined the effect of the legal regime on other variables related to accidents. Sloan, Reilly, and Schenzler (1995) explained the incidence of driving after drinking, which is inversely related to drivers' care levels. They found that more incidents of drunk driving occurred in states that use no-fault.[5] Cummins and Weiss (1992) used insurance claim data to examine the effect of no-fault on the number of claims for both property and bodily injury following automobile accidents. They found that adoption of no-fault both caused the total number of claims to increase. However a recent paper by Loughran (2001) uses difference-in-difference analysis and finds no significant relationship between adoption of no-fault and either accident rates or drivers' care levels.[6]

Finally, there have also been several studies that compare administrative costs under no-fault versus the tort system. Carroll and Kakalik (1993) found that costs fall by 80% if a pure no-fault system is adopted and by 24%–40% if a no-fault system with a fairly high verbal threshold is adopted. Carroll and Abrahamse (1998) find that costs fall by 21% when a typical U.S. no-fault system is adopted. Devlin (1992) found that costs fell by 24% when Quebec adopted the pure no-fault system. Cummins and Tennyson (1992) argued that the rate of increase in the cost of bodily

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significant difference between the number of accidents under the comparative negligence rule versus the contributory negligence rule. Nearly all U.S. states shifted from the contributory negligence rule to the comparative negligence rule for accident cases during the 1970s and early 1980s. The contributory negligence rule requires that injurers compensate victims for the full amount of their losses if the injurer is found negligent and the victim is not. See White (1998) for a summary of the empirical literature comparing the two rules.

5. The Sloan, Reilly, and Schenzler (1995) study also tests whether the results in no-fault states are significantly different from the results in states that use the contributory negligence rule rather than the comparative negligence rule.

6. Two studies examined the effect of Quebec's adoption of a pure no-fault system in 1978 and also found contradictory results. A problem for researchers is that, at the same time that Quebec adopted no-fault, it also made purchase of liability insurance mandatory and made liability insurance premiums flat rate rather than experience rated. These simultaneous changes make it difficult to separate out the effect of adopting no-fault from the effect of the changes in insurance regulation. Devlin (1992) argued that the adoption of no-fault caused the number of accidents involving fatalities in Quebec to increase by 9%, but Gaudry (1992) argued that the rise in fatalities was caused entirely by the changes in insurance administration.

injury insurance claims following automobile accidents was lower in no-fault states during the 1980s.[7]

3. Theory

No-fault is both a system of insurance and a liability rule. However in this paper we focus exclusively on its properties as a liability rule. In order to do so, we assume either that drivers self-insure or that they buy insurance from perfect insurance markets, where each driver's insurance premium equals the insurer's expected costs of providing the policy.[8] This assumption allows us to ignore the effects of insurance market distortions on the comparison between no-fault and other liability regimes.

We assume that all drivers are identical, they are risk neutral, and they drive identical vehicles. Thus the model represents a homogeneous population of automobiles, rather than a mixed population of automobiles and trucks. Each time period, some randomly chosen pairs of drivers are involved in accidents.[9]

Suppose an arbitrary driver is referred to as driver A. At time period 1, driver A decides on her care level. At that point, driver A does not know whether she will have an accident and, if an accident occurs, who the other driver involved will be. We assume that there are two levels of care—high and low. Thus driver A's care-level decision is viewed as a discrete decision whether or not to take a precaution—such as not driving after drinking. Driver A's care is high (h) when she takes the precaution and low (l) when she does not. We also allow mixed strategies, so that driver A

7. In other studies, Derrig, Weisberg, and Chen (1994) argued that insurance fraud is higher under no-fault. Harrington (1994) estimated a model which explains whether and when U.S. states adopted no-fault. He found that, holding other factors constant, states with more lawyers are less likely to adopt no-fault, whereas states with more medical doctors are more likely to adopt it.

8. The self-insurance assumption forces us to ignore the differences in compensation levels provided under no-fault versus tort systems. Note that drivers who self-insure are implicitly assumed to have adequate wealth to pay for legal costs and damages when an accident occurs.

9. We consider only two vehicle accidents, but we briefly consider the effect of introducing trucks into the population of vehicles in section 5. We assume that both drivers involved in an accident are covered by the liability system that prevails in the jurisdiction where the accident occurs. Therefore, except in the context of the choice regime, both drivers involved in accidents are subject to the same liability rule.

may use low care with probability ρ. Because all drivers are identical before an accident occurs, all of the other drivers in the population choose the same care level as driver A. After an accident occurs, we refer to the two drivers involved in an accident as driver A and driver B. There are four possible pairs of care levels that drivers A and B might have taken: (l, l), (l, h), (h, l), or (h, h). (The pairs (l, h) and (h, l) occur only when drivers play mixed strategies.)

The probability of an accident's occurring is denoted λ. There are four possible probabilities of accidents, corresponding to the four pairs of care levels. Because higher care by either driver reduces the probability of accidents, we assume that $\lambda(l, l) > \lambda(l, h)$ and $\lambda(h, l) > \lambda(h, h)$. Because all drivers are identical before accidents occur, $\lambda(l, h) = \lambda(h, l)$. Both drivers suffer losses of L when an accident occurs. There are four possible loss levels, corresponding to the four pairs of care levels. Because additional care by either driver reduces losses, $L(l, l) > L(l, h)$ and $L(h, l) > L(h, h)$. Because all drivers are identical before accidents occur, $L(l, h) = L(h, l)$. We refer to probabilities of accidents and loss levels as low, intermediate, or high. The cost of care per unit is assumed to be c for each driver.

The transaction costs of resolving damage claims following an accident are included in L when drivers do not file lawsuits. But if drivers file lawsuits—which may occur under the tort system or under mixed no-fault if drivers opt out—then there are additional transaction costs. Under the comparative negligence rule, either one or both drivers may have claims for damages following an accident. Therefore, there may be no lawsuit, one lawsuit (driver A sues driver B, or driver B sues driver A), or two lawsuits. The transaction costs of a lawsuit are assumed to be k per driver if there is one lawsuit, where k is assumed to be less than L. We also assume that transaction costs are sk if there are two lawsuits, where $1 < s < 2$. This implies that the second lawsuit between the two drivers is less expensive than the first—because most of the factual issues are the same. Thus total transaction costs of one lawsuit are $2k$ and of two lawsuits are $2sk$.[10]

10. More than 90% of lawsuits settle rather than reach a verdict in court. These transaction-cost terms represent the average cost per lawsuit, taking account of settlements and trials.

The due care level, which defines the threshold between negligent and nonnegligent behavior, is assumed to be between low and high care. We intentionally assume that the due care level is ambiguous because it is difficult to predict how courts will behave. Since the optimal care level in our model is nearly always between low and high care, the due care level is as close to the efficient level of care as possible, given the discreteness of the care-level decision.[11]

We also assume that the legal system makes errors in deciding whether drivers have been negligent. Errors occur because courts are assumed unable to directly observe drivers' care levels. However, they can and do observe drivers' losses. When loss levels are low $(L(l, l))$ or high $(L(h, h))$, the court infers correctly that both drivers used high or low care, respectively, and, therefore, no errors occur. But when losses are intermediate $(L(l, h)$ or $L(h, l))$, errors occur because the court may decide that driver A used high care and driver B used low care when the opposite actually occurred, or *vice versa*. We assume that the legal decision maker has a probability e of making either error.

If either driver files a lawsuit and the court finds that both drivers were negligent, then we assume that the driver who was sued pays a fixed fraction $0 \leq \sigma \leq 1$ of the other driver's losses.

3.1. First Best Outcome

We assume that there is never any litigation in the first best. The social cost of accidents therefore equals the sum of the costs of care plus the expected costs of accident damage. Suppose $0 \leq \rho \leq 1$ denotes drivers' probability of using low care. Because all drivers are identical as of period 1, they all choose the same level of ρ. Therefore social costs for an arbitrary pair of drivers are as follows:

$$\rho^2[2c + 2\lambda(l, l)L(l, l)] + (1 - \rho)^2[4c + 2\lambda(h, h)L(h, h)] + 2\rho(1 - \rho)[3c + 2\lambda(l, h)L(l, h)], \tag{1}$$

11. Note that if the due care level were above high care, then the results would be the same as under the pure no-fault rule. This is because plaintiffs would always lose in court, so they would never file lawsuits and would always bear their own losses.

where the three terms correspond to the expected costs of care plus accident damage to the two drivers when both use low care, both use high care, and one uses low care and one uses high care, respectively.[12]

Social costs are minimized if drivers' probability of using low care, denoted ρ^*, is

$$\rho^* = \frac{[\lambda(l,h)L(l,h) - \lambda(h,h)L(h,h) - .5c]}{[\lambda(l,h)L(l,h) - \lambda(h,h)L(h,h)] - [\lambda(l,l)L(l,l) - \lambda(l,h)L(l,h)]}. \tag{2}$$

If $\rho^* \leq 0$ or ≥ 1, then social costs are minimized when drivers always use high or low care, respectively. If $0 < \rho^* < 1$, then the first best outcome is for drivers to use low care with probability ρ^* and high care with probability $(1 - \rho^*)$.

