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Information-Forcing Effects of Non-Disclosure Rules *

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Abstract

Contract law traditionally applies different disclosure duties on buyers and sellers. Sellers are generally required to disclose "negative" information about hidden defects of the products they sell. Failure to disclose can make the contract voidable and can give rise to liability. By contrast, buyers are generally under no comparable duties to disclose "positive" information about hidden qualities of the products they buy. The leading explanation for the law's disparate treatment of buyers and sellers in these two asymmetric information problems is that imposing disclosure duties on buyers would undermine their incentives to acquire costly (but socially useful) information prior to forming a contract (Kronman, 1978). This explanation lacks a key step—the failure to correct asymmetric information problems would cause the inverse adverse selection problem (identified by Burckart and Lee (2016) and Dari-Mattiacci et al. (2021)) to arise. Uninformed sellers would withdraw from the market and resources would not move to higher-valuing users. In this paper, we develop a model to study the incentives created by disclosure and non-disclosure rules. We show that when parties can contract around defaults, the choice of alternative disclosure rules (duty to disclose vs. no duty to disclose) makes a difference. Unlike disclosure rules, non-disclosure default rules yield partially separating equilibria that preserve the buyers' incentives to acquire information. They also foster trade opportunities between expert buyers and uninformed sellers. Our results add to the existing literature by providing an additional rationale for the different treatment of buyers and sellers in asymmetric information problems.

JEL Codes : D44, D82, D86, K12.
Keywords: asymmetric information, penalty default rules, inverse adverse selection

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1. Introduction

Most contemporary legal systems protect uninformed buyers, imposing a duty on sellers to disclose "negative" private information (i.e., information that would reduce the value of the good, such as hidden defects).[1] However, no comparable protection exists for uninformed sellers: informed buyers are not generally required to disclose "positive" private information (i.e., information or hidden qualities that would increase the value of the traded good) to sellers. When considering compliance with duties of good faith and fair dealing, courts carve out a "safe harbor" for buyers who do not disclose positive information about the good they are buying. Restatement (Second) of Contracts § 161, Comment (a) articulates the general principle: "A party making a contract is not expected to tell all that he knows to the other party, even if he knows that the other party lacks knowledge on some aspects of the transaction." Restatement (Second) of Contracts §161, Comment (d) specifically introduces the distinction between duties to disclose hidden defects and (lack of) duties to disclose hidden qualities: "A seller of real or personal property is 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. … A buyer of property is not ordinarily expected to disclose circumstances that make the property more valuable than the seller supposes".[2]

[1] Many legal systems create affirmative duties to disclose private information that may negatively affect the value of the transaction to the other contracting party—e.g., disclosure of hidden defects of a product, disclosure of prior employment record, and disclosure of preexisting health conditions. In the U.S., non-disclosure of known defects by sellers is equivalent to misrepresentation. Restatement (Second) of Contracts § 161 (Am. Law Inst. 1981) describes situations where non-disclosure of relevant information can equate to an assertion that a defect does not exist. These situations present distinctions from the general principle that non-disclosure does not amount to a violation of the duties of good faith and fair dealing.

[2] In many other jurisdictions, courts grant protection in case of a violation of precontractual or contractual duties of good faith and fair dealing. French law is among the most far-reaching systems in protecting aggrieved parties under these rules. However, even under French law these remedial venues do not support the claims of uninformed sellers dealing with buyers who have acquired information through costly investments. The French CODE CIVIL [C. CIV.] [CIVIL CODE], art. 1112-1, comma 4 requires the aggrieved party

Restatement (Second) of Contracts § 161, Illustration 10 provides an example of the "safe harbor" that buyers enjoy when they fail to disclose legally obtained[3] information: "A, seeking to induce B to make a contract to sell A land, learns from government surveys that the land contains valuable mineral deposits and knows that B does not know this, but does not disclose this to B. B makes the contract. A's non-disclosure does not amount to a failure to act in good faith and in accordance with reasonable standards of fair dealing and is therefore not equivalent to an assertion that the land does not contain valuable mineral deposits. The contract is not voidable by B".[4] Similar "safe harbors" appear in civil law systems which exclude the application of just-price laws in similar situations.[5]

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to prove the existence of an affirmative duty to disclose the information as a condition for obtaining relief, and art. 1112-1, comma 3 of the French *Code Civil* does not enlist the disclosure of privately acquired positive information among the items subject to disclosure duties. Non-disclosure does not amount to a violation of standards of good faith and fair dealing except for the situations enumerated in the Restatement (Second) § 161. Similarly, Restatement (Second) of Contracts, §205 (on duties of fair dealing and good faith) and Restatement (Second) of Contracts §208 (on unconscionability) mark the scope of judicial policing of contracts. Courts have thus far provided a safe harbor to informed buyers who fail to disclose positive information to their sellers.

[3] The Buyer is not entitled to withhold positive information when that information was illegally obtained (see Restatement (Second) of Contracts §161, Illustration 11).

[4] In the U.S., concern over transactions involving uninformed sellers has been minimal compared to the attention and legal protection granted to uninformed buyers. *See, e.g.*, Daniel v. Ford Motor Co., 806 F.3d 1217 (9th Cir. 2015) (concluding that Ford Focus purchasers had provided sufficient evidence to establish a claim against Ford for failing to disclose known defects in the Ford Focus' rear suspension); Panther Partners Inc. v. Ikanos Commc'ns, Inc., 681 F.3d 114 (2d Cir. 2012) (requiring the chip maker to disclose its known "above average" defect rate to "inform the investing public" of the uncertainty associated with investing in the company); Vanderwier v. Baker, 937 N.E.2d 396 (Ind. Ct. App. 2010 (holding that sellers of real estate failed to adequately disclose known property defects to property buyers). Duties to disclose positive information by buyers are grounded in preexisting fiduciary relationships between parties. *See, e.g.*, Manning v. Dial, 245 S.E.3d 120 (S.C. 1978) (holding that the buyer of stock had a duty to disclose relevant facts that would have raised the value of stock because, due to the parties' preexisting fiduciary duty, non-disclosure amounted to fraud). Restatement (Second) of Torts § 551 (Am. Law Inst. 1977) provides tort remedies for misrepresentations and non-disclosures that cause a pecuniary loss. These legal duties are used to force the disclosure of negative information by sellers to buyers in the traditional lemons problem.

[5] In some civil law countries, an "action for lesion" gives a seller the right to rescind a sale when the price paid by the buyer falls below some threshold. *See* Arthur Taylor von Mehren (1974, pp. 321–23). Other jurisdictions grant just-price protection to parties when the price of goods is not adequate compared to their market value at the time of the sale. See, e.g., in France, the CODE CIVIL [C. CIV.] [CIVIL CODE] art. 1674 (protecting sellers of immovable property who sold their property for less than five twelfths of the fair market value); in Italy, the CODICE CIVILE [C.C.] [CIVIL CODE] art. 1448 (protecting sellers who enter a transaction involving movable or immovable property due to financial necessity); in Chile, the CÓDIGO [CÓD. CIV.] [CIVIL CODE] art. 1998 (protecting both sellers and buyers of movable and immovable property against unfair prices). Under these laws, sellers who sell their goods at a price substantially lower than the fair market value are

Even though contract law allows an informed buyer to refrain from disclosing hidden qualities of the good, the buyer is not allowed to proffer misleading or false information. Restatement (Second) of Contracts § 164 and Restatement (Second) of Torts § 551 (Am. Law Inst. 1977) provide tort remedies for misrepresentations that cause pecuniary losses, allowing courts to impose extra-compensatory damages for fraudulent misrepresentation.[6] As we will show in this paper, the legal distinction between untold truths and lies plays an important role in our problem.

In Section 2 of this paper, we discuss the recent theoretical literature that shows the economic consequences of asymmetric information situations involving uninformed buyers vs. uninformed sellers. Regardless of which contracting party is informed or uninformed (buyer or seller), both forms of asymmetric information are detrimental to social welfare when compared to an ideal world in which sellers and buyers are equally informed (or equally uninformed) and prices reflect the actual (or expected) quality of the goods.[7] The welfare loss derives from the fact that some desirable transactions—where buyers value the goods more than sellers—do not occur.

The extant literature explains the different legal duties imposed on buyers and sellers to disclose private information by focusing on (i) the incentives that disclosure rules generate before contract formation, (ii) the availability of market

allowed to challenge the sale ex post and obtain an augmentation of the price or a rescission of the sale. However, if the price gap is driven by positive information acquired by the buyer, the market value of the property at the time of the sale does not yet reflect the information about the good's hidden qualities. In these cases, just-price disproportion cannot be established for the purpose of this remedy, and no relief is available to uninformed sellers. Unlike these civil law jurisdictions, U.S. contract law does not grant just-price scrutiny of bargained-for exchanges. *See* Restatement (Second) of Contracts §71, Comment (a) (excluding the element of "adequacy" as a requirement of a valid consideration).

[6] In the U.S., the caselaw that developed after *Laidlaw v. Organ*, 15 U.S. (2 Wheat.) 178 (1817) points to situations where non-disclosure of relevant information in response to an explicit question may be treated as equivalent to an assertion. This could lead to voidability of the contract and liability for misrepresentation.

[7] Dari-Mattiacci et al. (2021) identify conditions under which symmetrical lack of information is allocatively preferable to asymmetric information.

solutions to asymmetric information problems involving informed buyers, and (iii) the limited enforceability of disclosure duties imposed on buyers.

With respect to the first explanation, Kronman (1978) observed that a duty to disclose positive information would dilute prospective buyers' ex ante incentives to search for and/or use valuable information.[8] According to this conceptualization, the absence of a duty to disclose can be seen as a "property right" in information which protects the informed party's ex ante investment in the search for information. Just as patents and copyrights protect intellectual property investments to stimulate innovation, non-disclosure rules encourage investment in information (hereinafter we shall refer to these incentives as "search incentives"). This explanation falls short, however, because by failing to correct asymmetric information problems, resources still might not move to higher valuing users. While non-disclosure rules encourage buyers to acquire information that they are not required to disclose, they also discourage uninformed sellers from entering transactions with potentially better-informed buyers (Burckart and Lee, 2016; and Dari-Mattiacci et al., 2021). This results in foregone trade opportunities (hereinafter we shall refer to this effect as "sellers' withdrawal problem").

The second set of explanations questions the actual need for imposing duties to disclose on buyers, focusing on the availability of market solutions to the asymmetric information problems involving informed buyers. Uninformed sellers can retain experts to appraise the value of goods that they intend to sell, or auctions can help to elicit information from informed buyers. However, these explanations omit a logical step—market opportunities can correct asymmetric information only when the information is readily available to appraisers and other expert buyers and

[8] With respect to legal duties to disclose positive information, scholars have argued that legal intervention should not be used to correct the informational advantage obtained through expertise or costly search investments because otherwise the acquisition and use of such information would be discouraged, and valuable resources would remain sub-optimally used. Kronman (1978) made this point convincingly and started an influential literature.

when sellers have reason to suspect the existence of some hidden quality of the good that they are selling.[9]

The third explanation considers the cost-effectiveness of imposing a duty to disclose on buyers, focusing on the ex ante and ex post information problems. Uninformed sellers have a limited opportunity to detect hidden qualities after the sale. This would hamper the effectiveness and enforceability of disclosure duties imposed on informed buyers. However, this explanation does not always fit the reality of asymmetric information transactions—the post-sale actions of expert buyers can reveal the existence of hidden qualities to the uninformed seller. Expert buyers' use of the good after the sale would facilitate the ex post detection of undisclosed information.

