On a Comprehensive Set of the Damage Measures Inducing Optimality and Voluntary Participation*

Iljoong Kim, Jaehong Kim*** and Hyunseok Kim******

<ABSTRACT>

We design a damage measure through which courts can elicit not only socially optimal behavior but also voluntary participation from contracting parties. Although a rich body of existing literature examined the optimality of specific damage measures, a universal testing standard has yet to be offered. Further, existing studies tend not to consider explicitly voluntary participation conditions. We attempt to fill the gap by a new measure, i.e., 'optimal damages' (OD) satisfying the full list of such conditions. Constituting a comprehensive set of optimal damage measures, OD is subsequently utilized to re-examine, in a fairly unified manner, the optimality of the measures widely discussed so far; some results contrary to the prevailing understanding are confirmed. OD can also be used to analyze new types of measures, and in fact allows for portraying numerous damage measures in terms of systematic 'set-relationships.' Finally, from analytical and practical perspectives, we highlight the potential merits that OD-related tasks will bring forth for ensuing studies in this area of substantive law.

***JEL* Classification**: K12, K19

Keywords: Contracts, Optimal Damages, Perfect Expectation Damages, Constant Damages, Efficient Breach, Overreliance, Incentive Compatibility, Voluntary Participation, Performance Cost

*. (Acknowledgement to be added later)

**. (The corresponding author)
Department of Economics, SungKyunKwan University (SKKU),
3-53 Myeongnyun-Dong, Jongno-Gu, Seoul, 110-745, South Korea.
E-mail: ijkim@skku.edu Tel: +82-2-760-0488 Fax: +82-2-760-0946.

***. School of Management and Economics, Handong University,
Pohang City, Kyungbuk, 791-708, South Korea.
E-mail: jhong@handong.edu

****. Department of Economics, SungKyunKwan University (SKKU),
E-mail: kevin82@skku.edu

On a Comprehensive Set of the Damage Measures Inducing Optimality and Voluntary Participation

I. Introduction

This paper, by way of synthesis, probes on generic conditions for the optimal damage measure in contracts, and subsequently, based on those conditions, examines the efficiency of the various damage schemes that primarily have been discussed in the existing literature. Contracts are often broken because of uncertain contingency, for instance, the prohibitively large costs of implementing the contract as promised. Thus, varying assessments across parties, regarding who is responsible for the breach and how much damages should be paid to the victim, will inevitably bring the court as an umpire into the game situation.

For a clearer understanding of the issue, consider a standard simple two-person three-stage contract game with uncertainty. At the first stage, parties simultaneously decide whether or not to sign the contract. At the second stage, if they have agreed to the contract, the promisee deposits some investment-purpose money to the promisor, and more importantly, chooses a reliance level. Following extant literature, representatively in the manner of Kornhauser (1983, p. 693), we assume that a higher level of reliance entails an additional expenditure but brings greater returns to the promisee in case the contract is performed. At the third stage, uncertainty regarding the cost of implementation is resolved, and the promisor decides to either perform the contract as promised or breach. Thus, either the parties divide returns from the investment according to the pre-agreed sharing rule if the contract is performed, or the promisor pays damages to the promisee in the case of default. The fundamental question then is whether the court legally can design some default measures that will elicit the parties to replicate voluntarily the socially optimal contract. We might expect that under well-designed damages, the promisor will choose to breach if and only if breaching is socially desirable, and the promisee will also choose optimal level of reliance.

Legal scholars and economists have long been studying about optimal damage measures, and have developed several convincing answers to this vexing question. First of all, 'expectation damages' (**ED**, hereafter), which are the most popular in reality,[1] can induce optimal behavior of the promisor, but not that of the promisee.[2] Secondly, 'constant damages' (**CD**, hereafter) guarantee optimal reliance from the promisee, but may not induce optimal behavior from the promisor.[3] Thirdly, the combination of these two mechanisms, that is, fixing an amount of damages for ED for the optimal reliance level, which is known also as 'perfect expectation damages' (**PED**, hereafter), will induce both optimal reliance and optimal breach.[4] In addition, various other damage

---

[1] The legal definition of ED is "*the kind of gains he would have made if the contract had been performed*" (Dobbs, 2001, p. 752). For common uses of ED, refer, for instance, the Uniform Commercial Code §1-305 (2005) or Restatement (Second) of Contracts §344 (1981) for the US and the Commission on European Contract Law (2000, p. 438) for Europe.

[2] This overreliance problem was recognized initially by Fuller and Purdue (1936), formally proven by Shavell (1980, pp. 478-479), and further explored in Cooter and Eisenberg (1985, p. 1466), Cooter (1985, pp. 13-14), and Cooter and Ulen (2008, pp. 214-215) to name a few.

[3] CD is occasionally called 'reliance-invariant damages.' For its economic characteristics in inducing reliance, refer to Shavell (1980, pp. 480-483), Rogerson (1984, pp. 46-47), Cooter (1985, pp. 14-19), Chung (1992, p. 291), Craswell (1989, p. 377), Cooter and Eisenberg (1985, p. 1467), among numerous others. In contrast, Shavell (1980, pp. 482-483) pointed out that two variants of CD, the restitution measure and no damages, cause breaching more frequently than ED and reliance damages.

[4] Although we are confident that our use of the terminology, PED, is legitimate, it appears that its formal definition has yet to be completely established in the literature. We later report our brief survey that bears upon this issue.

measures, such as reliance damages, restitution, liquidated damages, etc., have been examined regarding their optimality properties.[5]

Nonetheless, these existing studies might be incomplete and somewhat insufficient. First, they are incomplete in the sense that they do not provide the whole set of conditions required for the optimality of a damage measure; rather, they examine and/or compare the optimality natures of well-known or particularly designed measures. Second, they may be insufficient because they tend not (at least explicitly) to consider 'voluntary participation conditions' for contracting parties. Economic efficiency dictates that a contract be implemented if and only if it generates a positive total surplus. However, its social desirability by no means guarantees that parties will *voluntarily* join the contract. It is because there might exist a potential conflict regarding individual *vis-à-vis* collective rationality as in many other imperfect-competition situations or simply game environments. As will be proven later, for instance, PED, which is known as an optimal damage measure, might not be implemented because it fails to induce the promisor to sign the contract from the beginning. Therefore, it is imperative to check not only incentive compatibility but also the conditions for voluntary participation for meaningful optimality of a damage measure.

The main purposes of this paper are two-fold. First, we derive 'full conditions' for optimal damage measures, which would guarantee not only optimal reliance and breach but also voluntary participation in a contract that will generate a positive total surplus if

---

[5] For the literature in this line of studies, see generally Rogerson (1984), Cooter (1985), Cooter and Eisenberg (1985), Craswell (1989), Leitzel (1989), Chung (1992), Spier and Whinston (1995), Bebchuk and Png (1999), Edlin and Schwartz (2003), Sloof et al. (2003, 2006), Katz (2005). All these investigated the problems of sub-optimal reliance (e.g., overreliance under ED) with additional modeling assumptions including a third-party offer, a renegotiation option, a mutually competitive relationship, etc.

implemented. Second, in a unified manner based strictly on the full conditions, we re-examine the optimality of five damage measures that are relatively well known in the literature: ED, CD, PED, restitution (and no damages), and finally, reliance damages.

For these purposes, the paper is laid out as follows. In Section II, we present a contracting model that is simple but fairly useful especially from a practical point of view. We then outline existing propositions regarding optimal damage measures and motivate our work. Much work done in relation to PED and a need for further elaboration will be highlighted. In Section III, we derive the comprehensive set of conditions for an optimal damage measure, viz., the 'optimal damages' (**OD**, hereafter). Naturally, we start by identifying the social-optimum conditions, through which we can present intriguing findings associated with extant legal doctrines such as 'foreseeability.' We next formally derive the incentive compatibility and voluntary participation conditions of both parties for OD; their applicability will be addressed. In Section IV, the optimality of the five aforementioned measures is revisited; we check whether they satisfy the conditions of OD or not, and why. We highlight a systematic nature embedded in such investigating task and the advantages that it will bring about for ensuing studies in this area of substantive law. We conclude the paper in Section V by offering major implications and potentially lucrative extensions for the future.

