Bargaining Behaviour by Defendant Insurers: an Economic Model

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1. Introduction

Liability insurance, of one form or another, is the typical means by which victims of negligence are compensated. This is as true of professional negligence as it is of motor vehicle accidents or work injuries, where the vast majority of cases are brought. Consequently, a claim for damages is almost always referred by defendants to their insurer, whose lawyers are charged with the task of responding to the claim, by persuading the claimant to withdraw, by taking the case to court for adjudication, or by agreeing an acceptable settlement of the claim. While this system could in principle lead to a complex hierarchy of decision-taking agents, in practice the insurance company lawyer is given complete discretion to determine the defendant's response. In the majority of cases, this response will be a negotiated settlement with the plaintiff.

In the context of liability insurance, this raises a number of issues. From the insurer's point of view, the predictability of the length of time taken to settle, as well as the size of the eventual settlement, are factors of actuarial importance. Similarly the uncertain relationship of the settlement amount to the actual loss incurred raises questions about the adequacy and equity of the resulting compensation to the plaintiff. Finally, the settlement amounts are arguably providing potential tortfeasors with incentives to take care: if the process at arriving at a negotiated settlement is indeterminate or capricious, the appropriateness of the tort system as a means of providing efficient signals is also called into question. For all these reasons it is desirable to have some explanation of the settlement process as negotiated by liability insurers, and that is the task of this paper.

The paper is divided into an Introduction and four sections. Section 2, which follows, argues that attempts by economists to explain the incidence of settlement have ignored or marginalised the bargaining process. Section 3 proposes a formal model of this process, and presents an empirical specification. Section 4 discusses the data, and presents results.

2. Economic approaches to the settlement process

In the orthodox economic model of settlement and trial, the precise amount at which the parties settle is left indeterminate within bounds (Posner [1974], Landes [1971], Shavell

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[1982]). The lower bound is the plaintiff's "minimum ask", the upper bound is the defendant's "maximum offer". The plaintiff's minimum ask is the certainty equivalent of the uncertain prospect resulting from continuing litigation. In other words, it is the plaintiff's expected gain from litigation net of his expected costs. Similarly the defendant's maximum offer is his certainty equivalent of the same uncertain prospect. That is, it is his total expected loss from continuing litigation, including both damages and costs. Clearly, if both parties are risk neutral and agree on the likely verdict, there will be a well-defined bargaining range determined by the extent of each party's expected litigation costs. This can be shown more formally as follows, where A is the plaintiff's minimum ask, B the defendant's maximum offer, D is the amount of damages which would be awarded at court, and C is the amount of costs involved in litigation.

$$1. \quad A = E_p(D) - E_p(C)$$

$$2. \quad B = E_d(D) + E_d(C)$$

E_p and E_d are expectation operators for plaintiff and defendant respectively, so that if $E_p(D) = E_d(D)$, the bargaining range which exists between A and B amounts to $E_d(C) - E_p(C)$. Only if $E_p(D)$ and $E_d(D)$ are sufficiently different will no bargaining range exist, given that the requirement for litigation (rather than settlement),

$$3. \quad A > B \Rightarrow E_p(D) - E_d(D) > E_p(C) + E_d(C)$$

implies that the plaintiff or defendant (or both) overestimate their own chances of success in court sufficiently to override the cost incentive to settle out of court.

Introducing risk aversion into this model adds another component to the bargaining range. With risk aversion the certainty equivalents for both parties are determined as follows:

$$4. \quad U_p(A) = \int U_p(D)g_p(D)dD - \int U_p(C)f_p(C)dC$$

$$5. \quad U_d(B) = \int U_d(D)g_d(D)dD + \int U_d(C)f_d(C)dC$$

where $U_i(\cdot)$, $g_j(\cdot)$ and $f_j(\cdot)$ are functions representing the parties' utilities and subjective probabilities over damages and costs respectively. With concave utility functions, the values of A and B generated here must be less than those represented by equations 1 and 2 above, where the utility functions are implicitly linear. Because A represents a positive and B a negative sum, this means that risk aversion reduces the plaintiff's minimum ask and increases the defendant's maximum offer. Hence if R_p and R_d represent discount factors for risk, we could write:

