Remedies for Non-Disclosure in Asset Sales: Voidance vs. Damages*

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Abstract

This paper analyzes the problems of non-disclosure in the context of an asset sale between a buyer and a seller. The seller can have important information about the asset and can opportunistically decide not to disclose that information to the buyer, and the buyer may sue the seller ex post for remedy. The buyer and the court have a choice over different types of remedy. The paper considers three different remedy regimes: (1) no liability; (2) voidance; and (3) damages. Under voidance, the buyer can rescind the transaction (return the asset and get the price back), while with damages, the buyer receives monetary compensation from the seller. The analysis shows that, when comparing between voidance and damages, while voidance regime does poorly in deterring the opportunistic non-disclosure, by undoing inefficient transactions ex post, it can perform better than either damages or no liability. The paper analyzes circumstances under which one regime performs better than the others and also different types of damages.

1 Introduction

Imagine a buyer and a seller negotiating a sale of a house. Although the seller is aware of serious structural problems with the house, the seller deliberately withholds that information from the buyer, and the inspection does not uncover the problems. After the parties execute the contract and close the transaction, the buyer becomes aware of the structural problems and discovers that the seller withheld that information.

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If the buyer brings suit against the seller for misrepresentation, what remedy should the buyer be entitled to?[1] There are a number of choices. One possibility is for the buyer to "undo" the transaction, transferring the house title back to the seller and getting the price back. Another possibility is to be compensated for the "loss" that the buyer has suffered, measured either by the difference between the expected value (without structural problems) and the true value (with structural problems) of the house or between the price paid and the true value of the house. Unfortunately, the answer is not entirely clear under the current law. This is because the issues of misrepresentation are dealt with under both contract law and tort law, and different remedies are available under each law.

Under contract law, when the buyer can prove (along with other elements) that the seller should have disclosed the information, the buyer is entitled to rescind the contract and void the transaction.[2] The underlying idea is that, when a contract is formed based on (fraudulent or material) misrepresentation including non-disclosure, there is no valid "manifestation of mutual assent" (or more colloquially "meeting of the minds"), one of the principal elements necessary for contract formation. Hence, the court will determine that the contract was not validly formed and will order the parties to "return" to the state without contract by rescinding the transaction.

Under tort law, in comparison, a successful buyer is likely to receive monetary damages from the seller, without undoing the transaction.[3] The principal idea here is

[1]The case of Schwartz v. Rockey, 932 A.2d 885 (Pa. 2007) is exemplary. The Rockeys sold a house with serious water infiltration problem to the Schwartzes without fully disclosing that issue. Initially, the Rockeys sought monetary damages but later amended the pleading and sought rescission. Although ruling that an initial claim for damages does not foreclose a subsequent amendment for rescission, the Pennsylvania Supreme Court ultimately denied rescission because the buyers did not promptly seek rescission after becoming aware of the problem. The court also noted that the buyers could initially have made simultaneous pleading of different remedies. See Section 3 for a discussion on election of remedies.

[2]See Restatement (Second) of Contracts §§159 – 164. In particular, §164(1) states: "If a party's manifestation of assent is induced by either a fraudulent or material misrepresentation by the other party upon which the recipient is justified in relying, the contract is voidable by the recipient." While the Restatement takes the voidance as the principal remedy, the Uniform Commercial Code takes a more liberal approach. According to U.C.C. §2-721, "[r]emedies for material misrepresentation or fraud include all remedies available under this Article for non-fraudulent breach. Neither rescission or a claim for rescission of the contract for sale nor rejection or return of the goods shall bar or be deemed inconsistent with a claim for damages or other remedy. See Section 3.

[3]See Restatement (Second) of Torts §§525, 552B, and 552C. Compared to contract law, tort law tends to be more expansive in allowing different types of remedy. Especially for fraudulent (intentional) misrepresentation, tort law allows several different types of remedy, including out-of-pocket (rescissory) damages, benefit-of-the-bargain damages, voidance (rescission), reformation (where the court modifies the terms of the contract), and even punitive damages. See Section 3.

that by misrepresenting (e.g., non-disclosing material information) to the other, the injurer (the seller, in our example) has committed a "wrong," and the injured party (the buyer, in our example) is entitled to monetary damages to compensate for the loss.

What is interesting is that in many situations, the two laws overlap, and unlike conventional tort or contract cases, where the only available remedy often is damages, the buyer and the court are offered a menu of choices.[4] The buyer can attempt to either void (or "rescind") the transaction (for instance, by applying the contract law principles) or receive damages (for instance, under the tort law principles) from the misrepresenting (non-disclosing) seller. To make the matters more complex, even under each law, the court has latitude in deciding on other types of remedy as well. Under tort law, for instance, the court can grant rescission or allow the buyer to recover different types of damages.[5] This raises an interesting normative question. Which remedy should the injured party be entitled to in the case of misrepresentation or non-disclosure? When faced with a choice, which remedy should the court choose?

In answering some of these questions, this paper analyzes a model where the seller of an existing asset may strategically hide important information prior to a sale. Ex post, after uncovering evidence of seller's non-disclosure, the buyer may sue the seller to obtain a remedy. The paper considers three liability regimes: (1) no liability; (2) liability based on voidance (or "rescission"); and (3) liability based on monetary damages. These three regimes differ in their ability to deter non-disclosure, prevent inefficient trades, and the cost of enforcement (e.g., litigation costs). The analysis reveals several important insights.

First, even without any legal remedy, when the buyer is sufficiently concerned about seller's non-disclosure and overpaying for the asset, the market will impose a

[4]For instance, if a plaintiff has suffered harm due to a defendant's tortious action or breach of contract, the only feasible remedy is to allow the plaintiff to recover damages from the defendant. For breach of contract, though, there often is a choice between specific performance and damages but, under either one, the transaction does not get rescinded. See Shavell (2006) (showing that the contracting parties would prefer specific performance with respect to property conveyance but damages when the seller has to engage in production). In certain misrepresentation cases, undoing the transaction is difficult, rendering rescission an impractical remedy. Legal scholars have recognized and analyzed how different bodies of law have treated, sometimes inconsistently, the issues of misrepresentation and non-disclosure and how the courts have struggled in achieving consistency. See, e.g., DeMott (1994), Craswell (2006), and Normand (2016).

[5]The amount of damages, for instance, can be based on the out-of-pocket expenses or the benefit-of-the-bargain, and can include consequential and incidental damages. Under tort law, the court can also allow punitive damages. See Section 3.

pricing discipline on the seller, providing some deterrence against opportunistic non-disclosure. Moreover, the strength of deterrence gets larger as the buyer becomes more concerned about facing an informed seller (i.e., as the degree of asymmetric information becomes more severe). This market-based discipline, however, will generally not be sufficient to provide full deterrence against opportunistic non-disclosure. An additional remedy (e.g., a legal remedy) may be necessary for full deterrence. The upside of not providing any remedy, of course, is that society can avoid costly litigation, which can create a deadweight loss.

Second, the voidance remedy provides weak ex ante deterrence benefits but performs well in terms of ex post allocative efficiency. With voidance, the seller's downside is limited: when the buyer is successful in litigation, the seller simply gets the asset back and returns the payment to the buyer. Since the seller is no worse off than not participating in the sale, voidance provides relatively weak punishment for opportunistic non-disclosure. In fact, our analysis shows that, in general, the voidance remedy cannot fully deter opportunistic non-disclosure. To make things worse, because the buyer rationally expects some ex post remedy (that voids some undesirable purchase), the buyer would be willing to pay more to enter into a transaction, and the higher price further strengthens the seller's incentive to opportunistically withhold information and sell the asset. At the same time, the advantage of voidance is that it can "undo" transactions that turn out to be inefficient ex post.

Third, monetary damages may provide strong ex ante deterrence benefits but can perform poorly in terms of ex post efficiency. With monetary damages, the downside for the seller is potentially unlimited: large damages will provide strong (and even sufficient) incentive for the seller not to engage in opportunistic non-disclosure. The damages remedy does not undo inefficient transactions ex post, however. Compared to voidance, damages can be more efficient ex ante (in deterring non-disclosure) while inefficient ex post (by not undoing inefficient transactions while imposing litigation costs). If the damages are sufficiently large so as to deter the seller from engaging in opportunistic non-disclosure, damages are likely to perform better than voidance (or no liability). On the other hand, if damages are ineffective in deterring opportunistic non-disclosure, the damages regime is likely to perform worse.

The analysis also delivers insights regarding choice over remedy. First, if the seller is undeterred, the damages regime performs the worst in terms of welfare. With full participation by the seller with negative information, the damages regime makes things worse by magnifying the welfare loss through litigation. In comparison, the voidance regime does much better by undoing inefficient transactions ex post. In fact, so long as the welfare loss from litigation isn't too large, the voidance regime performs the best among the three liability regimes. Second, when all three liability

regimes provide some (but not full) deterrence against opportunistic non-disclosure, the damages regime performs the best. The reason has to do with the fact that damages can make the seller worse off than not participating and can provide a strong deterrence against opportunistic non-disclosure. By contrast, with weak deterrence, both the no liability regime and the voidance regime perform worse than the damages regime. In fact, the anlaysis shows that the no liability and the voidance regimes perform equally poorly.

The paper is organized as follows. In Section 2, we provide a brief review of the relevant literature. Section 3 provides a brief discussion on the legal background, focusing on contract and tort laws. Section 4 presents the basic model of (opportunistic) non-disclosure in the context of an asset sale. The Section derives and examines the respective equilibrium in the three liability regimes: (1) no liability; (2) voidance; and (3) damages. In the case of damages, consistent with the principles of tort law, the analysis assumes that, in case successful, the buyer is entitled to the difference between the price paid and the value of the asset. In Section 5, relying on the results of Section 3, we analyze the respective equilibrium welfare and make comparison across the three regimes. Section 6 discusses possible extensions of the analysis and Section 7 concludes with thoughts for future research. The Appendix is divided into two sections: Appendix A presents the proofs, while Appendix B presents supplemental analyses, in particular, the case of general damages, where the amount of recovery for the buyer is not confined to the difference between the price and the asset value.[6]

2 Literature Review

This paper extends the literature on the disclosure of information prior to the sale of an asset. Grossman (1981) and Milgrom (1981) introduced the famous unraveling result when sellers are privately informed about asset quality. Sellers of high quality assets have a clear incentive to disclose this information (to obtain a better selling price) and, as a consequence, sophisticated buyers draw adverse inferences when sellers *do not* disclose. Grossman and Hart (1981) explored the implications of full unraveling for disclosure laws in corporate takeovers. Grossman and Hart (1981), for instance, concluded that "the commonly held view that firms withhold information (which is free to release) in order to mislead traders into giving them better terms is false."[7]

Dye (1985, 2017), Farrell (1986), Shavell (1994), and Polinsky and Shavell (2012)

[6]In particular, we consider the possibility of setting the damages equal to the "expectation" or "benefit-of-the-bargain" damages (the difference between the expected value ($E(x)$) of the asset and the realized value (x_l)) or at any arbitrary level ($d \in [0, \infty)$).

[7]Grossman and Hart (1981) at 333.

showed that complete unraveling does not occur when buyers are uncertain as to whether the sellers actually have private information. In their analyses, sellers may be uninformed and sellers with low quality assets have an incentive to withhold the information from the market and pool with the uninformed types. Shavell (1994) focused on the incentive of sellers to acquire information prior to a sale. Although mandatory disclosure may be socially desirable conditional on the seller acquiring the information, it may chill the collection of socially valuable information. Polinsky and Shavell (2012) showed that when sellers are strictly liable for consumer harms stemming from defective products, and can take precautions to reduce product risks, then mandatory and voluntary disclosure are equivalent. These papers all assumed that disclosure, if mandated, is perfectly enforced.[8]

This paper, by contrast, assumes that disclosure cannot be perfectly (and costlessly) enforced and examines two ways of imposing liability: voidance (rescission) and damages.[9] In an earlier paper (Choi and Spier (2026)), we examined the possibility of costly enforcement against non-disclosure in the context of a firm selling stock to its investors in an initial public offering.[10] This paper departs from that analysis in at least a few important aspects. First, the current paper focuses on an asset sale between a buyer and a seller, where 100% of ownership over the asset gets transferred. By contrast, when a firm sells stock to investors and the investors sue

[8]Dye (2017) explores a model where mandatory disclosure is imperfectly enforced. Our analysis differs from Dye's core model in several important respects. First, in Dye (2017), the asset sale is assumed to always takes place (and is efficient) and the seller simply chooses the disclosure strategy to maximize the sale price. Liability only affects the seller's equilibrium disclosure strategy. In our analysis, liability for non-disclosure is socially valuable because it deters the seller from engaging in an inefficient sale transaction. Second, our analysis allows for false positives and negatives and litigation costs and the impact they have on disclosure and deterrence. Finally, we analyze different legal remedies, in particular, voidance and different damages.

[9]In the industrial organization literature, there are some papers that analyze the right of return given to consumers (return policies). Firms may offer generous returns policies to reduce the risk of risk-averse consumers (Che, 1996) or to signal high quality of experience goods (Inderst and Ottaviani, 2013; Inderst and Tirosh, 2015). See also Arya and Mittendorf (2004) and Kandel (1996). Wolinsky (1986) predicts the absence of return policies because consumers can learn product match values through pre-purchase inspection, eliminating any benefit from post-purchase returns. Janssen and Williams (2024) and Matthews and Persico (2007) offer nuanced predictions about the offering of returns policies and the relative efficiency of ex ante and ex post learning. While a return policy is similar to the right of rescission (voidance), when a retailer adopts a return policy, there usually are no disputes about whether the return is "rightful." The consumers also are not given a choice of receiving damages (a "warranty"). From the legal perspective, giving a free (or low fee) return policy is tantamount to giving the consumers an option "breach" the contract at zero (or low) termination fee (damages). See Scott and Triantis (2004).

[10]An important issue in these papers is the impact that a liability regime has on initial market pricing. See also Choi and Spier (2022) for an analysis of antitrust liability on monopoly pricing.

the firm for non-disclosure, the investors, through their equity stake, bear some of the cost of enforcement. Second, the current paper also examines different liability regimes: voidance and damages. As far as we are aware, this is the first paper to analytically examine the voidance regime in the context of an asset sale.

3 Legal Background

Under the US legal system, in a private transaction, one party's (unlawful) misrepresentation can grant the injured party a right to remedy. A common type of misrepresentation occurs in a contract formation setting, when one party misrepresents an important underlying fact and, justifiably relying on the misrepresentation, the recipient enters into a contract with the misrepresenter. Under contract law, misrepresentation is defined as "an assertion that is not in accord with the facts,"[11] and there are generally three ways one can misrepresent: (1) (active) misstatement or assertion; (2) concealment; and (3) non-disclosure.[12] The first two types of misrepresentation normally require a more "active" behavior by the mirepresenter, and non-disclosure can be thought of as a more "passive" form of misrepresentation.

While non-disclosure can constitute a misrepresentation, not all non-disclosures are misrepresentations. According to Restatement (Second) of Contracts §161(b), the non-disclosing party must know that "disclosure of the fact would correct a mistake of the other party as to a basic assumption on which that party is making the contract," and the non-disclosure amounts to a "failure to act in good faith and in accordance with reasonable standards of fair dealing." In a sense, the non-disclosed fact must be somehow be significant or important enough or "essential," so that the recipient would not have entered into the contract on the offered price.[13] Once the recipient has shown (along with other factors, such as reliance) that a misrepresentation has occurred, under contract law, the principal remedy for the recipient is voidance.[14]

[11]See Restatement (Second) of Contracts §159.

[12]See Restatement (Second) of Contracts §§160–164. The first type involves the seller making an affirmative statement ("this house does not have any structural issues"), while the second type involves the seller preventing the buyer from discovering the relevant information. By contrast, non-disclosure involves the seller staying silent even though the seller is aware of the information.

[13]The Restatement does not provide a lot of guidance on this issue. Comment d states: "In many situations, if one party knows that the other is mistaken as to a basic assumption, he is expected to disclose the fact that would correct the mistake. A seller of real or personal property is, for example, ordinarily expected to disclose a known latent defect of quality or title that is of such a character as would probably prevent the buyer from buying at the contract price."

[14]While voidance is the principal remedy, it is not the exclusive one. The Uniform Commercial Code takes a more liberal approach. U.C.C. §2-721 states: "[r]emedies for material misrepresentation or fraud include all remedies available under this Article for non-fraudulent breach. Neither rescission

For instance, Restatement (Second) of Contracts §164(1) states that "If a party's manifestation of assent is induced by either a fraudulent or a material misrepresentation by the other party upon which the recipient is justified in relying, the contract is voidable by the recipient." In short, when the recipient can show that (1) misrepresentation has occurred, (2) misrepresentation is either fraudulent or material, (3) the recipient is justified in relying on the misrepresentation and in entering into the contract, the recipient can void the transaction.

The US tort law generally recognizes three kinds of misrepresentation (fraudulent (or intentional), negligent, and innocent), and like contract law, covers three types of behavior (misstatement, concealment, and non-disclosure).[15] For instance, Restatement (Second) of Torts §525 states that "[o]ne who fraudulently makes a misrepresentation of fact, opinion, intention or law for the purpose of inducing another to act or to refrain from action in reliance upon it, is subject to liability to the other in deceit for pecuniary loss caused by him by his justifiable reliance upon the misrepresentation."[16] This is also known as the "common law fraud" doctrine. Similar to contract law, not all non-disclosures constitute misrepresentations. According to Restatement (Second) of Torts §551(2)(e), in a "business transaction," the undisclosed fact must be "basic" to the transaction and the "customs of the trade or other objective circumstances" would reasonably require disclosure. According to comment e, "a basic fact is a fact that is assumed by the parties as a basis for the transaction itself. It is a fact that goes to the basis, or essence, of the transaction, and is an important part of the substance of what is bargained for or dealt with." Both the tort law and the contract law adopt a similar standard regarding non-disclosure.

While the court has more latitude in crafting a remedy for tortious misrepresentation, with respect to commercial transactions, the principal remedy seems to be to allow the recipient to collect the difference between the price paid and the value of the

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or a claim for rescission of the contract for sale nor rejection or return of the goods shall bar or be deemed inconsistent with a claim for damages or other remedy. See also U.C.C. §2-608 cmt. 1 (stating that "the buyer is no longer required to elect between revocation of acceptance [of nonconforming goods] and recovery of damages for breach."