II. Literature and Major Motivations

1. A Review and Potential Extensions of the Literature

1) Basic Setting for Discussions

For analyzing an optimal contracting mechanism under perfect information across the contracting parties and the court, consider a simple two-person three-stage contract game with uncertainty. At the first stage, two risk-neutral[6] parties simultaneously decide whether to sign the contract or not. If they voluntarily join the contract, at the second stage, the promisee (**P1**), upon depositing an amount, i, with the promisor (**P2**), chooses a reliance level. Purely for demonstrative convenience, $i = 0$ is assumed without loss of any generality. There exist two levels of **P1**'s reliance, i.e., 'Low' (**L**) and 'High' (**H**). For **H**, **P1** has to spend additionally a reliance expenditure of $r\,(>0)$, but derives a net benefit of $b\,(>0)$ if the contract is performed. (For **L**, the reliance expenditure is assumed to be 0.)[7]

At the third stage, **P2**'s performance cost, θ, is realized. θ takes a value of 0 with probability $p\,(0 < p < 1)$ and $h\,(>0)$ with probability $(1-p)$.[8] We assume that p is known to the contracting parties and the court.[9] Upon the realization of θ,

[6] We use the risk-neutrality assumption following Shavell (1980). See, for example, Kornhauser (1983), Polinsky (1983), and Shavell (1984) for the risk-aversion case.

[7] A typical example of **H**, r, and b includes a newly-constructed hotel owner's big promotion plan, in anticipation of the completion of construction as contracted, for selling rooms and offering various gifts to guests in the opening week. Further, this framework can be applied readily to the cases in which an inadequate level of precaution results in losses to the promisee. The cost savings due to under-precaution would correspond to b, and the expected value of losses due to under-precaution to r, respectively. Actual court cases are introduced later.

[8] Several representative studies in earlier years adopted the exogeneity assumption concerning the performance cost such as in Shavell (1980, p. 473), Kornhauser (1983, p. 694), or Rogerson (1984, p. 42). The current model also has adopted a dichotomous assumption about the θ-related contingency, which is simple but has some merits to a nontrivial extent as discussed below.

[9] Under perfect information, the two parties, in principle, might be able to figure out optimal damages by themselves without the court's involvement. However, in this paper the court will be portrayed as the one who designs the measures in order not only to provide *ex ante*, but to enforce later, a 'default (or baseline) rule' for numerous contract disputes breaking out in reality. Providing a default rule will ameliorate '*the constraints that transaction costs place on the form of contracts*' as claimed by Rogerson (1984, p. 40). See also Polinsky (1983, p. 444). Further, even if contracting parties can form a contract, its successful

P2 decides to either perform (**P**) or breach (**B**).[10] In case of **P**, the net surplus produced by the performance, $\pi\,(>0)$, is distributed by the rule predetermined at the first stage: $k\pi$ to **P1** and $(1-k)\pi$ to **P2** ($0 < k < 1$). In contrast, **P2** is obliged to pay **P1** a certain amount of damages determined by the court *a priori* in case of **B**. <Table 1> summarizes the payoffs to **P1** and **P2** under this simple contracting game.

<Table 1> A Simple Contracting Game with the Court's Damages

		Promisor (**P2**)		
		P ($\theta = 0$)	**P** ($\theta = h$)	**B**
Promisee (**P1**)	**L**	$(1-k)\pi$ $k\pi$	$(1-k)\pi - h$ $k\pi$	$-x_l$ x_l
	H	$(1-k)\pi$ $k\pi + b$	$(1-k)\pi - h$ $k\pi + b$	$-x_h$ $x_h - r$

In <Table 1> we allow the amount of damages to vary across the reliance levels, although they are assumed to be independent of the promisor's performance cost (i.e., θ-invariant). Let us term as $x_l\,(\geq 0)$ and $x_h\,(\geq 0)$ as the amounts of damages corresponding to **L** and **H**, respectively.

The model in <Table 1> is dichotomous both in the reliance level and the

---

enforcement might not be warranted due to imperfect verification or lack of enforceability and so should lean on the court ultimately. Apparently, the court can resolve such disputes more easily if it already designed the default damages rule. We believe that many of existing models also have been discussed in this spirit, for instance, in Cooter (1985), Leitzel (1989), Bebchuk and Png (1999), etc.

[10] One can easily find these three stages as a very popular sequence of contracting. The identical sequence was used, for instance, in Shavell (1980), Leitzel (1989), and Sloof et al. (2003), while very similar sequences with minor modifications were used in many other studies.

performance cost.[11] Despite its simplistic nature, this dichotomy model has merits. First, from a theoretical aspect, this model makes it more tractable to convey the major implications without losing the critical essences that could be explained through a continuous model. Also, the **H**/**L** dichotomy leads to two distinct levels of optimal reliance, and thus allows us to explore more tangibly the mutual relationship between the entire intervals of x_l and x_h in equilibrium. In addition, the $0/h$ dichotomy in θ enables the promisor's performance/default decision to manifest itself readily.[12]

Second and more importantly, from a practical perspective, this simple setting can be more useful for the court's decision. We witness that legal disputes *per se* frequently are dichotomous such as whether the promisor and the promisee indeed '(efficiently) breached' and 'overrelied,' respectively. Therefore, the court's scrutiny is usually concerned with *whether or not* rather than *how much*. In passing, we observe that especially in overreliance-defense cases, the court's inquiry centers upon 'a specific reliance (or expenditure)' in question and ultimately seeks a Yes/No answer for that specific reliance.[13] We thus modestly submit that the current model will be beneficial,

---

[11] They are mostly continuous in the literature. For example, reliance is continuous in Cooter (1985, pp. 15-19), Bebchuk and Png (1999), and Sloof et al. (2003, 2006), while both are assumed to be continuous in Shavell (1980), Leitzel (1989), Craswell (1989), Chung (1992), and Spier and Whinston (1995).

[12] As will be explained in considerable detail, <Table 1> effectively can become a beneficial 2×2 matrix due mainly to the fact that **P** is efficient for $\theta = 0$, while **B** is efficient for $\theta = h$. For this, we will need ***Assumption 1*** in Section III.

[13] For exemplary court cases, refer to *Hadley v. Baxendale* [9Exch. 341, 156 Eng. Rep. 145 (1854)], *Victoria Laundry (Windsor) Ltd v. Newman Industries Ltd* [2 K.B. 528 (1949)], *Security Stove & Mfg. Co. v. American Ry. Express Co.* [App. 175, 51 S.W.2d 572 (1932)], and *Anglia Television Ltd. v. Reed* [1 Q.B. 60 (C.A. 1972)] among numerous others across jurisdictions.

as a workable guideline, at least for the purpose of delivering critical implications and actual assistance to courts in search of the *whether or not* answers.[14]

2) Existing Scrutiny of the Optimal Schemes Concerning PED

The field of law and economics has endeavored to find damage measures which simultaneously would align the incentives of the promisor and the promisee in an efficient manner, i.e., warranting the optimality of 'bilateral precaution' highlighted in Cooter (1985, p. 4). One proposition established definitely so far is: if the court has perfect information, it can always implement a measure which leads to optimal contracts. This proposition intuitively makes sense because the court, being informed of relevant information and calculating optimal solutions with respect to the reliance and performance/breach decisions, just has to impose 'severe punishment' *à la* Shavell (1980, p. 483, fn 40) to a party who has deviated from such optimal behavior.