$$6. \quad A = E_p(D) - E_p(C) - R_p$$

$$7. \quad B = E_d(D) + E_d(C) + R_d$$

so that equal expectations over the verdict would produce a bargaining range of $E_d(C) + E_p(C) + R_d + R_p$. Unfortunately, this is where the orthodox economic approach to the settlement process stops. It enables us to model the determinants of the decision to settle or litigate, and provides a convincing explanation for the predominance of settlements out of court, but it is relatively imprecise about the determination of the settlement amount itself. Operationalizing this model for settlements typically involves assuming that the settlement amount will be some weighted average of A and B : the process which determines the weights is assumed exogenous (Danzon and Lillard [1982]).

This model of the settlement process has been criticized in recent years for its restrictive assumptions. That is, it assumes that each party has full information about *A* and *B*, and that neither party acts strategically in the determination of the settlement amount. These assumptions have been modified within models which focus on informational asymmetries and/or strategic behaviour (Bebchuk [1984], P'ng [1983]). However, the principal motivation for these extensions has been to demonstrate that litigation might result even if a bargaining range exists in the sense shown above. Bebchuk, for example, presents a model in which the defendant is known to have superior information about the likely outcome of litigation, and the plaintiff is less confident about his own prediction. The plaintiff is then assumed to make a single take-it-or-leave-it offer of settlement, which is pitched at a level judged to maximize his expected utility from the claim, taking into account the possibility that it might not prove acceptable to the defendant. Hence litigation can take place even though a mutually acceptable settlement is available. While this approach is really not so much different from the orthodox model in which both parties have similar information but may disagree over its interpretation, it does put emphasis on the parties' subjective probability distributions over the likely verdict as factors which might influence bargaining behaviour. However, Bebchuk's model adopts a highly unrealistic model of the bargaining procedure followed by the parties, with the explicit intention of avoiding the "strategic issues introduced by the possibility of using settlement offers as signals". Moreover, even the game-theoretic approaches to modelling the settlement process, which emphasise strategic interdependence, have generally avoided the issue of bargaining behaviour by assuming that there is available an externally determined settlement amount. Indeed, P'ng (1983) has confessed that:

"We recognise that this is a very restrictive assumption: our justification is that a realistic model of the process of settlement must rely on a theory of bargaining. Such a theory is still in gestation."

Cooter and Marks (1982) have, in the context of divorce settlements, developed a model incorporating a bargaining process in which there are many sequential offers and counter-offers which gradually converge. The process is time-limited, so that a trial might take place if the offers do not converge quickly enough. While this approach is an advance insofar as it takes into account the possibility of both strategic behaviour and asymmetric information, the bargaining process as described does not seem typical of the behaviour of liability insurers, who seldom make more than one or two offers of settlement, often before a writ is issued, and sometimes spread over a considerable period of time.

An alternative perspective which helps shed some light on this behaviour can be found in the work of Phillips, Hawkins and Flemming (1975). They suggested that there was a fundamental asymmetry between the parties to a dispute in which liability insurance was present. That is, the defendant, as we have seen, is typically a repeat-playing specialist solicitor acting for an insurance company with a large diversified portfolio of risks. The plaintiff, on the other hand, is more usually a one-off player with a considerable sum at stake relative to his wealth and possibly acting with non-specialized legal advice. An obvious implication of this asymmetry in attitudes to risk is that there will be a reduction in the bargaining range, so settlements on the whole should be lower. In addition, however, there will be a clear advantage to defendants from demonstrating a reputation for hard bargaining, which is mostly absent for plaintiffs. The importance of this fact lies in its effect on the *credibility* of the parties' declared threats to go to court if a settlement is not agreed.

