ISSN 1045-6333

OPTIMAL INSURANCE CONTRACTS WHEN ESTABLISHING THE AMOUNT OF LOSSES IS COSTLY

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Discussion Paper No. 122

3/93

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The Program in Law and Economics is supported by a grant from the John M. Olin Foundation.

Optimal Insurance Contracts When Establishing the Amount of Losses is Costly

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Abstract

The problem of establishing the amount of losses covered by public and private insurance is often characterized by asymmetric information, in which the claimant already knows the extent of a loss but this can be demonstrated to the insurer only at a cost. It is shown that a simple arrangement, which provides greater coverage whenever individuals demonstrate unusually high losses, gives claimants an excessive incentive to establish the amount of their losses. This paper determines what insurance claims process, consistent with the form typically employed in existing insurance arrangements, is optimal.

*Harvard University and the National Bureau of Economic Research. I am grateful to A. Mitchell Polinsky, Steven Shavell, and Kathryn Spier for comments.

1. Introduction

An important feature of insurance in many contexts is that the insured will know the extent of a loss but it is costly to establish this to the insurer.[1] For example, with disability insurance, the extent of an injury may be apparent to the insured but not costlessly observable by others. This paper considers how to design insurance policies optimally when establishing losses is costly.[2]

A primary conclusion is that individuals may have excessive incentives to establish their losses. Suppose, for example, that an insured has suffered a loss whose magnitude, if established, would entitle him to $1000 of insurance coverage. He would then be willing to incur costs of up to $1000 to demonstrate his loss, so his gain will be smaller, possibly much smaller, than the $1000 of coverage he receives. Yet the insured pays fully, in his premium, for the prospect of receiving the $1000 of coverage. This suggests that the insured might be better off with a policy that sometimes discourages him from later spending to establish claims. When an insured decides how much to spend to demonstrate losses, he considers only his ex post situation, but the ex post gain is not closely related to the ex ante benefit of insurance, which is the efficient spreading of risk.

Section 2 first shows that insureds' incentives to establish losses are excessive for a natural type of insurance policy. It then characterizes the policy, consistent with the form typically employed in existing insurance arrangements, that maximizes expected utility. Under the optimal policy,

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1 The problem of verifying claims does not always have this feature. For example, with medical insurance, coverage is usually for expenditures that are reported both to the individual and to the insurer by the provider of medical care. For other work involving ex post verification, see, e.g., Mookherjee and Png (1989), Spier (1992), and Townsend (1979).

2 The discussion abstracts from insurer risk aversion, moral hazard, and other sources of administrative costs. See, e.g., Arrow (1963), Raviv (1979), Shavell (1979). Incorporating these previously studied dimensions obviously would affect the optimal contract, but the core features identified in this paper would remain. (For example, with moral hazard, optimal coverage when the amount of the loss is known would be less, but it still would be desirable for the level of coverage to depend on the amount of the loss.) This paper also ignores the possible effects of claims procedures on the incentive to file claims, including frivolous claims.

there is a range of "high" losses that, if demonstrated, do not entitle the claimant to greater coverage (even though greater coverage would be optimal taking as given that the loss has been demonstrated). Individuals suffering the highest losses -- above the range just noted -- do receive greater coverage (in fact, full coverage) when they demonstrate their loss. Individuals who do not demonstrate the amount of their loss (or who demonstrate a loss that is not high enough) receive a uniform, positive payment. Finally, the insurance company is forbidden from requiring that the amount of loss be demonstrated when individuals do not choose to do so, because this is not desirable but in some instances the insurance company would benefit by requiring demonstration of losses (if the level of coverage would then be optimal given that the loss has been demonstrated).

Section 3 concludes by discussing the extent to which important and controversial features of insurance schemes -- including public programs such as Social Security Disability Insurance, which involves annually over a million claims, payments of more than twenty billion dollars, and public administrative expenses approaching a billion dollars[3] -- are consistent with the results here, particularly those concerning the problem of excessive incentives to establish claims. This section also comments on the relationship between these results and others, such as Raviv (1979), concerning optimal insurance contracts in the presence of administrative costs.