The remainder of this paper is structured as follows. In Section 2.1, we review and discuss the limits of the three explanations for the different domains of legal intervention in contracts affected by asymmetric information. In Section 2.2, we provide an additional rationale for the different disclosure duties imposed on buyers and sellers in contract law. Departing from the conventional wisdom in the literature, we show that when parties can opt out of the applicable disclosure rules, rules that allow buyers to not disclose positive information (hereinafter, "non-disclosure default rules") have an advantage over legal rules that impose a duty to disclose (hereinafter "disclosure default rules"). Non-disclosure default rules operate as information-forcing default rules—default rules that encourage parties to reveal private information—leading to an indirect, bottom-up revelation of information that avoids sellers' withdrawal and protects some of the expert buyers' search investments.[10] As it will be shown in this paper, the counter-intuitive result

[9] Scheppele (1988) refers to these situations as "shallow secrets."

[10] The concept of information-forcing default rules was first formulated by Goetz and Scott (1980) who suggested that some legal rules purposefully allocate risk onto the party that is in the best position to disclose information relevant to the transaction. Ayres and Gertner (1989) introduced the concept of penalty default rules as default rules that are designed to give at least one party an incentive to contract around them.

is that non-disclosure rules may lead parties to acquire and disclose more, rather than less, information. In Section 3, we develop a formal model to illustrate our point, showing the different effects of disclosure and non-disclosure default rules. By reviewing the conditions under which parties may opt out of alternative default rules, we show that giving no protection to uninformed sellers as a default rule can generate superior information-forcing effects. Disclosure default rules allow sellers to perform a complete screening of buyers, undermining expert buyers' incentives to acquire information, as suggested by Kronman (1978). By not requiring informed buyers to disclose the positive information, expert buyers with negative information will separate themselves, resulting in a semi-pooling equilibrium. Non-disclosure default rules can solve Kronman's (1978) problem, preserving buyers' search incentives, while avoiding the sellers' withdrawal problem identified by Burkart and Lee (2016) and Dari-Mattiacci et al. (2021). Section 4 concludes with some ideas for future extensions and applications.

2. Informed buyers and uninformed sellers: Inverse adverse selection

Most of the problems of asymmetric information considered in legal and economic literature are characterized by transactions between informed sellers (employees or agents) and uninformed buyers (employers or principals).[11] Our

By doing so, penalty default rules encourage one or both parties to reveal information to the other party. An essential premise of the notion of penalty default rules is the idea that there may be strategic reasons for leaving a contract incomplete. Penalty default rules give parties incentives to negotiate ex ante by penalizing them for leaving inefficient gaps in their contracts. See also Bebchuk and Shavell (1991) for a different view.

[11] Asymmetry in information arises whenever participants in a transaction rely on different information relevant to their contract or relationship. In his article "The Market for Lemons," Akerlof (1970) illustrated this concept and considered its impact on the used-car market—a market where sellers frequently know more than buyers about the quality of the traded goods. When buyers cannot ascertain the quality of a used car, uncertainty depresses prices. Owners of high-quality cars consequently become less likely to put their cars on the market at the depressed prices, leaving the market predominantly populated by low-quality used

analysis focuses on the dual problem, which has been referred to as the "market for gems," mirroring Akerlof's "market for lemons."[12] In a market for gems, buyers (employers or principals), rather than sellers (employees or agents), possess private information (Burkart and Lee, 2016; Dari Mattiacci et al., 2021). This might be the case for unique goods of uncertain value—such as antiques or artwork—or for transactions between expert buyers and one-time sellers—such as between a real estate investor and a homeowner; a diamond dealer and an individual seller; experienced publishers and authors; or music producers and musicians. Bankruptcy procedures provide another example where the individual overseeing a sale is most likely less informed about the quality of the goods than are potential buyers. An informational advantage exists when art dealers select artists to be represented in their gallery or when professional sport scouts assess the talents of the athletes to be recruited for their teams. Thus, through a sort of role-reversal, the uninformed parties (sellers, agents and employees) in these markets find themselves in situations similar to that of the uninformed parties (buyers, principals and employers) in the standard market for lemons.[13]

"Market for gems" situations give rise to inverse adverse selection problems, which mirror the standard adverse selection problems. Dari-Mattiacci et al. (2021) explored the economic consequences of these two sets of asymmetric information problems. They showed that in markets characterized by uninformed

cars (lemons). This reduces the expected quality and price of the cars that remain on the market and drives additional prospective sellers out of the market. This process, known as "adverse selection," leads to a market failure; sellers exploit their informational advantage over buyers by putting only low-quality goods on the market. While Akerlof discussed the problem of asymmetric information within the context of the used-car market, its application extends to other contractual and market settings, including insurance, pharmaceuticals and labor markets, to name a few.

[12] While the metaphorical reference to lemons was made popular by Akerlof (1970), a reference to gems can be found in Kronman (1978), where he comments on an example given in the Restatement of Restitution where a jewelry shop mistakenly sells real gems for the price of cheap decorative stones. See also Wood v. Boynton, 64 Wis. 265, 25 N.W. 42 (1885) for the case of an individual selling a diamond to a jeweler on the assumption that it was a (worthless) topaz. Goldberg (1997) refers to it as the "gold ring problem."

[13] In the interest of readability, hereinafter we shall simply refer to the two groups of individuals as "sellers" and "buyers."

sellers and informed buyers, sellers may infer that, if buyers show interest in what the sellers are offering, the buyers most likely possess some private information about the quality or value of the good of which the sellers are not aware. This may induce the sellers to increase their asking price, which will eventually force low-quality goods out of the market. As in Akerlof's market for lemons, this inverse form of adverse selection may lead to a shrinking or an entire collapse of the market. These two scenarios differ, however, in that low-quality goods drive high-quality goods out of the market when sellers have an informational advantage, whereas high-quality goods drive low-quality goods out of the market when buyers have an informational advantage. The downward push in quality and prices observed in the lemons market mirrors the upward push observed in the gems market.[14] In both cases, the fact that some goods are not traded leads to a social welfare loss—which equals the difference between the prospective sellers' and buyers' valuations of the unsold goods.

Table 1 below highlights some of the relevant differences between the two cases of asymmetric information under consideration.

The duality in asymmetric information between markets for lemons and markets for gems can be seen in the following two numerical examples. Imagine a seller (she) owns an object to which she attaches a certain value, while a potential buyer (he) assigns it a possibly different value. Both valuations depend on the quality of the object.

[14] Unlike in the problem of adverse selection in the lemons market, which affects the salability of high-quality goods, inverse adverse selection in the gems market affects low-quality goods, leaving only high-quality goods on the market and pushing up prices. Dari Mattiacci et al. (2021) extend their analysis to show that there are situations under which markets with symmetric lack of information lead to preferable outcomes compared to markets with asymmetric information. This specific extension is not relevant for the thesis of our paper regarding the function of non-disclosure rules and is therefore omitted.

	Adverse Selection	**Inverse Adverse Selection**
Source of information	Experience/Use	Expertise/Search
Buyer	Uninformed	Informed
Seller	Informed	Uninformed
Goods on the market	Low-value goods (lemons)	High-value goods (gems)
Price	Low	High

Table 1: *Symmetries in Asymmetric Information*

To illustrate the problem of adverse selection in a lemons market, consider a seller selling a good that could be of either low or high quality. The seller knows the quality of the good and values a high-quality good at 70 and a low-quality good at 10. The buyer values the goods at 80 and 20, respectively, but cannot verify the quality of the good prior to purchase. Given the subjective valuations of the buyer and seller, if quality were observable by both parties, the buyer would be willing to buy and the seller would be willing to sell both types of goods. This, however, is not the case. The buyer knows only that there is a 50% chance that the seller is selling a high-quality good and a 50% chance that she is selling a low-quality good. Accordingly, the expected value of the good for the buyer is 50 (that is: 50%×20 + 50%×80); hence, the buyer would be willing to pay up to 50 for a good of uncertain quality if the seller was similarly uninformed. He knows, however, that for a price equal to or lower than 50, the informed seller would not sell a high-quality good and would only be willing to sell a good of low quality. Anticipating this outcome, the buyer's best strategy is to pay at most 20 for a good of uncertain—and thus,

low—quality, which the seller is willing to sell for any price above 10. As a result of this strategy, only low-quality goods will be traded.

Now, to illustrate the dual problem of inverse adverse selection in a gems market, consider the same two parties as above: a seller selling a good that could be of either high or low quality, with valuations of 70 and 10, respectively, and a buyer, with valuations of 80 and 20, respectively. In this case, however, it is the buyer who knows the quality of the good while the seller is uninformed. As in the previous example, if both parties were uninformed or if the quality of the good was observable to both parties, then both high-quality and low-quality goods would be traded. However, since both parties are not uniformed, this is not the case. The uninformed seller knows that there is a 50% chance that she is selling a high-quality good and a 50% chance that she is selling a low-quality good. The expected value of the good for the seller is 40 (that is: 50%×10 + 50%×70); hence, the seller would be willing to accept any amount above 40 for a good of uncertain quality. She knows, however, that for a price equal to or higher than 40, the informed buyer would only buy a good of high quality. Anticipating this outcome, the seller's best strategy is to ask at least 70 for a good of uncertain—and thus, high—quality, which the buyer is willing to buy for any price below 80. As a result of this strategy, only high-quality goods will be traded.

2.1 Disclosure duties for buyers vs. sellers: Revisiting the traditional explanations

From an allocative efficiency perspective, asymmetric information produces equally undesirable outcomes in the two illustrations above. However, as discussed in Section 1, most contemporary legal systems create affirmative duties for sellers to disclose negative information (e.g., hidden defects unknown to

buyers), but do not create symmetric duties for informed buyers to disclose positive information (e.g., hidden qualities unknown to sellers). Below, we provide a critical review of the main explanations in the existing legal and economic literature for the difference in disclosure duties imposed on buyers vs. sellers. In Section 2.2, we return to this question and provide a novel rationale for the divergent legal treatment of buyers and sellers in asymmetric information situations, thereby unveiling the information-forcing effect of non-disclosure default rules in gems markets.

2.1.1 Preserving search incentives

In a seminal paper, Kronman (1978) provides an important economic explanation of why contract rules provide different protections for uninformed buyers and sellers. Kronman also explains why most legal systems allow buyers, but not sellers, to exploit their informational advantage in asymmetric information transactions. Kronman observes that in most cases sellers acquire private information "casually," through their use of the good—for example, the seller of a defective car or a house infested with termites would have gleaned knowledge of deficiency or infestation through usage. Conversely, buyers acquire private information "deliberately," employing their expertise or investing in a costly search—such as an art expert who scouts through vintage stores and finds an unsigned and still unidentified valuable piece of art, or a geologist who carries out a targeted geological research to identify land rich in yet-undiscovered mineral resources.[15] Deliberate searches and use of expertise entail costs that a party would not incur without having a prospect of benefitting from the resulting information. As Kronman aptly delineates, "if information has been deliberately acquired (in the sense defined above), and its possessor is denied the benefits of having and using

[15] *See* Hill v. Jones, 151 Ariz. 81, (1986); *see also,* Consolidated Oil and Gas, Inc. v. Ryan, 250 F. Supp. 600 (W.D. Ark.), aff'd, 368 F.2d 177 (8th Cir. 1966).

it, he will have an incentive to reduce (or curtail entirely) his production of such information in the future. … one who has casually acquired information will not be discouraged from doing what—for independent reasons—he would have done in any case." (Kronman, 1978, pp. 13-14). For this reason, information acquired through expertise or costly search investments should not be subject to a duty to disclose.[16] The forced disclosure of such information to the seller would reduce its value and, in turn, discourage prospective expert buyers from investing in the search, acquisition, and use of that positive information.[17] Valuable resources would, consequently, remain in the hands of low-valuing owners; who would sub-optimally use or possibly destroy those resources. According to Kronman, "one effective way of ensuring that an individual will benefit from the possession of information (or anything else for that matter) is to assign him a property right in the information itself. … one (seldom noticed) way in which the legal system can establish property rights in information is by permitting an informed party to enter—and enforce—contracts … without disclosing the information to the other party. Imposing a duty to disclose upon the knowledgeable party deprives him of a private advantage which the information would otherwise afford. A duty to disclose is … antithetical to the notion of a property right. … The only feasible way of assigning property rights … is to permit those with such information to contract freely without disclosing what they know." (Kronman, 1978, pp. 14-15)

Along similar lines, Shavell (1994) focuses on the mirror-image case of a market for lemons. Shavell observes that negative information which is "casually" acquired through use by the owner should instead be disclosed to the buyer. This would avoid duplicative efforts among all prospective buyers to invest in acquiring

[16] Restatement (Second) of Contracts, §161 Reporter's Note. Comment d. on the enumerated listing of cases where non-disclosure can be construed as concealment, cites Kronman (1978) as doctrinal support for the non-disclosure rule.