Phillips, Hawkins and Flemming argued that this permits the defendant to extract all of the joint returns from settling rather than going to court. That is, the defendant, by making an offer of settlement equal to the plaintiff's minimum ask with a threat to go to court if it is not accepted, is able to save his own expected litigation costs together with a full reduction in the settlement reflecting the plaintiff's expected litigation costs and a discount factor for risk. What is not clear, though, is how the defendant determines the plaintiff's minimum ask. Implicitly, there appears to be an assumption that defendants begin with a low offer and increase this by increments until the plaintiff accepts, at which point the offer equals the plaintiff's minimum ask. The problem with this, as pointed out by Flemming (1976) in a subsequent unpublished paper, is that such a bargaining strategy will undermine the credibility of the defendant's threat to go to court if his offer is rejected. Flemming therefore argues that defendant insurers are likely to adopt a strategy aimed at avoiding this problem: that is, a strategy of few discrete offers each pitched at a level designed to achieve a particular probability of plaintiff acceptance. He suggested that the observed pattern of offers in the UK (based on a small sample of personal injury cases) was consistent with a target acceptance probability of around 0.55 at each round. If correct, this hypothesis has important implications for the outcome of the settlement process. It suggests that offers may be related to the defendant's subjective perception of the *plaintiff's* probability distributions over the court verdict and costs, rather than his own. And it suggests that there will be a predictable relationship between offers at different stages in the bargaining process, a relationship which should permit a satisfactory explanation of the pattern of settlements. We believe these insights represent the most promising direction for any attempt to model the path to settlement, and the following section formalizes them with a view to producing an empirical specification of such a model.¹

3. Model

In the previous section, equations 6 and 7 showed the plaintiff's minimum ask and the defendant's maximum offer. To these we can now add a third key variable, that is, the *defendant's estimate of the plaintiff's minimum ask* – which we denote A^* :

$$8. \quad A^* = E_D^p(D) - E_D^p(C) - R_D$$

where the three right hand side components represent the defendant's beliefs about the plaintiffs' expectation over damages and costs, as well as his discount factor for risk. In view of the discussion above, we might expect that a rational strategy for a defendant insurer would be to make an initial offer of A^* , providing that $0 < A^* < B$. This is because a defendant insurer who is known to make a genuine pre-estimate of what is likely to be an acceptable settlement, thereby maintains the credibility of his threat to go to court if such a "reasonable" offer is rejected. Whether this offer is in fact accepted by a particular plaintiff will depend on the relationship between A^* and A : if $A > A^*$, the offer will be rejected, otherwise it will be accepted. This again is a consequence of the asymmetry between plaintiff and defendant. If the plaintiff acts strategically by refusing to an offer in excess of A in

¹ While the model of section 2 follows the logic of Flemming's approach, we find it unnecessary to assume that defendants have in mind a "target" acceptance rate at a particular level. In our model the acceptance rate is determined endogenously by the relationship between the offer and the plaintiff's minimum ask.

order to try and extract a higher settlement, he runs the credible risk of being taken to court, an outcome yielding only A . Moreover, because the plaintiff is typically a one-off player in this game, he stands to gain nothing from demonstrating to the defendant that he meant what he said in threatening to go to court unless he received a higher offer.

Therefore, if the plaintiff does refuse an initial offer of A^* , the defendant will justifiably assume that the plaintiff's minimum ask is in excess of A^* – which was the defendant's best guess, given information about the plaintiff's declared losses, costs, and risk aversion. But this guess is, after all, drawn from a subjective probability distribution over A , so the defendant will presumably believe that this particular plaintiff's minimum ask lies in the upper portion of this probability distribution.² Figure 1 shows such a distribution:

Figure 1

The distribution $g_d^P(A)$ represents the defendant's *pdf* over A ; A^* is his expectation of A . Given that A^* is positive but below B , the defendant will make an offer at that level. If the offer is refused, he will infer that A really lies in the shaded part of the distribution. If he follows the logic of the earlier decision, he will revise his estimate of A so that it now represents the expectation of the shaded distribution, that is, $g_d^P(A)$, truncated at A^* . If this revised estimate is less than B , he will make a new offer at this level. If not, he will go to court. The process could be repeated for several further rounds, but in practice will be limited by the extent of the defendant's uncertainty and his maximum offer.