Based on this premise, scholars focused on 'expectation damages' (ED) finding that ED cannot warrant the optimal behavior of the promisee in spite of its property of aligning the promisor's behavior.[15] Subsequently, along with the discovery that 'constant damages' (CD) deter overreliance by the promisee, researchers came to a

[14] We also observe that even if multiple activities (expenditures) come under dispute, the court tends to determine 'for each one' whether it is overreliance or not; it is difficult to locate multiple such activities along a uniform spectrum of reliance due mainly to their heterogeneous nature. The court hardly derives an optimal level of reliance in judgments. We find similar practices in tort disputes. For instance, in applying the well-known Hand Formula for typical negligence-related cases, the court inquires *whether* the injurer's 'specific precaution (or negligence)' level can be justified rather than *how much precaution* would have been optimal. In principle, a continuous model in reliance and θ obviously will require courts to possess far more information.

[15] As is well known, the desirable characteristic of ED to induce the promisor's efficient breach was stated first in the 1972 edition of Posner (2007, 7th ed.), and formally proven in Shavell (1980, p. 478).

recognition that a CD scheme utilizing an ED amount that is calculated at the optimal reliance level can induce the optimal behaviors of both parties.

As mentioned in the Introduction, this powerful scheme has often been called as ‘perfect expectation damages’ (PED) about which a brief chronological survey appears to be useful. To the best of the authors’ knowledge, Cooter (1985, pp. 14-19) and Cooter and Eisenberg (1985, pp. 1465-1468) formulated the PED concept as it is currently understood (i.e., the combination of CD and ED at optimal reliance). Interestingly enough, these authors did not explicitly term the optimal scheme as PED. In contrast, it seems that around that time the meaning of ‘perfect’ in PED was, in all likelihood, merely ‘full’ according to, for instance, Cooter (1985, p. 12, fn 29). In any case, the optimality feature stemming from the combination was simply mentioned or alternatively proven in subsequent literature such as Craswell (1989), Chung (1992), Spier and Whinston (1995), and Bebchuk and Png (1999), etc.[16] Considering all these, in this paper we take the following explicit definition of PED, for instance, in Cooter and Ulen (2008, p. 216, bold added): “*By definition, perfect expectation damages equal the damages needed to restore the promisee* ***who relied optimally*** *to the position that he would have enjoyed if the promise had been kept.*”

[16] For example, Craswell (1989, p. 377) mentioned PED as a scheme that satisfies both optimal reliance and performance/breach, and cited Cooter (1985) as the major reference. Leitzel (1989, p. 98) also showed that PED leads to optimal reliance and indicated Cooter and Eisenberg (1985, p. 1467) and Cooter and Ulen (1988, pp. 304-316) as the main sources of the idea. In Chung (1992, p. 291), PED was treated as a variant of CD, and Cooter (1985), Craswell (1989), and Rogerson (1984) were cited as the existing literature. Spier and Whinston (1995, p. 182) called PED the ‘efficient expectation damages’ and explained that its efficient outcome had already been proven in Cooter and Eisenberg (1985), Craswell (1989), Leitzel (1989), and Chung (1992). Bebchuk and Png (1999, p. 328) introduced the ‘hypothetical expectation measure’ and its optimality characteristics, citing Cooter (1985) and Spier and Whinston (1995) as the sources.

To emphasize, the main tenet underlying PED is to induce optimality from both contracting parties. The addition of the CD feature of efficient reliance to the widely-used ED, which aligns the behavior of only the promisor, yields overall optimality; in this regard, it seems fairly appropriate to call it '*Perfect ED*.' Of course, in terms of the contracting sequence in <Table 1>, if the promisor did not choose efficient behavior, it will not be possible to induce the promisee's optimal reliance either. However, as will be reconfirmed below, the promisor always chooses optimal behavior in equilibrium, in turn preventing the promisee from deviating from the optimal reliance decision.

2. Voluntary Participation and the Entire Set of Optimal Damages

This paper starts from the claim that although PED is an optimal damage measure, such a 'contract' *per se* is not always warranted *ex ante*. In spite of an overall positive surplus in total, if the expected payoff from optimal behavior of either the promisor or the promisee is negative, the contract will not be made in the first place. This possibility certainly exists for PED.

In the contracting model as in <Table 1>, **B** is socially efficient if the cost of **P**, θ, is realized at a prohibitively high level. The promisee, on the other hand, is committed efficiently to a high level of reliance, **H**, if the probability of **B** is believed to be low enough. In principle, the strategies of both parties are optimal. Nonetheless, if the contingency results in a prohibitively high θ, the promisor should breach and pay the damages of an ED amount corresponding to **H** under the PED scheme. Even if the possibility of high θ is not high, the expected payoff to the promisor can be negative due to the high damages. Thus, it is rational for the promisor not to join the contract voluntarily *ex ante*. To reiterate, the fundamental reason for this phenomenon stems from the uncertainty related to θ. If θ becomes to be too high, the PED level corresponding to **H** would effectively become 'severe punishment,' in turn preventing the promisor's participation in contracting.[17]

This illustration contradicts the prevailing perception that PED leads to optimality under perfect information. As frequently encountered in many game-theoretic settings, one can describe this situation as a conflict between individual vs. collective rationality. Hence, it is imperative to check both 'incentive compatibility' (**IC**, hereafter) and 'voluntary participation' (**VP**, hereafter) conditions to derive the sufficient and necessary conditions for the 'optimal damages' (OD), viz., x_l and x_h in <Table 1>. Then, OD will represent the broadest set of all optimal damage measures.[18]

Further, this illustration implies a potentially lucrative opportunity to make a contribution to the existing stock of research on optimal damage measures through the *explicit* incorporation of VP conditions in the derivation of the 'full list of the OD criteria.' The derivation of the full list distinguishes this paper from the existing literature to an extent; the former will furnish a comprehensive picture of OD in a way that is completely independent of the specific forms of damage schemes, while the latter

[17] This is clearly different from the 'severe punishment' mentioned in Shavell (1980, p. 483) where the punishment is imposed supposedly on contracting parties who deviated from optimal behavior. The discussion in the text, on the contrary, indicates that the damages under PED in case of optimal reliance might be literally too severe a punishment to the promisor.

[18] It seems that not always have VP conditions been explicitly examined in the literature. Shavell (1980, p. 477) began his analysis with the assumption that VP conditions are fulfilled for both parties. Leitzel (1989, p. 94) considered the VP condition of only the promisee. Spier and Whinston (1995, p. 183), in analyzing liquidated damages, mentioned that "*both parties write a contract that maximizes their expected joint payoff*," but they did not formally treat the VP condition that we are addressing here. There is no discussion of VP conditions in the literature on optimal damages such as Cooter (1985), Craswell (1989), Chung (1992), Bebchuk and Png (1999), etc. To be sure, the VP condition might have been less relevant for specific purposes of some of these studies, for instance, for just comparing efficiency performances of two different damage schemes.

mostly investigated particular damage measures or undertook comparative analyses of these measures.[19] This encompassing nature of OD is also believed to convey well the optimality feature of 'bilateral precaution' emphasized in Cooter (1985). More intriguingly, the full OD conditions can be used to test readily whether a certain damage measure is optimal. OD is expected to play the role of a 'workable formula.'

III. Deriving the Full Conditions for the 'Optimal Damages' (OD)

1. Social Optimum Conditions

This section derives the conditions for x_l and x_h in <Table 1> to be 'optimal damages' (OD), which should then be regarded as the 'most generic scheme.' Of three broad categories of conditions to examine, we first consider the 'social optimum conditions.' We measure the social optimum as the total surplus following, for instance, Rogerson (1984), Cooter (1985), Polinsky (2003), or Cooter and Ulen (2008). A social optimum naturally requires three conditions. First, the promisor's behavior must maximize the total surplus against every possible contingency. Second, the promisee's behavior also must maximize the total expected surplus given the promisor's optimal behavior. Finally, the contract should be implemented if and only if it generates a non-negative total surplus.[20]

Let us first consider the optimal choice of the promisor. If $\theta = 0$ in <Table 1>, **P** yields a greater level of the total surplus than **B** regardless of the promisee's reliance.