3.2. Pure No-Fault

Under the pure no-fault system, drivers are never allowed to file lawsuits and, therefore, they always bear their own losses and never bear the other driver's losses when accidents occur. Drivers determine their care levels by minimizing their expected private costs of accidents. Because all drivers are identical as of period 1, in equilibrium they all choose the same care levels. Assuming that a unique equilibrium exists, there are three possible outcomes: all drivers play pure strategies of using low care, all drivers play pure strategies of using high care, or all drivers play mixed strategies. Conditioned on other drivers' using low care, driver *A* uses low care if her expected accident plus accident prevention (pre-accident) costs when she uses low care are less than or equal to her expected costs when she uses high care, or

$$c + \lambda(l, l)L(l, l) \leq 2c + \lambda(h, l)L(h, l) \tag{3}$$

Conditioned on other drivers' using high care, driver *A* uses high care if her expected pre-accident costs when she uses high care are less than or equal to her expected costs when she uses low care, or

$$2c + \lambda(h, h)L(h, h) \leq c + \lambda(l, h)L(l, h) \tag{4}$$

12. Note that optimal care would be the same if equation (1) were expressed as the cost of care plus expected accident costs for a single representative driver or for the entire population of drivers, rather than for two drivers.

Conditioned on other drivers' using low care with probability ρ, driver *A* plays mixed if her expected costs are the same regardless of whether she uses high care or low care, or

$$\rho[c + \lambda(l, l)L(l, l)] + (1 - \rho)[c + \lambda(l, h)L(l, h)]$$
$$= \rho[2c + \lambda(h, l)L(h, l)] + (1 - \rho)[2c + \lambda(h, h)L(h, h)] \quad (5)$$

The left-hand side is driver *A*'s expected costs when she uses low care, and the right-hand side is driver *A*'s expected costs when she uses high care, always assuming that other drivers use low care with probability ρ. When condition (5) holds, it determines the value of ρ. Because all drivers are identical, the same conditions that hold for driver *A* must hold for all drivers.[13]

Now consider how the equilibrium level of care under pure no-fault compares to the first best (economically efficient) level of care. Any of the three care levels—low care, high care, or mixed care by all drivers—might be economically efficient, and any might occur under the pure no-fault system. Thus there are nine possibilities to be considered. Because others have previously explored this issue (see Arlen, 1990), we skip the proof and simply state the result that, in the discrete case, drivers use either the efficient level of care or too little care. The intuition is that, because drivers are never liable for the damage they cause to other drivers, they ignore the benefits to other drivers of using additional care, which are that the probability of accidents falls and other drivers' losses are smaller when accidents occur.

3.3. The Pure Tort System

Under the pure tort system, there are no restrictions on drivers' right to file lawsuits following accidents, and all lawsuits are decided using the comparative negligence rule. The model now has two time periods. In period 1, drivers decide whether to use high care, use low care, or play mixed. At the end of period 1, accidents occur between randomly chosen

13. There is a unique low-care equilibrium if equation (3) holds, (4) does not hold, and (5) is satisfied only for values of $\rho > 1$ or <0. There is a unique high-care equilibrium if (3) does not hold, (4) holds, and (5) is satisfied only for values of $\rho > 1$ or <0. There is a unique mixed-strategy equilibrium if (3) and (4) are reversed and (5) is satisfied at a unique value of ρ between 0 and 1. Otherwise, there may be multiple equilibria.

Table 1. Period 2 Postaccident Costs, High Care

(h, h)	**B: file lawsuit**	**B: do not file**
A: file lawsuit	$L + sk, L + sk$	$L + k, L + k$
A: do not file	$L + k, L + k$	L, L

pairs of drivers. In period 2, drivers A and B, who have been involved in an accident, decide whether to file lawsuits. Following an accident, both drivers' care levels are assumed to be common knowledge.

After an accident, drivers A and B play a normal form game to determine whether either or both file a lawsuit. Each driver minimizes his or her postaccident private costs, assuming that the behavior of the other driver remains fixed. The Nash equilibrium of the game is assumed to be the outcome. There are four possible games, corresponding to the four pairs of care levels that drivers might have used: (l, l), (l, h), (h, l) and (h, h).

First assume that both drivers used high care in period 1, and consider the game in period 2. The entries in each block of Table 1 show driver A's postaccident costs, followed by driver B's. Here, L refers to the loss level $L(h, h)$ when both drivers use high care. Because both drivers used high care, the courts will never find any driver liable in a lawsuit. This means that filing a lawsuit has costs but no benefits for both drivers. The equilibrium of this game is therefore that neither driver files a lawsuit and each driver's postaccident costs are $L(h, h)$.

Second, assume that both drivers used low care in the first period. Because losses are high, courts will always find drivers negligent when lawsuits are filed, and this implies that damages will always be shared. Suppose driver A sues driver B. Then driver B will pay a share σ of driver A's damages, and driver A will bear the remaining share $(1 - \sigma)$. Now suppose driver B sues driver A. Then driver A will pay a share σ of driver B's damages, and driver B will bear the remainder. Drivers' postaccident costs are therefore as shown in Table 2, where L now refers to the loss level $L(l, l)$. Depending on parameter values, any of the four outcomes could be an equilibrium.

Third, suppose driver A used low care and driver B used high care. If courts did not make errors, then driver A would be found liable for driver B's damages when B sued A and driver B would not be found liable

Table 2. Period 2 Postaccident Costs, Low Care

(l, l)	B: file lawsuit	B: do not file
A: file lawsuit	$(1-\sigma)L + \sigma L + sk, \sigma L + (1-\sigma)L + sk$	$(1-\sigma)L + k, L + \sigma L + k$
A: do not file	$L + \sigma L + k, (1-\sigma)L + k$	L, L

for driver A's damages when A sued B. But since the loss level is intermediate, courts sometimes make errors in determining care levels. As a result, driver A will escape liability for driver B's damages with probability e and driver B will be found liable for A's damages with probability e. The game determining whether drivers file lawsuits in period 2 is shown as Table 3, where L now refers to the loss level $L(l, h)$. If $e = 0$, then the equilibrium of this game would be that driver A would never file a lawsuit and driver B would always file, because driver B would always collect from driver A and driver A would never collect from driver B. But, if $e > 0$, then any of the four outcomes may occur. The effect of errors in legal decision making is to increase driver A's incentive to sue, because errors sometimes cause her to win, and to reduce driver B's incentive to sue, because errors sometimes cause him to lose.

Finally, suppose driver A used high care and driver B used low care. Then courts again make errors in determining negligence and the game in period 2 is as shown in Table 4. The game in Table 3 is the reverse of the game in Table 4, and, again, any of the four outcomes could occur.

Now turn to period 1, when drivers make their decisions concerning care levels. For each pair of care levels, the outcome of one of the games in Tables 1–4 determines whether each driver files a lawsuit following an accident and each driver's postaccident costs. We convert each driver's postaccident costs to expected preaccident costs by multiplying by the probability of an accident at the assumed care levels and adding the cost of care. For example, if both drivers use high care, then the outcome of the game in Table 1 tells us that neither driver files a lawsuit. Therefore driver A's postaccident costs, denoted $\text{PAC}_A(h, h)$, are

Table 3. Period 2 Postaccident Costs, Mixed Care

(l, h)	B: file lawsuit	B: do not file
A: file lawsuit	$(1-e)(2L) + sk, e(2L) + sk$	$(1-e)L + k, L + eL + k$
A: do not file	$L + (1-e)L + k, eL + k$	L, L

Table 4. Period 2 Postaccident Costs, Mixed Care (Reversed)

(*h*, *l*)	***B*: file lawsuit**	***B*: do not file**
***A*: file lawsuit**	$e(2L) + sk, (1 - e)(2L) + sk$	$eL + k, L + (1 - e)L + k$
***A*: do not file**	$L + eL + k, (1 - e)L + k$	L, L

$L(h, h)$, and her expected pre-accident costs are $2c + \lambda(h, h)L(h, h)$. If both drivers use low care, then driver A's expected pre-accident costs are $c + \lambda(l, l)\text{PAC}_A(l, l)$, where $\text{PAC}_A(l, l)$ denotes driver A's postaccident costs in the equilibrium of the game in Table 2. Similarly, $\text{PAC}_A(l, h)$ and $\text{PAC}_A(h, l)$ denote driver A's postaccident costs in the equilibria of the games in Tables 3 and 4, respectively.

Now turn to period 1. Conditional on other drivers' using low care, driver A chooses a pure strategy of low care in period 1 if her expected costs when she uses low care are as low or lower than when she uses high care, or

$$c + \lambda(l, l)\text{PAC}_A(l, l) \leq 2c + \lambda(h, l)\text{PAC}_A(h, l). \tag{6}$$

Conditional on other drivers' using high care, driver A chooses a pure strategy of high care if her expected costs when she uses high care are as low or lower than when she uses low care, or

$$2c + \lambda(h, h)\text{PAC}_A(h, h) \leq c + \lambda(l, h)\text{PAC}_A(l, h) \tag{7}$$

Conditional on other drivers' using low care with probability ρ, driver A plays mixed if her expected costs are the same regardless of whether she uses high care or low care, or

$$\begin{aligned} &c + \rho[\lambda(l, l)\text{PAC}_A(l, l)] + (1 - \rho)[\lambda(l, h)\text{PAC}_A(l, h)] \\ &\quad = 2c + \rho[\lambda(h, l)\text{PAC}_A(h, l)] + (1 - \rho)[\lambda(h, h)\text{PAC}_A(h, h)]. \end{aligned} \tag{8}$$

When driver A plays mixed, (8) also determines the value of ρ. Because all drivers are identical, the same conditions that hold for driver A must hold for all drivers.[14]

3.4. Mixed No-Fault with a Zero or Infinite Threshold

Now turn to the mixed no-fault system. Here the structure of the game is the same as under the pure tort system. In period 1, drivers decide on

14. The conditions for a unique equilibrium to occur are identical to those discussed in the context of the pure no-fault rule.

their care levels. In period 2, if an accident occurs, they decide whether to opt out of no-fault and file lawsuits under the tort system. However, they are allowed to opt out or file lawsuits only if their accident losses exceed a threshold.