[17] Kronman's insight received criticism from subsequent scholars, who pointed out the need to qualify his argument by distinguishing between socially valuable and privately valuable (i.e., redistributive) information. See, Coleman et al. (1989) and Barnett (1992).

the same information. Goldberg (1997) contributed to this literature, noting that the production of information is both costly and potentially valuable, and that owners have incentives to economize. Conversely, third-party buyers may already possess information or have a comparative advantage in the search for information.[18] Bar-Gill and Porat (2020: 110) pushed the analysis further, showing that mandatory disclosure rules reduce the private value of information compared to voluntary disclosure. Bar-Gill and Porat considered two alternative scenarios: one where there is a mandatory duty to disclose and the other where parties choose to disclose voluntarily. In Section 2.2, we explore the effects of possible modifications of the default rule. By allowing parties to alter default rules through contracting,[19] we identify an additional rationale for the current configuration of duties to disclose in the law, and the asymmetric legal protection of uninformed buyers and sellers.

2.1.2 Availability of experts and auctions

Mirroring the lemons market, where informed sellers rationally withhold negative information from buyers, informed buyers in a gems market rationally withhold positive information from uninformed sellers. In a market where prospective buyers, rather than sellers, have private information, the operation of solutions is reversed. If prospective buyers can credibly convey negative information to their uninformed sellers (e.g., if a diamond expert can convince a prospective seller about the existence of a defect in the stone), a transaction could take place at a lower price. Informed buyers have incentives to signal negative information, just as informed sellers have incentives to signal positive information.

[18] Along similar lines, Guerra and Parisi (2021) showed the negative effect that adversarial discovery rules have on the incentives to invest in private evidence-producing technology.

[19] Bar-Gill and Porat (2020) assume sticky defaults and assume away the possibility that parties will contract around whatever the default rule is. While there are good reasons to believe that many parties will fail to alter the defaults due to transaction costs, in many settings some parties are sophisticated enough and/or the problems are large enough to justify renegotiation.

In this context, scholars have pointed out that the market opportunities that can correct asymmetric information in gems markets do not find an equally viable analogue in lemons markets. Solutions to gems problems may exist because a seller can acquire information about the quality of the good from an independent appraiser or extract information from the competitive bidding of informed buyers at an auction. However, these market solutions are available only when the market contains a sufficiently large number of experts and can fill the information gap only when the independent appraisers or the competing bidders have access to the same information as the prospective informed buyer.[20] Gems problems that cannot be corrected through auctions or appraisers arise because buyers have unique information that not even diligently informed owners or professional appraisers necessarily possess. Independent appraisers or bidders assess the value of the goods based on the market information at their disposal, without access to the specific information of a prospective expert buyer. For example, a geologist who makes an offer on an estate because he has learned about the existence of yet-undiscovered mineral resources possesses unique private information about the value of the property. This is not known by the owner and may not be easily ascertainable by an independent real estate appraiser or auction bidder. Without knowing the reason for the prospective buyer's interest in the estate, the appraiser or the competing bidders would have no reason to invest resources to explore the existence of mineral resources or to search for other idiosyncratic hidden qualities of the land.

[20] When viable, acquiring information through expertise in the case of gems imposes lower total social costs. Unlike in a market for lemons, in a market for gems only the owner needs to retain an expert to appraise the value of the good before the sale. Once they acquire that information, the owner can enter the transaction with symmetric information (relative to informed buyers), knowing the value of her good. In a market for lemons, instead, if an uninformed buyer retains an independent expert to ascertain the presence of defects or other negative information and decides not to buy the good, the cost of the expertise is sunk. Other prospective buyers would have to incur similar costs to inspect the good and discover the same defect before eventually avoiding the same transaction. Absent a legal duty to disclose negative information by the informed seller (or another similar remedy to protect uninformed buyers), the market for lemons case would yield a greater dissipation of resources. From a social point of view, the asymmetric legal protection for sellers and buyers in the market for lemons and the market for gems could thus be explained by the different social costs incurred from the acquisition of information through independent experts in the respective markets.

Appraisers and bidders will provide the prospective seller with an appraisal or make offers based on their best expertise in real estate.[21] Hence, the informed geologist could benefit from his unique informational advantage, and the information asymmetry would remain unfilled.[22] The focus of our paper is on these situations where there is limited access to expert information in the market, and where the engagement of independent appraisers or the use of auctions would fail to correct informational asymmetry to provide adequate protection to uninformed sellers.

2.1.3 Likelihood of ex post acquisition of information

An additional argument put forth in the literature for justifying adoption of different disclosure rules for buyers vs. sellers rests on pragmatic considerations. In the traditional lemons-type asymmetric information problem, sellers strategically withhold negative information. Prevalent contractual and legal solutions are therefore based on attaching remedies to the sale of a bad product. For instance, a warranty may give the buyer the right to return a defective good or to obtain a replacement, repair, or price reduction. These solutions to lemons problems hinge on the assumption that previously unknown information reaches the

[21] This is where Scheppele (1988, pp. 21-22) distinguishes between "deep" secrets (those of whose existence the other contracting party has no reason to suspect) and "shallow" secrets (those where the other party knows that something is being concealed, although he or she has no knowledge of the nature or content of the undisclosed information). Although sellers may be aware about the possible existence of hidden qualities, the lack of knowledge about the nature and content of the hidden information can also make shallow secrets difficult to correct by experts and auctions.

[22] In a lemons auction, the competition among uninformed buyers would not convey any information. In order to use market competition to solve the standard adverse selection problem in a market for lemons, competition would need to occur among informed sellers. In theory, this could happen in a procurement auction, where informed sellers bid downwards to the advantage of potentially uninformed buyers, but ideally the sellers should compete by revealing information over the same good, rather than similar goods sharing different individual characteristics. For this reason, sellers' competition over homogeneous goods would not convey private information that is unique to the specific items, such as defects or other negative information that could reduce the market value of the items (e.g., the sale of a used camera on eBay, even if clearly identified by brand and model). For this reason, auctions are not generally considered a viable solution to the traditional lemons problems. Manelli and Vincent (1995) show that under certain conditions, the buyer is better off by bargaining with an individual seller than by running a procurement auction.

uninformed buyer after execution of the contract.[23] In gems-type asymmetric information problems, legal remedies could hypothetically be triggered when positive information about quality reaches the uninformed seller at some time after the sale. However, scholars have pointed out that ex post acquisition of information may not materialize as easily in gems problems. In a gems market, a buyer might be better informed than the seller without the seller suspecting it. Sellers lose direct access to the goods they sell, and thus are less likely to harvest information about hidden qualities after a sale.

Scholars have pointed to these differences to suggest that remedies that normally, effectively correct lemons problems may not be equally effective for addressing gems problems.[24] This explanation cannot be generalized. In many situations, a seller can discover the hidden quality of the good they have sold by observing the actions of the buyer after the sale.[25] An informed buyer's use of the good can reveal information that was previously unknown to the seller. Returning to our example, if the geologist opens a goldmine on the farmland because the

[23] In lemons-type situations, sellers usually have an informational advantage due to their experience with the good. However, in some lemons settings, information may come from expertise. For instance, a pharmaceutical company (the seller) is better informed than buyers with respect to pharmaceutical products, but the company derives its special informational advantage from expertise rather than from use. For this reason, a buyer of pharmaceutical products may never learn whether the products he purchased contributed to or hindered his recovery. Therefore, the buyer of a drug cannot rely on warranties to the same extent as a used-car buyer. Along these lines, Katz (2007) argues that extensive ex ante regulation of pharmaceutical products stems from the ineffectiveness of ex post warranty-type solutions.

[24] From a policy standpoint, it has been argued that legal solutions that rely on after-the-contract acquisition of information may not present a cost-effective answer to the gems problem. The smaller the likelihood that uninformed sellers will detect the lack of disclosure-hidden qualities after the sale, the less beneficial it would be to impose legal duties to disclose on buyers. For these reasons, it has been suggested that courts and lawmakers may have pragmatically sought to minimize administrative costs by choosing a blanket rule permitting non-disclosure of positive information by expert buyers.

[25] A difference emphasized in the existing literature between lemons and gems problems lies in the likelihood that an uninformed party will acquire the previously unknown information after the transaction. In lemons settings, sellers plausibly have more information than buyers about some characteristics of their goods simply because they have used the good and the buyer's use of the good after the sale naturally corrects the asymmetry of information. Buyers thus acquire information as a natural consequence of their use of the product. In contrast, in gems settings, buyers have an informational advantage due to their expertise, and the existing literature assumes that it is generally harder to fill informational gaps due to expertise than those due to experience. However, as discussed above, in gems problems sellers who did not have expertise at the time of the sale may acquire information by observing the use of the good by expert buyers.

subsoil contains hidden mineral resources, this new land use reveals information to the uninformed sellers after the sale. Similarly, if the art expert offers an unsigned piece of art for sale at auction and lists the artwork as belonging to a famous artist, the original uninformed sellers have a good opportunity to discover the paternity of the unsigned piece after the initial sale. Overall, in many gems situations, although sellers lose direct access to the good, they are more, rather than less, likely to discover the hidden qualities of the goods *after* the sale. Under such circumstances, disclosure duties and liability rules could be effectively used to deter informed buyers from withholding positive information. The absence of disclosure duties in gems situations thus merits additional explanation.

2.2 An additional rationale: Disclosure effect of non-disclosure rules

The discussion in Section 2.1 brings us to question the rationale of the current legal regime and to search for a different explanation for the observed differences in the disclosure duties of buyers vs. sellers. In this section, we identify an alternative rationale, which rests on the information-forcing effects of alternative default rules. As the model presented in Section 3 will show more formally, departing from the assumption of much of the existing literature—which considers default rules as "sticky"—our analysis considers a more general scenario where parties can alter the defaults. This provides buyers and sellers with useful signaling or screening mechanisms. The analysis will show that the opportunity to bargain under non-disclosure default rules can foster trade opportunities between informed buyers and uninformed sellers, preserving the incentives of expert buyers to invest in socially valuable information.

In practical terms, parties can de facto alter the application of default rules through a variety of means that do not entail formal renegotiation. The effect of

non-disclosure rules can be undermined by questioning a fact that the other party has no duty to disclose, yet that any answer except an outright lie would reveal.[26] Parties can demand warranties or guarantees, refuse to trade if not given more information, or opt out of applicable default rules.[27] A variety of other legal and contractual instruments are used to correct asymmetric information problems. In lemons markets, implied or express warranties give buyers a right to return a defective good, to obtain its replacement, and/or to obtain compensation for any additional loss incurred due to the failed disclosure of negative information at the time of sale. These warranties operate as information-forcing instruments, penalizing informed sellers who do not disclose relevant negative information to their buyers (Priest, 1981).[28]

In gems markets, symmetrical instruments are available. For example, buyers can affirmatively state that the item being purchased is not a gem, de facto subjecting themselves to liability for fraudulent misrepresentation if the seller later discovers positive information. Sellers would be entitled to rescind a sale or obtain over-compensatory damages if they subsequently discovered that the informed

[26] Even in cases in which the law allows the informed party to be silent, that party is not allowed to provide misleading or false information. Porat and Yadlin (2016, pp. 623-33) discuss the legal distinction between untold truths and lies, pointing out that parties can alter default rules at will through a variety of means, such as by asking questions that would trigger liability for fraud. *See* Laidlaw v. Organ, 15 U.S. (2 Wheat.) 178 (1817), Restatement (Second) of Contracts § 164, and Restatement (Second) of Torts § 551 (Am. Law Inst. 1977) (providing extra-compensatory remedies for misrepresentations and non-disclosures that cause a pecuniary loss)*; see also* Gaines v. Krawczyk, 354 F.Supp.2d 573, 587 (W.D. Pa. 2004) (citing *Gibbs v. Ernst*, 647 A.2d 882, 207 n.12 (Pa. Super. Ct. 1994)) ("The tort of intentional non-disclosure has the same elements as the tort of intentional misrepresentation except that in a case of intentional non-disclosure the party intentionally conceals a material fact rather than making an affirmative misrepresentation.").