---

[19] For instance, Shavell (1980) and Rogerson (1984) investigated the merits and demerits among some measures, while new schemes were explored and their superiority compared in Cooter (1985), Cooter and Eisenberg (1985), Craswell (1989), Leitzel (1989), Chung (1992), and Spier and Whinston (1995).

[20] The contract in question should not be implemented if it produces a negative total surplus in spite of optimal behaviors on the part of each contracting party.

Thus, **P** is the optimal choice in case $\theta = 0$. If $\theta = h$, the optimal choice depends on the scale of h. However, we intend to highlight in this paper the situation of 'efficient breach' in a rather simple manner. Then, it would be appropriate to assume that under a sufficiently high value of h, **B** is optimal 'regardless of' the promisee's reliance: it is assumed that $h > \pi + r + b$ as follows.

Assumption 1. $h > \pi + r + b$. *(The Efficient Breach Condition)*[21]

Of course, with a more technical complication, the following analytic framework to derive OD can, in principle, be applied to situations in which h takes a different value. Next, we consider the promisee's optimal reliance given the promisor's optimal behavior. The choice is made prior to the realization of θ, so the optimal reliance should be made based on the expected total surplus given p. The expected values are $p(\pi) + (1-p)(0)$ and $p(\pi + b) + (1-p)(-r)$ for **L** and **H**, respectively. Let p^* be the level of p that equalizes the two expected values. Therefore, the socially optimal level is **L** if $p \leq p^*$, and **H** if $p > p^*$ where $p^* = r/(r+b)$.[22]

It is worth examining more closely the fact that the optimal reliance depends upon the two parameters, p and p^*. First, the former is the probability governing the lower

---

[21] Under this assumption, the model in <Table 1> can be reduced to a simple 2×2 model: the two breach/performance decisions depending on θ as well as the two optimal reliance levels depending on p. In other words, the contract game in <Table 1> is effectively 'reduced to a 2×2 matrix' consisting of the first and third columns. To be sure, it can actually hold that $h \leq \pi + r + b$. For example, if h is negligible, **P** by the promisor is most likely to be optimal. If h has an intermediate value, we suspect that **B** will be optimal with the promisee's **L**, but **P** will be efficient if **H** has been made. For ease of exposition, nonetheless, we selected a high value of h to focus primarily on efficient breach.

[22] This suggests that the amounts of OD, as well, should be derived separately depending on $p \leq p^*$ or $p > p^*$ because they would have to be subject to what the optimal reliance is after all. This suggestion is reinforced by the assumption that information on these parameters is well known to all.

performance cost. It intuitively makes sense that, *ceteris paribus*, the greater is p, the more likely is **H** to be the optimal choice. Second, note that $p^* = r/(r+b)$ is the inverse of the gross return rate of an additional investment, **H**, to the promisee. It thus follows that **H** is more likely to be socially optimal as the additional investment is predicted to be more lucrative *ceteris paribus* (that is, as p^* becomes smaller). This is also consistent with intuition. To sum up, **H** is socially desirable as the chance of the promisor's performance and the profitability of **H** increase. Of course, in the reverse situation, **L** should be optimal.

Finally, let us examine the condition that both parties should sign for the contract, that is, that the contract generates a positive expected total surplus. It is easy to confirm that, under ***Assumption 1*** and with optimal choices of both parties, the expected total surplus is always non-negative, so that the contract should be implemented.

Proposition 1. *Under* **Assumption 1**, *the socially optimal contract that produces a non-negative expected total surplus is as follows:*

*(i) Promisor: Perform (**P**) if* $\theta = 0$, *and Breach (**B**) if* $\theta = h$,

*(ii) Promisee: Low Reliance (**L**) if* $p \le p^*$, *and High Reliance (**H**) if* $p > p^*$

where $p^* = r/(r+b)$.

The question remains: how to induce the contracting parties to behave as described in ***Proposition 1***. We now turn to this question, i.e., the full conditions of OD.

2. Private Incentives of the Contracting Parties

1) Incentive Compatibility (IC) of the Promisor

The IC condition as indicated in ***Proposition 1*** dictates the following.

When $\theta = 0$, (given **P1**'s **L**) $EU_2(\boldsymbol{P}) = (1-k)\pi \ \ge \ EU_2(\boldsymbol{B}) = -x_l$ and (given **P1**'s **H**) $EU_2\,(\boldsymbol{P}) = (1-k)\pi \;\geq\; EU_2\,(\boldsymbol{B}) = -x_h$.

These are always met because each left-hand side (LHS) is positive and each right-hand side (RHS) is negative. Thus, if $\theta = 0$, the promisor chooses **P** optimally.

When $\theta = h$, (given **P1**'s **L**) $EU_2\,(\boldsymbol{P}) = (1-k)\pi - h \;\leq\; EU_2\,(\boldsymbol{B}) = -x_l$ and

(given **P1**'s **H**) $EU_2\,(\boldsymbol{P}) = (1-k)\pi - h \;\leq\; EU_2\,(\boldsymbol{B}) = -x_h$.

For these two conditions, it should hold that $x_l,\, x_h \;\leq\; h-(1-k)\pi$, the RHS of which reflects the promisor's loss from performance at $\theta = h$.

Lemma 1. *The promisor's IC conditions are the following.*

When $\theta = 0$, *the optimal* ***P*** *is always chosen.*

When $\theta = h$, *the optimal* **B** *is chosen iff* $x_l,\, x_h \;\leq\; h-(1-k)\pi$.

2) Incentive Compatibility (IC) of the Promisee

When $p \;\leq\; p^*$, the expected payoff for **P1**'s **L** is $EU_1(\boldsymbol{L}) = p(k\pi) + (1-p)(x_l)$, and that for **P1**'s **H** is $EU_1(\boldsymbol{H}) = p(k\pi + b) + (1-p)(x_h - r)$. Since the former should be greater than the latter, it holds that $x_h - x_l \leq r - \{p/(1-p)\}b$. By defining $\delta = r - \{p/(1-p)\}b$, the requirement that **P1** choose **L** is $x_h - x_l \;\leq\; \delta$. Likewise, the condition that **P1** chooses **H** optimally when $p > p^*$ is shortened as $x_h - x_l \;\geq\; \delta$.

Lemma 2. *The promisee's IC conditions are as follows (where* $\delta = r - \{p/(1-p)\}b$ *).*

When $p \;\leq\; p^*$, *the optimal* **L** *is chosen iff* $x_h - x_l \;\leq\; \delta$.

When $p > p^*$, *the optimal* **H** *is chosen iff* $x_h - x_l \;\geq\; \delta$.

Note*: The value of* δ *above varies depending on* p. *When* $p \;\leq\; p^*$, $0 \leq \delta < r$

(when $p = p^*$, $\delta = 0$, and when $p = 0$, $\delta = r$). When $p > p^*$, $\delta < 0$.[23]

There is an intriguing aspect in ***Lemma 2***. Define p^1 as the p value that equalizes EU_1 ***(L)*** and EU_1 ***(H)***. Then, $p^1 = (r + x_l - x_h)/(r + b + x_l - x_h)$. We can prove, for instance, that the promisee chooses **L** when $p \le p^1$. According to ***Lemma 2***, when $p \le p^*$, it was required that $x_h - x_l \le r - \{p/(1-p)\}b$ for the optimal choice of **L**. This requirement can be expressed as $p \le (r + x_l - x_h)/(r + b + x_l - x_h)$, in turn proving that the requirement is equivalent to $p \le p^1$. (Likewise, the required condition is transformed to $p > p^1$ when $p > p^*$.) The major implication of this illustration is: optimal reliance indeed can be induced even though the **P1**'s 'private threshold,' p^1, deviates from the 'social threshold,' p^*, defined in ***Proposition 1***.[24]

3) Voluntary Participation (VP) of the Promisee

The VP condition of the promisee requires that the expected payoffs from **L** and **H** be non-negative when $p \le p^*$ and $p > p^*$, respectively. When $p \le p^*$, **P1**'s expected payoff, EU_1***(L)*** defined above, is always non-negative because it is the sum of two positive (non-negative) terms. When $p > p^*$, EU_1***(H)*** is also positive.[25] In

---

[23] If $p \le p^*$, then $p \le r/(r+b)$. Rearranging the derived inequality, we obtain $r - \{p/(1-p)\}b \ge 0$. Since the LHS is identical to δ and always smaller than r, we can get $0 \le \delta < r$. By similar calculation, if $p > p^*$, then $\delta < 0$.