Suppose first that the threshold for opting out of no-fault is zero. In this case, the model is exactly the same as the pure tort system. To see this, consider period 2. Because the threshold under mixed no-fault is zero, both drivers always have the right to opt out. If drivers do not opt out (do not file lawsuits), then they bear their own damages under both systems. If drivers do opt out (file lawsuits), then the comparative negligence rule is used to resolve disputes under both systems. Finally, legal costs when drivers file lawsuits are assumed to be the same regardless of whether the pure tort system or the mixed no-fault system is in effect. Thus drivers have the same incentives to file lawsuits under the pure tort system as they have to opt out under mixed no-fault. This implies that the results in period 2 must be the same under both systems, so that drivers opt out of no-fault whenever they file lawsuits under the pure tort system and vice versa. Because the postaccident equilibrium must be the same under both systems, drivers' incentives to use care in period 1 must also be the same under both systems.

Now suppose the threshold for opting out is infinite. In this case, drivers are never allowed to opt out, so drivers' decisions to use care and to file lawsuits are the same as under the pure no-fault system.

3.5. Mixed No-Fault with an Intermediate Threshold for Opt Out

Now suppose the mixed no-fault system has an intermediate threshold for opting out, denoted T. Following an accident, drivers must have losses greater than T in order to opt out. In our discrete model, there are three threshold levels that exceed zero and are less than infinite: $T = L(h, h)$, $T = L(l, h) = L(h, l)$, and $T = L(l, l)$.

Suppose first that the threshold is $T = L(h, h)$. Because $L(h, h)$ is a low level of losses, drivers would be allowed to opt out if care levels were low or intermediate, but not if care levels were high. Now consider the second period games for the pure tort system, given in Tables 1–4. The equilibrium of the game when care levels are high, given in Table 1, is that neither driver opts out. Therefore, imposing the threshold for opting out does not change the outcome. The equilibria of the games when care levels are low or intermediate, given in Tables 2–4, are also unchanged, since losses when care levels are low or intermediate always exceed the threshold for opting out. Because the results in period 2 are unchanged when the low threshold is imposed, the outcome in period 1 also remains unchanged. Therefore, imposing a low threshold $T = L(h, h)$ leaves the outcome the same as under the pure tort system.

Now suppose the threshold is $T = L(l, h) = L(h, l)$, the intermediate loss level. Now drivers can opt out only if care levels were low at the pre-accident stage. The second stage games for intermediate care are given in Tables 3 and 4. Because neither driver has damage that exceeds the threshold, neither can opt out, and therefore no lawsuits are filed. Both drivers' postaccident losses are therefore $L(l, h)$. Now turn to the determination of care levels. When the threshold is $T = L(l, h) = L(h, l)$, driver A's expected pre-accident private costs are determined as under the pure no-fault system, but now we have $\text{PAC}_A(l, h) = L(l, h)$ and $\text{PAC}_A(h, l) = L(h, l)$. Because there is less opting out in period 2, care levels may change. Drivers may reduce their care levels when the threshold is raised, because a higher threshold makes the mixed no-fault system more like pure no-fault, under which drivers have an incentive to undersupply care. Alternately, drivers may increase their care levels in order to reduce other drivers' losses if an accident occurs. Using higher care may be worthwhile because, following accidents, the other driver is less likely to opt out and file a lawsuit.

Finally, suppose the threshold is $T = L(l, l)$, the high loss level. Since drivers never have higher losses than $L(l, l)$, they can never opt out, and the results are the same as under the pure no-fault system.

Thus the mixed no-fault system with a zero threshold for opting out is identical to the pure tort system, and the mixed no-fault system, with an infinite threshold is identical to the pure no-fault system. In between, an increase in the threshold for opting out, has ambiguous effects on care levels, which may either rise or fall.[15]

15. Because the theory suggests that mixed no-fault systems with low thresholds for opt out have results that are similar to those under pure tort systems, it should not be surprising that empirical studies of the effect of adopting no-fault on fatality rates had mixed results. Many U.S. jurisdictions that adopted no-fault had very low thresholds for opt out, especially during the 1970s (see the Appendix). Rolph, Hammet, and

3.6. The Choice System

Under the choice system, there are three time periods rather than two. At period 0, drivers decide between the pure tort rule and the pure no-fault rule. Then at periods 1 and 2, they make the same care level and litigation or opt out decisions as previously discussed. At period 0, drivers decide among a pure strategy of choosing the pure tort rule, a pure strategy of choosing no-fault, or a mixed strategy, which can be interpreted as making different choices at different time periods.[16] Because all drivers are identical, they all make the same choice at period 0. Suppose pt indicates a driver's choice of the pure tort rule and nf indicates a driver's choice of no-fault. Also t denotes the probability of drivers' choosing the pure tort rule, where $0 \leq t \leq 1$.

Consider period 2 first. After accidents occur, drivers A and B play normal form games to determine whether or not to opt out or file lawsuits. Following accidents, the two drivers are assumed to know both their own and the other driver's care levels and choice of liability rule. This means that there are now 16 distinct normal form games, corresponding to the four pairs of choices of liability rule (pt, pt), (pt, nf), (nf, pt), and (nf, nf) combined with the four pairs of care levels (h, h), (l, l), (l, h), and (h, l). The four games corresponding to (pt, pt) and the four pairs of care levels are the same as Tables 1–4. The four games corresponding to (nf, nf) and the four pairs of care levels all have the outcome that neither driver files a lawsuit. Finally the eight games corresponding to (pt, nf) and (nf, pt) are in between, because the driver that chose pure no-fault is barred from filing a lawsuit, whereas the other driver is not.

Now consider periods 0 and 1. Between periods 0 and 1, no strategic interaction occurs. But at period 1 driver A knows her own choice of liability rule. And because all drivers are identical, driver A knows that other drivers made the same choice of liability rule as she did. If drivers

Houchens (1985) found that 52% of accidents had damages above the \$200 threshold in New Jersey, 40% of accidents had damages above the \$500 threshold in Massachusetts, and 27% of accidents had damages above the \$750 threshold in Pennsylvania.

16. States that use the choice system require that insurers offer lower prices to drivers who choose no-fault. Because of our self-insurance assumption, our model does not allow this feature to be considered.

always choose the pure tort rule, then following an accident the pair of liability rules chosen by the two drivers must be (pt, pt). If drivers always choose pure no-fault, then following an accident the pair of liability rules chosen by the two drivers must be (nf, nf). But if drivers play mixed, then they anticipate that each of the four pairs of liability rules could occur in an accident. At period 1, drivers choose their care levels, knowing their own and other drivers' choice of liability rule. This means that there are four sets of care level decisions at period 1, corresponding to the four pairs of liability rule decisions that pairs of drivers involved in accidents might have taken.

Suppose first that all drivers chose the pure tort rule at period 0. Then driver *A* chooses her care level in order to minimize her expected accident plus accident-prevention costs, assuming that all other drivers' care levels remain constant. This decision was already discussed in the context of the pure tort rule and requires evaluating equations (6), (7) and (8). Suppose $EC_A(pt, pt)$ denotes driver *A*'s expected accident plus accident-prevention costs, as evaluated at the equilibrium levels of litigation and care.

Now suppose all drivers chose pure no-fault at period 0. Then we follow the analogous procedure to determine driver *A*'s equilibrium choice of care level at period 1. Suppose $EC_A(nf, nf)$ denotes driver *A*'s expected accident plus accident-prevention costs when all drivers choose pure no-fault at period 0, as evaluated at the equilibrium levels of litigation and care. We follow the analogous procedure to determine $EC_A(pt, nf)$ and $EC_A(nf, pt)$.

Finally, consider driver *A*'s choice of liability rule at period 0. Driver *A* makes her liability rule choice in order to minimize her expected accident plus accident-prevention costs, assuming that other drivers' liability rule choices are fixed. If other drivers always choose the pure tort rule, driver *A* always chooses the pure tort rule if

$$EC_A(pt, pt) \leq EC_A(nf, pt). \tag{9}$$

If other drivers always choose the pure no-fault rule, driver *A* always chooses no-fault if

$$EC_A(nf, nf) \leq EC_A(pt, nf). \tag{10}$$

If other drivers play mixed at period 0, driver A plays mixed if the following condition holds:

$$t\,\mathrm{EC}_A(\mathrm{pt},\mathrm{pt}) + (1-t)\,\mathrm{EC}_A(\mathrm{pt},\mathrm{nf}) = t\,\mathrm{EC}_A(\mathrm{nf},\mathrm{pt}) + (1-t)\,\mathrm{EC}_A(\mathrm{nf},\mathrm{nf}). \quad (11)$$

Here the left-hand side is driver A's expected accident plus accident-prevention costs if she chooses the pure tort rule, and the right-hand side is driver A's expected accident plus accident-prevention costs if she chooses the pure no-fault rule, conditioned on other drivers' choosing the pure tort rule with probability t. Conditions (9), (10) and (11) determine whether driver A always chooses the pure tort rule, always chooses pure no-fault, or plays mixed. And because all drivers are identical, other drivers make the same choice as driver A.