[27] In our problem, even without recourse through legal remedies, responding to a direct question with silence reveals the existence of information. Considering a scenario where a mining company learns about the existence of valuable minerals under a farmer's land and attempts to buy the farm without disclosing its information, Craswell and Schwartz (2012) point out: "Flatly refusing to answer the questions … would probably suggest to the farmer that the company did know something about the presence of minerals under the land."

[28] In a market for lemons, informed sellers can signal the lack of negative information (i.e., the fact that the sold good is not a lemon) by subjecting themselves to a disclosure regime and offering a warranty or by giving unsatisfied customers a right to rescind the contract and return the defective good (Grossman, 1981).

buyers committed a fraudulent misrepresentation.[29] Another possible way to signal a lack of positive information would be to grant sellers a right to receive a percentage (possibly up to 100%) of the profit generated by a resale. Buyers granting such a right could credibly signal an absence of private information on their part.[30]

As shown in Section 3, allowing parties to opt in or out of default disclosure regimes gives them the possibility to signal their information type, with resulting pooling, semi-pooling or separating equilibria. Buyers can bargain out of the default disclosure regime, but doing so would reveal some information to their prospective sellers. For example, informed buyers could opt out of disclosure rules and obtain a waiver from their legal duty to disclose. This would likely lead to an increase in price but would eliminate the risk of liability or rescission of the contract if positive information is later discovered. Below, we continue our analysis by considering how parties would bargain in the shadow of alternative default disclosure rules. As discussed below, in gems problems, non-disclosure rules operate as bottom-up

[29] In a market for gems, buyers can signal the lack of positive information (i.e., the fact that the sold good is not a gem) by voluntarily subjecting themselves to a disclosure regime or making an affirmative statement of lack of hidden qualities, such that, if hidden qualities are discovered after the sale, the seller could obtain some form of legal protection.

[30] Although the implementation and enforcement of this instrument can be problematic in transactions between anonymous parties, in cases where the resale activities are possible—such as for registered property, patents and other intellectual property rights, professional athletes, archived works of art, and goods traded at public auctions—this signaling solution may be effective. In the European Union, a *droit de suite* has been used to pursue different policy objectives, such as incentivizing artists to continue working so as to increase the value of their previously sold art. For example, following Directive 2001/84, a right to follow guarantees that artists receive a percentage of the resale price of their works of art. Each buyer of a piece of art who resells must transfer a percentage of the resale price. For a discussion concerning the limited acceptance of the right to follow in U.S. jurisdictions, see Reddy (1995). The right to follow appears in regulations related to transfers of professional soccer players in an effort to subsidize the junior leagues that provide training for many prospective athletes. Professional soccer teams may have a systematic informational advantage in detecting promising players through scouting. The mandated right to follow may reflect this pattern. The FIFA Regulations on the Status and Transfer of Players in Article 20 establishes that a "[t]raining compensation shall be paid to a player's training club(s): (1) when a player signs his first contract as a professional and (2) each time a professional is transferred until the end of the season of his 23rd birthday." FIFA, Regulations on the Status and Transfer of Players (2017), https://perma.cc/DNP7-DGGC. Moreover, "[t]he training costs are set for each category and correspond to the amount needed to train one player for one year multiplied by an average "player factor," which is the ratio of players who need to be trained to produce one professional player," (Id. Annex 4, Article 4), so that the training compensation covers the full ex ante costs of training professional players.

information-forcing default rules that mitigate the information gap and the resulting withdrawal of prospective sellers, without entirely undermining expert buyers' search incentives.

3. Disclosure effects of non-disclosure rules: A model

In this section, we will show that when parties can contract around defaults, the choice of alternative disclosure rules (duty to disclose vs. no duty to disclose) makes a difference in gems situations. We will proceed to consider in greater depth the conditions under which a non-disclosure default rule may be most desirable.

We consider a stylized scenario with a seller who has no information about the quality of the good that she is selling, and who rationally expects that some positive probability exists that the good she owns may possess some hidden qualities. For ease of presentation, we shall refer to a good that has been discovered to have hidden qualities as a "gem."[31] The content and value of the hidden quality is unknown to the seller and can take a range of values, with a given expected mean. For ease of presentation, we shall refer to a good that does not have hidden qualities as an "ordinary good."

We consider two types of buyers: "expert buyers," and "ordinary buyers." Search investment carried out by expert buyers can unveil the hidden qualities of a good and allow discovery of "gems." We assume the expert buyer to be initially uninformed about the good's quality. As in Goldberg (1997), we assume that the search for information is both costly and potentially valuable. The buyer may choose to invest $c \geq 0$ in information to discover if the good is a gem. Specifically, this investment in information is necessary for the expert buyer to discover and benefit from a gem. For example, only after undertaking geological surveys and

[31] The seller's knowledge about the possible existence of a hidden quality is what Scheppele (1988) refers to as a "shallow" secret.

soil explorations can an expert buyer learn about the quality and quantity of mineral deposits underneath a parcel of land. The buyer's expertise allows for the use of geological techniques not available to ordinary buyers to identify the presence and quality of mineral deposits.

We shall refer to expert buyers who invest in information as "informed expert buyers." An informed expert buyer may have learned about the existence of hidden qualities (we shall refer to him as "type-*H*" buyer) or about the nonexistence of hidden qualities (we shall refer to him as "type-*L*" buyer).

Expert buyers are only interested in acquiring gems and do not have any interest in acquiring ordinary goods. Expert buyers' acquisition of information before the trade helps them to identify gems and avoid purchasing ordinary goods.

We focus on the effect of different default rules under informational asymmetry between the expert buyer and seller. Asymmetric information problems arise when the expert buyer acquires information before the trade takes place. We thus consider expert buyers who acquire information and learn whether the good is a gem prior to entering a trade.

Ordinary buyers do not have the ability to invest in information to identify the hidden qualities of a good. We refer to this type of buyers as "type-*O*" buyers. Type-*O* buyers are not gem-hunters, they are interested in buying an ordinary good because they have a higher subjective value for it. The seller could potentially receive offers in all three alternative scenarios – from type-*L*, type-*H* and type-*O* buyers. Type-*H* and type-*O* buyers value the good more than the seller. Type-*L* buyers have the same valuation of the good as the seller.

Disclosure or non-disclosure rules are default rules, and the contracting parties can opt out of the applicable default rule in their agreement, facing transaction costs $\tau \geq 0$. Under a disclosure rule, liability is imposed on type-*H* buyers who fail to disclose when, after the sale, sellers discover hidden qualities.

Under a non-disclosure default rule, the buyer faces no liability when hidden qualities are discovered after the sale.

3.1 Setup

A risk-neutral buyer (he) and a risk-neutral seller (she) interact only once. The seller owns a good of unknown quality to her. The buyer belongs to a population of two types of buyers—experts and ordinary buyers. The seller and the ordinary (type-*O*) buyer are uninformed about the quality of the good. Specifically, they cannot acquire information and do not have the expertise to discover the hidden qualities of the good—formally, they face infinitely high information costs. An expert buyer is also initially uninformed but, unlike the seller and the type-*O* buyer, he can acquire information about the hidden qualities of the good at a cost $c \sim [0,\ \bar{c}], \bar{c} > 0$. Expert buyers are only interested in acquiring gems, and do not have any interest in acquiring ordinary goods as such.[32] We assume that the expert buyer can learn and realize gains H^+ (from a gem) after investing in the information acquisition about the good and discovering that the good is a gem. As will be seen below, the expert buyer acquires information if c falls below a certain threshold.

Type-*O* buyers value the ordinary good for what it appears to be and are primarily interested in buying the good because they have a higher subjective valuation than the seller, $L < L^+$.

Table 3.1 provides the valuation of "gems" and "ordinary goods" for the parties. All parties involved know that a good of unknown quality could possibly be a gem with probability p, or may instead be an ordinary good with probability $1 - p;\ p \in (0,1)$. The information about the quality of the good is private to the

[32] An ordinary good is of no use to the expert buyer. However, since the expert buyer can transfer it back to the seller at a price *L*, to keep things simple, we'll assume the expert buyer's valuation of an ordinary good to be *L*.

expert buyer. Neither the seller nor the type-*O* buyer can observe c. They also do not observe whether an expert buyer has invested in information. An ordinary buyer has no expertise to identify a gem or exploit its full value. Similarly, the seller cannot tell whether a prospective buyer is an expert or an ordinary buyer.

		Good	
		Ordinary	Gem
Party	Seller	L	H
	Ordinary buyer	L^+	H
	Expert buyer	L	H^+

Table 2: *Parties' Valuation of the Good*
$L < L^+$, $L^+ < H$, and $H < H^+$

Let,

$$V^S = p\,H + (1-p)L$$
$$V^O = pH + (1-p)L^+$$
$$V^E = pH^+ + (1-p)L$$

where V^S, V^O, and V^E denote the expected value of the good to the seller, ordinary buyer, and the expert buyer, respectively. Clearly, $L < V^S < V^O$ and $V^E < H^+$. Moreover, $V^O - V^S = (1-p)(L^+ - L)$; $V^E - V^S = p(H^+ - H)$. We assume that $(H^+ - H) >> (L^+ - L)$, i.e., the gains from the discovery and use of a gem by an expert are substantially higher than the ordinary gains from trade obtainable by type-*O* buyers, $(L^+ - L)$.

From the above, the seller will never accept a price lower than L, leaving no gains from trade for type-L expert buyers. Type-*O* buyers face gains from trade opportunities but will never agree to pay more than V^O.

Hence, a beneficial trade between the seller and an informed buyer will occur only if the good is gem, with expected social gains equal to $p(H^+ - H)$. This

means that information acquisition decision would be socially efficient when $c \leq p(H^+ - H)$. Expert buyers should remain uninformed otherwise.

As our analysis will show, the private incentives of expert buyers do not always align with the social optimum, c^*, because the informed buyer may not be able to fully internalize the benefits of his information investment. Depending on the applicable legal disclosure regime, the seller may, in fact, be able to infer the quality of the good from the buyer's offer, thereby leading the seller to increase the price or refrain from selling the good.

We consider two possible default legal regimes: (1) a "disclosure default rule" which imposes a duty to disclose private information about the quality of the good; (2) a "non-disclosure default rule" under which parties are not required to disclose private information about the quality of the good. In both cases, parties can opt out of the applicable default legal rule by facing a transaction cost, τ.

To capture the buyer's ability to opt out of the legally provided default, we allow the buyer to make one of the following representations of his type and thereby of the quality of the good, by sending a message $\mu \in \{\emptyset, L, H, O\}$ to the seller. Message $\mu = \emptyset$ indicates that the buyer wants to opt out of the legal duty to disclose the information that he may have regarding the quality of the good. In contrast, with messages $\mu = L$ and $\mu = H$ the buyer reveals information announcing that the good is of low or high quality, respectively. With message $\mu = O$ the buyer indicates that he is not an informed expert.

The default term determines the cost of sending such messages. Under a "disclosure" default rule, the buyer can opt-out of the legal default, paying a cost $\tau \geq 0$. When doing so, his message is $\mu = \emptyset$. Under a "non-disclosure" default rule, the buyer bears the cost τ only if he chooses to opt out of the legal default by affirmatively conveying to the seller information about his type, $\mu \in \{L, H, O\}$.