This simple model of settlement negotiation seems likely to generate a pattern of offers and acceptances quite close to that actually observed, with few discrete offers made by defendants, plaintiff acceptance rates around 50 % (providing that defendant's expectations

² Fleming claims that the defendant will also revise upwards the mean of his subjective distribution, on the assumption that he believes he is just as likely to be wrong as is the plaintiff. It is arguable whether defendants would make such an assumption, given that their uncertainty is incorporated into the subjective probability distribution.

over A are unbiased) and few cases going to trial. However, before we can confirm this by confronting the model with data, an empirical specification is needed.³ We shall adopt the following notation:

A, B, A^* are defined as above

X = vector of characteristic relating to expected damages

Y = vector of characteristics relating to expected costs

Z = vector of characteristics relating to uncertainty

α, β, γ = parameter vectors corresponding to the above

θ_i = offers of settlement ($i = 1, 2, 3, \dots$)

Unfortunately, we cannot directly observe A, B and A^* . As we have defined them, they are all latent variables which between them determine the offers made to plaintiffs, and likelihood that plaintiffs will accept them. By extension, they also therefore determine whether cases are abandoned or litigated, rather than settled out of court. Given that it is in principle possible to observe offers, acceptances, abandonments and trials, it might be possible to use this information in order to estimate the parameters of the model.

Consider first the abandonment of a claim. What this implies is that a claim is made by the plaintiff; the defendant does not respond with an offer and the plaintiff withdraws rather than going to court. While it is not possible to say anything about the plaintiff's expectations, the defendant's refusal to make an offer suggests that $A^* > B$. That is, the defendant's estimate of the plaintiff's minimum ask exceeds his maximum offer.

If a claim is not abandoned, it is either settled or litigated. We have argued above that the process of choosing between these options begins with the defendant making an initial offer at a level which he believes is the plaintiff's minimum ask. That is,

$$\begin{aligned} 9. \quad \theta_1 &= A^* && \text{if } A^* < B \\ \theta_1 &= 0 && \text{otherwise.} \end{aligned}$$

This offer will be acceptable to the plaintiff if it exceeds his minimum ask, A , otherwise not. We have argued above that the plaintiff will not behave strategically by refusing such an offer. A refusal will consequently indicate to the defendant that $A > \theta_1$, and any revised offer will take account of this new information. If the defendant again makes a "best guess" as to the true level of A , he will improve his offer to the extent of his expected prediction error, given the plaintiff's refusal. That is,

$$\begin{aligned} 10. \quad \theta_2 &= \theta_1 + E[\epsilon \mid \epsilon > 0] && \text{if } A > \theta_1 \\ \theta_2 &= 0 && \text{otherwise} \end{aligned}$$

where ϵ is a stochastic prediction error, with $\epsilon \sim N(0, \sigma_\epsilon^2)$. Again, the plaintiff will compare this new offer with his actual minimum ask, and will reject it if $A > \theta_2$. The process of offer revision could then continue, with the third round being determined as follows:

$$\begin{aligned} 11. \quad \theta_3 &= \theta_1 + E[\epsilon \mid \epsilon > E[\epsilon \mid \epsilon > 0]] && \text{if } A > \theta_2 \\ \theta_3 &= 0 && \text{otherwise.} \end{aligned}$$

³ The empirical model presented here owes a debt to the approach taken by Danzon and Lillard (1983); the provisional methodology adopted in this paper currently falls short of the FIML estimation of their study, and further work is being undertaken which will incorporate all of the available information from the offer distributions into a single likelihood function.

Clearly, the process of offer revision following plaintiff rejection can continue to fourth and subsequent rounds, but will be limited by the defendant's maximum offer. That is, at each round in the above process, the defendant may choose to go to court rather than revise his offer if the revised offer would exceed B . In fact, this is a comparatively rare outcome, so that almost all claimants have their cases disposed in accordance with the above framework, with the implication that the defendants' *own* views about the likely verdict, costs, etc. are typically relevant only to the extent that they influence his belief about the plaintiff's minimum ask. Of course, this leaves open the question of the possible use of offers by defendants in order to signal new or superior information, in which case the offer equations above would need to include this.