[15]See Restatement (Second) of Torts §§525, 552B, and 552C. Roughly speaking, misrepresentation is "fraudulent" when the maker knows the "untrue character of his representation." See §526 Comment a. "Negligent" misrepresentation takes place when the maker fails to exercise reasonable care in supplying correct information. See §552 Comment a. Misrepresentation is "innocent" when it is neither fraudulent nor negligent (for instance, when the seller "honestly" believed a false statement to be true).

[16]With respect to fraudulent misrepresentation, while most of the elements in contract and tort laws overlap, there is one important difference. Under contract law, the injured party does not need to show that the fraudulent misrepresentation was "material," while under tort law, they do.

service or the asset received (which amounts to rescissory damages).[17] For instance, Restatement (Second) of Torts §549(1) states that "[t]he recipient of a fraudulent misrepresentation is entitled to recover as damages in an action of deceit against the maker the pecuniary loss to him of which the misrepresentation is a legal cause, including (a) the difference between the value of what he has received in the transaction and its purchase price or other value given for it."[18]

At the same time, the law does not rule out more general damages or the possibility of voidance (rescission). Restatement (Second) of Torts §549(2), for instance, states that "[t]he recipient of a fraudulent misrepresentation in a business transaction is also entitled to recover additional damages sufficient to him him the benefit of his contract with the maker, if these damages are proved with reasonable certainty." The section seems to allow the recipient to recover damages that are similar to "expectation damages" under contract law. In fact, according to the official comment, the section gives the plaintiff "the option of either the out-of-pocket or the benefit-of-the-bargain rule" when the "latter measure can be established by proof in accordance with the usual rules of certainty in damages."[19] Furthermore, in the case of fraudulent misrepresentation, the plaintiff may also seek rescission (voidance). Comment (e) of §549 states: "[o]ne who is misled by the fraudulent misrepresentations of another may rescind the transaction induced by it."

The set of available damages is somewhat narrower in the case of either negligent or "innocent" misrepresentation. First, in the case of negligent misrepresentation, while the plaintiff is entitled to recover both the "out-of-pocket" and other "consequential" damages, the plaintiff is not entitled to the "benefit-of-the-bargain" damages. See Restatement (Second) of Torts §552B(2) (stating that "the damages recoverable for a negligent misrepresentation do not include the benefit of the plaintiff's contract

[17]Instead of using the phrase "rescissory damages," the Restatement calls this "out-of-pocket" loss. See Restatement (Second) of Torts §549 Comment b.

[18]The Restatement also allows for other pecuniary loss that the recipient has suffered "as a consequence of the recipient's reliance upon the misrepresentation." The damages rules are largely similar in the case of negligent misrepresentation. See Restatement (Second) of Torts §552B.

[19]See Restatement (Second) of Torts §549(2) comment g. According to the comment, "[i]f the value of what the plaintiff has received from the defendant is fully equal to the price he has paid for it or other value he has parted with and he has suffered no consequential damages, he may be unable to recover at all under the rules stated in Subsection (1)." The comment goes on to say that while some courts have been more liberal in granting plaintiffs benefit-of-the-bargain damages, the rule under (2) is meant to be more narrow. See also Illustration 4 ("A, seeking to sell land to B, fraudulently tells B that half of the land is covered with good pine timber. B buys the land from A for $5,000. There is no timber on the land but it is still worth $5,000. Competent evidence establishes that if the representation had been true the land, with the timber, would have been worth $9,000. B may recover $4,000 from A.").

with the defendant). Second, for "sale, rental or exchange" transactions involving "innocent" misrepresentation (i.e., a misrepresentation that is not made either fraudulently or negligently), Restatement (Second) of Torts §552C limits the damages to the difference between "the value of what the other had parted with and the value of what he has received in the transaction."[20]

When different remedies are available, the question over the choice of remedy becomes an important issue. Traditionally, the choice was given to the plaintiff: the plaintiff has to "elect" the remedy they are seeking, particularly when different remedies are "inconsistent."[21] This is often known as the "doctrine of election of remedy." Under this rule, for instance, the plaintiff can either seek to void or rescind ("disaffirm") the contract or let the contract stand ("affirm") and seek damages.[22] On top of the plaintiff's election, the court can also exercise its equitable powers. For instance, the court may declare that voiding the transaction is prohibitively difficult and instead grant the plaintiff rescissory damages. Partly due to the widespread criticism against the doctrine (which would sometimes deny "innocent" plaintiffs any recovery), the modern trend has been to allow plaintiffs to initially seek multiple, "inconsistent" remedies (also known as "alternative pleading") with the choice to be decided by court later in the proceeding (e.g., after the liability issue has been determined).[23]

4 The Model

Suppose a buyer and a seller are engaged in a possible sale of an asset. The value of the asset to the buyer is initially uncertain and can be one of two values: $x \in$

[20] According to comment f, "the damages given under this Section are restitutionary in nature."

[21] In other areas of the law, by statute, the plaintiff is given the right of either rescission or damages. For instance, under the Securities Act of 1933, when a buyer of securities in an initial public offering can show that the firm committed a misrepresentation, the buyer can either rescind the purchase or seek damages. See Securities Act of 1933 §12. See also Klass (2018) for a discussion of numerous other statutes (including consumer protection statutes) that deal with the problems of deceit and different types of remedy offered.

[22] See Dobbs and Roberts Law of Remedies 3d Ed. (2018) §9.3 Restitution plus Damages: Election of Remedies. Courts often apply this doctrine based on the rationale of avoiding duplicate relief but the doctrine has been widely criticized.

[23] See Dobbs and Roberts Law of Remedies 3d Ed. (2018) §9.3 Restitution plus Damages: Election of Remedies (stating that "[m]odern procedure permits alternative and inconsistent claims and also alternative and inconsistent defenses). See also Schwartz v. Rockey, 932 A.2d 885, 893 (Pa. 2007) (stating that a majority of jurisdictions apply modern rules of pleading to permit the simultaneous pleading of inconsistent claims for relief....Within the supporting rationale is the concern that requiring an early election may operate to the prejudice of an innocent party, given the inability to predict the course of the litigation relative to any particular claim for relief.")

$\{x_h, x_l\}$. The (reservation) value of the asset to the seller is x_s.[24] We assume that $x_h > x_s > x_l \geq 0$, so that when $x = x_l$, selling the asset to the buyer is inefficient. Initially, $prob(x = x_l) = q \in [0, 1]$ and $prob(x = x_h) = 1 - q$. We also assume that $E(x) = q \cdot x_l + (1-q) \cdot x_h \geq x_s$, so that, in expectation, the surplus from the transaction is (weakly) positive. That is, if neither party is aware of the valuation, they should go ahead and trade. Notwithstanding the ex ante uncertainty, the seller may be better informed about the asset's value. That is, we assume that with probability $\pi \in [0, 1]$, the seller privately observes the asset's realized value prior to sale (either x_h or x_l). This produces three possible seller types: (1) the h-type seller who knows that the realized value is x_h; (2) the l-type seller, who knows that the realized value is x_l; and (3) the u-type seller, who is unaware of the realized value.

We are interested in potential (opportunistic) non-disclosure by the seller, particularly the l-type, who knows that the asset value is low and the transaction is inefficient. Notwithstanding the inefficiency, the l-type would be inclined to offer to sell the asset to the buyer when the (market) price is sufficiently high. At the same time, a legal remedy against the seller can function as a potential deterrence.

We focus on three different legal remedies: (1) no remedy (regime n); (2) voidance (regime v); and (3) monetary damages (regime d). With no legal remedy (n), if the buyer agrees to purchase the asset, the buyer is not entitled to either undo the transaction or to collect damages from the seller. If the court orders voidance (v), the buyer returns the asset to the seller and gets the price back from the seller. Finally, if the court orders monetary damages (d), the completed transaction stays as is, but the seller has to pay the buyer damages of d. Although, in theory, the size of monetary damages is unrestricted, pursuant to the US law, we will assume that $d = p_d^* - x_l$.[25] That is, if the court finds that the seller withheld evidence of low value, the buyer would be paid the difference between the price paid and the value of the asset.

[24] We assume that the seller's reservation value is fixed for simplicity. We can, instead, assume that the seller's reservation value also varies, and while the equilibrium structure will change somewhat, the main conclusions will largely stay. For instance, instead of (x_h, x_l, x_s), we can let (x_h^b, x_l^b) to stand for buyer's valuation and (x_h^s, x_l^s) to represent the seller's valuation, such that $x_h^s < x_h^b$, $x_l^b \leqq x_l^s$, and $E(x_i^b) \geq E(x_i^s)$. See Choi (2007). With this structure, when π is relatively small, we'll still get a pooling equilibrium, but when π is sufficiently high, we'll have an equilibrium break-down, largely because the u-type's reservation value is higher than the l-type's reservation value: $E(x_i^s) > x_l^s$. This will make voidance perform even better than damages, because it will support an equilibrium in a larger range of π.

[25] See Section 3. In the appendix, we also consider the possibility of setting the damages equal to the "expectation" or "benefit-of-the-bargain" damages ($d = E(x) - x_l \equiv d_e$) or at any arbitrary level ($d \in [0, \infty)$). While the main results are qualitatively similar, the analysis is simpler because the damages no longer depend on the equilibrium price. See Appendix B.

The timing of the game is as follows. At $t = 0$, Nature chooses x_l with probability $q \in (0, 1)$ and x_h with probability $1-q$, and the seller observes the realized value with probability $\pi \in [0, 1]$. When $\pi = 0$, both the seller and the buyer are uninformed ("in the dark"): there is no asymmetric information. When $\pi = 1$, on the other hand, the seller knows the valuation for sure while the buyer does not: the "degree" of asymmetric information is maximized. (When $\pi = 1$ there is no u-type seller.)

At $t = 1$, the seller decides whether to participate and sell the asset and, if the seller is informed (h-type or l-type), whether to disclose the information to the buyer. At $t = 2$, a competitive market determines the price for the asset and the buyer decides whether to purchase or not. If the buyer decides to purchase, the buyer pays the (market-determined) price and the asset is transferred to the buyer. At $t = 3$, if the buyer has purchased the asset in the previous period, the buyer observes the realized value of the asset. At $t = 4$, the buyer can sue the defendant for non-disclosure. The court determines the winner of the litigation based on available evidence (described below) and, if the buyer prevails, grants the appropriate remedy.

Evidence of the seller's misconduct is imperfect. After the sale, conditional on $x = x_l$ and no disclosure at $t = 1$, the buyer receives an imperfect signal, $\sigma \in \{0, 1\}$, which indicates whether the seller unlawfully withheld information. If $\sigma = 0$, there is no hard evidence of misconduct and any lawsuit would be summarily dismissed. If $\sigma = 1$, the buyer receives hard evidence that would allow them to prevail at trial. There are both false positives and false negatives associated with the signal. More precisely, with non-disclosure, we assume that $prob(\sigma = 1|l\text{-}type) = \lambda_l$, $prob(\sigma = 1|u\text{-}type) = \lambda_u$, and $0 \leq \lambda_u < \lambda_l \leq 1$. Thus, the buyer is more likely to prevail against the l-type seller who unlawfully withheld information.

Finally, litigation is costly for the buyer. In both the damages and voidance regimes, the buyer's litigation cost is $\gamma \cdot (p_i^* - x_l)$ when the buyer successfully prosecutes its claim after observing that the aseet has low value ($x = x_l$). We assume $\gamma \in [0, 1]$. Note that litigation costs are proportional to the stakes of the case and the buyer has a credible threat to sue if the asset has low value.[26] For simplicity, we assume that the litigation cost for the seller is zero.

[26]The assumption of proportionate litigation cost (γ) allows us to bypass the litigation credibility issue while reflecting the fact that the cost increases as the size of litigation stake increases. Also, imposing the cost only on the buyer streamlines the analysis without affecting the substantive results. We will informally discuss relaxing these assumptions later.

4.1 No Liability: Benchmark

As a benchmark, suppose the buyer has no legal remedy against the seller. Two things are clear. First, the h-type will always voluntarily disclose its information to the buyer. By disclosing, the h-type seller can guarantee itself the highest possible selling price, $p = x_h$. Second, there cannot exist an equilibrium where the u-type participates and the l-type does not. If that were so, market forces would lead to price $p = E(x) > x_s > x_l$, which provides an incentive to the l-type to mimic the u-type, not disclose its information, and sell its asset for $p = E(x)$. Hence, if the u-type participates, the l-type is willing to participate, too.

We now characterize the equilibrium. Denote the asset price, conditional on non-disclosure, as p_n^* and the l-type's participation rate as $\beta_n^* \in [0, 1]$. Since the l-type's net payoff from participating and selling the asset is $p_n^* - x_s$, the probability that they participate satisfies:

$$\begin{cases} \beta_n^* = 0 & \text{if} \quad p_n^* < x_s \\ \beta_n^* \in [0,1] & \text{if} \quad p_n^* = x_s \\ \beta_n^* = 1 & \text{if} \quad p_n^* > x_s \end{cases} \tag{1}$$

If the seller does not disclose, the market cannot tell whether the seller is the u-type (who has no information to reveal) or the l-type. The market does know that u-types account for fraction $1 - \pi$ of all potential sellers, and that l-types who fail to disclose account for fraction $\pi q \beta_n^*$. Thus, competition among buyers will drive the asset price to the break-even point:

$$(1 - \pi)(E(x) - p_n^*) + \pi q \beta_n^* (x_l - p_n^*) = 0. \tag{2}$$

The first term, which is positive in equilibrium, reflects the buyer's return from purchasing the asset from the u-type; the second term, which is negative in equilbrium, reflects the buyer's return from purchasing from the non-disclosing l-type. Mechanically, we can see that if the l-type participates more often, so β_n^* is larger, then the price p_n^* must fall to compensate the buyer for the risk of overpaying for the asset.

Taken together, equations (1) and (2) characterize the equilibrium price and probability: p_n^* and β_n^*. With no liability, full deterrence is not possible. To see why, suppose that the l-type seller is fully deterred, $\beta_n^* = 0$. From (2), we can see that, to satisfy the equality, we need $p_n^* = E(x) > x_s$. With full deterrence, buyers would pay the expected value of the asset. But in this case, from (1), the l-type would mimic the u-type and participate as well. In equilibrium, the l-type seller is either undeterred, $\beta_n^* = 1$, or partially deterred, $\beta_n^* \in (0, 1)$. In the partial deterrence equilibrium, the price $p_n^* = x_s$ and the l-type randomizes between participating and not.

Whether the l-type is undeterred or partially deterred in equilibrium depends on whether the fraction of informed types π is above or below a threshold $\widehat{\pi}_n$ is implicitly defined by:

$$\frac{\widehat{\pi}_n q}{1-\widehat{\pi}_n} = \frac{E(x)-x_s}{x_s-x_l}. \tag{3}$$

This threshold was constructed by setting $\beta_n^* = 1$ and $p_n^* = x_s$ in equation (2) and rearranging terms. The left-hand side of (3) is the odds ratio of l-types to u-types. The right-hand side is the ratio of the buyer's surplus from the u-type divided by the buyer's loss from the l-type. If π is below this threshold, so the degree of asymmetric information is small, then there is partial deterrence. This makes sense. When there are very few l-types, they will mimic the u-types and obtain a price close to $E(x)$. If π is above the threshold, there is no deterrence. Proposition 1 describes the equilibrium when the buyer has no legal remedy against the seller.

Proposition 1. *(No Liability Equilibrium.) Suppose the buyer does not have a liability claim against the seller based on non-disclosure. The h-type seller always discloses its information and sells the asset to the buyer at $p = x_h$. The u-type seller and participating l-type seller do not disclose any information and sell the asset to the buyer at equilibrium price of $p_n^* \in [x_s, E(x)]$.*

1. *No Deterrence. If $\pi \leq \widehat{\pi}_n$, then the l-type seller does not disclose its information and sells the asset with probability $\beta_n^* = 1$. The equilibrium price is p_n^* is decreasing in π. As $\pi \to 0$, $p_n^* \to E(x)$; while as $\pi \to \widehat{\pi}_n$, $p_n^* \to x_s$*

2. *Partial Deterrence. If $\pi > \widehat{\pi}_n$, then the l-type seller does not disclose its information and sells the asset with probability*

$$\beta_n^* = \frac{1-\pi}{\pi} \cdot \frac{\widehat{\pi}_n}{1-\widehat{\pi}_n}. \tag{4}$$

   As $\pi \to 1$, $\beta_n^* \to 0$, while as $\pi \to \widehat{\pi}_n$, $\beta_n^* \to 1$. The equilibrium price is $p_n^* = x_s$.

When $\pi \leq \widehat{\pi}_n$, so that the buyer knows that the chances of facing an informed seller is relatively low, the buyer is willing to pay a sufficiently high price for the asset and this induces the l-type to participate for certain. With the probability of adverse selection relatively low, even with the full participation by the l-type, the equilibrium price of the asset is $p_n^* \in (x_s, E(x))$. As the chances of facing an informed seller rises, the equilibrium market price falls. When the chance of facing an informed seller is sufficiently high, $\pi > \widehat{\pi}_n$, then the l-type's full participation is no longer feasible and we get partial deterrence. As π grows larger, the l-type's participation probability falls. As π approaches one, l-type declines to participate, $\beta_n^* \to 0$. This is the familiar full unraveling result of Grossman (1981) and Milgrom (1981).

4.2 Voidance as Remedy

Suppose the buyer is entitled to void the contract when the buyer prevails in litigation. With voidance, the buyer gets to "undo" the transaction after observing the asset value. If the equilibrium price of the transaction is p_v^* and the asset value is x_l, then the buyer's "quasi" recovery from voidance is $p_v^* - x_l$. We assume that the cost of litigation is proportional to the recovery: $\gamma(p_v^* - x_l)$ where $\gamma \in [0,1]$. If $x = x_l$ and the buyer has hard evidence ($\sigma = 1$), then the buyer will bring suit. Litigation is credible because the buyer's net recovery is $(1-\gamma)(p^* - x_l) > 0$.