Thus, adherence to the "non-disclosure" default rule effectively constitutes sending a message of $\mu = \emptyset$ without a corresponding transaction cost.

As previously discussed in Section 2.2, parties can opt out of default rules in a variety of ways, all of which entail some transaction costs. Disclosure default rules can be avoided by obtaining waivers that entail negotiation and often legal assistance. Parties can dilute the effect of non-disclosure default rules by asking a question about a fact that the other has no duty to disclose, but so that any answer to the question except a straightforward lie would reveal the fact. The parameter τ captures the magnitude of these transaction costs and the resulting stickiness of the legal default: the higher τ, the more costly it is for the parties to meaningfully opt out of the default. We assume that $\tau > (L^+ - L)$. This means that an ordinary buyer would have no incentives to incur transaction costs to opt out of the default rule.

If the good is traded, courts impose liability on buyers who disclosed inaccurate information whenever the good's actual quality is found to be higher than what the buyer had represented. We denote damages for lack of proper disclosure as D. We assume that the total liability will include compensatory damages (equal to the difference between the actual value of the good and the value of the good announced by the buyer), plus additional punitive damages for the fraudulent misrepresentation, $F \geq 0$. For instance, if an expert buyer falsely represents to the seller that a gem is an ordinary good, he incurs liability equal to the difference between the two values of the good for the seller $(H - L)$, plus punitive damages, F, with total liability of $D = (H - L) + F$.[33]

The seller and the buyer interact in the following sequential game, with no discounting across dates, as depicted in Table 1.

[33] Even though contract law allows informed buyers to not disclose hidden qualities of the good, the buyer is not allowed to provide misleading or false information. *Restatement (Second) of Contracts* § 164 and *Restatement (Second) of Torts* § 551 (Am. Law Inst. 1977) provide extra-compensatory damages for fraudulent misrepresentation. As we will explain momentarily, we assume that type-*O* buyers will never incur liability for lack of disclosure because their ordinary use of the good will not unveil any new information about the existence of a gem.

t = 1	● Nature decides quality of the good. ● Default rule is decided.
t = 2	● Expert buyer learns about *c and* decides whether to invest in information.
t = 3	● Buyer sends quality message to seller. ● One of the parties makes a TIOLI offer/demand. ● The other party responds. ● If parties agree, the good is traded.
t = 4	● Quality of the good becomes known to all. ● When applicable, damages are paid.

Table 1: *Timeline*

1. At time t = 1, Nature draws the quality of the good owned by the seller. The default legal rule is set by the legal system.

2. At time t = 2, nature draws $c \sim [0, \bar{c}]$. The buyer learns of this cost, but the cost is unobservable to the seller. For each expert buyer, information costs c follow a distribution function G with associated density function g.[34] The buyer decides whether to invest in private information to discover the quality of the good; the buyer will invest in information only if the cost c falls below a given threshold. As will be shown, this threshold value will depend on the default rule. The buyer's decision to acquire information and the resulting information that he acquires are unobservable to the seller (i.e., the seller does not know whether the buyer is informed and what information he possesses).

[34] That is, distribution of c is iid across expert buyers.

3. At time t = 3, buyer and seller negotiate a trade. Trading consists of the following:

- A representation about the quality of the good, that is, a message $\mu \in \{\emptyset, L, H, O\}$. The buyer can opt out of the applicable default rule, paying cost τ. No cost will be incurred when the buyer remains subject to the applicable default.
- Bargaining takes place between the two parties. One of the parties makes a take-it-or-leave-it (TIOLI) offer.
- The other party can accept or reject the offer received. Each party accepts the offer/demand when they are indifferent between accepting and rejecting the offer/demand.

4. At time t = 4, if the trade took place with an expert buyer, the true value of the good is realized and becomes observable to all parties. If the good is a gem, the buyer pays damages equal to *D* in the following scenarios:

- Under a disclosure default rule, when (i) he did not send message $\mu = \emptyset$ to opt out of the legal default, or (ii) he did not send message $\mu = H$ to disclose his private information.
- Under a non-disclosure default rule, when he opted out of the legal default, falsely representing the quality of the good by sending a message $\mu \in \{L, O\}$.

Note that in our setup, the ordinary buyer trading with the seller will never learn whether he purchased a gem—only informed expert buyers can discover the hidden qualities and use the good as a gem—and no new information will thus be observed by others.

Summing up, our stylized set up the seller trades with just one buyer who comes from a pool of buyers. Every expert buyer who discovers a gem gets to trade with probability one.[35]

3.2 Disclosure defaults

Suppose the buyer has acquired information. Under a disclosure default rule, liability, D, is imposed on buyers when hidden qualities are discovered after the sale, unless if the buyer either sent message $\mu = H$ or opted out of the default rule, sending message $\mu = \emptyset$. By sending message $\mu = \emptyset$ the buyer indicates that he wants to obtain a waiver of his duty to disclose. Opting out of the default imposes transaction costs $\tau \geq 0$ on the buyer. Buyers who do not opt out of the default can disclose their type sending a message $\mu \in \{L, H, O\}$. These messages entail revealing information about the quality of the good to the seller. Buyers can make statements regarding the actual quality of the good, with messages $\mu = H$ or $\mu = L$, respectively affirming that the good is a gem or a regular good. Alternatively, buyers can send message $\mu = O$, affirming that they are ordinary buyers with no private information.

No type of buyer has an incentive to send a message reporting quality higher than what is known to him. Also, given a sufficiently high liability, F, for misrepresenting the quality of the good, we can show that no type of buyer can gain by underreporting the quality. For instance, suppose a type-H buyer (an expert buyer who knows that the good is a gem) reports quality to be L. The sale price of the good will be at least L (i.e., the seller's valuation of the good). Moreover, at t = 4, when the true quality becomes known to all, the buyer will face liability, $D =$

[35] We could alternatively assume that an expert buyer who discovers a gem gets to trade with a positive probability. In that case, the investment threshold will depend on the expert buyer's probability of trade. This alternative set up would not affect the qualitative results of our analysis.

$(H - L) + F$.[36] So, if $F > H^+ - H$, a type-*H* expert buyer cannot realize a positive economic gain, thereby deterring him from fraudulently underreporting the quality of the good in the first place.

For a stronger reason, a type-*H* buyer presenting as a type-*O* buyer (with V^O as the expected value of the good) would not be incentive compatible. In that case, the seller will demand a price equal to at least V^S. Moreover, at time t = 4, the buyer will have to pay damages $D = (H - V^S) + F$. If the additional damages for fraud are $F > H^+ - H$, then the type-*H* expert buyer's net gains from misrepresenting will be at most $H^+ - (H - V^S) - V^S - F < 0$, which would yield a negative payoff.

A type-*O* buyer would not have any incentive to pretend to be a type-*H* expert buyer, because this would increase the purchase price with no corresponding benefit. A type-*O* buyer may instead have incentives to present himself as a type-*L* expert buyer to obtain a lower price. However, we can rule out this possibility, since the seller would question why an expert buyer would want to purchase an ordinary good after discovering the lack of hidden qualities.[37]

Next, we examine which type of buyer (if any) has incentives to opt out of the disclosure default regime. A type-*L* buyer, if at all interested in entering the trade, will prefer to contract under the disclosure default regime to credibly reveal to the seller that he is neither a type-*H* nor a type-*O* buyer, and obtain a lower price. Similarly, type-*O* buyers are better off buying under the disclosure default rule,

[36] The inference will not change if *D* equals the difference between the known value of the good and the price paid for it.

[37] Without loss of generality, we can show this result by assuming that negotiating a deal by the parties (through offers and counter-offers) is costly. Even an arbitrarily small cost of trade is enough to rule out participation of type-*L* expert buyers in a trade deal, enabling the seller to screen out type-*L* buyers.

rather than opting out, because by opting out they would incur cost τ and signal the possible possession of private information, likely resulting in an increase in price.[38]

As a result, the seller knows that only type-*H* buyers might have an interest in opting out of the disclosure regime. A buyer seeking to opt out would therefore separate himself from the others, *de facto* revealing his type. Moreover, to opt out of the default disclosure rule, a type-*H* buyer would incur additional costs τ, making opt-out a strictly worse option than the default disclosure. In other words, although type-*H* buyers know that the good is a gem, buying in accordance with the default disclosure rule is preferable to opting out.

The combined use of a default disclosure rule and an effective liability system seems to resolve the market for gems problem, allowing sellers to perform a complete screening of all types of buyers. Under a disclosure default rule, all trades between an informed buyer and an initially uninformed seller would therefore happen under symmetric information. Under this symmetric information trading environment, we can follow the standard convention and assume that the parties will share the gains from trade in proportion to their relative bargaining power. Let α and $1-\alpha$ respectively denote the bargaining power of the seller and the buyer; $\alpha \in (0,1)$. Following the standard approach, we take α to be an exogeneous parameter.

Under the alternative bargaining protocol frequently used in the literature, the seller and buyer make a demand/offer with certain probability, exogenously given. Under this alternative protocol, the probabilities α and $1-\alpha$ can be understood as proxies for the bargaining power of the seller and buyer,

[38] Consider a type-*O* buyer seeking to opt out by sending a silent message $\mu = \emptyset$. This message costs τ to the buyer. For the seller message $\mu = \emptyset$ means that buyer is type-*O* or a type-*H* expert buyer (type-*L* buyers would not incur cost of sending message $\mu = \emptyset$). The presence of type-*H* buyers raises the possibility of the good being a gem. In such a scenario, the seller at the very least will not accept a price lower than V^S, his expected valuation of the good. In view of the assumption that $\tau > L^+ - L = V^o - V^S$, the type-*O* buyer's expected payoffs ($V^o - V^S - \tau$) are negative, even when the seller agrees to sell at her lowest acceptable price, V^S.

respectively.[39] Hereinafter, we shall therefore refer to TIOLI probabilities and parties' bargaining power interchangeably.

At time t = 2, an expert buyer knows that a profitable trade can happen only with probability p. With probability $1-p$, the good is not a gem and there are no gains from trade. Therefore, when the buyer faces the decision of whether to invest in information, his expected gains from information are $p(1-\alpha)(H^+ - H) + (1-p)\cdot 0 = (1-\alpha)p(H^+ - H)$.

So, the net expected gains for the buyer are $(1-\alpha)p(H^+ - H) - c$. Consequently, at t = 2, the expert buyer will invest in information acquisition only if $c \leq (1-\alpha)p(H^+ - H)$. Let us denote the threshold value of information costs that would lead to the acquisition of information under a disclosure default rule as

$$c^D = (1-\alpha)p(H^+ - H);\ c^D > 0. \qquad (1)$$

Therefore, the probability of information acquisition under a disclosure default rule is $G(c^D) > 0$. The probability of trade between an expert buyer and the seller is the same as the probability of investment in information, i.e., $G(c^D)$.

Under a disclosure default rule, at time t = 1, the expert buyer's net expected gains from an informed trade can be expressed as:

$$\pi_B^D(\alpha) = \int_0^{c^D} [(1-\alpha)p(H^+ - H) - c]g(c)dc \qquad (2)$$

[39] Assume the seller makes a take-it-or-leave-it (TIOLI) demand with probability $\alpha \in (0,1)$; the buyer makes a TIOLI offer with the remaining probability, $(1-\alpha)$. Under the disclosure default rule, if the seller knows that she is dealing with a type-H expert buyer, the seller's TIOLI demand will be nothing less than H^+. On the other hand, the buyer's TIOLI offer will be nothing more than H. So, if the good is a gem, the seller's expected gains from the trade are $\alpha(H^+ - H) + (1-\alpha)(H - H) = \alpha(H^+ - H)$. For the buyer the expected gains are $\alpha(H^+ - H^+) + (1-\alpha)(H^+ - H) = (1-\alpha)(H^+ - H)$. Alternatively put, the net gains from the trade between the expert buyer and the seller are $H^+ - H$, which will be split between the parties in proportion to their bargaining power. Even though the total gains from the trade are $(H^+ - H)$, the buyer can appropriate only a fraction of these gains.