4. Simulation

4.1. Specification and Parameter Values

Suppose the probability-of-accidents function is $\lambda = \lambda_0 x_A^{-\beta} x_B^{-\beta}$ and the loss function is $L = L_0 x_A^{-\alpha} x_B^{-\alpha}$. Here x_A and x_B denote drivers' care levels. We assume that low care by either driver is x_A or $x_B = 1$ and high care by either driver is x_A or $x_B = 2$. The probability of motor vehicle accidents per day of driving is .00014.[17] Assume that $\lambda = .00014$ when one driver uses low care and the other uses high care, which implies that $.00014 = \lambda_0 1^{-\beta} 2^{-\beta}$. Any pair of values of λ_0 and β that satisfies this condition can be used for the simulation, and we use $\beta = 4$ and $\lambda_0 = .00224$. The average damage per vehicle per accident is \$10,812, including the level of transaction costs that would occur under no-fault.[18] We assume that $L = \$10{,}812$ when one driver uses low care and the other

17. The number of accidents per year is 10.7 million, and the number of vehicle miles traveled per year is 2,422 billion. This implies that the accident rate per mile is .0000044. The number of miles traveled per vehicle per day is about 32, so that the probability of accidents per vehicle-day is .00014. Data are taken from the *Statistical Abstract of the U.S. 1997* (1997, Tables 1017, 1019).

18. Total automobile accident insurance premia were \$119.2 billion per year in 1996. Dividing this by the total number of accidents per year results in the figure of \$11,140 for the average insurance premium per accident. From this we subtract \$328, which represents the additional transaction cost of an accident under the tort system relative to the no-fault system, for a net cost per accident of \$10,812. Data on insurance premia are taken from *Statistical Abstract of the U.S. 1997* (1997, Table 828). The

uses high care, so that $10{,}812 = L_0 1^{-\alpha} 2^{-\alpha}$. Any pair of values of L_0 and α that satisfies this condition can be used for the simulation, and we use $\alpha = 1$ and $L_0 = \$21{,}624$.

We assume that the probability of legal errors, e, equals .15 and that the two drivers involved in an accident share the victim's damage equally when both are found negligent under the tort system, or $\sigma = .5$.[19] We also assume that when both drivers involved in an accident file lawsuits the cost of the second lawsuit is half as high as the cost of the first lawsuit, so that $s = 1.5$.

The two remaining parameters are the cost of care per unit, c, and the cost per driver of the first lawsuit, k. These are the central parameters that we focus on. Our best estimate of the value of c is \$43, and our best estimate of the value of k is \$328.[20] But we investigate a wide range of values of both c and k, in order to capture all possible outcomes of the model. We simulate all pairs of values of c from 1 to 100 and k from \$100 to \$10,000 (in increments of \$100 below \$1,000 and \$1,000 thereafter).

Given our base case assumptions, three possible loss levels exist: \$5,406 when care by both drivers is high, \$10,812 when care levels are intermediate, and \$21,624 when care by both drivers is low. This implies that there are four possible thresholds: $0 \leq T \leq \$5{,}406$; $\$5{,}406 < T \leq 10{,}812$; $\$10{,}812 < T \leq 21{,}624$; and $T > \$21{,}624$. The four thresholds correspond to four different liability regimes:

(I) Pure tort rule: Since $T \leq \$5{,}406$, the threshold for opting out is never binding.

(II) Mixed no-fault regime with a low threshold: Since $\$5{,}406 < T \leq 10{,}812$, drivers may opt out when care levels are low or intermediate,

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figure of \$328 for additional transaction cost under the tort system relative to no-fault is based on 14% of insurance premia's being devoted to transaction costs under the tort system and on transactions costs' being 21% lower under no-fault. These figures are taken from Carroll and Abrahamse (1998).

19. This .15 is the figure found by White (1994) in a study of medical malpractice cases.

20. Suppose use of high rather than low care involves reducing driving speed by an average of 10 miles per hour. At the average hourly wage of \$13.50 per hour and the average daily miles driven of 32, this implies that the cost of care c is (\$13.50 per hour)(32 miles per day)/(10 miles per hour) = \$43 per day. The wage figure is taken from the Economic Report of the President (2000, Table B-45). Source for the other figures are in n. 18.

but not when care levels are high. We refer to this system as mixed no-fault/LT.

(III) Mixed no-fault regime with a high threshold: Since $\$10{,}812 < T \leq 21{,}624$, drivers may opt out only when care was low. We refer to this system as mixed no-fault/HT.

(IV) Pure no-fault rule: Since $T >$ \$21,624, the threshold is always binding and drivers are never allowed to opt out.

(V) Choice between the pure tort rule (I) and the pure no-fault rule (IV). Note that in the initial simulations, we ignore the choice rule (V).

4.2. Simulation Results: Rules (I)–(IV)

For each pair of values of c and k, we first determine the social cost-minimizing levels of care. We then evaluate the model to determine the equilibrium levels of care and litigation under each of rules (I)–(IV). Finally we determine which rule or rules are socially preferred because they minimize total social costs and whether any liability rule or rules achieve the first best outcome.

Tables 5 and 6 show the base case results. In each of the four columns, c varies, but k is constant at \$100, \$1,000, \$4,000, or \$10,000. The first line in each entry refers to the first best outcome, denoted FB. It gives the optimal probability of using low care, ρ^*. The second through fifth lines in each entry refer to the outcomes under rules (I) through (V), respectively. The value of ρ is given first. The rest of the line indicates whether drivers A and B file lawsuits following an accident if care levels were (l, l), (l, h), (h, l), and (h, h), respectively. For each driver, f indicates that the driver files a lawsuit, n indicates that the driver does not file, and na indicates that lawsuits are not allowed because the no-fault rule is in effect and losses are below the threshold. The outcome or outcomes that may occur in equilibrium in period 2 are underlined. The liability rule or rules that achieve the lowest social costs are shown in boldface type and, if any rule or rules achieve the first best outcome (care levels equal to ρ^* and no litigation), they are starred.

Consider efficient care levels first. When c is less than or equal to 2 or greater than or equal to 94, the first best outcomes are for drivers always to use high care or low care, respectively. In between, the first best outcome is for drivers to play mixed, with a rising proportion of low care as the value of c increases. Now consider how care incentives compare

Table 5. Simulation Results, Base Case (Transaction Cost at $100 and $1,000)

Cost of Care (c)	Transaction Cost of Lawsuit (k = $100)	Transaction Cost of Lawsuit (k = $1,000)
1	(FB) 0 ***(I) 0 (f,f)(f,f)(f,f)(n,n)** ***(II) 0 (f,f)(f,f)(f,f)(na,na)** ***(III) 0 (f,f)(na,na)(na,na)(na,na)** ***(IV) 0** ***(V) [0–1] 0 same**	(FB) 0 ***(I) 0 (f,f)(f,f)(f,f)(n,n)** ***(II) 0 (f,f)(f,f)(f,f)(na,na)** ***(III) 0 (f,f)(na,na)(na,na)(na,na)** ***(IV) 0** ***(V) [0–1] 0 same**
2	(FB) 0 ***(I) 0 (f,f)(f,f)(f,f)(n,n)** ***(II) 0 (f,f)(f,f)(f,f)(na,na)** (III) 0.0116 (f, f)(na, na)(na, na)(na, na) (IV) 0.0117 ***(V) [0.577–1] 0 same**	(FB) 0 ***(I) 0 (f,f)(f,f)(f,f)(n,n)** ***(II) 0 (f,f)(f,f)(f,f)(na,na)** (III) 0.0109 (f, f)(na, na)(na, na)(na, na) (IV) 0.0117 ***(V) [0.457–1] 0 same**
3	(FB) 0.000739 **(I) 0.00990 (f,f)(f,f)(f,f)(n,n)** **(II) 0.00990 (f,f)(f,f)(f,f)(na,na)** (III) 0.0334 (f, f)(na, na)(na, na)(na, na) (IV) 0.0337 **(V) [1] 0.00990 same**	(FB) 0.000739 **(I) 0.00545 (f,f)(f,f)(f,f)(n,n)** **(II) 0.00545 (f,f)(f,f)(f,f)(na,na)** (III) 0.0314 (f, f)(na, na)(na, na)(na, na) (IV) 0.0337 **(V) [1] 0.00545 same**
11	(FB) 0.0887 **(I) 0.184 (f,f)(f,f)(f,f)(n,n)** **(II) 0.184 (f,f)(f,f)(f,f)(na,na)** (III) 0.208 (f, f)(na, na)(na, na)(na, na) (IV) 0.209725 **(V) [1] 0.184 same**	(FB) 0.0887 **(I) 0.170 (f,f)(f,f)(f,f)(n,n)** **(II) 0.170 (f,f)(f,f)(f,f)(na,na)** (III) 0.195 (f, f)(na, na)(na, na)(na, na) (IV) 0.209 **(V) [1] 0.170 same**
47	(FB) 0.484 **(I) 0.971 (f,f)(f,f)(f,f)(n,n)** **(II) 0.971 (f,f)(f,f)(f,f)(na,na)** (III) 0.994 (f, f)(na, na)(na, na)(na, na) (IV) 1 **(V) [1] 0.971 same**	(FB) 0.484 **(I) 0.914 (f,f)(f,f)(f,f)(n,n)** **(II) 0.914 (f,f)(f,f)(f,f)(na,na)** (III) 0.932 (f, f)(na, na)(na, na)(na, na) (IV) 1 **(V) [1] 0.914 same**
48	(FB) 0.495 (I) 0.993 (f, f)(f, f)(f, f)(n, n) (II) 0.993 (f, f)(f, f)(f, f)(na, na) (III) 1 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 0.993 same	(FB) 0.495 (I) 0.935 (f, f)(f, f)(f, f)(n, n) (II) 0.935 (f, f)(f, f)(f, f)(na, na) (III) 0.953 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 0.935 same
93	(FB) 0.9991 (I) 1 (f, f)(f, f)(f, f)(n, n) (II) 1 (f, f)(f, f)(f, f)(na, na) (III) 1 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 1 same	(FB) 0.991 (I) 1 (f, f)(f, f)(f, f)(n, n) (II) 1 (f, f)(f, f)(f, f)(na, na) (III) 1 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 1 same