We now characterize the equilibrium price p_v^* and the l-type seller's probability of participation $\beta_v^* \in [0,1]$. If the l-type seller participates and does not disclose the asset value, the seller's net payoff is

$$p_v^* - x_s - \lambda_l(p_v^* - x_s) = (1-\lambda_l)(p_v^* - x_s).$$

This payoff is strictly positive (negative) if $p_v^* > x_s$ ($p_v^* < x_s$).[27] The l-type seller's equilibrium participation probability must satisfy:

$$\begin{cases} \beta_v^* = 0 & \text{if} \quad p_v^* < x_s \\ \beta_v^* \in [0,1] & \text{if} \quad p_v^* = x_s \\ \beta_v^* = 1 & \text{if} \quad p_v^* > x_s \end{cases} \tag{5}$$

In equilibrium, if $p_v^* < x_s$, we get full deterrence; if $p_v^* > x_s$, we get no deterrence; and if $p_v^* = x_s$, we get partial deterrence.

With the l-type seller's equilibrium participation probability of β_v^*, the market price will satisfy the following break-even condition for the buyer:

$$(1-\pi)(E(x) - p_v^*) + \pi q \beta_v^*(x_l - p_v^*) + (1-\gamma)[(1-\pi)\lambda_u + \pi q \beta_v^* \lambda_l](p_v^* - x_l) = 0. \tag{6}$$

The first two terms are familiar from the break-even condition for the no-liability regime (2). The third term, which is new, represents the value the buyer obtains from being able to void the contract when the realized asset value is low. The expression $(1-\pi)\lambda_u + \pi q \beta_v^* \lambda_l$ is the probability of getting the transaction voided while $(1-\gamma)(p_v^* - x_l)$ represents the buyer's net return from voidance.[28]

[27] If, for instance, the seller has to bear $\delta(p_v^* - x_s)$ as litigation cost, the seller's net payoff will be given by $(1 - \lambda_l(1+\delta))(p_v^* - x_s)$, and, assuming that $(1 - \lambda_l(1+\delta)) \geq 0$, the rest of the analysis will remain the same. Note that imposing proportionate litigation cost on the seller has the similar effect to increasing λ_l.

[28] The voidance remedy imposes asymmetric litigation stakes on the buyer and the seller. The

Taken together, equations (5) and (6) determine the equilibrium probability β_v^* and price p_v^*. With voidance, full deterrence is not possible. Suppose that the l-type seller is fully deterred, $\beta_v^* = 0$. Rearranging (6), the price p_v^* would satisfy

$$p_v^* = E(x) + (1-\gamma)\lambda_u(p_v^* - x_l). \tag{7}$$

This implies that p_v^* would exceed $E(x)$. But since $E(x) > x_s$, the l-type seller would participate from equation (5)—a contradiction. With voidance, the seller's worst-case outcome is simply to recover the asset while refunding the price, which puts them exactly where they started. As a result, the seller has nothing to lose by participating. In equilibrium, the l-type will be either undeterred or partially deterred.

Proposition 2 characterizes the equilibrium under the voidance regime. Similar to the no liability regime, the equilibrium will depend on whether the fraction of informed types π is above or below a threshold, $\widehat{\pi}_v \in (0,1)$, implicitly defined by:

$$\frac{\widehat{\pi}_v q}{1-\widehat{\pi}_v} = \frac{E(x) - x_s + q\lambda_u(1-\gamma)(x_s - x_l)}{x_s - x_l - \lambda_l(1-\gamma)(x_s - x_l)}. \tag{8}$$

The left-hand side of (8) is the odds ratio of l-types to u-types. The right-hand side is the ratio of the investor's surplus from the u-type divided by the investor's loss from the l-type.

Proposition 2. *(Voidance Equilibrium.) Suppose the buyer can rescind the transaction after observing non-disclosure and $\sigma = 1$. The h-type seller always discloses its information and sells the asset to the buyer at $p = x_h$. The u-type seller and participating l-type seller do not disclose any information and sell the asset to the buyer at equilibrium price $p_v^* \geq x_s$.*

1. *No Deterrence. If $\pi \leq \widehat{\pi}_v$, then the l-type seller does not disclose its information and both the u-type and the l-type sell the asset to the buyer with probability $\beta_v^* = 1$. Equilibrium price p_v^* is strictly decreasing in π and $p_v^* \to x_s$ as $\pi \to \widehat{\pi}_v$.*

2. *Partial Deterrence. If $\pi > \widehat{\pi}_v$, then the l-type seller does not disclose its information and sells the asset with probability*

$$\beta_v^* = \frac{1-\pi}{\pi} \cdot \frac{\widehat{\pi}_v}{1-\widehat{\pi}_v}. \tag{9}$$

The u-type and the l-type seller sell the asset to the buyer at the equilibrium price of $p_v^* = x_s$. As $\pi \to 1$, $\beta_v^* \to 0$, while as $\pi \to \widehat{\pi}_v$, $\beta_v^* \to 1$.

stakes are $(p_v^* - x_s)$ for the seller, and for the buyer, the stakes are $(p_v^* - x_l)$, which is larger than $(p_v^* - x_s)$. This is in contrast to the damages regime.

Before we proceed, it is interesting to compare Proposition 2 with Proposition 1 where there is no liability for non-disclosure. As in the no-liability case, because the l-type seller faces no downside risk from voidance, the remedy cannot fully deter the l-type seller: deterrence is either absent or only partial. There are, however, several important differences. Comparing Propositions 1 and 2 reveals that the market price is higher under the voidance remedy, $p_v^* \geq p_n^*$. Because voidance allows the buyer to unwind a loss-producing transaction (when $x = x_l$), it increases the buyer's willingness to pay and thus raises the market price. This, in turn, implies $\widehat{\pi}_v \geq \widehat{\pi}_n$. As a result, the higher willingness to pay under voidance makes it more difficult to deter the l-type seller from participating and makes opportunistic participation more likely.[29]

4.3 Damages as Remedy

Suppose the buyer is entitled to damages ($d \in [0, \infty)$) as remedy for seller's non-disclosure. As discussed in Section 3, under the existing legal regime, the damages are usually limited to the "pecuniary loss" that the buyer suffers, measured by the difference between the price the buyer has paid and the value of the asset: $d = p_d^* - x_l$. This is equivalent to granting "rescissory damages" to the buyer, and we will focus on this damages measure.[30] If $x = x_l$ and the buyer brings suit and prevails and receives $d = p_d^* - x_l$, the buyer's return is $x_l + (1 - \gamma)(p_d^* - x_l)$ where $\gamma(p_d^* - x_l)$ represents the cost of litigation. The seller's return is $p_d^* - (p_d^* - x_l) = x_l$. As in the case with voidance, since the cost of litigation is proportional to the damage award, litigation is always credible for the buyer.

Monetary damages will impact the l-type seller's willingness to participate in the market. Recall that λ_l is the likelihood that the l-type will be found liable and be required to pay damages. The l-type seller's return from participating is positive if $p_d^* - \lambda_l(p_d^* - x_l) > x_s$ and negative if $p_d^* - \lambda_l(p_d^* - x_l) < x_s$. Rearranging terms, the l-type's equilibrium participation probability β_d^* depends on the price p_d^* as follows:

[29] Within the partial deterrence region, in order to satisfy the buyer's break-even condition, the l-type has to participate with a (weakly) higher probability with the voidance regime: $\beta_v^* \geq \beta_n^*$.

[30] In theory, the damages can be measured based on the difference the value that the buyer would have been willing to pay (conditional on either complete disclosure or non-disclosure) and the realized value of the asset: $d = E(x) - x_l = (1 - q)(x_h - x_l)$. This would be equivalent to granting "expectation damages." In Appendix B, we analyze more general damages ($d \in [0, \infty)$), including expectation damages. The results are qualitatively similar, though, when there is no upper limit on how large the damages can be, achieving full deterrence becomes much easier.

$$\begin{cases} \beta_d^* = 0 & \text{if} \quad p_d^* < x_s + \frac{\lambda_l}{1-\lambda_l}(x_s - x_l) \\ \beta_d^* \in [0,1] & \text{if} \quad p_d^* = x_s + \frac{\lambda_l}{1-\lambda_l}(x_s - x_l) \\ \beta_d^* = 1 & \text{if} \quad p_d^* > x_s + \frac{\lambda_l}{1-\lambda_l}(x_s - x_l) \end{cases} \tag{10}$$

Comparing equation (10) with the analogous condition for voidance in equation (5) reveals that deterrence is stronger in the damages regime. With damages, the defendant is fully deterred when $p_d^* < x_s + \frac{\lambda_l}{1-\lambda_l}(x_s - x_l)$ while with voidance the defendant is fully deterred when $p_d^* < x_s$. Although the conditions look similar, the damages regime imposes a harsher sanction against the seller. Conditional on an equilibrium price of p^*, from the seller's perspective, it is worse to pay damages of $p^* - x_l$ than to bear the loss from a return: $p^* - x_s$.

With the l-type seller's equilibrium participation probability of β_d^*, the equilibrium market price p_d^* will satisfy the following break-even condition for the buyer:

$$(1-\pi)(E(x) - p_d^*) + \pi q \beta_d^*(x_l - p_v^*) + (1-\gamma)[(1-\pi)\lambda_u + \pi q \beta_d^* \lambda_l](p_d^* - x_l) = 0. \tag{11}$$

This is identical to the buyer's break-even condition in the voidance regime (6). From the buyer's perspective, receiving monetary compensation $p_d^* - x_l$ is equivalent to being able to undo the transaction. As we will soon see, the difference between the two remedies manifests through deterrence and social welfare. Taken together, equations (10) and (11) determine the equilibrium probability β_d^* and price p_d^*.

An important departure from the previous analysis is that, unlike the cases with no liability or voidance, with damages, full deterrence is possible. Setting $\beta_d^* = 0$ in (11) and solving for the price produces:

$$p_d^* = \frac{E(x) - (1-\gamma)\lambda_u x_l}{1 - (1-\gamma)\lambda_u} > 0. \tag{12}$$

Now consider equation (10). If λ_l is sufficiently large, then $p_d^* < x_s + \frac{\lambda_l}{1-\lambda_l}(x_s - x_l)$ and, therefore, $\beta^* = 0$. The l-type will be fully deterred when the probability that they will be liable for damages (λ_l) is sufficiently high.

As with the earlier analysis, the equilibrium with the damages regime will hinge on whether the fraction of informed types π is above or below a threshold, $\widehat{\pi}_d$, implicitly defined by:

$$\frac{\widehat{\pi}_d q}{1 - \widehat{\pi}_d} = \frac{E(x) - x_s + q\lambda_u(1-\gamma)(x_s - x_l) - \lambda_l(E(x) - x_l)}{x_s - x_l - \lambda_l(1-\gamma)(x_s - x_l)}. \tag{13}$$

The left-hand side of (13), as before, is the odds ratio of l-types to u-types. The right-hand side is the ratio of the buyer's surplus from the u-type divided by the buyer's return from the l-type. Notice that if λ_l is large, then the numerator may be negative. We define the threshold value $\overline{\lambda}_l$ to be:

$$\overline{\lambda}_l \equiv \frac{E(x) - x_s + q\lambda_u(1-\gamma)(x_s - x_l)}{E(x) - x_l}. \tag{14}$$

As stated in the following proposition, when $\lambda_l \geq \overline{\lambda}_l$ then the l-type is fully deterred. When $\lambda_l < \overline{\lambda}_l$, then the defendant is either undeterred or partially deterred, depending on the degree of asymmetric information π.

Proposition 3. *(Damages Equilibrium.) Suppose the buyer can collect damages of $d = p_d^* - x_l$ from the seller after observing non-disclosure and $\sigma = 1$. The h-type seller always discloses its information and sells the asset to the buyer at $p = x_h$.*

1. *Full Deterrence. If $\lambda_l \geq \overline{\lambda}_l$, then the l-type seller is fully deterred and does not participate. $\beta_d^* = 0$.*

2. *No Deterrence. If $\lambda_l < \overline{\lambda}_l$ and $\pi \leq \widehat{\pi}_d \in [0,1]$, the l-type seller is undeterred and participates with probability $\beta_d^* = 1$. Equilibrium price p_d^* is a decreasing function of π.*

3. *Partial Deterrence. If $\lambda_l < \overline{\lambda}_l$ and $\pi > \widehat{\pi}_d \in [0,1]$, the l-type seller is partially deterred and participates with probability $\beta_d^* \in [0,1)$ where*

$$\beta_d^* = \frac{1-\pi}{\pi} \cdot \frac{\widehat{\pi}_d}{1-\widehat{\pi}_d}. \tag{15}$$

As $\pi \to 1$, $\beta_d^* \to 0$, and as $\pi \to \widehat{\pi}_d$, $\beta_d^* \to 1$. Equilibrium price $p_d^* > x_s$ does not depend on π.

When the seller is undeterred, $\beta_d^* = 1$, the equilibrium price under the damages regime is the same as that under voidance:

$$p_d^*(\pi) = p_v^*(\pi).$$

This follows directly from the identical break-even conditions for the damages and voidance regimes.[31] As we saw earlier, when the buyer is entitled to receive $d = p_d^* - x_l$ as damages, from the buyer's perspective, this is equivalent to being able to void the

[31] See also the proofs of Propositions and (2) and (3).

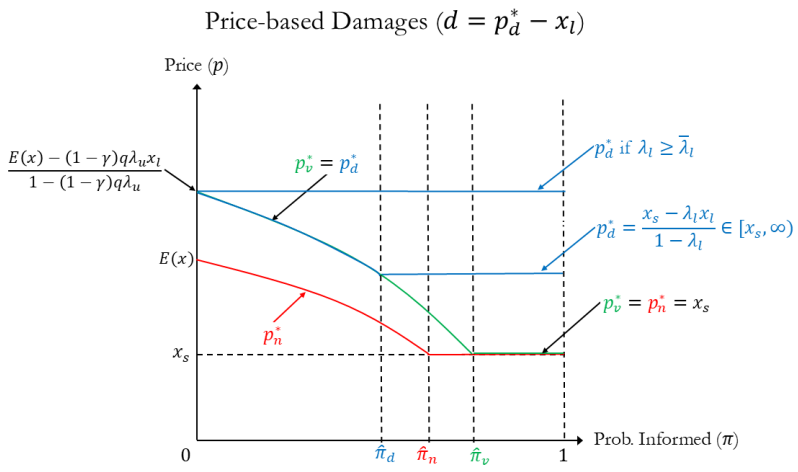


Figure 1: Equilibrium Prices with Price-based Damages

transaction. Hence, the buyer's willingness to pay will be the same in both regimes. With the l-type seller participating for certain ($\beta_d^* = \beta_v^* = 1$), satisfying the buyer's break-even conditions in (11) and (6) will generate the same equilibrium price.

On the other hand, within the partial deterrence region, the damages regime will render a higher equilibrium price compared to the voidance regime. Under voidance, with partial deterrence, we had $p_v^* = x_s$. With damages (of $d = p_d^* - x_l$), with partial deterrence, we have $p_d^* = x_s + \frac{\lambda_l}{1-\lambda_l}(x_s - x_l)$, which is strictly larger than x_s, so long as $\lambda_l > 0$. The result is intuitive. Although, from the buyer's perspective, both the damages and the voidance regimes allow for the "same" recovery, from the l-type seller's perspective, the damages regime imposes a stronger sanction against non-disclosure, since, when found liable, the seller has to pay $p^* - x_l$, instead of $p^* - x_s$. Hence, the l-type seller's expected profit will generally be lower under damages regime than under voidance regime, and in order to satisfy the l-type seller's indifference condition, the equilibrium price needs to be higher with damages than with voidance.

4.4 Equilibrium Comparison

Before we make welfare comparisons, it is helpful to compare the equilibria under three different liability regimes. Figure 1 plots three sets of equilibrium price lines. The red line depicts the equilibrium price when there is no liability. As seen earlier, when $\pi \leq \widehat{\pi}_n$, we get no deterrence and p_n^* decreases as π increases, whereas when $\pi > \widehat{\pi}_n$, we get partial deterrence ($\beta_n^* \in [0, 1]$) with $p_n^* = x_s$. The green line depicts

the equilibrium price under voidance, with a threshold of $\widehat{\pi}_v$. The set of blue lines depict the equilibrium price with damages. With respect to damages, the figure shows two possible equilibria: full deterrence (represented by the top horizontal blue line) and less-than-full deterrence (represented by the curved blue line combined with a horizontal blue line after $\pi \geq \widehat{\pi}_d$). When $\lambda_l < \overline{\lambda}_l$, we have either no deterrence (when $\pi \leq \widehat{\pi}_d$) or partial deterrence (when $\pi > \widehat{\pi}_d$).

Figure 1 shows a few notable results. First is the relative efficacy in providing deterrence. Notably, the range of π where we get no deterrence is the largest with voidance, while the range of no deterrence is the smallest with damages: $\widehat{\pi}_d \leq \widehat{\pi}_n \leq \widehat{\pi}_v$. Second, when we compare the three equilibrium price lines, compared to the red line (equilibrium price under no remedy), both the blue line and the green line are located above, implying that the equilibrium price will be higher with either damages or voidance. This is not surprising since with some remedy (voidance or damages), the buyer would be willing to pay more. Finally, as seen earlier, when both the damages and the voidance regimes are producing no deterrence ($\beta_d^* = \beta_v^* = 1$), the equilibrium prices are the same. This is due to the fact that, from the buyer's perspective, the net return the buyer gets from either voidance or damages is the same.

Corollary 1. *Deterrence is strongest in the damages regime, followed by no liability, followed by voidance:* $0 \leq \beta_d^* \leq \beta_n^* \leq \beta_v^* \leq 1$. *Partial deterrence is obtained for the widest range of parameter values by the damages regime, followed by no liability, followed by voidance:* $0 < \widehat{\pi}_d < \widehat{\pi}_n < \widehat{\pi}_v < 1$. *Asset prices are highest in the damages regime, followed by voidance, followed by no liability:* $0 < p_n^* \leq p_v^* \leq p_d^*$.