Since $c^D > 0$, we have $\pi_B^D > 0$. The expected net social gains from an informed trade can be expressed as:

$$W^D(\alpha) = \int_0^{c^D} [p(H^+ - H) - c]g(c)dc. \qquad (3)$$

Again $c^D > 0$, implies that $W^D(\alpha) > 0$ for all $\alpha \in (0,1)$. From (1) and (3) it can be seen that $\frac{\partial c^D}{\partial \alpha} < 0, \frac{\partial G(c^D)}{\partial \alpha} < 0$ and $\frac{\partial W^D}{\partial \alpha} < 0$. Information investments will only approach the socially optimal level in the limiting case where the buyer has full bargaining power and can capture the entire value of his information, $\lim_{\alpha \to 0} c^D = c^*$ and $\lim_{\alpha \to 0} W^D = W^*$. On the contrary, information investments approach zero when the seller has full bargaining power and can exploit the entire value of buyer's information $\lim_{\alpha \to 1} c^D = 0, \lim_{\alpha \to 1} G(c^D) = 0$ and $\lim_{\alpha \to 1} W^D = 0$.

As discussed earlier, from a social efficiency point of view, the expert buyer should invest in information if and only if $c \leq p(H^+ - H)$. Let us denote the socially efficient critical threshold for information acquisition as:

$$c^* = p(H^+ - H); c^* > 0. \qquad (4)$$

So, the socially efficient probability of information acquisition and trade is $G(c^*)$. Since $\alpha > 0$, we know that $0 < c^D < c^*$, and hence $G(c^D) < G(c^*)$. As conjectured by Kronman (1978), we can see that under a disclosure default rule, expert buyers will underinvest in information compared to the social optimum level of investment.

If investment decisions were efficient, the net social gains from information acquisition would be:

$$W^* = \int_0^{c^*} [p(H^+ - H) - c]g(c)dc; W^* > 0. \qquad (5)$$

Since $c^D < c^*$ and c < $p(H^+ - H)$ for all $c < c^*$, it follows that $W^D < W^*$. Summing up, we arrive at the following result:

Proposition 1. *Effect of Disclosure Defaults.* Under a disclosure default rule, the expert buyer's investment in information is lower than the socially efficient level. The probability of trade is also suboptimal, with a resulting social welfare loss. Information investments and trade opportunities are further reduced by an increase in the bargaining power of the seller.

3.3 Non-disclosure defaults

Under a non-disclosure default rule, no liability arises when hidden qualities are discovered after the sale. By remaining subject to the non-disclosure default rule, the buyer implicitly sends message $\mu = \emptyset$ to the seller, facing no transaction costs τ. Alternatively, the buyer can opt out of the default non-disclosure regime (at a cost τ), by making an affirmative statement regarding the quality of the good and sending a message $\mu \in \{L, H, O\}$.[40]

We will show that, under a non-disclosure default rule, parties' incentives and behavior will unravel differently, resulting in a semi-separating equilibrium. Let us begin by noting that, when faced with uncertainty about the good's type, the seller will not accept any offer below V^S for the good. Now, consider the incentives of type-L expert buyers. A type-L buyer has no incentive to send a message $\mu = L$, $\mu = O$ or $\mu = H$.[41] If a type-L buyer sends a message $\mu = \emptyset$, the seller remains uncertain about the quality. Therefore, the price of the trade will be at least V^S, which also exceeds the buyer's valuation of the good. Therefore, in our set up, the seller would know that a type-L expert buyer will never approach her for a trade. The market for low-quality goods will therefore thin out, leaving only type-O and

[40] In this case, opt out costs arise because buyers need to make persuasive and legally relevant statements, often necessitating a written form, that the seller can use as admissible evidence in case of fraud.

[41] With this message the trade would take place at a minimum price of L but the buyer would face a total cost of at least $L + \tau$, which exceeds his valuation of the good.

type-H in the market, as envisioned by Burckart and Lee (2016) and Dari-Mattiacci et al. (2021).

Moving on, we next consider the incentives of type-O buyers. In light of the above, a message $\mu = L$ coming from any buyer is not credible, as the seller knows that type-L expert buyers would have no interest in buying an ordinary good and would exit the market. If a type-O buyer sends a message $\mu = O$ to indicate his ignorance of the good's quality, the seller will demand a price of at least V^S. This means that the net expected gains for a messaging type-O buyer will be at most $V^o - V^S - \tau$, which is negative since by assumption $\tau > L^+ - L$. Thus, given the cost τ, ordinary buyers would not send a message $\mu = O$, opting instead to remain subject to the non-disclosure default.

Finally, consider the incentives of type-H expert buyers. In view of the above, a message $\mu = L$ would not be credible. Now, suppose a type-H expert buyer tries to opt out of the default by sending a message $\mu = O$—this act itself will enable the seller to infer that the buyer is type-H because a type-O buyer would not send any message. This would lead the seller to demand a high price. Even if the buyer succeeds in convincing the seller with his message $\mu = O$ and then buys the good at a price V^S, the buyer will still incur the opt out cost τ. Moreover, having made an affirmative misrepresentation, at t = 4 the type-H expert buyer will have to pay damages, $D = (H - V^S)$, and a punitive amount, F. So, the buyer's net gains will be $H^+ - V^S - D - F - \tau = H^+ - H - F - \tau < 0$.[42] That is, a type-$H$ expert buyer who opts out of the default and presents himself as a type-O buyer would either reveal his true type or receive a negative payoff. As will be shown below, type-H expert buyers are better off sticking to the default rule with message $\mu = \emptyset$, which shields them from liability if the seller subsequently discovers the goods quality. This will yield a semi-pooling equilibrium with type-O buyers.

[42] If the value of D is fixed as $D = (H - P)$, where P is the trade price, we reach the same conclusion.

For the following analysis, it is helpful to note that, under the alternative bargaining protocol described in footnote 40, a seller who knows that she is negotiating with a type-H expert buyer will make a TIOLI demand of H^+. Analogously, when negotiating with a type-O buyer, the seller's TIOLI demand will be V^O. During the negotiation, the seller expects that type-O and type-H buyers will stick to the non-disclosure default rule, sending message $\mu = \emptyset$. The seller cannot observe the buyer's type but knows that the buyer is type-H with probability Ω, and type-O with probability $1 - \Omega$.

As in the earlier section, we consider the bargaining protocol where the seller makes a TIOLI demand with probability $\alpha \in (0,1)$; with the remaining probability $(1 - \alpha)$ the buyer makes a TIOLI offer. In light of the seller's uncertainty about the quality of the good, any TIOLI offer greater than or equal to V^S will be acceptable to her. This means that when the buyer makes a TIOLI offer, he will make an offer of V^S.

All buyers would reject a seller's TIOLI demand higher than H^+, leaving the seller with zero gains. If the seller makes a TIOLI demand of H^+, only a type-H expert buyer will accept it. If the seller makes a TIOLI demand of V^O, both types of buyers will accept with certainty, and the gross gains for the seller will be V^O. A TIOLI demand below V^O is never optimal for the seller. Moreover, a TIOLI demand strictly between V^O and H^+ is also not optimum for the seller. In other words, given the pooling of type-H and type-O buyers, the seller faces a binary TIOLI choice—demand either H^+ or V^O. The seller's choice depends on the probability that she faces an expert buyer which, in turn, depends on the investment thresholds chosen by an expert buyer.

To see this connection, suppose an expert buyer invests in information if and only if $c \leq \tilde{c}$, where $\tilde{c} > 0$. This means that from uninformed seller's perspective, an expert buyer acquires information with probability $G(\tilde{c})$. So, the

expected number of informed expert buyers is $G(\tilde{c})\gamma N_B$, where γ is the share of expert buyers in the total population of buyer taken a N_B. The expected number of informed buyers discovering a gem is $pG(\tilde{c})\ \gamma N_B$.

Since, of the expert buyers, only those who discover a gem choose to trade, at date t = 3 the sellers knowns that the buyer is drawn from a pool that has $p\ G(\tilde{c})\gamma N_B$ number of experts *plus* $(1-\gamma)N_B$ number of ordinary buyers. So, the probability that the seller faces an expert buyer is $\Omega(\gamma, \tilde{c}) = \frac{pG(\tilde{c})\gamma}{pG(\tilde{c})\gamma+(1-\gamma)}$, which is increasing in the share of experts in the population and the investment threshold for the expert buyer. The investment threshold, in turn, depends on the seller's TIOLI demand.

If the seller makes a TIOLI demand of H^+, only an expert buyer will accept the demand, and for the given Ω the seller's expected (gross) gains from the trade will be ΩH^+. On the other hand, a TIOLI demand of V^O yields the seller V^O with certainty. The seller will choose between the two options depending on whether $\Omega\ H^+ \geq V^O$ or $\Omega\ H^+ < V^O$.

Focusing on a situation where the market contains only a few experts, let us begin by considering the case where γ is so small that in equilibrium $\Omega H^+ < V^O$ holds. Specifically, consider the case when $\Omega(\gamma, c_1^{ND})\ H^+ < V^O$ holds where

$$c_1^{ND} = p[H^+ - (\alpha V^O + (1-\alpha)\ V^S)] \qquad (6)$$

$$\Omega(\gamma, c_1^{ND}) = \frac{pG(c_1^{ND})\gamma}{pG(c_1^{ND})\gamma + (1-\gamma)}.$$

Clearly, $c_1^{ND} > 0$ for all values of α, and $\Omega(\gamma, c_1^{ND}) > 0$ for all $\gamma \in (0,1)$.

In this case, the choice of c_1^{ND} as the investment threshold for an expert buyer, on one hand, and choice of a TIOLI demand of V^O by the seller are mutually best responses.

To see this, suppose an expert buyer invests in information if and only if $c \leq c_1^{ND}$.

Given the investment threshold, c_1^{ND}, the probability that the seller faces an expert buyer is $\Omega(\gamma, c_1^{ND})$, as defined above. Since $\Omega(\gamma, c_1^{ND})\ H^+ < V^O$ holds, at t = 3, the seller's best TIOLI demand is V^O.

Now, assume that the seller's TIOLI demand is V^O, that is, to maximize the expected gains from the trade, the seller makes a demand as if she were negotiating with a type-*O* buyer. Since, the seller makes a TIOLI demand with probability α, the expert buyer's ex-post payoff will be: $\alpha\ [H^+ - V^O] + (1-\alpha)[H^+ - V^S] = H^+ - [\alpha V^O + (1-\alpha)\ V^S]$. So, at t = 2 an expert's profit maximizing decision is to invest in information as long as $c \leq H^+ - [\alpha V^O + (1-\alpha)\ V^S] = c_1^{ND}$, as defined above.

Summing up, under the most likely scenario in our set up, i.e., when $\Omega\ H^+ < V^O$ holds at c_1^{ND}, in equilibrium, at t = 2 experts will invest whenever $c \leq c_1^{ND}$, and at t = 3 the seller will demand V^O during trade negotiations.

Further, the expert buyer's net expected gains from investing in information and the consequent trade can be expressed as:

$$\pi_{1_B}^{ND} = \int_0^{c_1^{ND}} [p[H^+ - (\alpha V^O + (1-\alpha)\ V^S)] - c]g(c)dc \tag{7}$$

$\pi_{1_B}^{ND} > 0$ for all values of α. Since, $V^O < H$ and $V^S < H$, $p[H^+ - [\alpha V^O + (1-\alpha)\ V^S]] > p(1-\alpha)[H^+ - H]$. Therefore, from (1) and (6), we get:

$$c^D < c_1^{ND}, \text{and } G(c^D) < G(c_1^{ND}).$$

The contrapositive of the case considered above is $\Omega(\gamma, c_1^{ND})H^+ \geq V^O$. This case is likely to arise when the percentage of expert buyers in the population is

large, an improbable scenario under our setup.[43] In the Appendix, we show that even under this unlikely case, information investment and probability of trade are strictly higher under non-disclosure defaults than under the disclosure default. Specifically, we show that even when $\Omega(\gamma, c_1^{ND})H^+ \geq V^O$ holds, the information investment threshold will be at least c_2^{ND}, where

$$c_2^{ND} = (1-\alpha)p[H^+ - V^S]. \qquad (8)$$

Clearly, $c_2^{ND} > c^D$ and hence $G(c_2^{ND}) > G(c^D)$ for all $\alpha \in (0,1)$.