Table 5. Continued

Cost of Care (c)	Transaction Cost of Lawsuit (k = $100)	Transaction Cost of Lawsuit (k = $1,000)
94–100	(FB) 1 (I) 1 $\underline{(f, f)}(f, f)(f, f)(n, n)$ (II) 1 $\underline{(f, f)}(f, f)(f, f)$(na, na) (III) 1 $\underline{(f, f)}$(na, na)(na, na)(na, na) ***(IV) 1** (V) [1] 1 same	(FB) 1 (I) 1 $\underline{(f, f)}(f, f)(f, f)(n, n)$ (II) 1 $\underline{(f, f)}(f, f)(f, f)$(na, na) (III) 1 $\underline{(f, f)}$(na, na)(na, na)(na, na) ***(IV) 1** (V) [1] 1 same

Notes: See the text for interpretation. Parameter values in the base case are $e = .15$, $\sigma = .5$, $\alpha = 1$, $\beta = 4$, $L_0 = 21{,}624$, $\lambda_0 = .00224$, and $s = 1.5$. Rule (I) is pure tort, (II) is mixed no-fault/LT, (III) is mixed no-fault/HT, (IV) is pure no-fault, and (V) is the choice between the pure tort and pure no-fault rules.

to the first best. When $2 < c < 94$, drivers undersupply care under all four liability rules. Undersupply of care is lowest under the pure tort rule, greatest under pure no-fault, and intermediate under the mixed no-fault rules. The distortion can be substantial. For example when $c = 47$ and $k = 100$, the optimal probability of using low care is .484, but drivers actually use low care with probability .97 to .99 under all four liability rules.

Now consider how the liability rules perform. When $c \geq 3$, drivers use too little care under all four rules, but the care-level distortion is smallest under the pure tort rule and successively larger under the mixed no-fault/LT, mixed no-fault/HT, and pure no-fault rules. However, the pure no-fault rule has no litigation, whereas the mixed no-fault/HT, mixed no-fault/LT, and pure tort rules have successively higher levels of litigation. When the cost of care is relatively cheap, additional litigation is preferable to a larger care-level distortion. But as c rises drivers use less care, and therefore more litigation occurs. Also, as c rises, the first best care level falls, so that the cost of drivers' using too little care declines in importance. When $c \geq 48$ the tradeoff changes and the pure no-fault rule becomes the most efficient. This is because the gain from avoiding litigation under the pure no-fault rule more than offsets the cost of the care-level distortion.

Thus the overall result is that the pure tort and mixed no-fault/LT rules (I and II) are preferred when costs of care are low, but the pure no-fault rule (IV) is preferred when costs of care are high. This is shown in the top panel of Figure 1, where c is on the horizontal axis and k is on the vertical axis. Note that the shift from the pure tort and mixed no-fault rules' being most efficient to pure no-fault's being the most efficient regime always

Table 6. Simulation Results, Base Case (Transaction Cost at $4,000 and $10,000)

Cost of Care (c)	Transaction Cost of Lawsuit (k = $4,000)	Transaction Cost of Lawsuit (k = $10,000)
1	(FB) 0 ***(I) 0, (f,f)(n,f)(f,n)(n,n)** ***(II) 0, (f,f)(n,f)(f,n)(na,na)** ***(III) 0, (f,f)(na,na)(na,na)(na,na)** ***(IV) 0** ***(V) [0,1] 0 same**	(FB) 0 ***(I) 0 (f,f)(f,f)(f,f)(n,n)** ***(II) 0 (f,f)(f,f)(f,f)(na,na)** ***(III) 0 (f,f)(na,na)(na,na)(na,na)** ***(IV) 0** ***(V) [0–1] 0 same**
2	(FB) 0 ***(I) 0, (f,f)(n,f)(f,n)(n,n)** ***(II) 0, (f,f)(n,f)(f,n)(na,na)** (III) 0.00906 (f,f)(na,na)(na,na)(na,na) (IV) 0.0117389 ***(V) [0.289–1] 0 same**	(FB) 0 **(I) 0.00674 (f,f)(n,n)(n,n)(n,n)** **(II) 0.00674 (f,f)(n,n)(n,n)(na,na)** **(III) 0.00674 (f,f)(na,na)(na,na)(na,na)** (IV) 0.0117 (V) [0.9993–1] 0.00674 same or more
3	(FB) 0.000739 **(I) 0, (f,f)(n,f)(f,n)(n,n)** **(II) 0, (f,f)(n,f)(f,n)(na,na)** (III) 0.0260 (f,f)(na,na)(na,na)(na,na) (IV) 0.0337 **(V) [0.830–1] 0 same**	(FB) 0.000739 **(I) 0.0193 (f,f)(n,n)(n,n)(n,n)** **(II) 0.0193 (f,f)(n,n)(n,n)(na,na)** **(III) 0.0193 (f,f)(na,na)(na,na)(na,na)** (IV) 0.0337 **(V) [0.9998–1] 0.0193 same**
11	(FB) 0.0887 **(I) 0.133 (f,f)(n,f)(f,n)(n,n)** **(II) 0.133 (f,f)(n,f)(f,n)(na,na)** (III) 0.161 (f,f)(na,na)(na,na)(na,na) (IV) 0.209725 **(V) [1] 0.133 same**	(FB) 0.0887 **(I) 0.120 (f,f)(n,n)(n,n)(n,n)** **(II) 0.120 (f,f)(n,n)(n,n)(na,na)** **(III) 0.120 (f,f)(na,na)(na,na)(na,na)** (IV) 0.209 **(V) [0.9999–1] 0.120 same**
47	(FB) 0.484 **(I) 0.756 (f,f)(n,f)(f,n)(n,n)** **(II) 0.756 (f,f)(n,f)(f,n)(na,na)** (III) 0.773 (f,f)(na,na)(na,na)(na,na) (IV) 1 **(V) [1] 0.756 same**	(FB) 0.484 **(I) 0.575 (f,f)(n,n)(n,n)(n,n)** **(II) 0.575 (f,f)(n,n)(n,n)(na,na)** **(III) 0.575 (f,f)(na,na)(na,na)(na,na)** (IV) 1 **(V) [1] 0.575 same**
48	(FB) 0.495 (I) 0.773 (f,f)(n,f)(f,n)(n,n) (II) 0.773 (f,f)(n,f)(f,n)(na,na) (III) 0.790 (f,f)(na,na)(na,na)(na,na) **(IV) 1** (V) [1] 0.773 same	(FB) 0.495 (I) 0.588 (f,f)(n,n)(n,n)(n,n) (II) 0.588 (f,f)(n,n)(n,n)(na,na) (III) 0.588 (f,f)(na,na)(na,na)(na,na) **(IV) 1** (V) [1] 0.588 same
93	(FB) 0.991 (I) 1, (f,f)(n,f)(f,n)(n,n) (II) 1, (f,f)(n,f)(f,n)(na,na) (III) 1, (f,f)(na,na)(na,na)(na,na) **(IV) 1** (V) [1] 1 same	(FB) 0.990 (I) 1, (f,f)(n,f)(f,n)(n,n) (II) 1, (f,f)(n,f)(f,n)(na,na) (III) 1, (f,f)(na,na)(na,na)(na,na) **(IV) 1** (V) [1] 1 same

Table 6. Continued

Cost of Care (c)	**Transaction Cost of Lawsuit (k = $4,000)**	**Transaction Cost of Lawsuit (k = $10,000)**
94–100	(FB) 1	(FB) 1
	(I) 1, $\underline{(f,f)}(n,f)(f,n)(n,n)$	(I) 1, $\underline{(f,f)}(n,f)(f,n)(n,n)$
	(II) 1, $\overline{(f,f)}(n,f)(f,n)$(na, na)	(II) 1, $\overline{\underline{(f,f)}}(n,f)(f,n)$(na, na)
	(III) 1, $\overline{\underline{(f,f)}}$(na, na)(na, na)(na, na)	(III) 1, $\overline{\underline{(f,f)}}$(na, na)(na, na)(na, na)
	***(IV) 1**	***(IV) 1**
	(V) [1] 1 same	(V) [1] 1 same

Notes: See the text for interpretation. Parameter values in the base case are $e = .15$, $\sigma = .5$, $\alpha = 1$, $\beta = 4$, $L_0 = 21{,}6244$, $\lambda_0 = .00224$, and $s = 1.5$. Rule (I) is pure tort, (II) is mixed no-fault/LT, (III) is mixed no-fault/HT, (IV) is pure no-fault, and (V) is the choice between the pure tort and pure no-fault rules.

occurs at $c = 48$, regardless of the level of k. This is because the cost-of-care term involving c is additively separable from the other terms in the private and social cost functions. A surprising result is that neither of the mixed no-fault regimes is ever strongly socially preferred: in essence, neither rule (II) nor rule (III) ever achieves strictly more efficient results than the simpler pure tort and pure no-fault rules (I) or (IV).