[24] To elaborate, when $p^1 = p^*$, optimal reliance is induced regardless of the distribution of p. When $p \le p^*$, **P1** will choose **L** simply out of self-interest whether $p^1 > p^*$ ($p \le p^* < p^1$) or $p^1 < p^*$ ($p < p^1 < p^*$). A similar argument applies when $p > p^*$. This might indicate a certain level of the court's flexibility in awarding damages in contrast to align **P1**'s reliance incentive.

[25] For EU_1 ***(H)*** $= p(k\pi + b) + (1-p)(x_h - r)$ to be positive, we need $x_h > -\{p/(1-p)\}(k\pi) + \delta$. However, since $p > p^*$, $\delta < 0$. This makes the RHS of the inequality negative. Thus, the condition is always satisfied.

conclusion, the promisee's VP condition for the reduced contract in <Table 1> is always met given that the IC conditions of both parties are fulfilled.

4) Voluntary Participation (VP) of the Promisor

When $p \le p^*$, **P1**, by the IC condition, chooses **L**, but **H** otherwise. **P2**'s expected payoff then is $p(1-k)\pi + (1-p)(-x_l)$ when $p \le p^*$, and $p(1-k)\pi + (1-p)(-x_h)$ when $p > p^*$. The VP condition of the promisor requires that both payoffs be non-negative. Hence, it should hold that $x_l \le \{p/(1-p)\}(1-k)\pi$ when $p \le p^*$ and $x_h \le \{p/(1-p)\}(1-k)\pi$ when $p > p^*$. The $p/(1-p)$ term here might be interpreted as a risk factor that should be multiplied with the promisor's share of the surplus in case the contract is performed: as the probability of default rises, the upper limit on the damages decreases. ***Lemma 3*** follows from the two VP conditions.

Lemma 3. *Given the choices of optimal reliance and performance/breach by both parties, the promisor's VP condition requires that* $x_l \le \{p/(1-p)\}(1-k)\pi$ *when* $p \le p^*$ *and* $x_h \le \{p/(1-p)\}(1-k)\pi$ *when* $p > p^*$.[26]

3. Deriving the Full Conditions for OD

The IC and VP conditions so far result in ***Proposition 2*** that defines the 'Optimal Damages' (OD) as the most comprehensive set of all desirable damage schemes. ***Proposition 2*** ultimately consists of three conditions: the promisee's IC, the promisor's

---

[26] According to ***Lemma 3***, therefore, when $\theta = h$ (so that it is socially desirable for the promisor to choose breach), the damages should not be too large in order for the contract to be implemented. Otherwise, the promisor will not sign the contract from the beginning.

IC when $\theta = h$, and the promisor's VP. Effectively, OD is the 'entire set' of various optimal damage schemes.

Proposition 2. *Under perfect information and* **Assumption 1**, *the following full conditions define the scheme of Optimal Damages (OD) that warrants 'incentive compatibility' and 'voluntary participation' by both contracting parties.*

When $p \le p^*$,

$x_h - x_l \le \delta$ *(*$\delta \ge 0$*) (**Promisee's IC Condition**);*

$0 \le x_l,\ x_h \le h-(1-k)\pi$ *(**Promisor's IC Condition When*** $\theta = h(>0)$*); and*

$0 \le x_l \le \dfrac{p}{1-p}(1-k)\pi$ *(**Promisor's VP Condition**).*

When $p > p^*$,

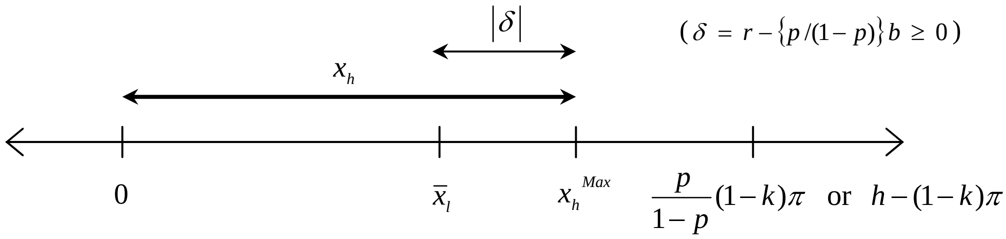
$x_h - x_l \ge \delta$ *(*$\delta < 0$*) (**Promisee's IC Condition**);*

$0 \le x_l,\ x_h \le h-(1-k)\pi$ *(**Promisor's IC Condition When*** $\theta = h(>0)$*); and*

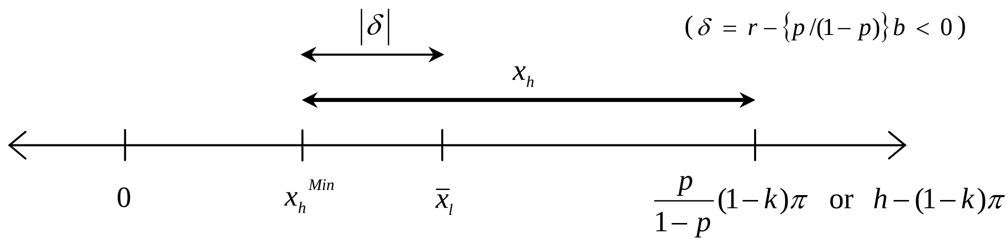
$0 \le x_h \le \dfrac{p}{1-p}(1-k)\pi$ *(**Promisor's VP Condition**).*

The mutual relationship between x_l and x_h can be understood better by graphic illustration. Since both are co-varying intervals, we depict the interval of the latter, given a fixed value of the former, satisfying the conditions in ***Proposition 2***. The relationship visually appears to make sense in general. Consider, for instance, the case in which $p \le p^*$ and **L** is the primisee's optimal reliance level. The interesting observation is that x_h is upper-limited and also can go down even to 0 in <Figure 1>. First, note that x_h can be as small as possible to elicit the promisee's **L**, and the promisor's **P** in case $\theta = 0$ or **B** in case $\theta = h$. Second, more importantly, note that x_h should not be too big. If x_h is too big, the promisee might choose overreliance, **H**, in anticipation of large compensation for $\theta = h$, and the promisor might choose **P** even with $\theta = h$ just to avoid paying the big damages. Moreover, the promisor will possibly not sign the contract since the expected return from the contract is negative.

<Figure 1> The OD Interval of x_h Given $\bar{x}_l$ When $p \leq p^*$



<Figure 2> The OD Interval of x_h Given $\bar{x}_l$ When $p > p^*$



4. Applicability of OD: 'OED' (Optimal Expectation Damages)

OD, as an 'entire set of the damage measures inducing optimality and VP,' potentially would include a large number of 'specific measures' (i.e., 'specific subsets') with such desirable characteristics.[27] To highlight the applicability of OD, we consider one hypothetical damage measure which is a variant of ED. In fact, its simple numeric demonstration has already been made in Cooter and Ulen (2008, Ch. 6), too.