Summing up, by leaving some informational asymmetry in the market, the non-disclosure default rule provides an advantage to the expert buyers. Recall that the disclosure default rule leads to perfect screening. This means that even when a type-*H* expert buyer makes a TIOLI offer, he would have to offer at least H to the seller. In contrast, under the non-disclosure default rule, the semi-pooling of type-*H* and type-*O* buyers provides informed expert buyers with larger gain opportunities—type-*H* buyers can get away paying only V^S to the seller, leading to an increase in buyers' expected gains and therefore a stronger incentive to invest in information.

Proposition 2. *Information Acquisition Under Non-Disclosure Defaults.* Expert buyers make larger investments in information under a non-disclosure default rule than under a disclosure default rule. The probability of trade is also higher under a non-disclosure rule. Information investments and trade opportunities increase with the bargaining power of the buyer.

[43] When the population of expert buyers is large, market mechanisms, such as auctions and appraisers, would arise to mitigate gems problems. In an auction, expert buyers would compete through the bidding process and reveal information to the seller. Uninformed sellers could similarly hire independent experts to appraise their good. The remaining gems problems are thus likely to persist only when the percentage of expert buyers in the population is 'small.'

Now, we compare the investment thresholds and number of expert buyers under different default rules with the socially optimum levels. Based on the above, we can see that $c_1^{ND} > c_2^{ND} > c^D$ for all $\alpha \in (0,1)$, hence $G(c_1^{ND}) > G(c_2^{ND}) > G(c^D)$.

As shown above, for any given information cost threshold, say $\tilde{c}$, the expected number of active expert buyers in the market is $p\,G(\tilde{c})\gamma N_B$, and their share among all active buyers is $\frac{pG(\tilde{c})\gamma}{pG(\tilde{c})\gamma+(1-\gamma)}$. Since $G(c_1^{ND}) > G(c_2^{ND}) > G(c^D)$, for any given γ, there are more active expert buyers under non-disclosure default rules, compared to the disclosure default.

The optimal share of active expert buyers is $\frac{pG(c^*)\gamma}{pG(c^*)\gamma+(1-\gamma)}$. To contrast this with the share of active expert buyers in our leading case where the percentage of expert buyers in the population is 'small' (i.e., when $\Omega\, H^+ < V^O$ holds), note that $c^* < c_1^{ND}$ holds. This means that: $G(c_1^{ND}) > G(c^*)$. Hence, as a direct consequence of over-investment in information, the market will contain too many expert buyers, reducing the share of ordinary buyers in trade below optimum level.[44]

Although non-disclosure default rules always foster greater participation of expert buyers in the market (relative to disclosure default rules), the resulting information investments are not necessarily first-best optimal. Depending on the factors discussed below, expert buyers' investments may fall short or exceed the socially optimal level. Expert buyers' under- or over-investment in information may lead to a departure from the socially optimum number of expert buyers.

Departures from the social optimum are affected by the share of expert buyers in the population (i.e., the sellers' likelihood of dealing with an informed expert), the value of gems relative to ordinary goods (i.e., the value of the gem-

[44] As the appendix shows, even when our lead scenario in does not hold (so when $\Omega\, H^+ \geq V^O$ holds), an excessive number of experts may still inundate the market.

hunters' information), and expert buyers' bargaining power (i.e., the expert buyers' ability to capture a larger portion of the gems' value in the trade).

Proposition 3. *Information Investments Effects of Non-Disclosure Rules.* Under non-disclosure default rules, expert buyers make larger investments in information than under disclosure default rules, but these investments may fall short of or exceed the socially optimal level. These departures from the optimal level of information may result in too many active expert buyers in the market.

Non-disclosure default rules yield greater information investments and trade opportunities than disclosure default rules. However, under non-disclosure default rules, expert buyers may underinvest or overinvest compared to the first-best social optimum. When the buyers' population consists of a large percentage of experts, information investments are more likely to fall short of the social optimum. When the percentage of experts in the buyers' population is small, investments in information increase and they may be more likely to exceed the socially optimal level of information-seeking.

The result that under non-disclosure rules there may be excessive investments in information is counterintuitive: although expert buyers are not able to fully capture the value of their investments in information, they over-invest in information. There are two explanations for this counterintuitive result.

First in the face of asymmetric uncertainty, expert buyers can semi-pool with ordinary buyers under a non-disclosure default rule. This confers two advantages onto expert buyers: (1) when it is their turn to make the TIOLI offer, expert buyers can more easily offer only V^S to the seller; (2) when it is the seller's turn to make a TIOLI demand, the seller would likely demand only V^O (rather than H^+) to avoid foreclosing trade opportunities with type-O buyers. These two effects mean that expert buyers can extract a larger share of the surplus from the trade, thereby incentivizing excessive investment in information.

Second, by acquiring information, expert buyers obtain an asymmetric-information advantage over their uninformed sellers, which may create negative externalities. By investing in information, an expert buyer possesses more information than a seller and other non-expert buyers about the quality of a product. This informational asymmetry generates a negative effect not only for sellers, but also for other buyers, as they experience partial crowding out. These are purely redistributive price effects that give an advantage to the expert buyer, with no net social gain. As is generally the case, the activity that creates the externality (here, the buyers' search for information) will occur at a rate that exceeds the socially optimal level. When expenditures in information exceed their net social value, the private incentives to search for information can thus exceed the social optimum.

3.4 Welfare effects of alternative disclosure rules

Our analysis has thus far focused on the effects of different default rules on investments in information. Below we present a brief extension to show non-disclosure rules will likely yield higher social welfare. Specifically, we consider the surplus from the trade between the seller and an expert buyer. From Proposition 2, we know that non-disclosure default rules always yield larger investments in information and thus increases the probability of trade between expert buyers and sellers, relative to disclosure rules.[45]

Recall that in markets with many experts, market mechanisms would arise to mitigate gems problems. Expert buyers would compete through the bidding process of an auction and thereby reveal information to the seller. Uninformed sellers could similarly retain available experts to appraise their good. Gems

[45] In the following, we shall focus on the surplus from trade generated by the participation of expert buyers and will generally refer to the net surplus obtained from trade as 'social welfare.' In smaller markets, where the entry of experts could reduce the goods available to ordinary buyers, the quantification of social welfare should account for the foregone gains from trade with type-*O* buyers.

problems instead persist when a market contains a small number of experts and when market solutions such as auctions and appraisers are not available.

It follows that for the purpose of our paper, we should consider situations with few expert buyers in the population, focusing on our lead case where the percentage of expert buyers in the population is 'small.' Specifically, we focus on situations where, in equilibrium, $\Omega\, H^+ < V^O$ holds. For this case, we have seen that investment in information will be c_1^{ND}, as defined above.

Furthermore, the surplus from the trade between the seller and the expert buyer is given by

$$W_1^{ND} = \int_0^{c_1^{ND}} [p(H^+ - H) - c]g(c)dc \qquad (9)$$

Since $c_1^{ND} > c^*$, we can re-write W_1^{ND} as: $W_1^{ND} = \int_0^{c^*} [p(H^+ - H) - c]g(c)dc + \int_{c^*}^{c_1^{ND}} [p(H^+ - H) - c]g(c)dc$. In other terms:

$$W_1^{ND} = W^* + \int_{p(H^+ - H)}^{c_1^{ND}} [p(H^+ - H) - c]g(c)dc \qquad (10)$$

The first term is the social optimum trade surplus, W^*. The second term on the RHS depends on α but is negative. Therefore, $W_1^{ND}(\alpha) < W^*$ for all $\alpha \in (0,1)$. When the percentage of experts in the buyers' population is small, the reduction in social welfare, $W^* - W_1^{ND}$, is driven by the excessive investments in information. However, it can be seen that c_1^{ND} is decreasing in α. This means that the second term in (10) is increasing in α, so $\frac{\partial W_1^{ND}}{\partial \alpha} > 0$ always holds!

Since $c^D < c^* < c_1^{ND}$, we can re-write the trade surplus as

$$W_1^{ND} = \int_0^{c^D} [p(H^+ - H) - c]g(c)dc + \int_{c^D}^{c^*} [p(H^+ - H) - c]g(c)dc + \int_{c^*}^{c_1^{ND}} [p(H^+ - H) - c]g(c)dc.$$ From (3), we know that the first term on the RHS is the trade surplus under disclosure, i.e., $W^D(\alpha)$. So, we get:

$$W_1^{ND}(\alpha) - W^D(\alpha) = \int_{c^D}^{c^*} [p(H^+ - H) - c]g(c)dc + \int_{c^*}^{c_1^{ND}} [p(H^+ - H) - c]g(c)dc. \quad (11)$$

The first term in the RHS of (11) is positive, whereas the second term is negative. As is seen above $0 < W_1^{ND}(\alpha) < W^*$ for all $\alpha \in (0,1)$. Moreover, we know that $\lim_{\alpha \to 0} W^D = W^*$. This implies that as $\alpha \to 0$, the left-hand side (LHS) of (11) (i.e., $W_1^{ND}(\alpha) - W^D(\alpha)$), approaches $[W_1^{ND} - W^*]$ and becomes negative. This means that that as $\alpha \to 0$, the second term on RHS dominates the first term. Specifically, $W_1^{ND}(0) < W^D(0)$.

On the other hand, $\lim_{\alpha \to 1} W^D = 0$. Therefore, when $\alpha \to 1$, the LHS and the RHS of (11) approach $W_1^{ND}(\alpha = 1)$, which is strictly positive. This means that as $\alpha \to 1$, the term $[W_1^{ND}(\alpha) - W^D(\alpha)]$ as a whole is positive. Additionally, in view of the above, $\frac{\partial (W_1^{ND} - W^D)}{\partial \alpha} > 0$. Therefore, there exists $\hat{\alpha}$ such that $W_1^{ND}(\hat{\alpha}) = W^D(\hat{\alpha})$. For all $\alpha < \hat{\alpha}$, $W_1^{ND}(\alpha) < W^D(\alpha)$; for all $\alpha > \hat{\alpha}$, $W_1^{ND}(\alpha) > W^D(\alpha)$.

As shown in Figure 2, non-disclosure default rules outperform disclosure defaults in the prevalent range of situations involving a relatively small number of experts in the buyers' population.