Figure 2 plots the respective $\widehat{\pi}_i$ and the equilibrium participation probabilities of the l-type (β_i^*) depending on the legal regime. As shown in Corollary (1), in terms of π, the region in which we get only partial deterrence is largest with voidance regime and smallest with damages regime: $\widehat{\pi}_v > \widehat{\pi}_n > \widehat{\pi}_d$. When π is relatively small ($\pi \leq \widehat{\pi}_i$ in respective legal regime), the l-type participates with probability one. Once we pass the threshold ($\pi > \widehat{\pi}_i$), the l-type's participation probability decreases and converges to zero as $\pi \to 1$. We can see that, for all $\pi \in [0, 1]$, the l-type's participation probability is (weakly) lowest with the damages regime and the highest with the voidance regime. In other words, the deterrence is strongest with damages remedy and weakest with voidance remedy.

5 Social Welfare

In the earlier section, we analyzed three possible legal regimes: (1) no liability; (2) liability backed with voidance; and (3) liability backed with damages ($d = p_d^* - x_l$).

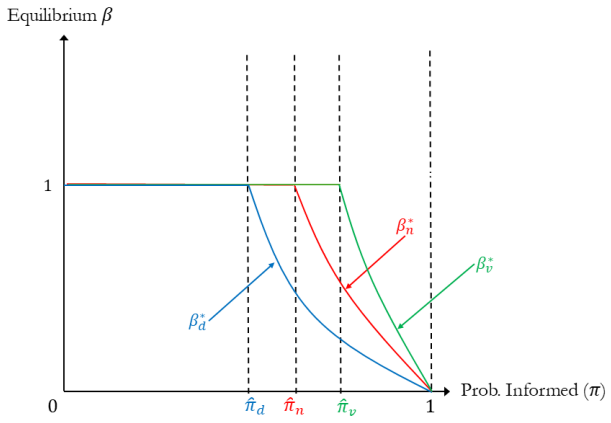


Figure 2: Equilibrium Probability of l-type's Participation

In this section, we compare welfare properties of the three regimes. There are two sources of inefficiency: (1) transactional inefficiency, which happens when the buyer acquires and keeps an asset that is worth x_l; and (2) litigation inefficiency, which are the resources the buyer spends in pursuing its claim against the seller. With respect to the first, there are two ways of improving transactional efficiency. First, as the legal regime does a better job of deterring the l-type seller from participating in the sale, efficiency will improve. At the same time, if the buyer can "undo" inefficient transactions, this will also increase the transactional efficiency. Note that the second way of efficiency improvement is available in the voidance regime.

5.1 No Liability

First, with no liability, the equilibrium social welfare is given by:

$$SW_n = E(x) - x_s + \pi q(1 - \beta_n^*)(x_s - x_l). \tag{16}$$

The first part of equation (16), $E(x) - x_s$, is the hypothetical surplus that would be created if the buyer acquires and keeps the asset, regardless of the seller's type. Social welfare is higher than this, of course, when the l-type is deterred from participating. The second part, $\pi q(1 - \beta_n^*)(x_s - x_l) > 0$, is the social benefit from deterrence. The l-type is deterred with probability $1 - \beta_n^*$, and the transactional efficiency is a social good.

Corollary 2. *(No Liability Welfare.) Suppose the buyer has no remedy against the seller for non-disclosure. The following constitutes the equilibrium social welfare.*

1. *If $\pi \leq \widehat{\pi}_n$ there is no deterrence, $\beta_n^* = 1$. Welfare is*

$$SW_n = E(x) - x_s$$

which is independent of π.

2. *If $\pi > \widehat{\pi}_n$ there is partial deterrence, $\beta_n^* \in (0,1)$. Welfare is:*

$$SW_n = \pi(1-q)(x_h - x_s).$$

As $\pi \to 1$, $SW_n \to (1-q)(x_h - x_s)$.

Corollary 2 establishes that the equilibrium welfare under no liability regime depends on whether we ger no deterrence or partial deterrence. In the case of no deterrence, with certain participation by the l-type seller, the social welfare is given by $(1-q)(x_h-x_s)+q(x_l-x_s)$, which is constant with respect to π. This is intuitive. Given that the buyer transacts with all types of seller with probability one, the expected welfare will be determined by the expected net surplus. The term $(1-q)(x_h - x_s)$ represents the expected surplus from purchasing the high-value asset, where as the term $q(x_l - x_s)$ represents the expected surplus (which is negative) from purchasing the low-value asset (from either the u-type or the l-type).

When we move into the partial deterrence equilibrium, the expected welfare is given by $\pi(1-q)(x_h - x_s)$. Note that this is equal to the (ex ante) expected profit for the h-type seller. This is also not surprising. With the equilibrium price of $p_n^* = x_s$ and the buyer's break-even condition, the expected profits for the buyer, the u-type seller, and the l-type seller are all zero. Only the h-type seller realizes profit in the partial deterrence region, and the social welfare is equal to the h-type seller's profit. Per our analysis earlier, as $\pi \to 1$, $\beta_n^* \to 0$, $SW_n(\pi > \widehat{\pi}_n) \to (1-q)(x_h - x_s)$. Without any legal remedy, as π increases, when $\pi \leq \widehat{\pi}_n$, the expected welfare loss is constant, whereas when $\pi > \widehat{\pi}_n$, the expected welfare loss is strictly decreasing with respect to π and is equal to zero when $\pi = 1$.

5.2 Voidance

With voidance as remedy, the expected social welfare is:

$$SW_v = E(x) - x_s + \pi q(1-\beta_v^*)(x_s - x_l) + [(1-\pi)q\lambda_u + \pi q \beta_v^* \lambda_l](x_s - x_l - \gamma(p_v^* - x_l)). \quad (17)$$

The first line of equation (17) is familiar from no liability case in equation (16). $E(x) - x_s$ is the welfare that would be obtained if the buyer purchased and retained the asset, regardless of the seller type, and $\pi q(1-\beta_v^*)(x_s - x_l)$ is the social surplus from ex ante deterrence. With the voidance remedy, the l-type is deterred with probability $1 - \beta_v^*$, preventing a socially inefficient transaction. The second line is new, and highlights both the benefits and cost that come ex post from the lawsuit. The term in square brackets, $(1 - \pi)q\lambda_u + \pi q\beta_v^*\lambda_l$, is the probability of a lawsuit. The cost of a lawsuit is proportional to the value at stake, $\gamma(p_v^* - x_l)$. The benefit of a lawsuit is that inefficient transactions are voided, creating value $x_s - x_l$.

Corollary 3. *(Voidance Welfare.) Suppose the buyer is entitled to void the transaction for seller's opportunistic participation. The following constitutes the equilibrium social welfare.*

1. *If $\pi \leq \widehat{\pi}_v$ there is no deterrence, $\beta_v^* = 1$. Social welfare is:*

$$SW_v(\pi) = E(x) - x_s + [(1 - \pi)q\lambda_u + \pi q\lambda_l](x_s - x_l - \gamma(p_v^* - x_l)).$$

   SW_v increases with respect to π.

2. *Suppose $\pi > \widehat{\pi}_v$. The equilibrium welfare is:*

$$SW_v(\pi) = \pi(1 - q)(x_h - x_s).$$

   As $\pi \to 1$, $SW_n(\pi) \to (1 - q)(x_h - x_s)$.

With voidance as remedy, unlike the case of no remedy (or damages), the buyer will seek to void the transaction when $x = x_l$. This will have two important implications. Unlike the case of no remedy, with voidance, the buyer can sometimes undo the inefficient transactions and this will increase the expected welfare. On the other hand, however, pursuing voidance is costly and the litigation cost will decrease the expected welfare. In the no deterrence region, whether the voidance regime will generate a higher (expected) social welfare than the no remedy regime will depend on the size of litigation expenditure (γ). As the corollary demonstrates, when γ is sufficiently small, voidance regime will not only perform better than the no remedy regime, but also the relative advantage will increase as π increases. This is because a larger π implies that there are likely more transactions with the l-type seller that can be undone to improve transactional efficiency.

In the partial deterrence region, Corollary 3 shows that the expected social welfare is given by $SW_v(\pi > \widehat{\pi}_v) = \pi(1 - q)(x_h - x_s)$. This expression is equal to the h-type seller's (ex ante) expected profit. Though somewhat surprising, this is intuitive. In

the partial deterrence region, we know that, with voidance, the equilibrium price is equal to the seller's reservation value: $p_v^* = v_s$. This implies that, for both the l-type and the u-type sellers, their expected profits are equal to zero. We also know that, in equilibrium, the buyer's break-even condition is satisfied. Only the h-type seller is making any positive profit in this region and the (expected) social welfare consists solely of the h-type's expected profit. Finally, note also that, in the partial deterrence region, the expected social welfare is equal to that under no remedy. In other words, conditional on partial deterrence, voidance regime does no better than no liability.

5.3 Damages

When the buyer is entitled to collect damages of $d = p_d^* - x_l$ as remedy for seller's non-disclosure, the expected social welfare is:

$$SW_d = E(x) - x_s + \pi q(1 - \beta_d^*)(x_s - x_l) - [(1 - \pi)q\lambda_u + \pi q\beta_d^*\lambda_l]\gamma(p_d^* - x_l). \quad (18)$$

The first two terms are the same as no liability and voidance. The term in square brackets is the probability of a lawsuit. The last term $\gamma(p_v^* - x_l)$ represents the litigation cost.

Corollary 4. *(Damages Welfare.) Suppose the buyer is entitled to receive damages of $d = p_d^* - v_l$ for seller's opportunistic participation. The following constitutes the equilibrium social welfare.*

1. *Full Deterrence. Suppose $\lambda_l \geq \overline{\lambda}_l$. The equilibrium social welfare is:*

$$SW_d(\lambda_l \geq \overline{\lambda_l}) = E(x) - x_s + \pi q(x_s - x_l) - (1 - \pi)q\lambda_u\gamma(p_d^* - x_l).$$

   When $\pi = 0$, $SW_d(\lambda_l \geq \overline{\lambda}_l, \pi = 0) < E(x) - x_s$. As SW_d increases at a constant rate as π gets larger, and $SW_d(\lambda_l \geq \overline{\lambda}_l, \pi = 1) = (1 - q)(x_h - x_s)$.

2. *No Deterrence. Suppose $\lambda_l < \overline{\lambda}_l$ and $\pi \leq \widehat{\pi}_d$. The equilibrium welfare is:*

$$SW_d(\lambda_l < \overline{\lambda}_l, \pi \leq \widehat{\pi}_d) = E(x) - x_s - [(1 - \pi)q\lambda_u + \pi q\lambda_l]\gamma(p_d^* - x_l).$$

   When $\pi = 0$, $SW_d(\lambda_l < \overline{\lambda}_l, \pi = 0) = SW_d(\lambda_l \geq \overline{\lambda}_l, \pi = 0)$. As π increases, SW_d decreases.

3. *Partial Deterrence. Suppose $\lambda_l < \overline{\lambda}_l$ and $\pi > \widehat{\pi}_d$. The equilibrium welfare is:*

$$SW_d(\lambda_l < \overline{\lambda}_l, \pi > \widehat{\pi}_d) = E(x) - x_s + \pi q(1 - \beta_d^*)(x_s - x_l) - [(1 - \pi)q\lambda_u + \pi q\beta_d^*\lambda_l]\gamma(p_d^* - x_l).$$

As π increases, SW_d increases and when $\pi = 1$, $SW_d(\lambda_l < \overline{\lambda}_l, \pi = 1) = (1 - q)(x_h - x_s)$.

The statements about the social welfare in the case of full deterrence are straightforward. With full deterrence, the welfare loss stems solely from transacting with the u-type: the (expected) transactional inefficiency of $(1 - \pi)q(x_s - x_l)$ and the (expected) litigation cost of $(1 - \pi)q\lambda_u(p_d^* - x_l)$. As π increases, because the chances of facing the u-type gets smaller, the expected welfare also increases. When $\pi = 1$, in both full deterrence and partial deterrence settings, the social welfare converges to $(1 - q)(x_h - x_s)$. On the other hand, when $\pi = 0$, in both full deterrence and no deterrence settings, the social welfare is the same. This is because, with $\pi = 0$, in either the full deterrence or no deterrence regions, the buyer is only facing the u-type in equilibrium.

In the case of no deterrence ($\pi \leq \widehat{\pi}_d$ and $\beta_d^* = 1$), Corollary 4 shows that as π increases, the social welfare falls. This is due to the fact that, with full participation by the l-type, an increase in π will only lead to a larger litigation expenditure. Furthermore, compared to the cases of no remedy or voidance, the social welfare is lower. Comparison with no remedy is clear: in both cases, the l-type always participates but the damages regime leads to a further welfare loss from litigation. On the other hand, the corollary shows that the damages welfare is lower than that from voidance. This stems from two reasons. We know that, with voidance, the buyer gets to void some of the inefficient transactions. At the same time, we know from earlier that the equilibrium prices in both liability regimes are the same (because the buyer's reservation values are the same). This implies that the expected litigation cost will be the same in both regimes. Hence, voidance regime imposes lower transactional inefficiency while creating the same amount of litigation inefficiency.

With respect to the welfare in the partial deterrence region, recall that in both the no liability and voidance scenarios, conditional on partial deterrence, the expected social welfare was equal to $\pi(1 - q)(x_h - x_s) > 0$, which is simply the h-type seller's expected profit. With damages, by comparison, in addition to the h-type's expected profit, we also have the u-type's expected profit, and the social welfare is strictly larger. Unlike the no liability or the voidance regimes, with damages, because the l-type seller is subject to a larger sanction ($p^* - x_l > p^* - x_v$), in order to make the l-type indifferent, the equilibrium price has to be higher: $p_d^* = \frac{x_s - \lambda_l x_l}{1 - \lambda_l} \geq x_s$. With a higher equilibrium price, the u-type will now be able to realize a positive profit.[32]

[32]More concretely, it is straightforward to show that, in the partial deterrence region, with damages, the l-type participates with a lower probability than in the case of voidance: $\beta_d^* < \beta_v^*$. With a higher equilibrium price, the buyer suffers a bigger loss when $x = x_l$ (and a smaller profit when

5.4 Welfare Comparison

Having examined each liability regime's social welfare, we can make comparisons across different legal regimes. Unfortunately, however, due to the fact that each regime has different thresholds ($\widehat{\pi}_i$), this makes more general comparison difficult. On the other hand, when all three regimes produce the same type of equilibrium (partial or no deterrence), it is much easier to make welfare comparisons across different regimes. The following corollary, based on the anlaysis that has been presented so far, summarizes the welfare comparisons.

Corollary 5. *(Welfare Comparison.) The equilibrium welfare depends, in particular, on λ_l and π.*

1. *Suppose $\lambda_l \geq \overline{\lambda}_l$, so that we do get full deterrence under the damages regime. We have the following welfare comparisons.*
   (a) *No Deterrence Region. Suppose $\pi \leq \widehat{\pi}_d$, so that $\beta_n^* = \beta_v^* = 1$ and $\beta_d^* = 0$. As $\pi \to 0$, $SW_d(\lambda \geq \overline{\lambda}_l) \to E(x) - x_s - q\lambda_u\gamma(p_d^*(\pi = 0) - x_l) < E(x) - x_s = SW_n(\pi = 0)$. With a sufficiently small π, $SW_d \leq min\{SW_n, SW_v\}$.*
   (b) *Partial Deterrence Region. Suppose $\pi > \widehat{\pi}_v$ so that $\beta_i^* \in (0, 1]\ \forall i \in \{n, v\}$ and $\beta_d^* = 0$. $SW_d(\lambda \geq \overline{\lambda}_l) \geq SW_n = SW_v$. As $\pi \to 1$, $SW_d(\lambda \geq \overline{\lambda}_l) \to (1 - q)(x_h - x_s)$.*
2. *Suppose $\lambda_l < \overline{\lambda}_l$, so that we do not get full deterrence with damages. We have the following welfare comparisons.*
   (a) *No Deterrence Region. Suppose $\pi \leq \widehat{\pi}_d$, so that $\beta_n^* = \beta_v^* = \beta_d^* = 1$. $SW_d \leq min\{SW_n, SW_v\}$ and $SW_n \lesseqgtr SW_v$. When γ is sufficiently small, $SW_v \geq SW_n$, whereas as γ is sufficiently large, $SW_v < SW_n$.*
   (b) *Partial Deterrence Region. Suppose $\pi > \widehat{\pi}_v$ so that $\beta_i^* \in (0, 1]\ \forall i \in \{n, v, d\}$. $SW_d \geq SW_n = SW_v$.*

Figure 3 graphically represents the expected social welfare for the respective liability regime. The red line represents the expected social welfare in the case of no liability. The green line represent social welfare in the voidance regimes. For the damages regime, the dotted blue line represents the case of full deterrence ($\lambda_l \geq \widehat{\lambda}_l$), whereas the solid blue line represents the case of partial and no deterrence ($\lambda_l < \widehat{\lambda}_l$), as indicated in the figure. Starting with the expected social welfare in the no liability regime (SW_n), in the no deterrence region ($\pi \leq \widehat{\pi}_n$), the expected social welfare

$x = x_h$), and in order to satisfy the buyer's break-even condition, β needs to be lower. The lower rate of participation by l-type, in turn, leads to a higher social welfare.

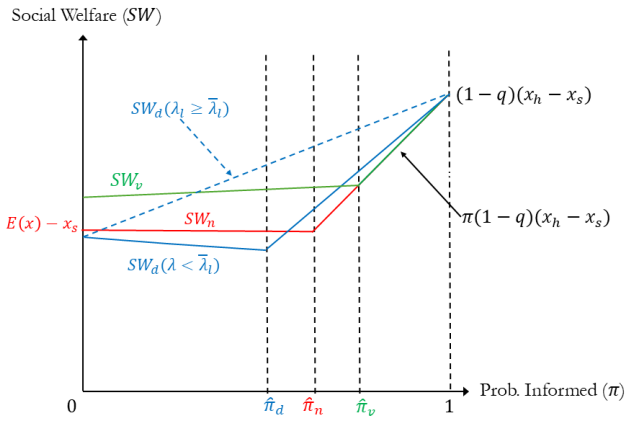


Figure 3: Social Welfare Comparison

is given by $(1-q)(x_h - x_s) + q(x_l - x_s) = E(x) - x_s$, which is independent of π. When the l-type always participates, since the welfare loss is determined by the expected transactional inefficiency, which is $q(x_s - x_l)$. Once we move into the partial deterrence region ($\pi > \widehat{\pi}_n$), as we established earlier, the social welfare is given by $\pi(1-q)(x_h - x_s)$, which increases until it reaches $(1-q)(x_h - x_s)$ when $\pi = 1$. When $\pi = 1$, the seller always observes the realized value of x and we get complete unraveling, such that only the h-type transacts with the buyer, yielding the expected surplus of $(1-q)(x_h - x_s)$.