2. Analysis

2.1. The Model

Individuals may suffer losses, the existence of which is costlessly observed but the amount of which is observed only by individuals. Individuals choose whether to demonstrate the amount of their losses to the insurer at a cost. (Later, the possibility that the insurer can choose to demonstrate the amount of a loss is also considered.) Insurance contracts provide coverage that is a function of the loss if the amount of the loss is demonstrated;

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3 Social Security Administration (1991).

otherwise, coverage for any loss is a single, specified amount.[4] The notation is as follows:

w = initial wealth

u = individuals' utility functions, $u' > 0$, $u'' < 0$

p = probability of a loss

ℓ = amount of loss

$f(\ell)$ = positive distribution of losses on $[0, w]$

c = cost of demonstrating amount of a loss

x = insurance coverage if amount of a loss is not demonstrated

$x(\ell)$ = insurance coverage if a loss in the amount ℓ is demonstrated

π = actuarially fair insurance premium

Let $\mathcal{L}$ denote the set of losses for which individuals do not demonstrate the amount of their loss and $\sim\mathcal{L}$ the set for which losses are demonstrated. Expected utility is then given by the following expression.

$$(1)\quad EU = (1-p)u(w - \pi) + p\int_{\mathcal{L}} u(w - \pi - \ell + x)f(\ell)d\ell$$
$$+ p\int_{\sim\mathcal{L}} u(w - \pi - \ell + x(\ell) - c)f(\ell)d\ell.$$

The problem is to determine $x(\ell)$ and x to maximize (1) subject to the actuarial requirement that

$$(2)\quad \pi = px\int_{\mathcal{L}} f(\ell)d\ell + p\int_{\sim\mathcal{L}} x(\ell)f(\ell)d\ell$$

and an incentive compatibility constraint, which indicates that an individual will choose to demonstrate the amount of his loss (i.e., $\ell \notin \mathcal{L}$) if and only if

[4] It would be straightforward to interpret this model more broadly or generalize it in important respects. For example, it is unessential that observing the existence of a loss is costless. Moreover, what is initially assumed to be known (possibly after some expenditure) could be the type of a loss or its approximate magnitude. Alternatively, the model could be interpreted as applying to determining whether a loss occurred (see note 18). But more complicated contracts, such as the type that might be designed using the revelation principle, see Myerson (1979) and the articles cited in note 1, are not considered; attention is confined to examining optimality within the general framework of claims processes -- public and private -- that actually are used. (The optimal contract described in Proposition 2 is, however, analogous to the best contract that could be implemented with a deterministic audit policy of the sort examined in Reinganum and Wilde (1985) and Townsend (1979).)

(3) $x(\ell) - c \geq x$.

In the familiar case in which it is implicitly assumed that $c = 0$, the optimal insurance contract involves full coverage ($x(\ell) = \ell$ for all ℓ), each individual's loss is demonstrated, and the insurance premium equals the expected loss.[5]

2.2. Excessive Incentives under Simple Insurance Contracts

When establishing the amount of a loss is costly, the problem changes. Before characterizing the optimal contract, consider individuals' incentives to establish their losses under policies in which individuals who demonstrate losses receive coverage $x(\ell)$ that is continuously increasing in the amount of the loss ℓ that is demonstrated. (This includes, for example, a policy of full coverage which, as will be demonstrated below, is the optimal level of coverage taking as given that ℓ is demonstrated.)

Proposition 1. If $x(\ell)$ rises continuously with ℓ and there exists an $\ell < w$ such that there is an incentive to demonstrate ℓ, then there is an excessive incentive to demonstrate some losses. In particular, expected utility is higher under an alternative contract that is the same as the initial one except that some individuals who demonstrate losses receive coverage of x (or $x(0)$, if $x < x(0) - c$) rather than the previously specified $x(\ell)$.

Proof: Consider individuals whose ℓ is such that the incentive compatibility constraint (3) holds as an equality, and who thus are indifferent as to whether to demonstrate their loss. (The assumptions that some individuals have an incentive to demonstrate ℓ and that $x(\ell)$ is continuous guarantee that such an ℓ exists unless all individuals demonstrate their ℓ, which can only occur if $x < x(0) - c$; it is straightforward to show that such a contract involves an excessive incentive to demonstrate losses.[6])

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5 Alternatively, when there is a fixed cost of processing any claim, the optimal policy involves a deductible, with full coverage for losses over the deductible. (See section 3 for a discussion of prior literature.) In practice, most costs of claim processing presumably involve evaluating the claim, rather than merely printing a check. Thus, it is natural to consider the possibility that insured individuals might collect a flat amount if they do not choose to undergo a more expensive evaluation process.