The results in Tables 5 and 6 also show that care levels are responsive to changes in the cost of litigation. For example, when the pure tort rule is in effect and $c = 47$, the probability of drivers' using low care under the pure tort rule falls from .971 when $k = \$100$ to .756 when $k = \$4{,}000$. Also, only one rather than two lawsuits occurs when care levels are intermediate. When lawsuits are more expensive, it is worthwhile for drivers to use additional care in order to reduce litigation—both by reducing the number of accidents and reducing the amount of opt out (litigation) when accidents occur.[21]

21. We also simulated the model using $\alpha = 1.5$ rather than 1. This change means that the elasticity of accident losses with respect to care levels is higher than in the base case. The main difference in the results is that optimal and actual care levels are higher. As a result, the shift from the pure tort and mixed no-fault/LT rules' being most efficient to the pure no-fault rule's being most efficient occurs when $c = 67$, compared to $c = 47$ in the base case. Finally, we simulated the model using $\beta = 1$ rather than 4. This change means that the elasticity of the probability of accidents with respect to care levels is lower than in the base case. Optimal and actual care levels are much lower than in the base case and the shift from the pure tort and mixed no-fault/LT rules' being most efficient to the pure no-fault rule's being most efficient occurs when $c = 5$.

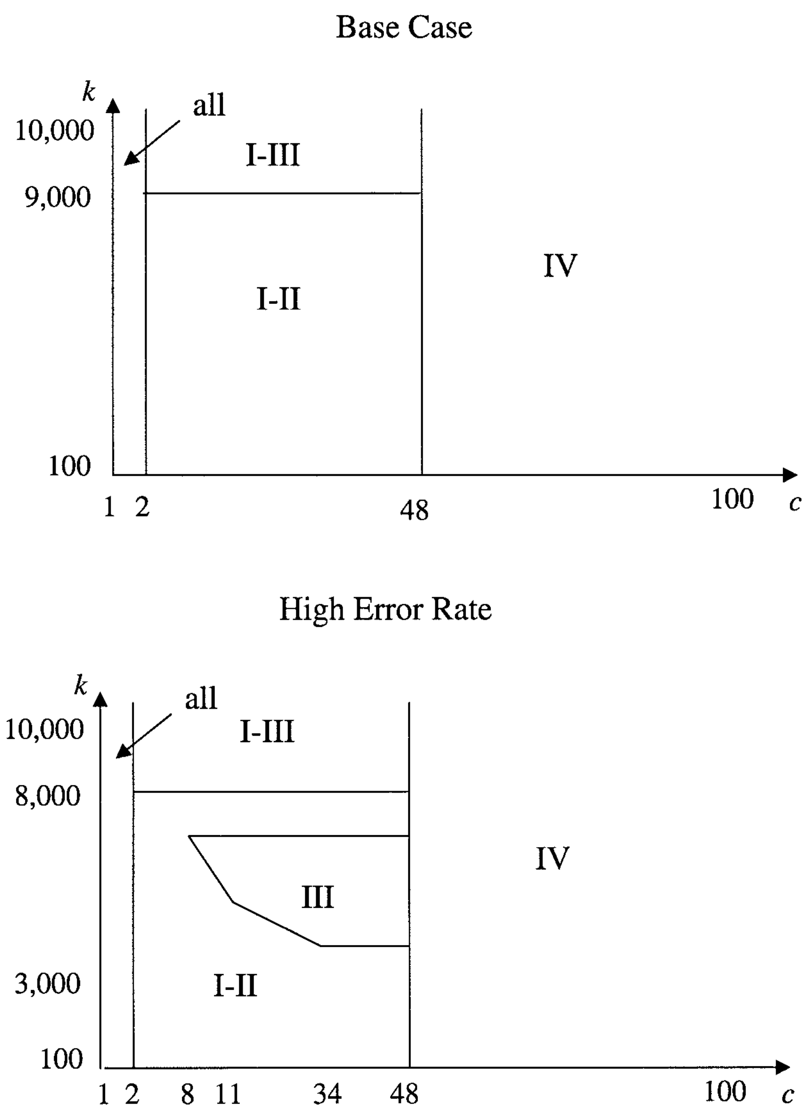

Figure 1. Preferred liability rules.

4.3. Simulation Results: High Error Rates

We reran the simulation with an error rate of $e = .30$, rather than .15, and the results are shown in Tables 7 and 8. In general the higher error rate causes additional litigation, because drivers who use low care are more likely to win when they sue drivers who used high care. Drivers also tend to lower their care levels when error rates rise, because additional care is less effective in discouraging litigation. However both effects are small in magnitude. For example when $k = \$4{,}000$ and $c = 11$, the probability of low care rises from .13 to .14 when error rates rise, and the number of lawsuits if care is intermediate rises from one to two.

When litigation is sufficiently costly, the mixed no-fault/HT rule (III) sometimes achieves strongly more efficient results than any of the other rules, because the higher threshold saves litigation costs and the savings are greater when error rates are high. As an example, when $c = 11$ and $k = 4{,}000$, rules (I) and (II) are most efficient when error rates are low, but rule (III) is most efficient when error rates are high. Drivers file lawsuits except when both use high care under rules (I) and (II). But under rule (III), lawsuits occur only when both drivers use low care.

Figure 1, lower panel, shows the general pattern when the error rate is high. Compared to the upper panel, there is a new region in the center of the figure where the mixed no-fault/HT rule (III) strictly dominates all other liability rules. But regime (III) is preferred only at intermediate values of both c and k. If care costs are high, then the pure no-fault rule is preferred because optimal care levels are low, so that no-fault does not seriously distort care incentives. If care costs are very low, then it is efficient for drivers to use high care, and the pure tort and mixed no-fault/LT rules are preferred because they distort drivers' care level decisions by less than the mixed no-fault/HT rule. Finally, if k is high and $c < 48$, then little litigation occurs, so that there is little gain from preventing litigation by imposing a high threshold for opting out.[22]

22. In the theoretical model, we pointed out that raising the threshold for opt out under the mixed no-fault system might cause equilibrium levels of care either to rise or fall. In the simulation results discussed so far, equilibrium care levels always decreased monotonically as the threshold increased. But, when the error rate is high, this result is sometimes reversed. For example if $c = 57$ and $k = \$4{,}000$, the equilibrium probability of high care is $1 - .945 = .055$ under the pure tort and mixed no-fault/LT rules, but it rises to $1 - .943 = .057$ under the mixed no-fault/HT rule. Thus a rise in the threshold for opt out may cause drivers to use more rather than less care.

Table 7. Simulation Results, High Error Rate (Transaction Cost at $100 and $1,000)