When we compare the expected social welfare from no liability (SW_n) with that of damages (SW_d), note that, when damages lead to no deterrence ($\lambda_l \geq \widehat{\lambda}_l$ and $\pi \leq \widehat{\pi}_d$), the social welfare is lower with damages than that with no liability (the solid blue line lies below the green and red lines). This is intuitive, since, with no deterrence, damages regime will lead to not only the transactional inefficiency, which is the same as in the no liability regime, but also the litigation inefficiency. In other words, with no deterrence, damages regime performs poorly. Once we move into the partial deterrence region ($\pi > \widehat{\pi}_d$), as with the other two liability regimes, the social welfare begins increasing until it reaches $(1-q)(x_h - x_s)$ at $\pi = 1$. As we established earlier, in the partial deterrence region, the damages regime performs the best, since it induces a lower rate of participation by the l-type. This is seen by the the solid blue line that is higher than the other two when $\pi > \widehat{\pi}_d$.[33]

[33]It is also easy to see that, as the size of damages gets larger, the damages regime will perform worse in the no deterrence region while better in the partial deterrence region. This implies that,

The more interesting comparison is with voidance. Comparing the expected welfare from voidance to the other two becomes more challenging due to its unique feature of being able to undo (some) inefficient transactions. With voidance, the upside of being able to eliminate some of the transactional inefficiency is counter-balanced by the downside of litigation cost. In the no deterrence region ($\pi \leq \widehat{\pi}_v$), as shown in Corollary (5), voidance performs better than damages. While both regimes impose the same deadweight loss from litigation, voidance gets to undo some inefficient transaction, and this leads to the better welfare result under voidance. When the size of the litigation cost (γ) is not too large, voidance performs better than no liability as well. With no deterrence, conditional on litigation, welfare loss from litigation is given by $\gamma(p_v^* - x_l)$ while the welfare gain from undoing inefficient transaction is $x_s - x_l$. When $(x_s - x_l) \geq \gamma(p_v^* - x_l)$, voidance will outperform no liability. The Figure assumes that this is the case, and the green line is higher than the red and the solid blue lines (when $\pi \leq \widehat{\pi}_v$. Once we move into the partial deterrence region, however, voidance and no liability regimes produce the same expected welfare. This is because the expected returns of all three players (the buyer, the l-type seller, and the u-type seller) are equal to zero. In the figure, this is shown by the fact that the green and the red curves overlap when $\pi \geq \widehat{\pi}_v$.

The welfare comparison analysis shows that the optimal liability regime depends crucially on π, the "degree of asymmetric information." When it is unlikely that the seller has private information (i.e., when π is close to 0), because the market imposes little discipline on strategic participation by the l-type, damages regime becomes unattractive and the optimal remedy is either voidance or no liability. When the seller is quite likely to have private information (i.e., when π is close to 1), on the other hand, damages regime performs the best. Translating this to the real-world settings, perhaps the types of transactions where the seller is less likely to have informational advantages are settings where the buyer is well informed about the underlying asset, for instance, due to to its own knowledge (sophistication) or through its own due diligence. In such a case, when choosing between voidance and damages, the court should choose voidance. If voidance is not feasible due to the difficulty (or the cost) of unwinding a transaction, the court should decline to provide any remedy. On the other hand, when the seller is much more likely to have private information about the asset, e.g., when the buyer is relatively unsophisticated or the private information is very difficult to uncover through due diligence, the court should grant damages as remedy.

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when comparing rescissory damages with the benefit-of-the-bargain ("expectation") damages, rescissory damages will be better in the no deterrence region while expectation damages will be better in the partial deterrence region. See Appendix B.

6 Extensions (Preliminary)

There are several different ways that the current analysis can be extended. First is with respect to a voluntary buy-back clause (a "buy-back guarantee"), similar to a free return policy used by retailers for customers. Currently, the voidance regime performs a similar function but this is being imposed by the legal system and imposes a litigation cost. If the u-type were offer a "buy-back" clause to the buyer that would allow the buyer to return the asset at a price of $p_r \in [x_l, x_h)$, the l-type would become unwilling to mimic the u-type. What is interesting is that while such a buy-back guarantee is commonly observed among retailers (and some manufacturers), it is virtually unheard of in larger transactions, such as real estate and corporate sales. This may be due to at least a few important differences. First, with respect to these "larger" transactions, it may be important to incentivize the buyer to engage in pre-sale inspection.[34] Second, unlike retail sales, executing (and undoing) these transactions can be quite costly (e.g., advisory fees, transfer costs, etc.), which can make a buy-back inefficient. It is straightforward to show that, with a no fault buy-back, the buyer will have little to no incentive to engage in inspection ("due diligence") and if executing a transaction is costly, a no fault buy-back can impose substantial inefficiency in equilibrium.[35]

Second, with respect to litigation cost, the model has conveniently assumed a proportionate cost structure: the buyer pays γ fraction of its recovery as cost of litigation. This has allowed us to bypass the issues of litigation credibility. One extension is to generalize the cost structure to have both fixed and proportionate components. Keeping the γ the same, we can assume that the buyer has to bear the fixed cost of $\psi \geq 0$ to file suit against the seller.[36] This can have two possible effects on the equilibrium. First, when litigation remains credible, the additional fixed cost component will reduce the buyer's expected return. From Figure 1, this means that the equilibrium prices for the damages and the voidance regimes will be lower.

Third, it is also possible that the size of the stakes are too small for the litigation to be credible. This will happen, for instance, when $(1-\gamma)(p_i^* - v_l) \leq \psi$. In that case, either liability regime becomes de facto equivalent to the no liability regime.

[34] This may be especially true if the buyer has some idiosyncratic valuation component. For instance, in a corporate acquisition context, the buyer can get a better understanding of how much "merger synergies" the buyer may be able to realize through due diligence.

[35] In a slightly different vein, if the buyer can cancel the contract based on pre-sale inspection (but without a post-sale return policy), this can lead the buyer to engage in "too much" inspection. See, for instance, Daley, Geelen, and Green (2024).

[36] In footnote 27, we briefly discussed the possibility of imposing proportionate litigation cost ($\delta \geq 0$) on the seller and showed that the substantive arguments will remain the same.

With respect to the equilibrium price, for instance, expecting the litigation to be non-credible, the equilibrium price for either remedy regime will be equal to the no liability regime. From Figure 1, as we move from $\pi = 0$, it is straightforward but messy to show that the price lines for damages and voidance converge to the price line for no remedy. When we cross the threshold where $(1-\gamma)(p_i^* - v_l) \leq \psi$, the price lines for either remedy regimes will be equal to the no remedy regime. It's also possible that when ψ is sufficiently large (and/or $(1-\gamma)$ is sufficiently small), litigation is never credible, in which case the equilibrium prices will simply be equal to that under no remedy.

Another assumption we have made so far is that the l-type seller can withhold its information about the low asset value and participate in a sale. If the seller's opportunistic (wrongful) non-disclosure was discovered by the buyer ex post (with probability $\lambda_l \in [0,1]$), the seller was subject to either voidance or damages as sanctions. While opportunistic non-disclosure is an important issue in many asset sale transactions, non-disclosure is only one type of misrepresentation, with the other two types being misstatement (active assertion) and concealment. While legally distinguishing between a misstatement and a non-disclosure can be subtle and nuanced, the current analysis can also be extended to the case of misstatement.

One possibility of incorporating active assertion is by allowing the l-type (or even the u-type) seller to pretend that it is the h-type. Since the h-type has information about the asset value, for the l-type to pretend to be the h-type, an active misstatement would be necessary. One of the assumptions in the analysis was that non-disclosure is costless. By contrast, we can assume that, for the l-type seller to pretend to be the h-type, it has to make up tangible evidence to do so (e.g., "cook the books") and this would be costly. For instance, we can assume that for the l-type to pretend to be the h-type, it will cost the l-type $\phi > 0$ (If we assume that $\phi \leq x_h - E(x) = q(x_h - x_l)$, this will provide a stronger incentive to the seller to misstate.) With this assumption, the l-type will have three choices: (1) not participate in a sale; (2) not disclose its information to the buyer, pretend to be the u-type and participate in a sale; and (3) actively misstate that it is the h-type and participate in a sale.

The l-type seller's choice will, in turn, depend on the sanctions. In the case of no liability, the l-type seller's net return from non-disclosure is $p_{nu}^* - x_s$, while the net return from misstatement is $p_{nh}^* - x_s - \phi$. (The subscript nu denotes no liability (n) and the seller pretending to be the u-type (u).) Assuming, as before, that $p_{nu}^* \geq x_s$, so that non-disclosure is a (weakly) attractive strategy, the l-type seller will engage in misstatement if $p_{nh}^* - x_s - \phi \geq p_{nu}^* - x_s \Leftrightarrow p_{nh}^* - p_{nu}^* \geq \phi$. One possible equilibrium is where the l-type misstates, in which case $p_{nh}^* \leq x_h$ and $p_{nu}^* = E(x)$. Another

possibility is where the l-type engages in non-disclosure, in which case $p^*_{nh} = x_h$ and $p^*_{nu} < E(x)$. Unfortunately, depending on the equilibrium price, there are other types of equilibrium, as well: (1) the l-type engages in non-disclosure with probability β^*_{nu} but does not engage in misstatement; (2) the l-type engages in misstatement with probability β^*_{nh} but does not engage in non-disclosure; and (3) the l-type engages in non-disclosure with probability β^*_{nu} and in misstatement with probability β^*_{nh}, such that $\beta^*_{nu} + \beta^*_{nh} \leq 1$.

With voidance, the seller's net payoff from non-disclosure and sale is $p^*_{vu} - x_s - \lambda_l(p^*_{vu} - x_s) = (1 - \lambda_l)(p^*_{vu} - x_s)$, which is (weakly) positive whenever $p^*_{vu} \geq x_s$. On the other hand, if the seller were to pretend to be the h-type, assuming that the probability of ex post discovery is the same, the seller's net payoff becomes: $p^*_{vh} - \phi - \lambda_l(p^*_{vh} - x_s) - x_s = (1 - \lambda_l)(p^*_{vh} - x_s) - \phi$, which (weakly) is positive when $p^*_{vh} \geq x_s + \frac{\phi}{1-\lambda_l}$. Even if we were to assume that $p^*_{vh} \geq p^*_{vu}$, although voidance did not provide full deterrence against non-disclosure, it *can* provide full deterrence against misstatement, when either ϕ or λ_l is sufficiently large.

In the case of damages, with the assumption that $d = p^*_d - x_l$, we saw earlier, that the l-type seller would engage in (opportunistic) non-disclosure if $p^*_{du} - \lambda_l(p^*_{du} - x_l) \geq x_s \Leftrightarrow p^*_{du} \geq \frac{x_s - \lambda_l x_l}{1-\lambda_l}$. Again, assuming that the probability of liability (λ_l) is the same under misstatement, the l-type seller would engage in misstatement if $p^*_{dn} - \phi - \lambda_l(p^*_{dh} - x_l) \geq x_s \Leftrightarrow p^*_{dh} \geq \frac{\phi}{1-\lambda_l} + \frac{x_s - \lambda_l x_l}{1-\lambda_l}$. Note that, in both the voidance and the damages regime, the lower bound on the equilibrium price on misstatement is higher by $\frac{\phi}{1-\lambda_l}$. As in the earlier case, so long as λ_l is sufficiently large, the damages regime can provide full deterrence against both misstatement and non-disclosure.

With the possibility of misstatement, characterizing the equilibrium and the relevant thresholds becomes a challenge. The complexity arises from the fact that, now, there are two different types of undesirable behavior: non-disclosure and misstatement. Earlier, just with non-disclosure, there were three types of equilibrium: (1) full deterrence (which was possible only with damages); (2) no deterrence; and (3) partial deterrence. Once the l-type seller can also misstate and pretend to be the h-type, we can have one of the three types of equilibrium on each type of behavior. To further complicate the analysis, determining the equilibrium boundaries will present additional complexity. For instance, only with possible non-disclosure, as π gradually increased, the equilibrium shifted from no deterrence to partial deterrence (against non-disclosure). While the concepts of no deterrence and full deterrence may be clear, partial deterrence can involve partial deterrence against non-disclosure only, against misstatement only, or against both types of misbehavior.

7 Conclusion

This paper examined the role of legal remedies in guarding against a party's opportunistic (and wrongful) non-disclosure in the context of an asset sale. Under the existing US law, the injured party can be compensated either through rescission (by voiding the transaction) or through monetary damages, and this raises an important question over what the appropriate remedy is. The paper has, in particular, focused on the possibility of voidance and damages and have made a number of comparisons. For instance, while the voidance remedy is relatively weak in providing deterrence against opportunistic non-disclosure (and sale), because it allows the injured party to undo the transactions ex post, the remedy can actually generate better outcome especially when overall deterrence is weak. In short, while the damages remedy performs better when it can provide strong deterrence against opportunistic non-disclosure, when deterrence is generally weak, voidance remedy can outperform deterrence or no liability.

The analysis also offers a number of issues for future research. For one, for the sake of parsimony and tractability, the analysis has focused largely on opportunistic non-disclosure (and sale), while shying away from more in-depth analysis on (active) misstatement. As briefly mentioned in the introduction and the extension section, there are different types of misrepresentation and, depending on the type, what the injured party must establish in order to receive legal relief tend to be different. One important variation, of course, is (more passive) non-disclosure versus (more active) misstatement (or even concealment). If the seller were given a choice between non-disclosure and (active) misstatement, for instance, presumably, the seller's choice will depend on the respective sanctions that attach. At the same time, from the social welfare perspective, sanctions should, in theory, depend on the social "harm" caused by different types of misrepresentation. Either of these factors can lead to divergent requirements imposed on the injured party to receive legal relief and also to different types of remedy. Incorporating this more holistic view can be fruitful.

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Appendix A: Proofs

Proof of Proposition 1. (No Liability Equilibrium.) The proof that the h-type seller discloses its information and sells the asset at $p = x_h$ is straightforward. We therefore focus on the l-type and u-type.

Suppose, first, that the l-type seller participates with probability one, and suppose the equilibrium price is p_n^*. In that case, the buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - p_n^*) + q(x_l - p_n^*)) + \pi q(x_l - p_n^*) = 0.$$

When we solve for p_n^*, we get:

$$p_n^* = \frac{(1-\pi)E(x) + \pi q x_l}{(1-\pi) + \pi q}$$

From the expression, we can see that $p_n^* \in [x_l, E(x)]$. When $\pi = 0$, for instance, we get $p_n^* = E(x)$. There are no l-type in equilibrium here, and with probability zero, when there is no disclosure, the buyer is willing to pay $E(x)$. At the other end, when $\pi = 1$, we get $p_n^* = x_l < x_s$. With the seller's reservation value of x_s, $p_n^* = x_l$ violates the seller's participation constraint. Hence, we have two possibilities.

First, suppose the equilibrium price is sufficiently high so as to satisfy the seller's participation constraint:

$$p_n^* = \frac{(1-\pi)E(x) + \pi q x_l}{(1-\pi) + \pi q} \geq x_s.$$

Note that when $\pi = 0$, $p_n^* = E(x)$. When we re-write this expression with respect to π, we get:

$$\pi \leq \frac{E(x) - x_s}{E(x) - x_s + q(x_s - x_l)} = \frac{E(x) - x_s}{(1-q)(x_h - x_s)} \equiv \widehat{\pi}_n \in [0, 1].$$

The expression implies when the the probability of facing an informed seller is sufficiently low ($\pi \leq \widehat{\pi}_n$), we can have an equilibrium where the l-type participates for certain.

Second, suppose $\pi > \widehat{\pi}_n$. Here, due to the high probability of facing an informed l-type seller, the market price of the asset will be too low when the l-type seller participates with probability one. As we saw earlier, we also cannot have a possibility of no participation by the l-type, since then, we will get $p_n^* = E(x) > x_l$. The

only possibility is a mixed strategy equilibrium, where $p_n^* = x_s$ (to ensure l-type's indifference) and the l-type participates with probability $\beta_n^* \in [0,1]$. Given that $p_n^* = x_s$, we can also have the u-type seller participating with probability less than one, but, for simplicity, we will assume that the u-type will participate for certain when $p_n^* = x_s$.

Suppose $p_n^* = x_s$, and the l-type participates with probability $\beta_n^* \in [0,1]$. The buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - x_s) + q(x_l - x_s)) + \pi q \beta_n^* (x_l - x_s) = 0.$$

When we solve for β_n^*, we get:

$$\beta_n^* = \frac{(1-\pi)(E(x) - x_s)}{\pi q (x_s - x_l)}.$$

Note that, as $\pi \to 1$, we get $\beta_n^* \to 0$. When $\pi = \widehat{\pi}$, we get:

$$\beta_n^* = \frac{(1-\widehat{\pi})}{\widehat{\pi} q} \cdot \frac{(E(x) - x_s)}{(x_s - x_l)} = \frac{x_s - x_l}{E(x) - x_s} \cdot \frac{E(x) - x_s}{x_s - x_l} = 1.$$

In sum, when $\pi \geq \widehat{\pi}$, we can have a mixed strategy equilibrium, where the u-type participates for certain, and the l-type participates with probability β_n^*, which is equal to 1 when $\pi = \widehat{\pi}$, decreases as π increases, and is equal to 0 when $\pi = 1$. □

Proof of Proposition 2. (Voidance Equilibrium.) First, we know that, in equilibrium, the h-type seller will always disclose its information to the buyer. This implies that $p_v^* < x_h$ and the buyer does not have incentive to bring suit when $x = x_h$. When the buyer observes non-disclosure, therefore, the buyer is facing either the u-type or the l-type. With these possibilities, the buyer's break-even condition is:

$$\begin{aligned}(1-\pi)((1-q)(x_h - p_v^*) + q(1-\lambda_u)(x_l - p_v^*) + q\lambda_u\gamma(x_l - p_v^*)) \\ + \pi q \beta_v^* ((1-\lambda_l)(x_l - p_v^*) + \lambda_l \gamma (x_l - p_v^*)) = 0,\end{aligned}$$

which becomes:

$$(1-\pi)(E(x) - p_v^*) + \pi q \beta_v^* (x_l - p_v^*) - (1-\gamma)[(1-\pi)\lambda_u + \pi q \beta_v^* \lambda_l](x_l - p_v^*) = 0.$$

The first two terms $((1-\pi)(E(x) - p_v^*))$ and $(\pi q \beta_v^* (x_l - p_v^*))$ represent the buyer's expected transactional returns with respect to the u-type and the l-type, respectively.