6 In particular, individuals whose ℓ is near 0 have an excessive incentive to demonstrate their losses. To see this, consider the alternative contract that sets $\hat{x} = x(0)$. Then, individuals with losses sufficiently small that $x(\ell) < \hat{x} + c$ will not demonstrate their losses. Each such individual is better off ex post than under the original contract. Moreover, these

Individuals for whom (3) holds as an equality have the same wealth and thus the same utility ex post whichever decision they make. But, if the loss is demonstrated, the insurance premium (2) is higher, because $x(\ell)$ exceeds x by c. Similarly, by continuity of the utility function, individuals with losses such that $x(\ell)$ is slightly higher than that for which (3) holds as an equality will benefit ex post only slightly by demonstrating the amount of their loss, but the premium must rise by an amount that exceeds c. Thus, there exists a range of ℓ for which it would be better if individuals did not establish the amount of their losses. Finally, as will be elaborated upon below, there exists an incentive compatible way to accomplish this result: the contract could provide coverage of x when losses in that range are established, which would eliminate the incentive to demonstrate the amount of the loss. Q.E.D.

2.3. The Optimal Insurance Contract

It will be useful initially to characterize optimal coverage, taking as given which losses are demonstrated. For any $\ell \in \sim\mathcal{L}$, the first-order condition for $x(\ell)$ is

$$(4) \quad \frac{dEU}{dx(\ell)} = -\frac{d\pi}{dx(\ell)}\cdot\bar{u}' + pf(\ell)u'(w - \pi - \ell + x(\ell) - c) = 0,$$

where $\bar{u}'$ is the expected marginal utility of wealth. Determining $d\pi/dx(\ell)$ from (2), this condition reduces to

$$(5) \quad u'(w - \pi - \ell + x(\ell) - c) = \bar{u}'.$$

That is, the level of coverage should equate the marginal utility of wealth when the loss is demonstrated with the expected marginal utility of wealth. Observe that expression (5) implies that $x(\ell)$ equals ℓ plus a constant. In particular, it can be shown that $x(\ell) = \ell + c$.[7] Similar analysis indicates

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individuals receives less from the insurer, so the insurance premium is lower. Thus, the modified contract, in which individuals with low losses are discouraged from demonstrating their loss, is superior.

[7] Expression (5) indicates that the marginal utility of wealth in states in $\sim\mathcal{L}$ equals $\bar{u}'$. Expression (6), below, indicates that the expected marginal utility of wealth for states in $\mathcal{L}$ also equals $\bar{u}'$. Therefore, the marginal utility of wealth in states without a loss, $u'(w - \pi)$, also must equal $\bar{u}'$. Thus, (5) implies that $-\ell + x(\ell) - c = 0$. (Note that if c were borne by the insurance company, $x(\ell)$ would be lower by c and expected utility would be

that optimal coverage when the amount of the loss is not demonstrated is determined by the condition

(6) $\bar{u}'_{\mathcal{L}} = \bar{u}'$,

where $\bar{u}'_{\mathcal{L}}$ is the expected marginal utility of wealth for states in which there is a loss the amount of which is not demonstrated.[8]

Second, it can be shown that the optimal, incentive compatible contract will provide the level of coverage given by (5) for all losses that *optimally* and feasibly are demonstrated and the level of coverage given by (6) for all other losses, ***regardless of whether they are demonstrated***. The only reason to deviate from the coverages given by (5) for demonstrated losses and (6) for others would be to affect individuals' incentives to demonstrate losses. If, for some ℓ, individuals' incentives are excessive -- i.e., it is optimal for ℓ not to be demonstrated but (3) holds when $x(\ell)$ and x are given by (5) and (6) -- the contract may simply specify that $x(\ell) = x$ rather than the value given by (5). Then, (3) clearly is not satisfied, as individuals would not spend c to receive the same coverage in any event. Moreover, coverage of x is optimal given that the loss is not demonstrated. If, for some ℓ, individuals incentives are inadequate when coverage is given by (5) and (6), (3) indicates that $x(\ell) - c < x$, or $\ell < x$ (recalling that $x(\ell) = \ell + c$). Such an individual is overinsured for the loss when it is not demonstrated. But there is no feasible way to overcome this problem without reducing expected utility, because raising $x(\ell)$ to induce demonstration does not avoid the overinsurance problem and reducing x to induce demonstration decreases welfare for those who continue not to demonstrate their losses while also reducing welfare when individuals are induced to demonstrate their losses due to incurring the demonstration cost.[9] Thus, the optimal, incentive compatible contract indeed

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unaffected. Who bears c, therefore, is relevant only to incentives to demonstrate ℓ.)