We are now in a position to specify the full model. The latent variables A , B and A^* as well as the offers are in logarithmic form, reflecting the probable multiplicative nature of the relationships posited above. Also we can use the formula for a truncated normal distribution in order to simplify the offer revision hypothesis: this formula states that, for a variable ϵ distributed as $N(0, \sigma_\epsilon^2)$:

$$12. \quad E[\epsilon \mid \epsilon > k] = \sigma_\epsilon \cdot \frac{\Phi(k)}{1 - \Phi(k)}$$

which implies that the first round revision should equal

$$\sigma_\epsilon \cdot [0.5/1 - 0.5] = \sigma_\epsilon$$

and that the second round revision should be

$$\sigma_\epsilon \cdot [0.242/1 - 0.841] = 1.522 \cdot \sigma_\epsilon$$

with similar calculations available for further rounds. A formal model of the first three rounds can now be specified.

$$\begin{aligned} A &= \alpha_p X - \beta_p Y - \gamma_p Z + u_1 \\ B &= \alpha_d X + \beta_p Y + \gamma_d Z + u_2 \\ A^* &= \alpha_d^p X - \beta_d^p Y - \gamma_d^p Z + u_3 \\ 0_1 &= A^* \text{ if } A^* < B \\ 0_1 &= 0 \text{ otherwise} \\ 0_2 &= 0_1 + \sigma_\epsilon + v \text{ if } A > 0_1 \\ 0_2 &= 0 \text{ otherwise} \\ 0_3 &= 0_1 + 1.522 \sigma_\epsilon + w \text{ if } A > 0_2 \\ 0_3 &= 0 \text{ otherwise} \end{aligned}$$

where α_p , α_d , α_d^p , β_p , β_d , β_d^p , γ_p , γ_d , γ_d^p and σ_ϵ are parameters to be estimated. The stochastic error terms u_1 , u_2 , u_3 , v , w , reflect in each case a combination of prediction errors – attributable to the relevant individual – and measurement errors – attributable to the data. These errors are assumed to be multivariate normal with zero mean and variance-covariance matrix:

$$\Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{13} & \sigma_{1v} & \sigma_{1w} \\ & \sigma_2^2 & \sigma_{23} & \sigma_{2v} & \sigma_{2w} \\ & & \sigma_3^2 & \sigma_{3v} & \sigma_{3w} \\ & & & \sigma_v^2 & \sigma_{vw} \\ & & & & \sigma_w^2 \end{bmatrix}$$

Initial estimates of the model's parameters can be estimated by means of a sequence of selectivity-corrected regressions using the method of Heckman (1979). This procedure removes the bias which would result from using data on offers in order to infer something about the latent variables. As we have seen, whether an offer is made at any stage is determined by criteria applied by defendant and plaintiff in relation to the acceptance, rejection or revision of previous offers. This is a non-random sampling process, recognition of which requires corrections to be made to the classical regression model in order to obtain consistent estimates of the parameters. Probit analysis is applied initially to estimate the criterion functions; a correction factor is calculated for each observation; this is then incorporated as an additional variable in the offer equations. A development of the Heckman method by Greene (1981) was used here, as implemented in his computer program, LIMDEP. These estimates were then used as starting values for maximum likelihood estimation of the model's parameters and the variance-covariance matrix; the likelihood functions were maximised using the method of Davidson, Fletcher and Powell. However, while this removes the bias associated with the selection of individuals to receive further offers in any one round, it does not take into account the estimation difficulties associated with the non-random samples at each successive stage of the process. In other words the sampling process is interdependent, so that the above parameters should in principle be estimated consistently by means of a full information maximum likelihood approach, along the lines pursued by Danzon and Lillard (1982). With such an approach the structural parameters are estimated simultaneously, and care must be taken to ensure that any identifying restrictions are justifiable. The approach adopted here is only a partial solution to these estimation problems: a future paper will extend the analysis.