The last term $(-(1-\gamma)[(1-\pi)\lambda_u + \pi q\beta_v^*\lambda_l](x_l - p_v^*))$, which is positive, represents the buyer's expected return from voiding the transaction against the both the u-type and the l-type seller.

When we solve for p_v^*, after some algebra, we get:

$$p_v^* = \frac{(1-\pi)E(x) + \pi q\beta_v^* x_l - (1-\gamma)[(1-\pi)\lambda_u + \pi q\beta_v^*\lambda_l]x_l}{(1-\pi) + \pi q\beta_v^* - (1-\gamma)[(1-\pi)\lambda_u + \pi q\beta_v^*\lambda_l]}.$$

Given that $x_s > x_l$, it is not certain a priori that $p_v^* \geq x_s$. As we saw earlier, it is not possible to have full deterrence, which requires $p_v^* < x_s$. As in the case with no liability, there are two possible cases: no deterrence (where $p_v^* \geq x_s$) and partial deterrence (where $p_v^* = x_s$).

First, suppose we have no deterrence: $\beta_v^* = 1$ (and $p_v^* \geq x_s$). The equilibrium price becomes:

$$p_{v(\beta_v^*=1)}^* = \frac{(1-\pi)E(x) + \pi q x_l - (1-\gamma)[(1-\pi)\lambda_u + \pi q\lambda_l]x_l}{(1-\pi) + \pi q - (1-\gamma)[(1-\pi)\lambda_u + \pi q\lambda_l]}.$$

We need to make sure that, in equilibrium, $p_{v(\beta_v^*=1)}^* \geq x_s$.

Before we check on this inequality, we first make a few comparisons with respect to the litigation cost (γ). When $\gamma = 0$, we get:

$$p_{v(\beta_v^*=1,\gamma=0)}^* = \frac{(1-\pi)E(x) + \pi q x_l - [(1-\pi)\lambda_u + \pi q\lambda_l]x_l}{(1-\pi) + \pi q - (1-\gamma)[(1-\pi)\lambda_u + \pi q\lambda_l]}$$
$$> \frac{(1-\pi)E(x) + \pi q x_l}{(1-\pi) + \pi q} = p_n^*$$

When litigation is costless, with no deterrence, voidance regime provides a higher expected (gross) return for the buyer than the no liability regime. This is not surprising, since, with voidance, the buyer avoids (with some positive probability) of having to acquire a low-value asset, and this makes the buyer willing to pay more.

On the other hand, when $\gamma = 1$, we get:

$$p_{v(\beta_v^*=1,\gamma=1)}^* = \frac{(1-\pi)E(x) + \pi q x_l}{(1-\pi) + \pi q} = p_n^*$$

With $\gamma = 1$, all the returns from litigation are dissipated through litigation cost, and the buyer gets no (net) benefit from being able to void the transaction. In other

words, the buyer's expected return is the same as that with no liability (under no deterrence). In between these two extremes, as γ increases, p_v^* decreases: $\frac{dp_v^*(\gamma)}{d\gamma} < 0$.

Coming back to the condition on p_v^*, to sustain no deterrence, we need:

$$p_{v(\beta^*=1)}^* = \frac{(1-\pi)E(x) + \pi q x_l - (1-\gamma)[(1-\pi)\lambda_u + \pi q \lambda_l]x_l}{(1-\pi) + \pi q - (1-\gamma)[(1-\pi)\lambda_u + \pi q \lambda_l]} \geq x_s.$$

When we rewrite this inequality in terms of π, we get:

$$\pi \leq \frac{E(x) - x_s + (1-\gamma)\lambda_u(x_s - x_l)}{(1-q)(x_h - x_s) + (1-\gamma)(\lambda_u - q\lambda_l)(x_s - x_l)} \equiv \widehat{\pi}_v \geq \widehat{\pi}_n.$$

Recall that $\widehat{\pi}_n = \frac{E(x)-x_s}{(1-q)(x_h-x_s)}$. The last (weak) inequality ($\widehat{\pi}_v \geq \widehat{\pi}_n$) is established since $\lambda_u > \lambda_u - q\lambda_l$. Note that we get $\widehat{\pi}_v = \widehat{\pi}_n$ when $\lambda_u = \lambda_l = 0$, which is equivalent to the buyer having no chance to void the transaction. Also, we see that when $\gamma = 1$, $\widehat{\pi}_v = \widehat{\pi}_n$, and as γ decreases, $\widehat{\pi}_v - \widehat{\pi}_n$ gets larger. This is consistent with the analysis above. Hence, with voidance, when $\pi \leq \widehat{\pi}_v$, we can get no deterrence equilibrium.

When $\pi > \widehat{\pi}_v$, on the other hand, no deterrence equilibrium is not possible. We can, however, construct a partial deterrence equilibrium. As done earlier with the case of no liability, suppose, in equilibrium, $p_v^* = x_s$, which makes the seller indifferent between selling and not selling the asset. Suppose, in equilibrium, the l-type seller participates with probability β_v^* while the u-type seller participates with probability one. When $p_v^* = x_s$, the buyer's break-even condition becomes:

$$\begin{aligned}(1-\pi)((1-q)(x_h - x_s) + q(1-\lambda_u)(x_l - x_s) + q\lambda_u\gamma(x_l - x_s)) \\ + \pi q\beta_v^*((1-\lambda_l)(x_l - x_s) + \lambda_l\gamma(x_l - x_s)) = 0,\end{aligned}$$

which is equivalent to:

$$(1-\pi)((1-q)(x_h - x_s) + q((1-\lambda_u) + \lambda_u\gamma)(x_l - x_s)) - \pi q\beta_v^*((1-\lambda_l) + \lambda_l\gamma)(x_s - x_l) = 0.$$

When we solve for β_v^*, we get:

$$\begin{aligned}\beta_v^* &= \frac{(1-\pi)((1-q)(x_h - x_s) - q((1-\lambda_u) + \lambda_u\gamma)(x_s - x_l))}{\pi q((1-\lambda_l) + \lambda_l\gamma)(x_s - x_l)} \\ &= \frac{(1-\pi)(E(x) - x_s) + (1-\pi)q\lambda_u(1-\gamma)(x_s - x_l)}{\pi q(x_s - x_l) - \pi q\lambda_l(1-\gamma)(x_s - x_l)}.\end{aligned}$$

Recall that, in the case of no liability and partial deterrence, we have $\beta_n^* = \frac{(1-\pi)(E(x)-x_s)}{\pi q(x_s - x_l)}$.

We can see that, conditional on partial deterrence, $\beta_v^* \geq \beta_n^*$. This is intuitive. Compared to the case of no remedy, with voidance, the buyer gets to undo some of the loss-producing transactions, though, due to the litigation cost, the buyer gets to keep only $(1-\gamma)$ of the recovery $(x_s - x_l)$. So long as $\gamma < 1$, conditional on $p_v^* = x_s$, the buyer's expected profit gets larger. In order to satisfy the buyer's break-even condition, the l-type seller needs to participate more often. Hence, with voidance, the l-type seller is more likely to participate and sell the low value asset than in the case with no remedy. □

Lemma 1. *(Full Deterrence Probability.) When the buyer is entitled to receive damages $(p_d^* - x_l)$ as remedy against seller's non-disclosure,*

$$\exists\, \lambda_l = \frac{E(x) - x_s + q\lambda_u(1-\gamma)(x_s - x_l)}{E(x) - x_l} \equiv \overline{\lambda}_l,$$

such that when $\lambda_l \geq \overline{\lambda}_l$, we get $\beta_d^* = 0$. $\overline{\lambda}_l \in \left[\frac{E(x)-x_s}{E(x)-x_l}, \frac{E(x)-(qx_l+(1-q)x_s)}{E(x)-x_l}\right]$. As $\lambda_u \to 0$ or $\gamma \to 1$, $\overline{\lambda}_l \to \frac{E(x)-x_s}{E(x)-x_l}$, and as $\lambda_u \to 1$ and $\gamma \to 0$, $\overline{\lambda}_l \to \frac{E(x)-(qx_l+(1-q)x_s)}{E(x)-x_l}$.

Lemma 1 shows that, with sufficiently large probability of holding the l-type seller liable $(\lambda_l \geq \overline{\lambda}_l)$, we can achieve full deterrence. This is consistent with the observation above about the β_d^* and the l-type seller's incentive to participate. For instance, when $\lambda_l \approx 1$, after selling the asset for p_d^*, the l-type seller will almost always be found liable for damages of $p_d^* - x_l$, which leaves the seller with the proceeds of x_l. Obviously, this is worse than not participating in sale. With sufficiently high detection probability, therefore, the damages regime (with $d = p_d^* - x_l$) can achieve full deterrence. From the expression, we can also see that the full deterrence threshold $(\overline{\lambda}_l)$ is independent of π.

Proof of Lemma 1. (Full Deterrence Probability.) We present the proof in somewhat backward order: we will first assume full deterrence and then find the necessary condition to achieve that equilibrium. Suppose, in equilibrium, we have $\beta_d^* = 0$. With this, buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)(p_d^* - x_l) = 0.$$

From the expression, we get the equilibrium price (p_d^*):

$$p_d^* = \frac{E(x) - q\lambda_u(1-\gamma)x_l}{1 - q\lambda_u(1-\gamma)}.$$

Now, to ensure that we get $\beta_d^* = 0$, we need $\frac{E(x)-q\lambda_u(1-\gamma)x_l}{1-q\lambda_u(1-\gamma)} < \frac{x_s-\lambda_l x_l}{1-\lambda_l}$. From this, we get:

$$\lambda_l > \frac{E(x) - x_s + q\lambda_u(1-\gamma)(x_s - x_l)}{E(x) - x_l} \equiv \overline{\lambda}_l.$$

Note that, holding q and x_i's constant, $\overline{\lambda}_l$ increases as either λ_u increases or γ decreases. When $\lambda_u = 1$ and $\gamma = 0$, we get $\overline{\lambda}_l = \frac{E(x)-(qx_l+(1-q)x_s)}{E(x)-x_l} < 1$. The inequality is established since $x_s > x_l$. When $\lambda_u = 0$, on the other hand, we get $\overline{\lambda}_l = \frac{E(x)-x_s}{E(x)-x_l} < 1$.

As an aside, if we were to impose an upper bound on λ_u, such that $\lambda_u \leq \lambda_l$, when $\gamma = 0$ and $\lambda_u = \overline{\lambda}_l$, we get: $\overline{\lambda}_l = \frac{E(x)-x_s}{E(x)-(qx_s+(1-q)x_l)} < 1$. The inequality is established since $qx_s + (1-q)x_l < x_s$.

□

Lemma 2. *(No Deterrence Probability.) Suppose the buyer is entitled to receive damages $(p_d^* - x_l)$ as remedy against seller's non-disclosure, and $\lambda_l \in [0, \overline{\lambda}_l)$.*

$$\exists\, \pi = \frac{(1-q)[(x_h - x_s) - \lambda_l(x_h - x_l)] - q((1-\lambda_u) + \gamma\lambda_u)(x_s - x_l)}{(1-q)[(x_h - x_s) - \lambda_l(x_h - x_l)] - q(1-\gamma)(\lambda_l - \lambda_u)(x_s - x_l)} \equiv \widehat{\pi}_d(\lambda)$$

such that, if $\pi \leq \widehat{\pi}_d(\lambda)$, $\beta_d^* = 1$, whereas if $\pi > \widehat{\pi}_d(\lambda)$, $\beta_d^* \in (0, 1]$. $\frac{\partial \widehat{\pi}_d(\lambda)}{\partial \lambda_l} < 0$; $\widehat{\pi}_d(\lambda_l = \overline{\lambda}_l) = 0$; and $\widehat{\pi}_d(\lambda_l = \lambda_u = 0) = \widehat{\pi}_n$.

Lemma 2 shows that when λ_l is not sufficiently high enough to completely deter the l-type from participating, as in the cases of no remedy and voidance, we get two possible equilibria, depending on the degree of asymmetric information (π). For each $\lambda_l \in [0, \overline{\lambda}_l$, we get $\widehat{\pi}_d(\lambda)$, such that if $\pi \leq \widehat{\pi}_d(\lambda)$, we get no deterrence ($\beta_d^* = 1$), whereas if $\pi > \widehat{\pi}_d(\lambda)$, we get partial deterrence ($\beta_d^* \in (0, 1]$). With these two Lemmas, we have the following proposition.

Proof of Lemma 2. (No Deterrence Threshold.) Suppose $\lambda_l \in [0, \overline{\lambda}_l)$ and $\beta^* = 1$. For no deterrence, we need $p_d^* > \frac{x_s-\lambda_l x_l}{1-\lambda_l} \in [x_s, \infty)$. The buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)(p_d^* - x_l) - \pi q(1 - \lambda_l(1-\gamma))(p_d^* - x_l) = 0.$$

Conditional on $\lambda_l \in [0, \overline{\lambda}_l)$, let's find $\widehat{\pi}_d$ such that $p_d^* = \frac{x_s-\lambda_l x_l}{1-\lambda_l}$. First, with $p_d^* = \frac{x_s-\lambda_l x_l}{1-\lambda_l}$, we get: $x_h - p_d^* = \frac{x_h(1-\lambda_l)-x_s+\lambda_l x_l}{1-\lambda_l}$ and $p_d^* - x_l = \frac{x_s-\lambda_l x_l-x_l+\lambda_l x_l}{1-\lambda_l} = \frac{x_s-x_l}{1-\lambda_l}$. With

these expressions, the buyer's break-even condition becomes:

$$(1-\pi)(1-q)(x_h(1-\lambda_l)-x_s+\lambda_l x_l)-q(1-(1-\gamma)(1-\pi)\lambda_u-(1-\gamma)\pi\lambda_l)(x_s-x_l)=0.$$

When we solve for π, we get:

$$\pi=\frac{(1-q)[(x_h-x_s)-\lambda_l(x_h-x_l)]-q((1-\lambda_u)+\gamma\lambda_u)(x_s-x_l)}{(1-q)[(x_h-x_s)-\lambda_l(x_h-x_l)]-q(1-\gamma)(\lambda_l-\lambda_u)(x_s-x_l)}\equiv\widehat{\pi}_d(\lambda).$$

It is easy to verify that $\frac{\partial\widehat{\pi}_d(\lambda)}{\partial\lambda_l}<0$.

In terms of some of the properties of $\widehat{\pi}_d(\lambda)$, first, recall that:

$$\widehat{\pi}_v=\frac{(1-q)(x_h-x_s)-q((1-\lambda_u)+\gamma\lambda_u)(x_s-x_l)}{(1-q)(x_h-x_s)-q(1-\gamma)(\lambda_l-\lambda_u)(x_s-x_l)}.$$

From this, we can see that $\forall\ \lambda_l\in[0,\overline{\lambda}_l]$, $\widehat{\pi}_v\geq\widehat{\pi}_d(\lambda)$ and the inequality is strict whenever $\lambda_l>0$.

As two endpoints, suppose $\widehat{\pi}_d(\lambda)=0$. From the definition of $\widehat{\pi}_d(\lambda)$, when we solve for λ_l, we get:

$$\lambda_l(\pi=0)=\frac{E(x)-x_s+q\lambda_u(1-\gamma)(x_s-x_l)}{(1-q)(x_h-x_l)}=\overline{\lambda}_l.$$

In other words, when $\lambda_l=\overline{\lambda}_l$, we get $\widehat{\pi}_d(\lambda_l=\overline{\lambda}_l)=0$. At the opposite end, suppose $\lambda_l=0$. Then, we get:

$$\widehat{\pi}_d(\lambda_l=0)=\frac{E(x)-x_s+q(1-\gamma)\lambda_u(x_s-x_l)}{(1-q)(x_h-x_s)+q(1-\gamma)\lambda_u(x_s-x_l)}.$$

Givne that we have imposed the assumption that $\lambda_l\geq\lambda_u$. Hence, we if let $\lambda_l=\lambda_u=0$, we get:

$$\widehat{\pi}_d(\lambda_l=\lambda_u=0)=\frac{E(x)-x_s}{(1-q)(x_h-x_s)}=\widehat{\pi}_n.$$

This is intuitive. When $\lambda_l=\lambda_u=0$, this is equivalent to having no remedy. Hence, we get the same threshold of $\widehat{\pi}_n$. □

Proof of Proposition 3. (Damages Equilibrium.) Most of the proofs are provided in the proofs for the Lemmas. Recall that the buyer's break-even condition is given

by:

$$(1-\pi)[(1-q)(x_h-p_d^*)-q(1-\lambda_u(1-\gamma))(p_d^*-x_l)]-\pi q\beta_d^*(1-\lambda_l(1-\gamma))(p_d^*-x_l)=0.$$

In the case of no deterrence ($\beta_d^*=1$), the buyer's break-even condition becomes:

$$(1-\pi)[(1-q)(x_h-p_d^*)-q(1-\lambda_u(1-\gamma))(p_d^*-x_l)]-\pi q(1-\lambda_l(1-\gamma))(p_d^*-x_l)=0.$$

When we solve for p_d^*, we get:

$$p_d^*=\frac{(1-\pi)E(x)+\pi q x_l-(1-\gamma)q[(1-\pi)\lambda_u+\pi\lambda_l]x_l}{(1-\pi)+\pi q-(1-\gamma)q[(1-\pi)\lambda_u+\pi\lambda_l]}\geq x_s.$$

In the case of partial deterrence, from the l-type's participation constraint, we know that $p_d^*=\frac{x_s-\lambda_l x_l}{1-\lambda_l}$. From the buyer's break-even condition, when we solve for β_d^*, we get:

$$\beta_d^*=\frac{(1-\pi)\{(1-q)(x_h-p_d^*)-q(1-\lambda_u(1-\gamma))(p_d^*-x_l)\}}{\pi q(1-\lambda_l(1-\gamma))(p_d^*-x_l)}.$$

When we substitute the expressions of $x_h-p_d^*=\frac{x_h-\lambda_l(x_h-x_l)-x_s}{1-\lambda_l}$ and $p_d^*-x_l=\frac{x_s-x_l}{1-\lambda_l}$, we get:

$$\beta_d^*=\frac{(1-\pi)(E(x)-x_s)-(1-\pi)[(1-q)\lambda_l(x_h-x_l)-q\lambda_u(1-\gamma)(x_s-x_l)]}{\pi q(x_s-x_l)-\pi q\lambda_l(1-\gamma)(x_s-x_l)}.$$

□

Proof of Corollary 2. (No Liability Welfare.) We saw that the equilibrium, and the corresponding social welfare, depended on the degree of asymmetric information (π). When $\pi\leq\frac{E(x)-x_s}{(1-q)(x_h-x_s)}\equiv\widehat{\pi}_n$, we know that there is no deterrence and $\beta_n^*=1$. Hence, the expected social welfare is:

$$\begin{aligned}SW_n(\pi\leq\widehat{\pi}_n)&=\pi(1-q)(x_h-x_s)+(1-\pi)(E(x)-x_s)+\pi q(x_l-x_s)\\&=(1-q)(x_h-x_s)+q(x_l-x_s),\end{aligned}$$

and, the expected welfare loss is:

$$WL_n(\pi\leq\widehat{\pi}_n)=q(x_s-x_l).$$

When $\pi > \widehat{\pi}_n$, on the other hand, we get $\beta_n^* = \frac{(1-\pi)(E(x)-x_s)}{\pi q(x_s-x_l)}$, so that

$$SW_n(\pi > \widehat{\pi}_n) = \pi(1-q)(x_h-x_s)+(1-\pi)(E(x)-x_s)+\pi q\beta_n^*(x_l-x_s) = \pi(1-q)(x_h-x_s),$$

and

$$WL_n(\pi > \widehat{\pi}_n) = ((1-\pi)+\pi\beta_n^*)q(x_s-x_l) = (1-\pi)[E(x)-(1-q)x_s-qx_l].$$

The last equalities in the $SW_n(\pi > \widehat{\pi}_n)$ and $WL_n(\pi > \widehat{\pi}_n)$ functions are given by substituting the expression for β_n^*.