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$$\bar{u}'_{\mathcal{L}} = \frac{\int_{\mathcal{L}} u'(w - \pi - \ell + x)f(\ell)d\ell}{\int_{\mathcal{L}} f(\ell)d\ell}.$$

provides coverage of x given by (6) for those who do not demonstrate their losses.

Third, it can be established that the optimal contract involves individuals demonstrating their losses if and only if they exceed a critical value, $\hat{\ell}$. The only losses that might optimally be demonstrated are those in the range $\ell \geq x$, as the incentive compatibility constraint requires that $x(\ell) - c \geq x$ and (5) implies that $x(\ell) = \ell + c$. If it is optimal for any such loss to be demonstrated, moreover, it must be optimal for all higher ℓ to be demonstrated, because the value of full coverage for losses (rather than coverage of x) is greater the higher is the loss.

To make the argument formally and to derive the condition for $\hat{\ell}$, consider whether expected utility (1) increases when moving some ℓ from $\mathcal{L}$ to $\sim\mathcal{L}$ -- that is, from demonstrating an ℓ that is not demonstrated. Substituting for π from (2) and using the fact that x is set optimally (6), the effect on expected utility is:

$$(7)\quad pf(\ell)[u(w - \pi - \ell + x(\ell) - c) - u(w - \pi - \ell + x) - (x(\ell) - x)\bar{u}'].$$

The first two terms in brackets indicate the change in utility when individuals with losses of ℓ demonstrate their losses and the third term is the change in the insurance premium, weighted by the expected marginal utility of income. Recalling from (5) that $x(\ell) = \ell + c$, it follows that the derivative of the bracketed expression in (7) with respect to ℓ is

$$(8)\quad u'(w - \pi - \ell + x) - \bar{u}'.$$

Moreover, (5) and (6) imply that $\bar{u}' = u'(w - \pi)$ -- this is proved in note 7. Therefore, when $\ell > x$, the bracketed expression in (7) is increasing in ℓ. And, as previously noted, the only losses it might be optimal and feasible to

[9] More precisely, if one raises $x(\ell)$, the individual who demonstrates ℓ to receive the now higher $x(\ell)$, which cannot be less than x + c, is overcompensated as much or more than when receiving coverage of x, and the insurance premium would be higher as well. If one lowers x, welfare is reduced for those who continue not to demonstrate their losses. In addition, when individuals with losses of ℓ are just induced to demonstrate ℓ -- when (3) holds as an equality -- welfare is further reduced, as such individuals have the same wealth as when their loss is not demonstrated, but the insurance premium must be higher (because c is spent and is covered).

demonstrate are those such that $\ell \geq x$. Thus, if (7) is positive for some ℓ that is demonstrated, it must be positive for any higher loss. In summary, the optimal contract involves losses being demonstrated whenever $\ell > \hat{\ell}$, where $\hat{\ell}$ is the value of ℓ for which expression (7) equals zero and $x(\hat{\ell}) - c \geq x$ (equivalently, $\hat{\ell} \geq x$).[10]

Finally, $x(\hat{\ell}) - c > x$ (i.e., $\hat{\ell} > x$), because the third term of (7) is negative, so the first two terms together must be positive if (7) is to equal zero. This means that there is a nonempty set of losses, $\ell \in [x, \hat{\ell})$, that individuals would have an incentive to demonstrate if $x(\ell)$ were given by (5), but it is optimal that they not be demonstrated, so the optimal $x(\ell)$ for such losses equals x, given by (6).

This establishes:

Proposition 2. The optimal insurance contract is as follows:

a. *for all $\ell > \hat{\ell}$, coverage is $x(\ell) = \ell + c$;*
b. *for all $\ell \leq \hat{\ell}$, coverage is x, determined implicitly by (6);*
c. *$\hat{\ell}$ is the value of ℓ such that (7) equals zero and $\hat{\ell} > x$.*[11]

Remark: Observe that the optimal contract characterized in Proposition 2 involves a function $x(\ell)$ that is discontinuous: it equals x for $\ell \leq \hat{\ell}$ and a value exceeding $x + c$ for all higher ℓ. This is consistent with Proposition 1's demonstration that it is not optimal for a contract to have $x(\ell)$ continuously increasing in ℓ.