We below show that this damage measure can meet the various conditions corresponding to those in ***Proposition 2***; therefore, in advance, we label it as the 'optimal expectation damages' (**OED**, hereafter). In other words, the OED analysis

[27] Although we occasionally use the two terms, 'optimal' and 'optimal and VP-inducing,' interchangeably for convenience, the latter is used when we intend to emphasize the VP aspect distinctly.

seeks the interval of optimal x_h with the value of x_l fixed at $k\pi$. The motivation behind OED may lie in that underreliance does not transpire under ED (as will be formally proven in Section IV.1). Thus, OED applies the ED amount for **L**, i.e., $x_l = k\pi$ in <Table 1>, and seeks x_h for **H**. OED appears to command a certain degree of practical applicability; it utilizes the merit of the popular ED for the reliance level **L**, which cannot be underreliance under ED, but attempts alternatively to impose OD amounts for the level **H** in which overreliance is possible.[28]

Let us examine the characteristics of OED in more detail. Replacing x_l with $k\pi$ in <Table 1>, we first confirm that under ***Assumption 1***, the optimum conditions are exactly identical to those of ***Proposition 1*** regarding OD.[29] By the same calculation as before or plugging $k\pi$ into x_l in the relevant conditions for OD, the IC and VP conditions for OED can be derived as follows.

Lemma 1-1. *The promisor's IC conditions are as follows.*

When $\theta = 0$, *the optimal* ***P*** *is always chosen.*

When $\theta = h$, *the optimal* ***B*** *is chosen iff* $x_h \le h-(1-k)\pi$.[30]

Lemma 2-1. *The promisee's IC conditions are as follows (where* $\delta = r - \{p/(1-p)\}b$*).*

When $p \le p^*$, *the optimal* ***L*** *is chosen iff* $x_h \le k\pi + \delta$.

---

[28] Refer to Leitzel (1989, pp. 96-97) and Craswell (1989, pp. 377-378) for the damage measures in fact similar to OED, which are variants of PED discussed earlier.

[29] One can easily expect this to hold as long as the main parametric settings in <Table 1> remain intact. Any change in x_l or x_h is only a distributional matter, and thus it would not affect the socially optimal conditions for both contracting parties. Of course, there is no change in the p^* equation.

[30] Since $h-(1-k)\pi > k\pi + r + b$ by ***Assumption 1***, it always holds that $x_l = k\pi \le h-(1-k)\pi$. Accordingly, only the condition for x_h is necessary.

When $p > p^*$, *the optimal* ***H*** *is chosen iff* $x_h \geq k\pi + \delta$.

Lemma 3-1. *Given the choices of optimal reliance and the optimal performance/breach decisions of both parties, the promisor's VP condition requires that* $k \leq p$ *when* $p \leq p^*$ *and* $x_h \leq \{p/(1-p)\}(1-k)\pi$ *when* $p > p^*$.

Therefore, the full conditions for OED follow in ***Proposition 2-1***.

Proposition 2-1. *Under perfect information and* ***Assumption 1****, the following conditions define OED (which maintains ED for* ***L*** *by fixing* x_l *at* $k\pi$*) that warrants 'incentive compatibility' and 'voluntary participation' by both contracting parties.*

When $p \leq p^*$,

$x_h \leq k\pi + \delta$ $(\delta \geq 0)$ *(**Promisee's IC Condition**);*

$0 \leq x_h \leq h-(1-k)\pi$ *(**Promisor's IC Condition When*** $\theta = h\,(>0)$*); and*

$k \leq p$ *(**Promisor's VP Condition**).*

When $p > p^*$,

$x_h \geq k\pi + \delta$ $(\delta < 0)$ *(**Promisee's IC Condition**);*

$0 \leq x_h \leq h-(1-k)\pi$ *(**Promisor's IC Condition When*** $\theta = h\,(>0)$*); and*

$0 \leq x_h \leq \dfrac{p}{1-p}(1-k)\pi$ *(**Promisor's VP Condition**).*

OED in ***Proposition 2-1*** is a subset of OD where x_l is fixed at $k\pi$ for low reliance. It is, like PED, another conjectural example made of (partially) combining ED and CD as discussed in the Introduction. Nonetheless, its usefulness seems to be apparent, additionally because of our actual observation that there is a much smaller discrepancy about low-level reliance during the overreliance-related legal disputes of the Yes/No type. In other words, practically, OED may become more useful by deterring only overreliance, and applying the standard ED to the lower level for which underreliance is not a possibility to be concerned about under ED.

IV. Re-testing the Optimality of Various Damage Measures

Constituting the entire set of optimal damage measures, OD allows us to use it in a unified manner, to examine the optimality of a specific damage measure. If the measure meets the conditions in ***Proposition 2***, it should be not only optimal (by the IC conditions) but also implementable (by the VP conditions). We take up five damage measures (with their formal definitions), which have been popular in the literature.[31] While the primary claims in the literature are generally confirmed, some new properties will be revealed, too.

1. Expectation Damages (ED): $x_l = k\pi$, $x_h = k\pi + b + r$

When $p \le p^*$, since $0 \le \delta < r$, it holds that $x_h - x_l = b + r > \delta$ under ED. This contradicts the promisee's IC condition, viz., $x_h - x_l \le \delta$. There is overreliance as has been emphasized in the literature. The promisor's IC condition, $0 \le x_l,\ x_h \le h - (1-k)\pi$, is always satisfied by ***Assumption 1***. Finally, because the

[31] In the following discussions, the optimality will be confirmed through the amounts (or definitions) of x_l and x_h. In other words, the scope of the damage measure that we can examine is confined to that characterized only by the parameters given in <Table 1> such as p, θ, π, r, b, and k. However, liquidated damages, for instance, would require another variable such as 'stipulated damages in advance' for undertaking the confirmation task, which limits the use of ***Proposition 2***. In the exactly same context, ***Proposition 2*** will be unlikely to be able to test the optimality, for instance, of the 'penalty doctrine' in Chung (1992) or the 'perceived expectation damages' in Craswell (1989).

promisor's VP condition, $0 \le x_l,\ x_h \le \{p/(1-p)\}(1-k)\pi$, is met only under limited circumstances, ED can sometimes exclude the promisor's initiation of the contract.[32]

When $p > p^*$, the optimal reliance is achieved; it always is the case that $x_h - x_l \ge \delta$ because $\delta < 0$. Intriguingly enough, this result intimates a primary explanation regarding the lack of discussions associated with underreliance in existing ED studies; such studies are concerned dominantly about overreliance. The promisor's IC is confirmed, but voluntary participation is not warranted as when $p \le p^*$.[33] In conclusion, ED causes overreliance to the promisee, and further, according to ***Proposition 2***, does not warrant the voluntary participation of the promisor.

2. Generalized Constant Damages (GCD): $x_l = x_h = x_1 \ge 0$ when $p \le p^*$, $x_l = x_h = x_2 \ge 0$ when $p > p^*$

GCD is a generalized version of the aforementioned CD, $x_l = x_h = x \ge 0$, in that it has been unconstrained to take different values depending on whether or not $p \le p^*$. As has been established for CD, GCD also elicits the promisee's optimal reliance: it satisfies $x_h - x_l \le \delta$ ($\delta \ge 0$) when $p \le p^*$, and $x_h - x_l \ge \delta$ ($\delta < 0$) when $p > p^*$. However, as indicated in the Introduction as well, GCD is uncertain with respect to the promisor's optimal behavior and voluntary participation; only for $x_1,\ x_2 \le Min\{h-(1-k)\pi,\ \{p/(1-p)\}(1-k)\pi\}$, the two properties are warranted.

---

[32] $x_l = k\pi \le \{p/(1-p)\}(1-k)\pi$ when $k \le p$. Also, $x_h = k\pi + r + b \le \{p/(1-p)\}(1-k)\pi$ only when $p \ge (k\pi + r + b)/(\pi + r + b)$.

[33] Except for the reliance aspect, the results of examining ED through the OD criteria are the same regardless of whether $p \le p^*$ or $p > p^*$, which makes sense because ED, in principle, is not subject to the interval of p.

3. PED: $x_l = x_h = k\pi$ when $p \le p^*$; $x_l = x_h = k\pi + b + r$ when $p > p^*$

Although PED has been analyzed as a uniquely designed damage measure in the literature, it is in fact an element of the above GCD set. Nonetheless, let us examine PED separately here considering its significance as discussed in Section II.1.