□

Proof of Corollary 3. (Voidance Welfare.) First, suppose $\pi \leq \widehat{\pi}_v$. We get $\beta_v^* = 1$, and

$$p^*_{v(\beta_v^*=1)} = \frac{(1-\pi)E(x)+\pi q x_l-(1-\gamma)[(1-\pi)\lambda_u+\pi q\lambda_l]x_l}{(1-\pi)+\pi q-(1-\gamma)[(1-\pi)\lambda_u+\pi q\lambda_l]} \geq x_s.$$

Expected social welfare is given by:

$$\begin{aligned} SW_v(\pi \leq \widehat{\pi}_v) &= \pi(1-q)(x_h-x_s)+(1-\pi)((1-q)(x_h-x_s)+q(1-\lambda_u)(x_l-x_s)-q\lambda_u\gamma(p_v^*-x_l)) \\ &\quad + \pi q((1-\lambda_l)(x_l-x_s)-\lambda_l\gamma(p_v^*-x_l)) \\ &= (1-q)(x_h-x_s)+q[(1-\pi)(1-\lambda_u)+\pi(1-\lambda_l)](x_l-x_s) \\ &\quad - q[(1-\pi)\lambda_u+\pi\lambda_l]\gamma(p_v^*-x_l). \end{aligned}$$

The expected welfare loss is given by:

$$WL_v(\pi \leq \widehat{\pi}_v) = q[(1-\pi)(1-\lambda_u)+\pi(1-\lambda_l)](x_s-x_l)+q[(1-\pi)\lambda_u+\pi\lambda_l]\gamma(p_v^*-x_l).$$

When we differentiate the social welfare function wtih respect to π, we get:

$$\frac{\partial SW_v(\pi \leq \widehat{\pi}_v))}{\partial \pi} = q(\lambda_l-\lambda_u)(x_s-x_l-\gamma(p_v^*-x_l))-q((1-\pi)\lambda_u+\pi\lambda_l)\gamma\frac{\partial p_v^*}{\partial \pi}.$$

Given that $\frac{\partial p_v^*}{\partial \pi} < 0$, the second term on the right hand side (with the negative sign) is positive. However, with $p_v^* \geq x_s$, $q(\lambda_l-\lambda_u)(x_s-x_l-\gamma(p_v^*-x_l)) \lesseqgtr 0$. Hence, as π increases, social welfare may increase or decrease. However, when γ is sufficiently small, $q(\lambda_l-\lambda_u)(x_s-x_l-\gamma(p_v^*-x_l)) \geq 0$, and the social welfare will increase as π increases.

Also, recall that, conditional on no deterrence, the expected social welfare in the case of no remedy was given by:

$$SW_n(\pi \leq \widehat{\pi}_n) = (1-q)(x_h - x_s) + q(x_l - x_s).$$

When we examine the difference between the two social welfare expressions, we get:

$$\begin{aligned} SW_v(\pi \leq \widehat{\pi}_v) - SW_n(\pi \leq \widehat{\pi}_n) &= q[(1-\pi)\lambda_u + \pi\lambda_l](x_s - x_l) - q[(1-\pi)\lambda_u + \pi\lambda_l]\gamma(p_v^* - x_l) \\ &= q[(1-\pi)\lambda_u + \pi\lambda_l]((x_s - x_l) - \gamma(p_v^* - x_l)). \end{aligned}$$

We know that $p_v^* \geq v_s$ and, hence, $(p_v^* - x_l) \geq (x_s - x_l)$. Compared to the no liability regime, the voidance regime performs better on transactional efficiency but worse on litigation efficiency. It is a priori unclear whether, conditional on no deterrence, the voidance regime performs better or worse than the no liability regime. When the cost of litigation (γ) is sufficiently small, the voidance regime will perform better than the no liability regime, and the opposite will be true when γ is large.

Second, in the case of partial deterrence ($\pi > \widehat{\pi}_v$), as we saw earlier, $p_v^* = x_s$ and

$$\beta_v^* = \frac{(1-\pi)(E(x) - x_s) + (1-\pi)q\lambda_u(1-\gamma)(x_s - x_l)}{\pi q(1 - \lambda_l(1-\gamma))(x_s - x_l)}$$

The expected social is:

$$\begin{aligned} SW_v(\pi > \widehat{\pi}_v) = \pi(1-q)(x_h - x_s) + (1-\pi)((1-q)(x_h - x_s) + q(1-\lambda_u)(x_l - x_s) - q\lambda_u\gamma(p_v^* - x_l)) \\ + \pi q\beta_v^*((1-\lambda_l)(x_l - x_s) - \lambda_l\gamma(p_v^* - x_l)), \end{aligned}$$

while the expected welfare loss is:

$$\begin{aligned} WL_v(\pi > \widehat{\pi}_v) = q[(1-\pi)(1-\lambda_u) + \pi\beta_v^*(1-\lambda_l)](x_s - x_l) \\ + q[(1-\pi)\lambda_u + \pi\beta_v^*\lambda_l]\gamma(x_s - x_l). \end{aligned}$$

We also saw earlier that, as $\pi \to 1$, $\beta_v^* \to 0$, and $WL_v(\pi \geq \widehat{\pi}_v) \to 0$. This is similar to the case with no remedy.

In the partial deterrence region, for the social welfare function, when we substitute in the expressions for $p_v^* = x_s$ and $\beta_v^* = \frac{(1-\pi)(E(x)-x_s)+(1-\pi)q\lambda_u(1-\gamma)(x_s-x_l)}{\pi q(1-\lambda_l(1-\gamma))(x_s-x_l)}$, after some algebra, we get:

$$SW_v(\pi > \widehat{\pi}_v) = \pi(1-q)(x_h - x_s).$$

□

Proof of Corollary 4. (Damages Welfare.) As in the formal statements of Corollary 4, we divide the proof into three cases: (1) full deterrence; (2) no deterrence; and (3) partial deterrence.

Case 1: Full Deterrence. First, suppose $\lambda_l \geq \overline{\lambda}_l$, so that $\beta_d^* = 0$. Recall that, $p_d^*(\lambda_l \geq \overline{\lambda}_l) = \frac{E(x)-q\lambda_u(1-\gamma)x_l}{1-q\lambda_u(1-\gamma)}$. With full deterrence, the expected social welfare is:

$$SW_d(\lambda_l \geq \overline{\lambda}_l) = \pi(1-q)(x_h-x_s)+(1-\pi)((1-q)(x_h-x_s)+q(x_l-x_s)-q\lambda_u\gamma(p_d^*-x_l)).$$

The expected welfare loss is:

$$WL_d(\lambda_l \geq \overline{\lambda}_l) = (1-\pi)q((x_s-x_l)+\lambda_u\gamma(p_d^*-x_l)).$$

With $p_d^*(\lambda_l \geq \overline{\lambda}_l) = \frac{E(x)-q\lambda_u(1-\gamma)x_l}{1-q\lambda_u(1-\gamma)}$, the social welfare becomes:

$$SW_d(\lambda_l \geq \overline{\lambda}_l) = \pi(1-q)(x_h-x_s) + (1-\pi)\left[E(x) - x_s - q\lambda_u\gamma\frac{E(x)-x_l}{1-q\lambda_u(1-\gamma)}\right].$$

The first term on the right hand side represents the surplus from transacting with the h-type, while the second term represents the surplus from transacting with the u-type. Note that $(1-q)(x_h-x_s) > \left[E(x) - x_s - q\lambda_u\gamma\frac{E(x)-x_l}{1-q\lambda_u(1-\gamma)}\right] = (1-q)(x_h-x_s) + q(x_l-x_s)q\lambda_u\gamma\frac{E(x)-x_l}{1-q\lambda_u(1-\gamma)}$. When we differentiate the welfare function with respect to π, we get:

$$\frac{\partial SW_d(\lambda_l \geq \overline{\lambda}_l)}{\partial \pi} = (1-q)(x_h-x_s) - \left[E(x) - x_s - q\lambda_u\gamma\frac{E(x)-x_l}{1-q\lambda_u(1-\gamma)}\right] > 0.$$

As π gets larger, SW_d gets larger (and WL_d gets smaller) at a constant rate. As $\pi \to 0$, we get: $SW_d(\lambda_l \geq \overline{\lambda}_l, \pi = 0) = \frac{(1-q\lambda_u)(E(x)-x_s)-q\lambda_u\gamma(x_s-x_l)}{1-q\lambda_u(1-\gamma)} < E(x) - x_s$. When $\pi = 1$, on the other hand, $SW_d = (1-q)(x_h-x_s)$ and $WL_d = 0$.

Case 2: No Deterrence. Suppose $\lambda_l < \overline{\lambda}_l$ and $\pi \leq \widehat{\pi}_d$. The expected social welfare is:

$$\begin{aligned} SW_d(\lambda_l < \overline{\lambda}_l, \pi \leq \widehat{\pi}_d) &= (1-\pi)((1-q)(x_h-x_s) + q(x_l-x_s) - q\lambda_u\gamma(p_d^*-x_l)) \\ &\quad + \pi(1-q)(x_h-x_s) + \pi q((x_l-x_s) - \lambda_l\gamma(p_d^*-x_l)) \\ &< (1-q)(x_h-x_s) + q(x_l-x_s). \end{aligned}$$

The expected welfare loss is:

$$WL_d(\lambda_l < \overline{\lambda}_l, \pi \leq \widehat{\pi}_d) = q(x_s - x_l) + ((1-\pi)\lambda_u + \pi\lambda_l)q\gamma(p_d^* - x_l) > q(x_s - x_l).$$

When $\pi = 0$, we get $SW_d = ((1-q)(x_h - x_s) + q(x_l - x_s) - q\lambda_u\gamma(p_d^* - x_l))$ and $WL_d = q(x_s - x_l) + \lambda_u q\gamma(p_d^* - x_l)$. As π increases, SW_d decreases and WL_d increases. We saw earlier that, conditional on no deterrence, the expected social welfare is $SW_n(\pi \leq \widehat{\pi}_n) = (1-q)(x_h - x_s) - q(x_s - x_l)$ and the welfare loss from no liability (with no deterrence) is $q(x_s - x_l)$. This implies that, conditional on no deterrence, social welfare from damages regime will always be lower than that under no liability. This is intuitive, since with no deterrence, damages regime leads to additional welfare loss from litigation.

At the same time, with voidance, conditional on no deterrence, the social welfare is given by:

$$\begin{aligned} SW_v(\pi \leq \widehat{\pi}_v) = (1-\pi)((1-q)(x_h - x_s) + q(1-\lambda_u)(x_l - x_s) - q\lambda_u\gamma(p_v^* - x_l)) \\ + \pi(1-q)(x_h - x_s) + \pi q((1-\lambda_l)(x_l - x_s) - \lambda_l\gamma(p_d^* - x_l)). \end{aligned}$$

Since we also know that $p_d^* = p_v^*$ in the no deterrence region, this implies that $SW_v > SW_d$ (and also $WL_v < WL_d$) when the l-type participates for certain. This is intuitive. We saw that the buyer is indifferent between voidance and damages, when damages are measured based on the price paid by the buyer, and this led to the same equilibrium price for the voidance and the damages regime when there is no deterrence. The benefits of voidance is that, through voidance, the parties get to undo some of the inefficient transactions. Hence, even though the size of litigation inefficiency ($\gamma(p_i^* - x_l)$) is the same under both regimes, voidance regime does strictly better with respect to transactional inefficiency.

Case 3: Partial Deterrence. Finally, suppose $\lambda < \overline{\lambda}_l$ and $\pi > \widehat{\pi}_d$. The expected social welfare is given by:

$$\begin{aligned} SW_d(\lambda_l < \overline{\lambda}_l, \pi > \widehat{\pi}_d) = (1-\pi)((1-q)(x_h - x_s) + q(x_l - x_s) - q\lambda_u\gamma(p_d^* - x_l)) \\ + \pi(1-q)(x_h - x_s) + \pi q\beta_d^*((x_l - x_s) - \lambda_l\gamma(p_d^* - x_l)). \end{aligned}$$

The expected welfare loss is given by:

$$WL_d(\lambda_l < \overline{\lambda}_l, \pi > \widehat{\pi}_d) = ((1-\pi)q + \pi q\beta_d^*)(x_s - x_l) + ((1-\pi)\lambda_u + \pi\beta_d^*\lambda_l)q\gamma(p_d^* - x_l).$$

We know that when $\lambda_l < \overline{\lambda}_l$ and $\pi > \widehat{\pi}_d$ $p_d^* = \frac{x_s - \lambda_l x_l}{1-\lambda_l}$, and

$$\beta_d^* = \frac{(1-\pi)(E(x) - x_s) - (1-\pi)[(1-q)\lambda_l(x_h - x_l) - q\lambda_u(1-\gamma)(x_s - x_l)]}{\pi q(x_s - x_l) - \pi q\lambda_l(1-\gamma)(x_s - x_l)}.$$

As we can see from the expressions, as $\pi \to 1$, $\beta_d^* \to 0$, $SW_d \to (1-q)(x_h - x_s)$, and $WL_d \to 0$.

While somewhat tedious, with the expressions on p_d^* and β_d^*, we can show that

$$\begin{aligned} SW_d(\lambda_l < \overline{\lambda}_l, \pi > \widehat{\pi}_d) &= \pi(1-q)(x_h - x_s) \\ &+ (1-\pi)((1-q)(p_d^* - x_s) + q(1-\lambda_u)(p_d^* - x_s) + q\lambda_u(p_d^* - x_s - (p_d^* - x_l))) \\ &= \pi(1-q)(x_h - x_s) + (1-\pi)[(p_d^* - x_s) - q\lambda_u(p_d^* - x_l)] \\ &= \pi(1-q)(x_h - x_s) + (1-\pi)(\lambda_l - q\lambda_u)\frac{x_s - x_l}{1-\lambda_l}. \end{aligned}$$

The last equality is derived by substituting in $\frac{x_s - \lambda_l x_l}{1-\lambda_l}$ for p_d^*. The first expression, $\pi(1-q)(x_h - x_s) > 0$, corresponds to the h-type seller's (ex ante) expected profit. The second expression, $(1-\pi)(\lambda_l - q\lambda_u)\frac{x_s - x_l}{1-\lambda_l} > 0$, is equal to the u-type seller's (ex ante) expected profit.

□

Appendix B: Supplemental Analyses

B1 General Damages ($d \in [0, \infty)$) Remedy

In the main section, we assumed that the damages were given by: $d = p_d^* - x_l$, the difference between the price paid by the buyer and the (low) asset value. In this part, we analyze more general damages measure. Suppose the buyer is entitled to damages ($d \in [0, \infty)$) as remedy for seller's non-disclosure. In theory, the damages can be measured based on the difference in values that the buyer would have been willing to pay under either complete disclosure or non-disclosure. That is, we can have $d_e = E(x) - x_l = (1-q)(x_h - x_l)$. (We use the subscript e to denote "expectation damages" or "benefit-of-the-bargain damages.")[37] However, for now, we will just let $d \lessgtr d_e$. With damages d and litigation cost γd, when $x = x_l$ and the buyer bring suit and prevails, the buyer's return is $x_l + (1-\gamma)d$ and the seller's return is $p_d^* - d$.[38] As in the case with voidance, since the cost of litigation is given by $\gamma \cdot d$, litigation will always be credible for the buyer.

Monetary damages will impact the l-type seller's decision to participate in the market. Recall that λ_l is the likelihood that the l-type will be found liable and be required to pay damages. If $p_d^* - \lambda_l d > x_s$ then the l-type seller's return from participating is positive, and if $p_d^* - \lambda_l d < x_s$ their return is negative. Similar to the case with voidance, the following expressions represent three possible equilibria where β_d^* is the probability that the l-type participates.

$$\begin{cases} \beta_d^* = 0 & \text{if} \quad p_d^* - \lambda_l d < x_s \\ \beta_d^* \in [0,1] & \text{if} \quad p_d^* - \lambda_l d = x_s \\ \beta_d^* = 1 & \text{if} \quad p_d^* - \lambda_l d > x_s \end{cases} \tag{19}$$

Given participation probability β_d^*, the market price p_d^* is determined by the buyer's break-even condition:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)d) \\ + \pi q \beta_d^*(x_l - p_d^* + \lambda_l(1-\gamma)d) = 0. \tag{20}$$

Before we proceed, from the buyer's break-even condition, we see that the buyer's respective return (from the u-type and the l-type) depends on d. Given that $\lambda_l > \lambda_u$,

[37] Although we use the term "expectation" damages, since the remedy is based not on contract law but on tort law, this is equivalent to fully compensatory damages.