Note that, ideally, it would be desirable for low values of ℓ to be demonstrated. In particular, there exists a critical value of ℓ that is less

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10 The continuity of $u(\cdot)$ and $x(\ell)$ implies that there exists an $\ell \geq x$ such that (7) equals zero, unless either (7) is negative at $\ell = w$ -- i.e., demonstration is never desirable -- in which case one can let $\hat{\ell} = w$, or (7) is positive for all ℓ in the optimal scheme -- i.e., it is optimal for all ℓ to be demonstrated. But a contract in which all ℓ are demonstrated cannot be optimal, because it is dominated by one in which $x = x(0) = c$ and individuals for whom $\ell < c$ do not demonstrate their ℓ. Such a contract obviously is feasible, as individuals who demonstrate such ℓ can be given coverage of $x(\ell) = x = c$. In states with such ℓ, individuals wealth exceeds that under the contract involving ℓ always being demonstrated. (For the latter contract, coverage is $\ell + c$, but individuals spend c, leaving them with a net of ℓ.) Moreover, the insurance premium is lower under the alternative contract.

11 Recall from note 10 that if (7) is negative throughout the relevant range, $\hat{\ell}$ can be taken to equal w.

than x - c such that (7) equals zero, and it would increase welfare if all lower values of ℓ were demonstrated.[12] The preceding analysis shows, however, that there is no incentive compatible and desirable manner to induce individuals to demonstrate low losses. There remains the option of demonstrating all losses.[13] In fact, the insurance company may have an incentive to do this if permitted, even though it would not be optimal.

Proposition 3. If the optimal contract in Proposition 2 is modified to allow the insurance company to require that losses be demonstrated when individuals do not choose to do so, with coverage of $x(\ell) = \ell + c$ if losses are thus demonstrated, then the insurance company may have an excessive incentive to demonstrate losses.

Proof: The insurance company has an incentive to require that ℓ be demonstrated if the resulting expected payments to individuals who do not choose to demonstrate ℓ (the mean of $x(\ell)$ over the set $\mathcal{L}$) is less than x.[14] An example in the footnote indicates that this incentive may exist.[15] When it

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12 When $\ell < x$, (8) indicates that the bracketed expression in (7) is decreasing in ℓ. And when $\ell < x - c$, the third term is positive, so there will exist a critical value of ℓ for which the first two terms are negative and (7) equals zero (unless the expression is negative throughout the interval $[0, x - c]$, in which case it would not be desirable to demonstrate any low losses).

13 The demonstration of all ℓ could be accomplished either by inducing all individuals to demonstrate ℓ, as by setting $x \leq 0$ and $x(\ell) = \ell + c$, or by having the contract specify that ℓ be demonstrated in all cases (if the insurance company can independently spend c to demonstrate ℓ). Observe that the insurance company is unable to act strategically in light of whether individuals choose to demonstrate ℓ. If an individual demonstrates ℓ, there is nothing for the insurance company to do. If an individual does not demonstrate ℓ, the insurance company can do nothing or can demonstrate ℓ itself. The former corresponds to the case in which the insurance company cannot act ex post to demonstrate ℓ and the latter amounts to always demonstrating ℓ.

14 This result does not depend on the fact that, in the model, individuals rather than the insurance company pay c. If the insurance company paid c, the incentive to demonstrate all ℓ would exist when the mean of the $x(\ell)$ over $\mathcal{L}$ was less than x by at least c, but the values of the $x(\ell)$ would be less than otherwise by c (see note 7).

15 Consider the following case (which does not precisely fit the assumptions of the model concerning the form of $u(\cdot)$ and that ℓ is distributed as a continuum, but clearly indicates the existence of more complex examples that would):

$$w = 100$$

$$u'(y) = \begin{cases} \infty, & \text{for } y \in [0,\ 90) \\ 1 - .00001y, & \text{for } y \geq 90 \end{cases}$$

$$p = .01$$

does, Proposition 2 (see note 10) indicates that the incentive is excessive. Q.E.D.