4. Data and results

The data are drawn from a large-scale survey of individuals who experienced some interruption of their normal activities due to illness or injury, carried out at the Centre for Socio-Legal Studies in 1976. A sample of 2,142 individuals were asked about their experiences in claiming compensation for their losses (Harris et al. [1984]) and the effects of their illness/injury (Fenn [1981], Brittan and Vlachonikolis [1982]). Some 224 cases reported that they had pursued a claim for compensation against an individual held responsible for their loss. The majority of those pursued this claim through a lawyer, but some 11 % did not. Most of the cases reported were either road or work accident cases, where the defendant was the relevant liability insurer. For the purpose of this study we excluded 12 cases which were initiated before 1969, so the data relates to claims begun after that date: all financial variables have been adjusted to 1976 prices. These data were further supplemented by a follow-up survey of plaintiff solicitors, at which point detailed information about the settlement process was obtained, including the amount and dates of offers, a breakdown of the total settlement by heads of damage and costs, and whether or not there was any dispute between the parties about liability, prognosis, or quantum. This information can be examined in conjunction with other data relating to the severity of injury in order to test the model developed above. Table 1 gives a breakdown of the means and standard deviations for the variables used in this analysis. The independent variables can be defined under the following headings:

Damages

Economic loss is the product of the number of weeks off work and the wage rate at the time

of the injury, adjusted to the 1976 prices, and transformed logarithmically. *Hospital* is a binary variable taking the value 1 if the plaintiff was in hospital for more than two weeks, 0 otherwise. *Residual disability* is a binary variable taking the value 1 if the plaintiff self-reported continuous residual physical or mental effects from his injury, 0 otherwise. *Loss of amenities*, which is self-explanatory, is another binary variable. *Blame* is a binary variable taking the value 1 if the plaintiff felt that the defendant was wholly to blame for his injury.

Costs

Plaintiff pays all takes the value of 1 if the plaintiff had to pay the whole cost of his lawyer's services. *TU solicitor* and *Other solicitor* indicate representation by a trade union or other lawyer respectively.

Uncertainty

Liability, *Prognosis*, and *Quantum* are binary variables with value 1 if these issues are said to be disputed by the plaintiff or his solicitor. While these may reflect increasing uncertainty over a given unexpected verdict, it is also likely that they will reflect informational asymmetry between the parties.

The results are presented in Tables 2-4. The probit equations, in Table 2, show the effects of the independent variables on the probabilities that the plaintiff will receive offers at each of the first three rounds.

Round 1: It appears that those claimants most likely to receive an offer are those without residual disability who hold the defendant wholly to blame for their injury. While these factors may simply reflect the necessary stamina and motivation required by successful claimants, it is also the case that residual disability and contributory negligence increase the uncertainty faced by plaintiffs, and this may be well known to defendants. This may also explain the negative effect of the plaintiff's anticipated cost burden. On the other hand, it is clear that legal representation is a significant factor determining the likelihood of receiving an offer of some kind.

Round 2: Our expectation was that the probability of first offers being rejected would be effectively random if the defendants had unbiased beliefs about the plaintiff's minimum demands and pitched their offers accordingly. This is mainly borne out by the results, with none of the damage or cost variables showing significance. However, where prognosis or quantum (particularly the latter) is said to be in dispute, the possibility of rejection increases significantly. Presumably this indicates the existence of private information by one party: the plaintiff's minimum demand in these cases is in excess of what the defendant thinks it ought to be.⁴

Round 3: Interestingly, the effect of asymmetric information is no longer evident at this stage: this may indicate that the informational content of the first offer is taken into account in the second round, removing the asymmetry which was previously present. The rejection probability at this stage is consequently unsystematic, except for an apparent reduction in the likelihood of rejection as the delay between first and second offers increases. This suggests a narrowing of the gap between the offer and the demand as time elapses.

⁴ The disputed liability is not significant, which runs counter to the widely held views that it is cases where liability is in the balance which are least likely to settle out of court. (Priest and Klein [1984]).