[38] We can potentially limit the size of damages to the payment that the seller has received, $d \leq p_d^*$, and impose a wealth constraint.

ceteris paribus, as d gets larger, the buyer's expected return with respect to the l-type gets larger at a faster rate than the buyer's return with respect to the u-type. This implies that, when d is sufficiently large, the buyer can prefer contracting with the l-type than with the u-type. In order to avoid this atypical result, we impose the following "regularity" condition:

Assumption 1: $d \leq \frac{(1-q)(x_h-x_l)}{(1-\gamma)(\lambda_l-q\lambda_u)} \equiv d_{max}$.

This upper limit on damages guarantees that the buyer's expected return from the l-type does not exceed that from the u-type. With the assumption, we can see that:

$$\begin{aligned}(E(x) - p_d^* + q\lambda_u(1-\gamma)d) &\geq (x_l - p_d^* + \lambda_l(1-\gamma)d) \\ &\Leftrightarrow (1-q)(x_h - x_l) \geq (1-\gamma)(\lambda_l - q\lambda_u)d \\ &\Leftrightarrow d \leq \frac{(1-q)(x_h-x_l)}{(1-\gamma)(\lambda_l-q\lambda_u)} \equiv d_{max}.\end{aligned}$$

When we derive the equilibrium, we will ensure that the regularity condition is satisfied. Note that $d_e = E(x) - x_l \leq d_{max}$.

B1.1 Full Deterrence

Unlike the case with voidance or no remedy, where the size of the litigation recovery is de facto given, with damages regime, we need to examine equilibrium structure depending on the size of damages. Foremost, given that there is no limit on how large the damages can be, it is not difficult to imagine that, with sufficiently large damages, we can achieve full deterrence against the l-type seller. The following Lemma formalizes the result.

Lemma 3. *(Full Deterrence Damages.) When the buyer is entitled to receive damages (d) as remedy against seller's non-disclosure,* $\exists\ d = \frac{E(x)-x_s}{\lambda_l - q\lambda_u(1-\gamma)} \equiv \overline{d} \in (0, d_{max})$*, such that when* $d \geq \overline{d}$*, we get* $\beta_d^* = 0$.

Proof of Lemma 3. (Full Deterrence Damages.) We present the proof in somewhat backward order: we will first assume full deterrence and then find the necessary condition to achieve that equilibrium. Suppose, in equilibrium, we have $\beta_d^* = 0$. With this, buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)d = 0.$$

From the expression, we get the equilibrium price (p_d^*):

$$p_d^* = E(x) + q\lambda_u(1-\gamma)d.$$

Now, to ensure that we get $\beta_d^* = 0$, we need $p_d^* - \lambda_l d < x_s$ or $E(x) + q\lambda_u(1-\gamma)d < x_s$. From this, we get:

$$d > \frac{E(x) - x_s}{\lambda_l - q\lambda_u(1-\gamma)} \equiv \overline{d}.$$

Note that, given that $E(x) - x_s > 0$ and $\lambda_l > \lambda_u > q\lambda_u(1-\gamma)$, we have $\overline{d} > 0$. When we compare $\overline{d}$ with the regularity condition of $d \leq \frac{(1-q)(x_h - x_l)}{(1-\gamma)(\lambda_l - q\lambda_u)}$, since $(1-q)(x_h - x_l) = E(x) - x_l > E(x) - x_s$ and $\lambda_l - q\lambda_u(1-\gamma) > (1-\gamma)(\lambda_l - q\lambda_u) = (1-\gamma)\lambda_l - (1-\gamma)q\lambda_u$, we see that $\overline{d} < \frac{(1-q)(x_h - x_l)}{(1-\gamma)(\lambda_l - q\lambda_u)} = d_{max}$. □

The Lemma shows that, with sufficiently large damages ($d \geq \overline{d}$), we can achieve full deterrence, and the full deterrence threshold ($\overline{d}$) is independent of π. One question that is not fully addressed in the proof is whether we can achieve full deterrence with expectation damages ($d_e = E(x) - x_l$). Unfortunately, this is not clear.

Remark 1: $\overline{d} \lesseqgtr d_e = E(x) - x_l$.

From the respective expressions, we see that:

$$\overline{d} = \frac{E(x) - x_s}{\lambda_l - q\lambda_u(1-\gamma)} \lesseqgtr E(x) - x_l = d_e$$

Although we know that $E(x) - x_s < E(x) - x_l$, when $\lambda_l - q\lambda_u(1-\gamma)$ is sufficiently small, we get $\overline{d} > E(x) - x_l = d_e$. For instance, when λ_l (and λ_u) is small, the buyer gets to recover damages from the non-disclosing l-type with low probability. With low probability of detection, we need larger damages to achieve full deterrence and the expectation damages ($d_e = E(x) - x_l$) would be insufficient. Punitive damages may be necessary. On the other hand, as $\lambda_l \to 1$ and $\lambda_u \to 0$, for instance, we get $\overline{d} \to E(x) - x_s > E(x) - x_l$. With high detection probability, expectation damages would be sufficient to achieve full deterrence.

B1.2 No Deterrence

At the other end of the spectrum on damages, we can imagine that when the damages are relatively small, they will provide no deterrence against the l-type seller from strategically non-disclosing its information to the buyer. The following Lemma formalizes the result.

Lemma 4. *(No Deterrence Damages.) When the buyer is entitled to receive damages (d) as remedy against seller's non-disclosure,* $\exists\ \underline{d}(\pi) \in [0, \overline{d}]$*, such that when* $d \leq \underline{d}$*, we get* $\beta_d^* = 1$*. Furthermore,* $\exists\ \widehat{\pi}_0 = \widehat{\pi}_n$*, such that (1)* $\forall \pi \in [\widehat{\pi}_0, 1]$*,* $\underline{d}(\pi) = 0$*, and (2)* $\forall \pi \in [0, \widehat{\pi}_0)$*,* $\underline{d}(\pi) > 0$ *and* $\underline{d}'(\pi) < 0$*.*

Proof of Lemma 4. (No Deterrence Damages.) Suppose $\exists\ \underline{d} \geq 0$, such that, if $d \leq \underline{d}$, we get $\beta_d^* = 1$. When $d = \underline{d}$, we should have the l-type (just) being indifferent, which implies that $p_d^* - \lambda_l \underline{d} = x_s$ or $p_d^* = \lambda_l \underline{d} + x_s$. From the buyer's break-even condition, when $\beta_d^* = 1$, we get:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)\underline{d}) \\ + \pi q(x_l - p_d^* + \lambda_l(1-\gamma)\underline{d}) = 0.$$

When we use the expression $p_d^* = \lambda_l \cdot \underline{d} + x_s$, and solve for $\underline{d}$, after some algebra, we get:

$$\underline{d}(\pi) = max\left\{\frac{(1-\pi)(E(x) - x_s) - \pi q(x_s - x_l)}{(1-\pi)(\lambda_l - q\lambda_u(1-\gamma)) + \pi q\lambda_l\gamma}, 0\right\}.$$

It is straightforward, though somewhat messy, to show that $\underline{d} \leq \overline{d}$. First, when $\pi = 0$, focusing on the left expression in the curly brackets, we see that:

$$\frac{(1-\pi)(E(x) - x_s) - \pi q(x_s - x_l)}{(1-\pi)(\lambda_l - q\lambda_u(1-\gamma)) + \pi q\lambda_l\gamma} = \frac{E(x) - x_s}{\lambda_l - q\lambda_u(1-\gamma)} = \overline{d} > 0.$$

Hence, $\underline{d}(\pi = 0) = \overline{d} > 0$. When $\pi = 1$, we get:

$$\frac{(1-\pi)(E(x) - x_s) - \pi q(x_s - x_l)}{(1-\pi)(\lambda_l - q\lambda_u(1-\gamma)) + \pi q\lambda_l\gamma} = \frac{-q(x_s - x_l)}{q\lambda_l\gamma} < 0.$$

Given that $\underline{d}(\pi = 0) > 0$, $\frac{-q(x_s - x_l)}{q\lambda_l\gamma} < 0$, and $\frac{d}{d\pi}\left(\frac{(1-\pi)(E(x) - x_s) - \pi q(x_s - x_l)}{(1-\pi)(\lambda_l - q\lambda_u(1-\gamma)) + \pi q\lambda_l\gamma}\right) < 0$, $\exists$ $\widehat{\pi}_0 \in [0, 1]$, such that $\underline{d}(\widehat{\pi}_0) = 0$. For this to be true, we need:

$$(1 - \widehat{\pi}_0)(E(x) - x_s) - \widehat{\pi}_0 q(x_s - x_l) = 0,$$

from which, we get:

$$\widehat{\pi}_0 = \frac{E(x) - x_s}{(1-q)(x_h - x_s)} = \widehat{\pi}_n.$$

The cutoff threshold is the same as that of the no remedy benchmark. This is intuitive. When $d = \underline{d}(\widehat{\pi}_0) = 0$, this is equivalent to the no liability regime. Hence, we get the

same π threshold to separate between the no deterrence and partial deterrence equilibria. Finally, it is fairly straightforward to show that $\frac{d}{d\pi}\left(\frac{(1-\pi)(E(x)-x_s)-\pi q(x_s-x_l)}{(1-\pi)(\lambda_l-q\lambda_u(1-\gamma))+\pi q\lambda_l\gamma}\right) < 0$. □

From the full deterrence analysis, we saw that $\overline{d} \lesseqgtr d_e = E(x) - x_l > 0$, and that if $d_e \leq \overline{d}$, we cannot get full deterrence with expectation damages ($d_e = E(x) - x_l$). More generally, when $d \leq \overline{d}$, $\exists\ \widehat{\pi}_d \in [0, \widehat{\pi}_0]$, such that: $\underline{d} \geq d$ when $\pi \leq \widehat{\pi}_d$ and $\underline{d} < d$ when $\pi > \widehat{\pi}_d$. In other words, with $d < \overline{d}$, when $\pi \leq \widehat{\pi}_d$, we get no deterrence, whereas if $\pi > \widehat{\pi}_d$, we get partial deterrence. The following Remark provides more formal statements of these points.

Remark 2: When $d \leq \overline{d}$, $\exists\ \widehat{\pi}_d(d) \in [0, \widehat{\pi}_0]$ such that we get no deterrence when $\pi \leq \widehat{\pi}_d(d)$ and partial deterrence when $\pi > \widehat{\pi}_d(d)$. As d increases, $\widehat{\pi}_d(d)$ increases, $\widehat{\pi}_d(0) = \widehat{\pi}_0 = \widehat{\pi}_n$, and $\widehat{\pi}_d(\overline{d}) = 0$.

B1.3 Damages Equilibrium

The two Lemmas have established the boundaries on d, $\overline{d}$ and $\underline{d}(\pi)$,such that we get either full deterrence (when $d \geq \overline{d}$) or no deterrence (when $d \leq \underline{d}(\pi)$). The Remark shows that, when the damages are somewhere in between these two boundaries, the equilibrium depends on the degree of asymmetric information (π). When we combine these analyses, we have the following proposition.

Proposition 4. *(General Damages Equilibrium.) Suppose the buyer can collect damages of $d \geq 0$ from the seller after observing non-disclosure and $\sigma = 1$. The h-type seller always discloses its information and sells the asset to the buyer at $p = x_h$. For the u-type and the l-type, the following constitutes an equilibrium.*

1. *Full Deterrence. If $d \geq \overline{d} = \frac{E(x)-x_s}{\lambda_l - q\lambda_u(1-\gamma)}$, then the l-type seller is fully deterred and does not participate ($\beta_d^* = 0$). The u-type sells for certain at an equilibrium price of $p_d^* = E(x) + q\lambda_u(1-\gamma)d$.*

2. *No Deterrence. If $d \leq \underline{d}(\pi) = max\left\{\frac{(1-\pi)(E(x)-x_s)-\pi q(x_s-x_l)}{(1-\pi)(\lambda_l-q\lambda_u(1-\gamma))+\pi q\lambda_l\gamma}, 0\right\}$, then both the l-type and the u-type participate for certain ($\beta_d^* = 1$) at an equilibrium price of*

$$p_d^* = \frac{(1-\pi)(E(x) + q\lambda_u(1-\gamma)d) + \pi q(x_l + \lambda_l(1-\gamma)d)}{(1-\pi) + \pi q}.$$

3. *Partial Deterrence. If $d \in (\underline{d}(\pi), \overline{d})$, then while the u-type participates for cer-*

tain, the l-type seller participates with probability

$$\beta_d^* = \frac{(1-\pi)(E(x) - x_s - (\lambda_l - q\lambda_u(1-\gamma))d)}{\pi q(x_s - x_l + \lambda_l \gamma d)},$$

and the u-type and the l-type sell at $p_d^* = x_s + \lambda_l d$. *As* $\pi \to 1$, $\beta_d^* \to 0$, *and as* $\pi \to \widehat{\pi}_d$, $\beta_d^* \to 1$.

Proof of Proposition 4. (General Damages Equilibrium.) As we saw from Lemma 3, when $d \geq \overline{d} = \frac{E(x)-x_s}{\lambda_l - q\lambda_u(1-\gamma)}$, the l-type seller is fully deterred ($\beta_d^* = 0$). In that case, the buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)d) = 0.$$

When we solve for p_d^*, we get: $p_d^* = E(x) + q\lambda_u(1-\gamma)d$. Note that p_d^* is independent of π.

From Lemma 4, we know that when $d \leq \underline{d}(\pi)$, we get no deterrence: $\beta_d^* = 1$. With no deterrence, the buyer's break-even condition becomes:

$$(1-\pi)((1-q)(x_h - p_d^*) + q(x_l - p_d^*) + q\lambda_u(1-\gamma)d) + \pi q(x_l - p_d^* + \lambda_l(1-\gamma)d) = 0.$$

When we solve for p_d^*, we get:

$$p_d^* = \frac{(1-\pi)(E(x) + q\lambda_u(1-\gamma)d) + \pi q(x_l + \lambda_l(1-\gamma)d)}{(1-\pi) + \pi q}.$$

We see that, when $\pi = 0$, $p_d^*(\pi = 0) = E(x) + q\lambda_u(1-\gamma)d$.

Finally, if $d \in (\underline{d}(\pi), \overline{d})$, we get partial deterrence. In order to make the l-type seller indifferent, we need $p_d^* = x_s + \lambda_l d$. With this equilibrium price, the buyer's break-even condition becomes:

$$\begin{aligned}(1-\pi)((1-q)(x_h - (x_s + \lambda_l d)) + q(x_l - (x_s + \lambda_l d)) + q\lambda_u(1-\gamma)d) \\ + \pi q \beta_d^*(x_l - (x_s + \lambda_l d) + \lambda_l(1-\gamma)d) = 0.\end{aligned}$$

When we solve for β_d^*, we get:

$$\beta_d^* = \frac{(1-\pi)(E(x) - x_s - (\lambda_l - q\lambda_u(1-\gamma))d)}{\pi q(x_s - x_l + \lambda_l \gamma d)}.$$

As $\pi \to 1$, $\beta_d^* \to 0$, and as $\pi \to \widehat{\pi}_d$, $\beta_d^* \to 1$. □

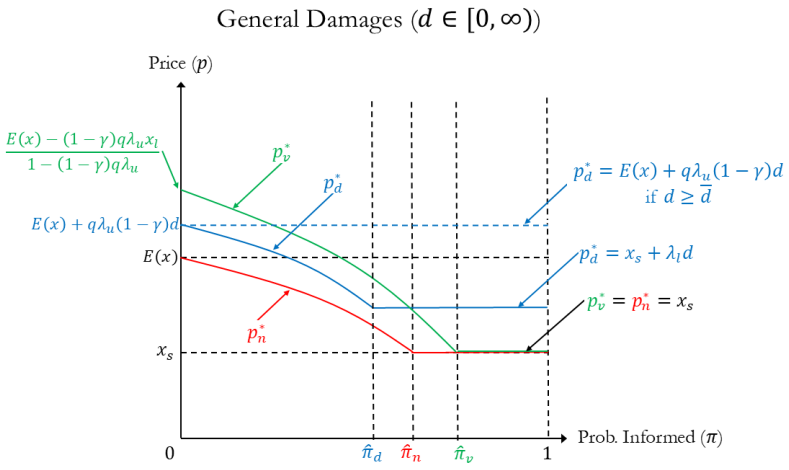


Figure 4: Equilibrium Prices with General Damages

As in the case of $d = p_d^* - x_l$, with general damages, we have three possible equilibria. With sufficiently high damages ($d \geq \overline{d}$), we can achieve full deterrence where only the u-type seller engages in sale without disclosure. When the damages are not sufficiently large, we get either no deterrence or partial deterrence, depending, in particular, on the severity of the asymmetric information (π). More precisely, we have the lower bound threshold on damages, $\underline{d}(\pi)$, that determines the region of no deterrence. In some sense, this is where the "market" is working together with the liability regime. As π gets larger, when confronted with non-disclosure, the buyer becomes more suspect and punishes non-disclosure with a lower price. This, in turn, requires smaller legal sanctions to achieve, at least, partial deterrence: $\underline{d}(\pi)$ decreases as π increases. Also, within the partial deterrence region, as π increases, β_d^* decreases (the l-type participates with a lower probability).

Figure 4 graphically presents the equilibrium with general damages. Most of the findings from the earlier case carry through, and the figure looks qualitatively similar to Figure 1. There is one important difference, however. With d untethered from the equilibrium price (p_d^*), we no longer have the case where the buyer treats voidance and damages as being equivalent. The buyer's reservation value will differ (depending on d versus $p_d^* - x_l$) and this is reflected by the fact that the equilibrium p_v^* (represented by the green line) diverges from the equilibrium p_d^* (represented by the solid blue line). In the figure, we are assuming that when $\pi = 0$, the buyer is willing to pay more under voidance than under damages (represented by the green line lying above the blue line).