2.4. An Example

To illustrate how the cost of establishing the amount of losses affects the optimal form of an insurance contract, consider the following simple example. Individuals have a 1% chance of suffering a loss. If they suffer a loss, it has an equal probability of being $1000 or $3000. Individuals have constant-absolute-risk-aversion utility functions of the form $u(y) = 1 - e^{-\eta y}$, where η is the coefficient of risk aversion. The discussion will consider cases in which η is .0001 and .0005 (corresponding to an individual being indifferent between a gamble involving an equal probability of gaining and losing $1000 and suffering a certain loss of $50 and $241 respectively).

If the contract takes the simple form in which individuals receive optimal coverage taking as given whether the loss is demonstrated, coverage would be $1000 for those who are silent and $3000 + c for those who spend c to demonstrate a loss of $3000. If the contract forbids individuals from demonstrating the amount of their loss (i.e., if they receive the optimal amount for those who are silent even if they demonstrate the high loss), all individuals who suffer a loss (whether $1000 or $3000) would receive coverage of $2050 when η = .0001 and $2240 when η = .0005. A third option to be considered is that individuals do not to purchase any insurance.

For the case in which η = .0001, individuals would prefer the contract in which the high loss is demonstrated to that in which it is not as long as the

$$\ell = \begin{cases} 0, \text{ with probability } .5 \\ 100, \text{ with probability } .5 \end{cases}$$

$$c = 10$$

It is apparent that the optimal scheme if the insurance company is not permitted to require demonstration of ℓ involves some x in the interval [90, 100) and the loss never being demonstrated. (If the loss is demonstrated, $x(0) = 10$ and $x(100) = 110$.) The insurance company, however, would have an incentive to require that ℓ be demonstrated, for the expected insurance payment when ℓ is demonstrated is 60, while the payment when ℓ is not demonstrated is at least 90. (If the insurance company must pay the cost of 10, the $x(\ell)$ would each be lower by 10 -- see note 7 -- and the incentive would be the same.)

cost does not exceed \$100. That is, when the cost of demonstrating a high loss exceeds \$100, the optimal form of the contract involves individuals being deterred from demonstrating that their loss is high (with the result that they are undercompensated, and that since the same coverage applies to high and low losses, individuals with a low loss are overcompensated). In addition, a contract in which high losses are demonstrated is dominated by no insurance coverage at all when the cost of demonstration exceeds 546. (No insurance never dominates the policy in which high losses are not demonstrated, because no administrative cost is incurred under such a policy.)

For the case in which $\eta = .0005$, individuals would prefer the contract in which the high loss is demonstrated to that in which it is not when the cost does not exceed \$485. In addition, a contract in which high losses are demonstrated is dominated by no insurance coverage at all only when the cost of demonstration exceeds \$4179.

Further analysis reveals, as one would expect, that allowing demonstration of high losses is more likely to be desirable (i.e., remains preferable for higher levels of the demonstration cost) the greater is individuals' risk aversion (and thus the more valuable is finely tuned insurance coverage), and the greater is the range of possible losses.[16] (When there are more than two possible levels of loss, the optimal contract, recall, generally involves demonstration of the highest losses but not others.)

3. Discussion

Existing Insurance Arrangements. The main result in this model of insurance claims is that an optimal policy involves insured individuals being entitled to a payment after an initial determination, while providing them with the opportunity to demonstrate that their losses are significantly higher. Interpreted more broadly, an insurance claims process would have

[16] Increasing the magnitude of the losses, keeping their dispersion unchanged, need not affect the relative desirability of demonstrating high losses, because the amount paid to those who do not demonstrate their losses increases by the amount of any upward shift in the amount of the losses. Of course, if losses are greater, it is more likely that a contract that allows excessive demonstration of losses will be preferred to no insurance at all.

relatively cheap initial assessments, with the option of more elaborate consideration prompted by individual appeals. At the same time, appeals should not freely be permitted for all individuals who may be entitled in principle to coverage exceeding their initial awards, even if they bear the full costs of such appeals, because the ex post private gain exceeds the ex ante benefit of improved risk allocation.