When $p \le p^*$, that $x_h - x_l \le \delta$ ($\delta \ge 0$) guarantees the promisee's optimal reliance and the promisee's optimal behavior is clear by $0 \le x_l = x_h \le h - (1-k)\pi$. Certainly, it is under this rationale that researchers have praised PED. However, for the VP condition, i.e., $0 \le x_l = x_h \le \{p/(1-p)\}(1-k)\pi$, it is necessary that $k \le p$. The requirement indicates that the probability of a low cost of performance should be relatively high. If $k > p$, PED in not implemented although it is surplus-increasing. Note that the chance of having a high p decreases because of the $p \le p^*$ situation, which lowers the chance of PED being a subset of OD. Likewise, when $p > p^*$, optimal reliance and the efficient breach follow since $x_h - x_l = 0 > \delta$ ($\delta < 0$) and $0 \le x_l = x_h \le h - (1-k)\pi$, respectively. However, a rather critical condition, $k\pi + b + r \le \{p/(1-p)\}(1-k)\pi$, is required for the promisor's voluntary participation.

Thus, PED is incentive compatible for both contracting parties as advocated in the literature (i.e., one of the superior elements of GCD), but it is not always implementable because the promisor sometimes would not join the contract in the first place. Given that the essence of PED is to apply ED only in case of optimal reliance, it is plausible for us to imagine a slightly generalized definition: i.e., $x_l = k\pi$ and $x_h \ge 0$ when $p \le p^*$ and $x_h = k\pi + r + b$ and $x_l \ge 0$ when $p > p^*$.[34] An examination based

[34] Refer to Leitzel (1989, pp. 96-97) and Craswell (1989, pp. 377-378) for some examples of this generalized PED. The current argument in the text would be applied equally to them.

on ***Proposition 2*** reveals that this ‘generalized PED’ (GPED) utilizing x_h (when $p \leq p^*$) and x_l (when $p > p^*$) still does not meet the OD criteria always. In other words, changing a fixed-damage into a variable-damage scheme for the non-optimal behavior on the part of the promisee does not make PED a sure subset of OD.

4. No Damages or Restitution: $x_l = x_h = 0$ [35]

The two damage measures, which also have often been discussed in the literature, are optimal as they satisfy the OD criteria.[36] Nonetheless, it can be readily confirmed that, under no damages, **P1**’s VP is likely to be violated if $i > 0$. Of course, **P1**’s VP would be reinforced under restitution if $i > 0$.

5. Reliance Damages (RD) : $x_l = 0$, $x_h = r$

When $p \leq p^*$, this scheme causes overreliance as expected because it does not hold that $x_h - x_l \leq \delta$; i.e., $x_h - x_l = r > r - \{p/(1-p)\}b = \delta$.[37] RD induces the promisor’s optimal behavior, and the voluntary participation is warranted, too. When $p > p^*$, the optimal high reliance is obtained since $x_h - x_l \geq \delta$ ($\delta < 0$). Also, the

---

[35] Since the promisee’s initial investment was normalized to $i = 0$ in <Table 1>, the two damage measures, no damages and restitution, are identical in our model.

[36] It is worthwhile to recall, however, that this result holds under ***Assumption 1***. If not, neither of restitution and no damages will completely guarantee the optimality. As Shavell (1980, p. 482) argued, for example, if h is not high enough, both restitution and no damages will cause default too frequently despite the fact that performing the contract is socially desirable.

[37] The identical claim was made, for instance, in Shavell (1980, p. 479) (among many others), and also in the models of Rogerson (1984, p. 49) and Cooter (1985, p. 50).

promisor's optimal behavior is induced, but the voluntary participation condition is not met. Therefore, RD is not a subset of OD at all.[38]

V. Concluding Remarks

The two distinct features of this paper are a 'top-down approach' and the 'simplicity of the model.' As to the former, we have derived a comprehensive damage measure, OD, which is equivalent to the entire set of desirable damage measures from an economic perspective, i.e., warranting 'optimality' and 'voluntary contract participation.' Further, although the model has been assumed to be dichotomous both in reliance and the performance cost, this simple setting could perhaps be fairly useful for the court's decision in actual legal disputes. We hope that the major findings and implications briefly summarized below, along with the existing stock of related research in law and economics, can be delivered readily to not only academics but also field experts.

In order to derive the full conditions for OD, we began with the conditions for social optimum. Apart from the well-expected conclusion that the promisor's efficient breach is subject predominantly to the performance cost realized *ex post*, we have formally obtained an intriguing finding about the promisee's reliance. Higher reliance is optimal as the 'perceived chance' of the promisor's performance rises and as the 'profitability of

---

[38] Although RD, just like ED, causes **P1**'s overreliance when $p \le p^*$ and also violates **P2**'s VP condition when $p > p^*$, the two schemes are distinguished quantitatively. First, for fulfilling the VP condition, ED and RD have requirements $(k\pi + r + b)/(\pi + r + b) < p$ and $r/\{r + (1-k)\pi\} < p$, respectively, when $p > p^*$. The LHS of the former inequality being always greater than that of the latter, RD can be said to have a higher possibility of meeting the VP condition. Second, we have shown that **P1** chooses **H** when $p \le p^*$ as $x_h - x_l = r + b > \delta$ for ED and $x_h - x_l = r > \delta$ for RD. Thus, ED appears to deviate more significantly from the IC condition. However, ED's relative inferiority based on this algebraic comparison might hold only in a limited sense because both measures violate the IC condition anyway.

reliance' increases. The latter aspect, in particular, has caught our attention; courts should take into more serious account the profitability of a certain reliance activity, whether it is new investment or insufficient precautionary effort, when they inquire into the doctrine of 'foreseeability' as in the case of *Hadley v. Baxendale*.

We next have derived a 'full list of conditions' for OD. The conditions are expressed in a fairly straightforward way because of the compactness of the model. Nonetheless, they are believed to possess a non-trivial level of applicability in explaining actual or conjectural damage measures as exemplified by OED. Constituting the entire set of optimal damage measures, OD has been used to examine the characteristics of both incentive compatibility and voluntary participation for five well-known damage measures: i.e., ED, CD, PED, no damages (and restitution), and RD.

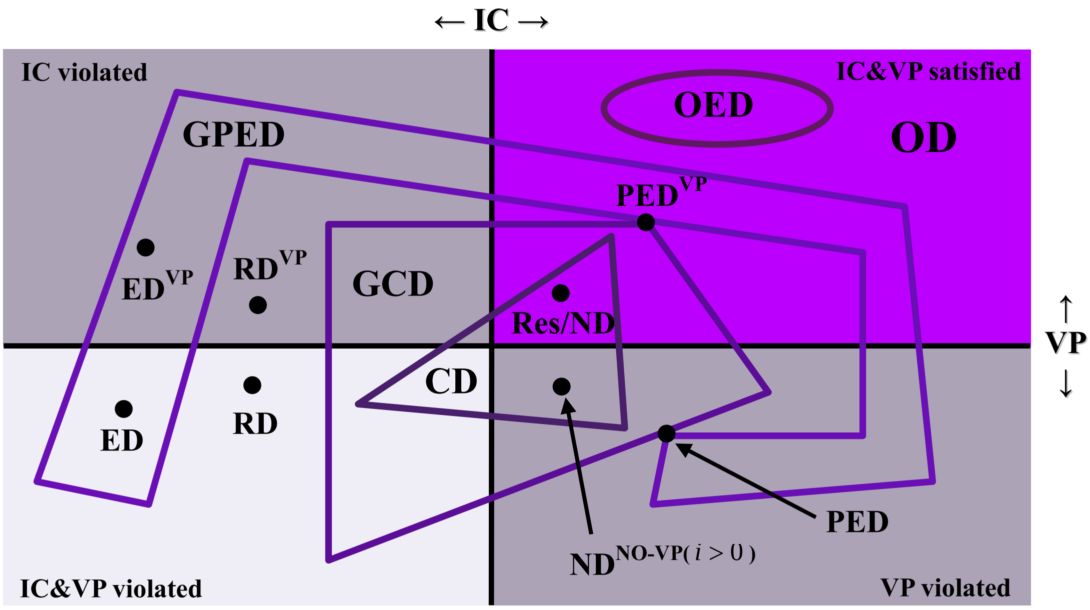
Although we generally have confirmed the existing claims in the literature, we believe there are noticeable aspects of our investigations from an analytic-framework perspective. In the systematic examination presented, we have portrayed popular damage measures in terms of the 'set-relationships' as far as possible and have obtained some clarifying results. For example, we have examined OED as an applicable subset of OD. In addition, we have defined a new measure, GCD, which includes CD as another subset, showing that PED is an element of GCD but that the latter is not always a subset of OD. To elaborate, the traditionally praised measure of PED turns out to have a condition that is yet to be met, i.e., the 'promisor's voluntary participation condition,' which could be more critical, especially in practice, than is commonly presumed. This is because individual rationality often conflicts with collective rationality as in many other game situations. All in all, we tentatively submit that the full conditions for OD can play an effective role as an 'operational guideline' for inquiring into the optimality of a specific damage measure: OD appears not only to nest existing models but to be useful for analyzing new types.[39]