Cost of Care (c)	**Transaction Cost of Lawsuit (k = $100)**	**Transaction Cost of Lawsuit (k = $1,000)**
1	(FB) 0	(FB) 0
	***(I) 0, $(f,f)(f,f)(f,f)(n,n)$**	***(I) 0 $(f,f)(f,f)(f,f)(n,n)$**
	***(II) 0, $(f,f)(f,f)(f,f)$(na, na)**	***(II) 0 $(f,f)(f,f)(f,f)$(na, na)**
	***(III) 0, (f,f)(na, na)(na, na)(na, na)**	***(III) 0 (f,f)(na, na)(na, na)(na, na)**
	***(IV) 0**	***(IV) 0**
	***(V) [0–1] 0 same**	***(V) [0, 1] 0 same**
2	(FB) 0	(FB) 0
	***(I) 0, $(f,f)(f,f)(f,f)(n,n)$**	***(I) 0 $(f,f)(f,f)(f,f)(n,n)$**
	***(II) 0, $(f,f)(f,f)(f,f)$(na, na)**	***(II) 0 $(f,f)(f,f)(f,f)$(na, na)**
	(III) 0.0116 (f,f)(na, na)(na, na)(na, na)	(III) 0.0109 (f,f)(na, na)(na, na)(na, na)
	(IV) 0.0117	(IV) 0.0117
	***(V) [0.913–1] 0 same**	***(V) [0.750–1] 0 same**
3	(FB) 0.000739	(FB) 0.000739
	(I) 0.0198 $(f,f)(f,f)(f,f)(n,n)$	**(I) 0.0148 $(f,f)(f,f)(f,f)(n,n)$**
	(II) 0.0198 $(f,f)(f,f)(f,f)$(na, na)	**(II) 0.0148 $(f,f)(f,f)(f,f)$(na, na)**
	(III) 0.0334 (f,f)(na, na)(na, na)(na, na)	(III) 0.0314 (f,f)(na, na)(na, na)(na, na)
	(IV) 0.0337	(IV) 0.0337
	(V) [1] 0.0198 same	**(V) [1] 0.0148 same**
11	(FB) 0.0887	(FB) 0.0887
	(I) 0.194 $(f,f)(f,f)(f,f)(n,n)$	**(I) 0.180 $(f,f)(f,f)(f,f)(n,n)$**
	(II) 0.194 $(f,f)(f,f)(f,f)$(na, na)	**(II) 0.180 $(f,f)(f,f)(f,f)$(na, na)**
	(III) 0.208 (f,f)(na, na)(na, na)(na, na)	(III) 0.195 (f,f)(na, na)(na, na)(na, na)
	(IV) 0.209	(IV) 0.209
	(V) [1] 0.194 same	**(V) [1] 0.180 same**
47	(FB) 0.484	(FB) 0.484
	(I) 0.981 $(f,f)(f,f)(f,f)(n,n)$	**(I) 0.923 $(f,f)(f,f)(f,f)(n,n)$**
	(II) 0.981 $(f,f)(f,f)(f,f)$(na, na)	**(II) 0.923 $(f,f)(f,f)(f,f)$(na, na)**
	(III) 0.994 (f,f)(na, na)(na, na)(na, na)	(III) 0.932 (f,f)(na, na)(na, na)(na, na)
	(IV) 1	(IV) 1
	(V) [1] 0.981 same	**(V) [1] 0.923 same**
48	(FB) 0.495	(FB) 0.495
	(I) 1 $(f,f)(f,f)(f,f)(n,n)$	(I) 0.944 $(f,f)(f,f)(f,f)(n,n)$
	(II) 1 $(f,f)(f,f)(f,f)$(na, na)	(II) 0.944 $(f,f)(f,f)(f,f)$(na, na)
	(III) 1 (f,f)(na, na)(na, na)(na, na)	(III) 0.953 (f,f)(na, na)(na, na)(na, na)
	(IV) 1	**(IV) 1**
	(V) [1] 1 same	(V) [1] 0.944 same
93	(FB) 0.990	(FB) 0.990
	(I) 1 $(f,f)(f,f)(f,f)(n,n)$	(I) 1, $(f,f)(f,f)(f,f)(n,n)$
	(II) 1 $(f,f)(f,f)(f,f)$(na, na)	(II) 1, $(f,f)(f,f)(f,f)$(na, na)
	(III) 1 (f,f)(na, na)(na, na)(na, na)	(III) 1, (f,f)(na, na)(na, na)(na, na)
	(IV) 1	**(IV) 1**
	(V) [1] 1 same	(V) [1] 1 same

Table 7. Continued

Cost of Care (c)	**Transaction Cost of Lawsuit (k = \$100)**	**Transaction Cost of Lawsuit (k = \$1,000)**
94–100	(FB) 1 (I) 1 $\underline{(f,f)}(f,f)(f,f)(n,n)$ (II) 1 $\underline{(f,f)}(f,f)(f,f)$(na, na) (III) 1 $\underline{(f,f)}$(na, na)(na, na)(na, na) ***(IV) 1** (V) [1] 1 same	(FB) 1 (I) 1, $\underline{(f,f)}(f,f)(f,f)(n,n)$ (II) 1, $\underline{(f,f)}(f,f)(f,f)$(na, na) (III) 1, $\underline{(f,f)}$(na, na)(na, na)(na, na) ***(IV) 1** (V) [1] 1 same

Notes: See the text for interpretation. Parameter values are $e = .3$, $\sigma = .5$, $\alpha = 1$, $\beta = 4$, $L_0 = 21{,}624$, $\lambda_0 = .00224$, and $s = 1.5$. Rule (I) is pure tort, (II) is mixed no-fault/LT, (III) is mixed no-fault/HT, (IV) is pure no-fault, and (V) is the choice between the pure tort and pure no-fault rules.

4.4. Simulation Results: The Choice System

Now turn to the results when we include the choice between the pure tort and pure no-fault rules, rule (V). We reran the base case simulation including rule (V) as a fifth liability rule. The results are shown in the bottom line of each entry in Tables 5 and 6. The entry in square brackets is the equilibrium probability t that drivers choose the pure tort rule. When a range of values is given, there are multiple equilibria. The next entry is drivers' probability of using low care under the choice rule, ρ, and the final entry indicates whether there is more, less, or the same amount of litigation under the choice rule as under the pure tort rule. Results for rule (V) are shown in boldface if they achieve the same level of efficiency as the best of the other liability rules and are asterisked if they achieve the first best outcome.

The choice rule sometimes achieves the same level of efficiency as the best of the other liability rules, but never is strongly more efficient because drivers almost always choose the pure tort rule. Figure 2 shows the regions in which the choice system performs as well as any of the other liability rules. When $c \leq 47$, the pure tort rule and the mixed no-fault/LT rule previously achieved the most efficient results and the choice rule achieves the same level of efficiency. But when $c \geq 48$, drivers who are under the choice rule always choose pure tort even though pure no-fault is more efficient. Therefore the choice rule leads to inferior results in this region. The reason is that individual drivers who consider shifting from the pure tort to the pure no-fault rule assume that other drivers' behavior will remain the same even though their own behavior changes. As a result, choosing no-fault costs them the gain from suing the other

Table 8. Simulation Results, High Error Rate (Transaction Cost at $4,000 and $10,000)

Cost of Care (*c*)	Transaction Cost of Lawsuit (*k* = $4,000)	Transaction Cost of Lawsuit (*k* = $10,000)
1	(FB) 0 ***(I) 0, (f,f)(f,f)(f,f)(n, n)** ***(II) 0, (f,f)(f,f)(f,f)(na, na)** ***(III) 0, (f,f)(na, na)(na, na)(na, na)** ***(IV) 0** ***(V) [0, 1] 0 same**	(FB) 0 ***(I) 0, (f,f)(n, n)(n, n)(n, n)** ***(II) 0, (f,f)(n, n)(n, n)(na, na)** ***(III) 0, (f,f)(na, na)(na, na)(na, na)** ***(IV) 0** ***(V) [0–1] 0 same**
2	(FB) 0 ***(I) 0, (f,f)(f,f)(f,f)(n, n)** ***(II) 0, (f,f)(f,f)(f,f)(na, na)** (III) 0.00906 (f, f)(na, na)(na, na)(na, na) (IV) 0.0117 ***(V) [0.369–1] 0 same**	(FB) 0 **(I) 0.00674 (f,f)(n, n)(n, n)(n, n)** **(II) 0.00674 (f,f)(n, n)(n, n)(na, na)** **(III) 0.00674 (f,f)(na, na)(na, na)(na, na)** (IV) 0.0117 (V) [0.9994–1] 0.00712 same or more
3	(FB) 0.000739 **(I) 0.00154 (f,f)(f,f)(f,f)(n, n)** **(II) 0.00154 (f,f)(f,f)(f,f)(na, na)** (III) 0.0260 (f, f)(na, na)(na, na)(na, na) (IV) 0.0337 (V) [0.9982] 0.00158 more	(FB) 0.000739 **(I) 0.0193 (f,f)(n, n)(n, n)(n, n)** **(II) 0.0193 (f,f)(n, n)(n, n)(na, na)** **(III) 0.0193 (f, f)(na, na)(na, na)(na, na)** (IV) 0.0337 (V) [0.9998–1] 0.0204 same or more
11	(FB) 0.0887 (I) 0.141 (f, f)(f, f)(f, f)(n, n) (II) 0.141 (f, f)(f, f)(f, f)(na, na) **(III) 0.161 (f,f)(na, na)(na, na)(na, na)** (IV) 0.209 (V) [0.9892] 0.142 more	(FB) 0.0887 **(I) 0.120 (f,f)(n, n)(n, n)(n, n)** **(II) 0.120 (f,f)(n, n)(n, n)(na, na)** **(III) 0.120 (f,f)(na, na)(na, na)(na, na)** (IV) 0.209 (V) [0.99998–1] 0.127 same or more
47	(FB) 0.484 (I) 0.770 (f, f)(f, f)(f, f)(n, n) (II) 0.770 (f, f)(f, f)(f, f)(na, na) **(III) 0.773 (f,f)(na, na)(na, na)(na, na)** (IV) 1 (V) [0.9886] 0.772 more	(FB) 0.484 **(I) 0.601 (f,f)(n, n)(n, n)(n, n)** **(II) 0.601 (f,f)(n, n)(n, n)(na, na)** **(III) 0.601 (f,f)(na, na)(na, na)(na, na)** (IV) 1 **(V) [1] 0.601 same**
48	(FB) 0.495 (I) 0.788 (f, f)(f, f)(f, f)(n, n) (II) 0.788 (f, f)(f, f)(f, f)(na, na) (III) 0.790 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [0.9891] 0.789 more	(FB) 0.495 (I) 0.614 (f, f)(n, n)(n, n)(n, n) (II) 0.614 (f, f)(n, n)(n, n)(na, na) (III) 0.614 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 0.614 same
93	(FB) 0.990 (I) 1, (f, f)(f, f)(f, f)(n, n) (II) 1, (f, f)(f, f)(f, f)(na, na) (III) 1, (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 1 same	(FB) 0.990 (I) 1 (f, f)(n, n)(n, n)(n, n) (II) 1 (f, f)(n, n)(n, n)(na, na) (III) 1 (f, f)(na, na)(na, na)(na, na) **(IV) 1** (V) [1] 1 same

Table 8. Continued

Cost of Care (c)	**Transaction Cost of Lawsuit (k = \$4,000)**	**Transaction Cost of Lawsuit (k = \$10,000)**
94–100	(FB) 1 (I) 1, $\underline{(f, f)}(f, f)(f, f)(n, n)$ (II) 1, $\underline{(f, f)}(f, f)(f, f)$(na, na) (III) 1, $\underline{(f, f)}$(na, na)(na, na)(na, na) ***(IV) 1** (V) [1] 1 same	(FB) 1 (I) 1 $\underline{(f, f)}(n, n)(n, n)(n, n)$ (II) 1 $\underline{(f, f)}(n, n)(n, n)$(na, na) (III) 1 $\underline{(f, f)}$(na, na)(na, na)(na, na) ***(IV) 1** (V) [1] 1 same

Notes: See the text for interpretation. Parameter values are $e = .3$, $\sigma = .5$, $\alpha = 1$, $\beta = 4$, $L_0 = 21{,}624$, $\lambda_0 = .00224$, and $s = 1.5$. Rule (I) is pure tort, (II) is mixed no-fault/LT, (III) is mixed no-fault/HT, (IV) is pure no-fault, and (V) is the choice between the pure tort and pure no-fault rules.

driver following an accident without giving them the benefit of not being sued themselves.