Private insurance policies appear to have at least some of these properties. It is common for claims to be established initially through inexpensive procedures (when compared, say, to tort suits when the extent of damages is contested). Individuals, then, are often permitted an appeal, perhaps to an arbitrator who will make a binding determination. What is less certain is how coverage is determined at each stage. The analysis here suggests two features. First, the coverage awarded at the initial stage should be the optimal coverage for those who will not appeal (which cannot be observed at the time of the determination); thus, such payments should be less than what would be optimal if no appeal were permitted. Second, when there is an appeal, individuals should receive higher payments only if their demonstrated loss exceeds the initial award by a nontrivial, and perhaps substantial, amount, so as to avoid what would otherwise be an excessive incentive to appeal claims. Neither feature may be explicit in existing insurance arrangements, although it is possible that claims adjusters and arbitrators behave in this manner in any event. If these features are not present in practice, expenditures to establish claims are likely to be excessive.[17]

Procedures for public insurance programs, such as Social Security Disability Insurance, have been quite controversial. In particular, unsuccessful claimants have challenged arrangements in court on the grounds that insufficiently elaborate procedures are provided.[18] While the present

17 The analysis here proves that incentives are excessive even when the claimant ex post bears all the costs of demonstrating claims. If some of the costs are borne by the insurer, the incentive is even more excessive.

18 See, e.g., Mathews v. Eldridge, 424 U.S. 319 (1976). The model here concerned establishing the amount of a loss, but the analysis is obviously relevant to determining the existence of a loss, which is often the contested

analysis does not indicate how much accuracy is best or how it can best be produced, it does lead one to expect that, even in an optimally designed system, there will be individuals with valid claims who would wish the opportunity to demonstrate their validity but who would not be induced or permitted to do so.

Prior Literature on Optimal Insurance Contracts. Previous analysis of administrative costs (loading) and optimal insurance contracts has focused on how a given cost structure affects optimal coverage, rather than on the source of administrative costs and the problem of asymmetric information concerning losses. See Gollier (1987), Raviv (1979), Shavell (1978).[19] In the present model, unlike others, costs arise from establishing the amount of claims, and the problem of an optimal contract is complicated by the effect of coverage provisions on the incentive to incur these costs. Also note that the resulting cost function in the optimal contract derived here is discontinuous: costs are zero for low losses and a positive constant for high losses.

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issue. If coverage is constrained to be all or nothing, there might be an initial determination, with denials for what appear to be weak claims. Individuals knowing that they have stronger claims would then appeal. But there would be individuals with only slightly stronger claims who would have an incentive to demonstrate this if they were permitted a recovery but who might optimally be discouraged or prevented from pursuing their claims due to the cost. Note that in an all-or-nothing system, the incentive of individuals with actual claims near the eligibility boundary will be particularly great, far exceeding the social benefit of eligibility if indeed the boundary has been set appropriately.

[19] This work determines optimal coverage when there are fixed costs for obtaining coverage or for all claims, or where costs are a continuous function of the amount of the insurance payment. (Note 5 discusses claim processing costs further.)

References

Arrow, Kenneth J., "Uncertainty and the Welfare Economics of Medical Care," *American Economic Review*, December 1963, *53*, 941-973.

Gollier, Christian, "Pareto-optimal Risk Sharing with Fixed Costs per Claim," *Scandinavian Actuarial Journal*, 1987, *13*, 62-73.

Mookherjee, Dilip and Ivan Png, "Optimal Auditing, Insurance, and Redistribution," *Quarterly Journal of Economics*, May 1989, *104*, 399-415.

Myerson, Roger, "Incentive Compatibility and the Bargaining Problem," *Econometrica*, 1979, *47*, 61-74

Raviv, Artur, "The Design of an Optimal Insurance Policy," *American Economic Review*, March 1979, *69*, 84-96.

Reinganum, Jennifer F. and Louis L. Wilde, "Income Tax Compliance in a Principal-Agent Framework," *Journal of Public Economics*, 1985, *26*, 1-18.

Shavell, Steven, "Theoretical Issues in Medical Malpractice," in Simon Rottenberg, ed., *The Economics of Medical Malpractice* (Washington: American Enterprise Institute), 1978, 35-64.

__________, "On Moral Hazard and Insurance," *Quarterly Journal of Economics*, February 1979, *93*, 541-562.

Social Security Administration, Annual Statistical Supplement, *Social Security Bulletin*, 1991.

Spier, Kathryn E., "Incomplete Contracts and Signalling," *Rand Journal of Economics*, Autumn 1992, *23*, 432-443.

Townsend, Robert M., "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, 1979, *21*, 265-293.