We are aware that our analyses are not without limitations. An example is the assumption taken for analytic compactness that the high performance cost, h, is sufficiently high. Under that assumption, the promisor's breach was desirable not only for the promisor but for all of society. Of course, this assumption should be useful for many real-world disputes of the Yes/No type. However, as our exemplary conjecture reveals, when h takes a certain intermediate value, breach can perhaps be good for the promisor but not for social efficiency especially when a high level of reliance has been made in good faith. That being the case, in order to induce the promisor to perform, the damages amount ought not to be too generous. As such, a rigorous attempt, under alternative cases concerning the size of h, to derive the full conditions equivalent to the current OD criteria will be a valuable extension from a theoretical perspective. Also, as another extension to reflect the reality yet better, it will be interesting to see changes in equilibrium in which h is assumed to be private information only of the promisor in a similar fashion, for instance, to that in Craswell (1989). The promisor is predicted to have, at least sometimes, an incentive not to divulge its true value. The informational asymmetry can equally be adopted for the promisee's reliance expenditures to savor analytic results from a different angle.

---

[39] <Appendix> depicts the subset-element-relationships among the major damage schemes discussed far. We observe a few noticeable facts. All of GCD, CD, and GPED can either fulfill the OD-criteria, or violate one of the IC and VP conditions, or violate both the IC and VP conditions. ED turns out to be an element of GPED. However, ED can never belong to OD. Neither can RD. Very intriguingly, PED is not only an element both of GPED and GCD, but also is the only common element of the latter two. Of course, there is no guarantee that PED is an element of OD.

<Appendix> Description of Subset-Element-Relationships among Schemes



Notes: 1) 'G' in a scheme '<u>G</u>*XXX*' indicates that a) the scheme distinguishes between $p \leq p^{*}$ and $p > p^{*}$ and b) there is now at least one more damages amount expressed as a range *vis-à-vis* the scheme '*XXX*.' 2) Res = Restitution and ND = No damages. 3) The major set or element relationships as the bases of this diagram are: a) CD$\subset$GCD$\not\subset$OD, GPED$\not\subset$OD, OED $\subset$ OD. b) PED $\in$ GCD/GPED, GCD $\cap$ GPED = PED, PED $\notin$ OD. c) ED $\in$ GPED, ED/RD$\notin$OD, Res/ND$\in$CD/GCD/OD.

References

American Law Institute, *Restatement (Second) of the Law of Contracts*, 1981, St. Paul, Minn.: American Law Institute Publishers.

American Law Institute and National Conference of Commissioners on Uniform State Laws, *Uniform Commercial Code* (2005 ed.), 2005, St. Paul: Thomson/West.

Bebchuk, Lucian Arye and Ivan P. L. Png, "Damage Measures for Inadvertent Breach of Contract," *International Review of Law and Economics*, 1999, vol. 19, pp. 319-331.

Chung, Taiyeong, "On the Social Optimality of Liquidated Damage Clauses: An Economic Analysis," *Journal of Law, Economics, and Organization*, 1992, vol. 8, pp. 280-305.

Commission on European Contract Law, *Principles of European Contract Law, Parts I and II* (Combined and Rev.), in Lando, Ole and Hugh Beale (eds), 2000, Boston: Kluwer Law Institutional.

Cooter, Robert D., "Unity in Tort, Contract, and Property: The Model of Precaution," *California Law Review*, 1985, vol. 73, pp. 1-51.

Cooter, Robert D. and Melvin Aron Eisenberg, "Damages for Breach of Contract," *California Law Review*, 1985, vol. 73, pp. 1432-1481.

Cooter, Robert D. and Thomas Ulen, *Law and Economics* (5th ed.), 2008, Boston: Pearson Addison Wesley.

Craswell, Richard, "Performance, Reliance, and One-sided Information," *Journal of Legal Studies*, 1989, vol. 18, pp. 365-401.

Dobbs, Dan B., *Law of Remedies: Damages, Equity, Restitution* (2nd ed.), 2001, St. Paul: West Publishing Co..

Edlin, Aaron S. and Alan Schwartz, "Optimal Penalties in Contracts," *Chicago-Kent Law Review*, 2003, vol. 78, pp. 33-54.

Fuller, Lon Luvios and William R. Purdue, Jr, "The Reliance Interest in Contract Damages: 1," *Yale Law Journal*, 1936, vol. 46, pp. 52-96.

Katz, Avery W., "Remedies for Breach of Contract Under the CISG," *International Review of Law and Economics*, 2005, vol. 25, pp. 378-396.

Kornhauser, Lewis A., "Reliance, Reputation, and Breach of Contract," *Journal of Law and Economics*, 1983, vol. 26, pp. 691-706.

Leitzel, Jim, "Damage Measures and Incomplete Contracts," *RAND Journal of Economics*, 1989, vol. 20, pp. 92-101.

Polinsky, A. Mitchell, "Risk Sharing through Breach of Contract Remedies," *Journal of Legal Studies*, 1983, vol. 12, pp. 427-444.

Polinsky, A. Mitchell, *An Introduction to Law and Economics* (3rd ed.), 2003, NY: Aspen Publishers.

Posner, Richard Allen, *Economic Analysis of Law* (7th ed.), 2007, NY: Wolters Kluwer Law & Business: Aspen Publishers.

Rogerson, William P., "Efficient Reliance and Damage Measures for Breach of Contract," *RAND Journal of Economics*, 1984, vol. 15, pp. 39–53.

Shavell, Steven, "Damage Measures for Breach of Contract," *Bell Journal of Economics*, 1980, vol. 11, pp. 466-490.

Shavell, Steven, "The Design of Contracts and Remedies for Breach," *Quarterly Journal of Economics*, 1984, vol. 99, pp. 121-148.

Sloof, Randolph, Edwin Leuven, Hessel Oosterbeek, and Joep Sonnemans, "An Experimental Comparison of Reliance Levels under Alternative Breach Remedies," *RAND Journal of Economics*, 2003, vol. 34, pp. 205-222.

Sloof, Randolph, Edwin Leuven, Hessel Oosterbeek, and Joep Sonnemans, "Breach Remedies, Reliance, and Renegotiation," *International Review of Law and Economics*, 2006, vol. 26, pp. 263-296.

Spier, Kathryn E. and Micheal D. Whinston, "On the Efficiency of Privately Stipulated Damages of Breach of Contract: Entry Barriers, Reliance, and Renegotiation," *RAND Journal of Economics*, 1995, vol. 26, pp. 180-202.