An example is useful to illustrate. Assume that $c = 93$ and $k =$ \$1,000. Table 5 and Figure 1 show that the pure no-fault rule achieves the best results, but drivers who are under the choice regime always choose pure tort. Drivers' private cost if they all choose the pure no-fault rule is $c + \rho(l, l)L(l, l) = 93 + (.00224)(21{,}624) = \$141.40$, which is lower than their private cost of $93 + (.00224)(21624 + (1.5)(1000)) = \$144.80$ if they all choose the pure tort rule. But for individual drivers

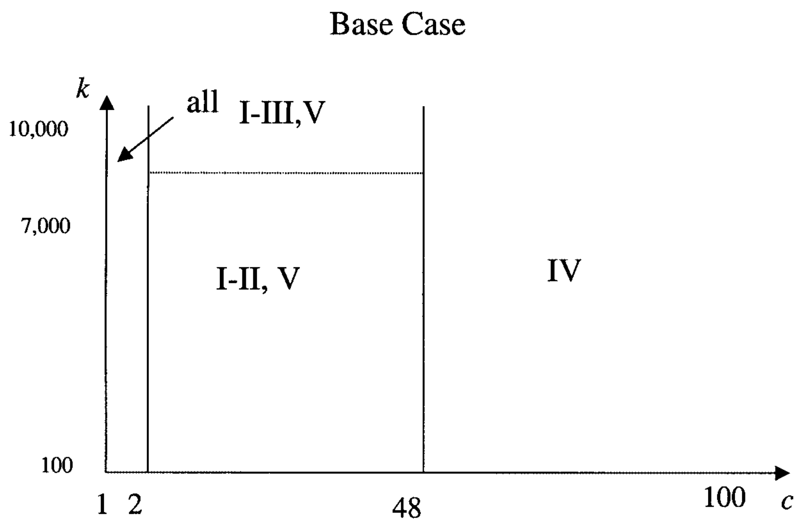

Figure 2. Preferred liability rules including choice rules.

to choose the pure tort rule in equilibrium, their costs when they choose the pure tort rule must be lower than their costs when they choose the pure no-fault rule, conditioned on other drivers' choosing the pure tort rule, or $\text{EC}(\text{pt}, \text{pt}) < \text{EC}(\text{nf}, \text{pt})$. The left-hand side of this expression is $93 + (.00224)(21624 + (1.5)(1000)) = \$144.80$ and the right-hand side is $93 + (.00224)(21624(1.5) + (1)(1000)) = \$167.90$. Given that other drivers choose the pure tort rule, an individual driver who shifts to the pure no-fault rule saves litigation costs of $(.00224)(.5)(1000) = \$1.10$, because she does not sue the other driver following an accident but incurs additional damage of $(.00224)(.5)(21624) = \$24.20$ because she does not recover part of her own damage from the other driver. As a result, individual drivers are worse off if they shift to the pure no-fault rule. But if all drivers shifted, then the individual driver would save an additional $(.00224)(1000 + (.5)(21624)) = \$26.50$ in legal costs and damages because she would not be sued following an accident.

Because the results under the choice rule are always the same as under the pure tort rule, the choice rule never achieves strongly more efficient results than any of the other liability rules. This suggests that a justification for making the no-fault rule mandatory is that drivers do not choose it voluntarily even when doing so would be socially more efficient. An additional argument against the choice rule is that its high complexity is not justified by better results than could be obtained using much simpler rules.[23]

4.5. Policy Implications

What should public officials conclude from our results? Suppose public officials were willing to accept the many assumptions of our model and wished to adopt the liability rule that is most efficient at the values of c and k that are most likely to hold in practice ($c = \$43$ and $k = \$328$). In this case, our results suggest that they should adopt the pure tort rule (I). This result is robust to variations in the value of k and robust to changes in the error rate in legal decision making. But it is quite sensitive to changes in the value of c, since the pure no-fault rule would be the most efficient

23. We also simulated a choice regime in which drivers choose between the pure tort and mixed no-fault rules with low or high thresholds. Results are available from the authors.

liability rule if the true value of c turned out to be \$48 or higher, rather than \$43.

5. Conclusion

In this article we compare incentives and efficiency under the pure tort system (the comparative negligence rule) to those under no-fault. We analyze a variety of no-fault and choice regimes actually used by U.S. states and non-U.S. jurisdictions.

Our main theoretical result is that the mixed no-fault rule is identical to the pure tort rule when the threshold for opt out is zero and identical to the pure no-fault rule when the threshold for opt out is infinite. In between, the mixed no-fault system with an intermediate threshold for opt out differs from both pure systems. As the threshold for opt out rises, drivers may either raise or lower their care levels. This is because a rising threshold makes the mixed no-fault rule more like pure no-fault, under which drivers have an incentive to undersupply care, but the rising threshold sometimes gives drivers an incentive to increase care so that other drivers are less likely to opt out and file lawsuits when accidents occur.

Our main simulation result is that no single liability rule always dominates the others on efficiency grounds. The pure tort rule achieves the most efficient results when the cost of care is low, whereas pure no-fault achieves the most efficient results when the cost of care is high. When court error rates are relatively low, the mixed no-fault rule never achieves strongly more economically efficient results than the pure tort or pure no-fault rules, but mixed no-fault sometimes does better when error rates are high. This is because high error rates encourage drivers to substitute litigation for care under the pure tort rule, so that preventing litigation when damages are low by imposing a threshold for opting out can improve efficiency. We also find that the choice regime never achieves strongly more efficient results than the underlying liability rules, because drivers tend to choose the pure tort rule even when no-fault is more efficient. Because individual drivers treat other drivers' behavior as fixed, they assume that shifting from the pure tort to no-fault will cost them the right to sue without giving them the gain from not being sued. This suggests that a justification for adopting no-fault as a mandatory liability rule is that drivers do not choose it voluntarily even when it leads to economically efficient results. Our results also suggest that use of choice rules does not lead to any efficiency gains that might justify their complicated structures. Finally, at the most likely values of the parameters, we find that the pure tort rule achieves the most efficient results.

Our analysis has not considered whether no-fault rules should be applied to trucks. When an accident occurs between a car and a truck, the car and its occupants generally suffer much greater damage than the truck and its occupants. As a result, truck drivers have a strong incentive to undersupply care. In fact, since trucks have a tendency to roll over, they may cause more damage to their own occupants by swerving to avoid an accident with a car than by allowing the accident to happen. Adoption of no-fault exacerbates this problem by partially or fully eliminating truck owners' liability to victims of accidents. These considerations suggest that no-fault systems should not be applied to trucks.[24]

Appendix

This appendix lists characteristics of no-fault systems used by U.S. states and other jurisdictions. The data are taken from Schermer (1995, chapt. 17) and are for 1995.

Jurisdictions that use pure no-fault: Quebec, Northern Territory in Australia, New Zealand, and Israel.

Jurisdictions that adopted no-fault but later repealed it: Arkansas, Connecticut, Georgia, South Carolina, and Texas.

Jurisdictions that use mixed no-fault and thresholds for opt out (dollar figures are for medical expenses): Colorado ($2,500); District of Columbia (expenses exceeding the no-fault medical coverage limit); Hawaii ($10,000); Kansas ($2,000); Kentucky ($1,000); Massachusetts

24. New Jersey's no-fault statute excludes trucks and commercial vehicles completely. Among the other states' no-fault laws, Florida, Hawaii, Kansas, Michigan, and Pennsylvania do not distinguish between trucks and other vehicles. The remaining states that have no-fault laws impose some additional liability on trucks, such as waiving opt out thresholds.

($2,000); Minnesota ($4,000); North Dakota ($2,500); Utah ($3,000); Nevada (“disfigurement”); Colorado, Kansas, Kentucky, Minnesota, Florida, Utah, and DC (“permanent disfigurement”); New Jersey and New York (“significant disfigurement”); Massachusetts, Michigan, and Pennsylvania (“permanent, serious disfigurement”); Hawaii (“permanent serious disfigurement which results in mental or emotional suffering”); and Tasmania.

Jurisdictions that use the choice system: Kentucky, New Jersey, and Pennsylvania.

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