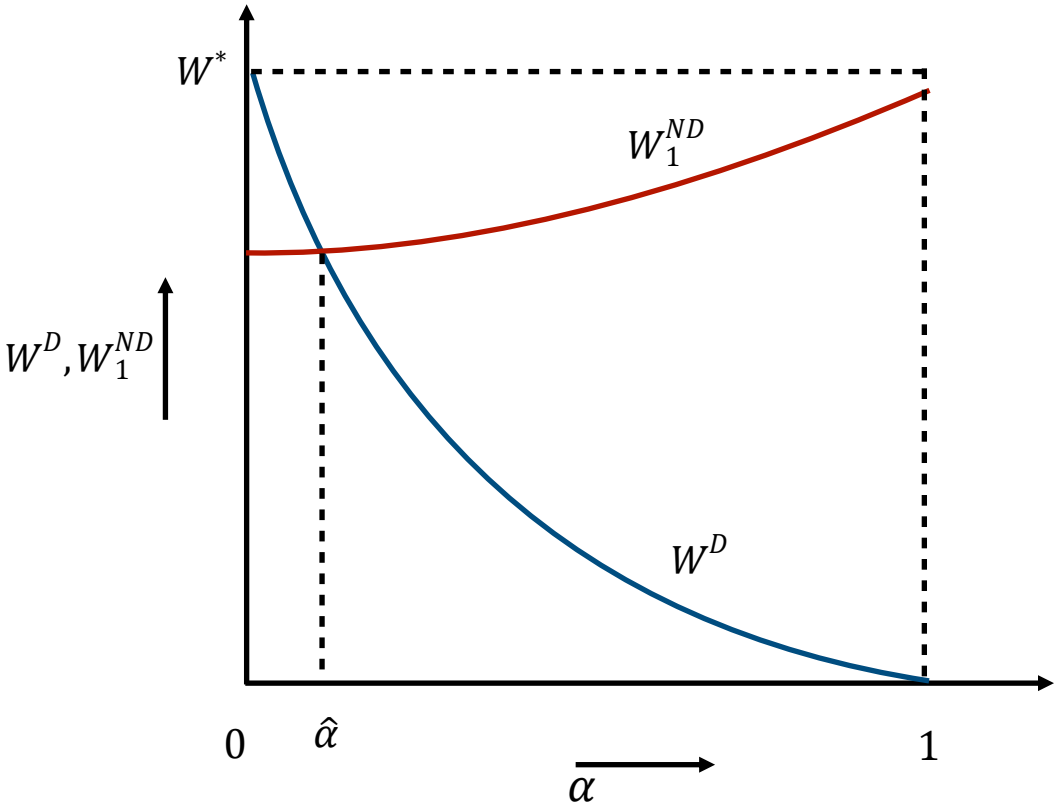

Figure 2: *Welfare Effects of Disclosure vs Non-Disclosure Defaults*

The results show that when the percentage of expert buyers in the population is small, $\frac{\partial W_1^{ND}}{\partial \alpha} > 0$ always holds. This an interesting finding. Generally, a decrease in bargaining power for the party making investments is expected to reduce social surplus. Our results show that in some contexts the opposite may occur. In our set up, a decrease in the bargaining power of expert buyers mitigates their excessive investments in information, leading to an increase in social welfare.

Summing up, we can state the following.

Proposition 4. *Superiority of Non-Disclosure Default Rules.* When the percentage of expert buyers in the population is small, non-disclosure default rules generate higher levels of welfare compared to disclosure default rules in the prevalent range of situations.

As shown in Figure 2, the disclosure default rule can only dominate in the (narrow) range of situations with very low values of α, in which the seller has a negligible bargaining power. This is not surprising, because due to their bargaining power, buyers would act as a price-setters in those situations and would capture most of the surplus from trade, notwithstanding their disclosure of information to the seller. In this limited set of circumstances, a disclosure default rule would not reduce the value of the buyer's information, thereby preserving buyers' incentives to acquire information.

However, situations that fall in this range rarely occur in the real world. The information investment made by an expert buyer is a sunk cost unless a trade takes place. The seller can leverage the buyer's contract-specific investment, increasing her bargaining power.[46] Non-disclosure rules thus emerge as the normatively desirable defaults in all plausible gems situations.[47]

[46] After a disclosure of information occurs, the seller can identify the expert buyer after he has incurred his sunk investment.

[47] It is also interesting to note that the social welfare loss is less vulnerable to the market powers of the parties (i.e., the effect of α is smaller) under a non-disclosure rule than a disclosure rule. We can see this by noting that, while in a disclosure regime W^D can vary, depending on α, all the way from 0 to W^*, a non-disclosure regime restricts variability to the term $\int_{p(H^+-H)}^{p[H^+-(\alpha V^O+(1-\alpha)\,V^S)]}[p(H^+-H)-c]g(c)dc$. Therefore, when the percentage of the expert buyers is small, the impact of the parties' bargaining power on social welfare, W_1^{ND}, is small, especially when the difference in value between gems and ordinary goods, $(H-L^+)$ or $(H-L)$, is small. Similarly, with respect to a comparatively higher percentage of the expert buyers, α has a milder effect on the trade surplus under the non-disclosure default rule.

4. Moving forward

Departing from the assumption of much of the existing literature which considers default rules as "sticky," hence nullifying the difference between mandatory and default rules, in this paper we explored the effects of alternative disclosure rules when parties can contract around them. Our results support Kronman's (1978) conclusion that expert buyers should not be required to disclose their positive information to uninformed sellers while unveiling a fundamentally different rationale for this conclusion. The choice of alternative default rules in gems situations (duty to disclose vs. no duty to disclose) makes a difference. When parties can contract around the applicable default rules, non-disclosure rules create a greater information-forcing effect than disclosure default rules. Although expert buyers need not disclose their positive information, other buyers will be more likely to separate themselves, signaling a lack of private information. This results in a partially separating equilibrium, which preserves buyers' search incentives and mitigates sellers' withdrawal problem identified by Burckart and Lee (2016) and Dari-Mattiacci et al. (2021).

The problems of asymmetric information appear at the core of most principal-agent problems, from insurance to labor markets, to mention a few. As in Akerlof's scenario, which focuses on the case of informed sellers and uninformed buyers, the principal-agent literature generally focuses on relationships between informed agents and uninformed principals. Future research should extend the results of our paper to other cases of asymmetric information that mirror the contractual principal-agent scenarios, considering situations where the principal, rather than the agent, has private information. Our paper will hopefully lay the foundations for those extensions.

An extension of our analysis should consider the fact that default disclosure rules may endogenously affect the parties' bargaining power. As mentioned above,

a seller may plausibly have greater bargaining power under a disclosure default, given her ability to identify informed buyers and to leverage their sunk investments under such a disclosure rule.

As previously discussed, in some market for gems situations sellers may experience difficulty detecting the presence of hidden qualities after transferring the good to the buyer. Further extensions should examine how remedies could be tailored and how damages should be gauged to address situations with high detection errors. Further, some of the disclosure regimes that we considered may create adverse incentives for informed and uninformed buyers alike. Buyers know that, if sellers discover positive information, remedies may be triggered, thereby dissipating the surplus realized from their transaction. Fearing this outcome, an expert buyer may therefore delay or avoid resale opportunities or other exploitation of his information. Future extensions should consider the effect of alternative legal remedies and default disclosure rules on the ex-post incentives to use positive information, when buyers' use of a purchased good can endogenously affect the probability of detection and enforcement.

Appendix: Investment and Frequency of Trade under $\Omega(\gamma, c_1^{ND})H^+ \geq V^O$.

Here we present out findings for the case $\Omega(\gamma, c_1^{ND})H^+ \geq V^O$. As mentioned in the text, this condition can hold when a population contains a high percentage of expert buyers, which represents an unlikely scenario under our setup. Here, we consider the two mutually exhaustive possibilities: $\Omega(\gamma, c_2^{ND})H^+ \geq V^O$ and $\Omega(\gamma, c_2^{ND})H^+ < V^O$, where

$$c_2^{ND} = (1-\alpha)p[H^+ - V^S]. \tag{122}$$

It is obvious that $\frac{\partial c_2^{ND}}{\partial \alpha} < 0$. Also, $c_1^{ND} > c_2^{ND} > 0$ for all $\alpha \in (0,1)$.

Case 1: Suppose $\Omega(\gamma, c_2^{ND})H^+ \geq V^O$ holds. Under this condition, given the choice of c_2^{ND} as investment threshold chosen an expert buyer, the seller's TIOLI demand will be H^+. That is, the seller will make a demand that is targeted to type-H buyers. So, the expert buyer's payoff will be:

$$\alpha\,[H^+ - H^+] + (1-\alpha)[H^+ - V^S] = (1-\alpha)[H^+ - V^S].$$

This means that at time t = 2, the expert buyers will have an expected gain from trade of $(1-\alpha)p[H^+ - V^S]$. So, the expert buyer will invest in information if and only if $c \leq c_2^{ND}$.

To sum up, when the percentage of expert buyers in the population is sufficiently large such that $\Omega(\gamma, c_2^{ND})H^+ \geq V^O$ holds, in equilibrium the seller will make a TIOLI demand of H^+, and an expert will acquire information if and only if $c \leq c_2^{ND}$.

Since, $V^S < H$, $(1-\alpha)p[H^+ - V^S] > (1-\alpha)p[H^+ - H]$. This means that $c_2^{ND} > c^D$, hence $G(c_2^{ND}) > G(c^D)$ for all $\alpha \in (0,1)$. In other words, even when the population share of expert buyers is large, the level of investment in information under a non-disclosure default is strictly greater than under a disclosure

default. At time t = 2, the expert buyer's net expected gains from an informed trade can be expressed as:

$$\pi_{2_B}^{ND} = \int_0^{c_2^{ND}} [(1-\alpha)p(H^+ - V^S) - c]g(c)dc \tag{13}$$

Comparing $\pi_{2_B}^{ND}$ with π_B^D reveals that, for all $\alpha \in (0,1)$, $\pi_{2_B}^{ND} > \pi_B^D > 0$.

That is, by leaving some informational asymmetry in the market, the non-disclosure default rule provides an advantage to the expert buyers. Recall, the disclosure default rule enables perfect screening. This means that even when a type-*H* expert buyer makes a TIOLI offer, he would have to offer at least H to the seller. In contrast, under the non-disclosure default rule, the semi-pooling of type-*H* and type-*O* buyers provides larger gain opportunities to informed expert buyers—type-*H* buyers can pay only V^S to the seller, leading to an increase in their expected gains and a resulting stronger incentive to invest in information.

Case 2: $\Omega(\gamma, c_2^{ND})\ H^+ < V^O < \Omega(\gamma, c_1^{ND})\ H^+$. Note that $c_1^{ND} > c_2^{ND}$, hence $G(c_1^{ND}) > G(c_2^{ND})$ and $\Omega(\gamma, c_2^{ND}) < \Omega(\gamma, c_1^{ND})$ for any given γ. Therefore, depending on γ and $G(.)$, we cannot rule out the possibility that $\Omega(\gamma, c_2^{ND})\ H^+ < V^O < \Omega(\gamma, c_1^{ND})\ H^+$. Case 2 pertains to such a situation. Under such an unlikely but possible case, if the expert buyer chooses c_1^{ND} as investment threshold, then the seller's best response would be to make a TIOLI demand of H^+ rather than V^O, since $V^O < \Omega(\gamma, c_1^{ND})\ H^+$. However, given that the seller has a TIOLI demand of H^+, the expert buyer's choice of investment threshold will be c_2^{ND}. This, in turn, means the seller is better off with a TIOLI demand of V^O, and so on. That is, the choices of c_1^{ND} as investment threshold by the expert buyer and TIOLI demand of V^O by the seller are not mutually best responses. Similarly, choices of c_2^{ND} as investment threshold by the expert buyer and TIOLI demand of H^+ by the seller would not mutually best responses.

Such a scenario will likely warrant some randomization by the seller between H^+ and V^O. Given our focus on investment in information, it is sufficient to note that regardless of the choices made by the seller, an expert buyer's investment will always be between c_2^{ND} and c_1^{ND}.

This is easy to see. In view of the above, it is clear that an expert buyer's investment threshold is decreasing in the TIOLI demand by the seller. As c_2^{ND} corresponds to the maximum demands by the seller, and any randomization can only reduce the expected TIOLI demand, an expert buyer will choose threshold of at least c_2^{ND}. By similar logic, the maximum investment threshold is c_1^{ND}.

Recall, the socially efficient critical threshold for information acquisition is $c^* = p(H^+ - H)$. The comparison between c^D and c^* reveals that $c^D < c^*$ for all $\alpha \in (0,1)$.

In principle, $(1-\alpha)[H^+ - V^S]$ can be smaller, equal, or greater than $(H^+ - H)$. Therefore, $c_2^{ND} \leq c^*$ or $c_2^{ND} > c^*$ can hold. Therefore, even when the share of expert buyers is large, excessive investment in information cannot be ruled out.

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