Table 3 reports the results for the offer equation. The first offer is strongly related to the measure of economic loss, hospital stay, and loss of amenities. The elasticity of the offer with respect to economic loss is quite low, possibly reflecting the fact that most claimants receive some form of wage-loss compensation from other sources. There is no significant effect of the variables used to proxy the potential cost of litigation. This may reflect the degree to which British plaintiffs are insulated from cost pressures, or the inadequacy of the proxies used. There is, however, some suggestion that the offer is increased as time elapses, reinforcing the impression gained that defendants are willing to move gradually in this direction. The subsequent offer revisions are modelled as functions of a constant only, in order to test whether the revision process approximates the simple model outlined above. If the model is correct, the standard deviation of the defendant's prediction error is 0.361 – the constant in the first revision. We would then expect the second revision to equal $0.361 \times 1.522 = 0.55$. In fact, the fitted constant in the second revision is quite close, at 0.562. Admittedly, this is a rather crude way of testing the hypothesis, in the absence of an independent estimator for the defendant's prediction error. However, it does suggest that there is some consistent judgemental exercise underpinning the settlement process, rather than a tug-of-war.⁵

Finally, Table 4 presents our tentative estimates of the underlying latent variable equations, representing the defendant's maximum offer (B), the plaintiff's minimum ask (A), and the defendant's belief about the plaintiff's minimum ask (A^*). In order to construct the parameter estimates for A and B from the earlier probit results, it was necessary to impose linear restrictions on the variance-covariance matrix. This is because the parameters in the probit equations are estimable only up to a scale factor – each coefficient in Table 2 represents the “true” parameter divided by the standard error of the relevant criterion function. Given the structure of the model, these standard errors cannot be observed. Hence we impose the restrictions that:

$$13. \quad \sigma_1^2 = \sigma_2^2 = \sigma_3^2$$

and the fact that

$$14. \quad Var(u_1 - u_3) = \sigma_1^2 + \sigma_3^2 - 2\sigma_{13}$$

$$15. \quad Var(u_2 - u_3) = \sigma_1^2 + \sigma_3^2 - 2\sigma_{23}$$

in order to identify all the relevant parameters. Clearly the restrictions at 13. are undesirable – they imply that the degree of subjective uncertainty is the same for both plaintiff and defendant – so the results for A and B in Table 4 should be treated with caution. Bearing this in mind, the results reiterate the findings established above: all equations are sensitive to economic loss, length of stay in hospital, and loss of amenities, factors thought to affect the expected award in court. Plaintiff cost factors (as proxied) appear to be relatively unimportant. There is strong evidence that information is (initially) asymmetrically distributed between the parties, and that offers are used as signalling devices to remove this asymmetry. Finally there are indications that there is an underlying tendency for a continuous movement over time in the parties' bargaining positions in the direction of settlement.

⁵ It is of course possible that σ_ϵ is non-constant, which would imply both a need to correct for heteroskedasticity in the estimation of θ_1 , and the possibility of specification error in the estimation of θ_2 and θ_3 . We are hoping to address these difficulties in the development of this paper.

5. Conclusion

This paper has attempted to develop and estimate a model of bargaining behaviour in out of court settlements, where the typical defendant is a liability insurer. Both theory and evidence in this area is limited, and although the analysis reported here is provisional, and based on a fairly small sample, some of the findings suggest promising lines of enquiry. It appears that Fleming's attempt to model the "search for settlement" in terms of a consistent sequence of discrete offers is, at least in part, borne out by the results, although the model developed here, unlike Flemming's, does not require an exogenously determined "target acceptance rate". The results also suggest that defendants and plaintiffs use offers, and the rejection of offers, as means by which private information can be conveyed to each other. Presumably, it is the cases in which the informational asymmetries cannot be resolved which are most likely to lead to litigation. Finally, it could be argued that some of our results have been consistent with an underlying dynamic model of bargaining in which the parties concession rates determine the final settlement (c. f. Cooter and Marks [1982]). Consequently, the settlement process should perhaps be seen as a way of exchanging information about changes in reservation prices while minimizing the costs of strategic behaviour.

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