Vicarious Liability for Bad Corporate Governance: Are We Wrong about 10b-5?

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I formulate a rational expectations signaling model of vicarious liability for securities fraud, particularly the much criticized ''fraud-on-the-market'' private class action arising under Rule 10b-5. I show that fraudulent misreporting by managers occurs in the absence of managerial moral hazard—that is, where managers simply maximize shareholder payoffs—and that vicarious liability can serve as an appropriate deterrent, creating separating equilibrium. I then show that the particular remedy under Rule 10b-5 can perfectly deter fraud and perfectly compensate purchasers, and that Rule 10b-5 class actions may function better than critics claim. (*JEL* D21, G34, K22, K42, M48)

1. Introduction

The chief securities antifraud mechanism in the United States is the private class action lawsuit under Rule 10b-5: the so-called fraud-on-the-market class action in which plaintiffs may seek to recover their investment losses from the

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firm. While these lawsuits are a prominent part of the U.S. capital markets, it is unclear how well they work. Commentary in the business community has been harsh—the Economist (2006) branded 10b-5 suits "economic lunacy"—and an ever-growing academic literature has questioned the merits of the fraud-on-the-market rule with a number of significant theoretical objections. For instance: Assuming securities frauds are solely the result of managerial agency costs, how can firm-level liability be the appropriate deterrent? Do securities class actions actually compensate or deter anyone, or do they simply amount to shareholders suing themselves—a net negative once litigation costs are factored in? Is the measure of 10b-5 losses—the decline in share value upon the revelation of the fraud—the right one, or does prospective liability feed into price declines and distort recoveries? And if 10b-5 really is effective as a deterrent, how can there be so much fraud litigation in the first place? Such objections have been influential in framing the debate among legal scholars and regulators and in shaping proposals to reform the capital markets.

To help shed light on these sorts of questions, I develop in this article an economic model of securities fraud. First, I inquire into the nature of what causes corporate fraud. I focus especially on the contention that fraud is the result of agency costs (i.e., the manager acting against the collective wishes of shareholders). Second, I address whether firm-level liability (known in the legal literature as "vicarious liability," due to the firm's liability for acts of its agents) functions well given these incentives to commit fraud, or whether, as is commonly claimed, it simply punishes blameless shareholders. Third, I examine whether the particular vicarious liability rule that we have in the United States—the fraud-on-the-market class action under Rule 10b-5—serves as an adequate deterrent and compensatory mechanism, or whether certain proposed reforms are likely to be an improvement.

In addressing the first question, I find that securities fraud can arise from shareholder incentives: Even in the absence of managerial agency costs, fraud will occur in equilibrium—that is, both good and bad firms will report their type as good, leading investors to be unable to tell them apart. Using a signaling model of a manager's decision to disclose his private information to the market, fraud occurs where the manager maximizes current shareholders' aggregate welfare *ex post*. This is because current shareholders are always going to be net sellers of the firm's shares in aggregate; hence, the manager who maximizes aggregate shareholder welfare will prefer,

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ceteris paribus, to falsely inflate the trading price of the firm's shares. That is, it would be incorrect to assert that fraud must be the product of managerial agency costs.[1] In a world where shareholders run the firm directly or can write a complete and an unobservable contract with the manager, current shareholders themselves might prefer "bad" corporate governance that causes managers to inflate firm value. As a corollary, managers who serve loyally the interests of current shareholders as corporate law generally mandates—which is also likely because current shareholders vote, while future shareholders do not—will commit some degree of fraud on their behalf.[2] This means, among other things, that even if current reforms designed to increase shareholder power and managerial accountability are effective, incentives to commit fraud will remain.

In addressing the second question—whether firm-level or "vicarious" liability can deter such fraud—I show that given shareholder incentives to commit fraud, there exists some level of vicarious liability that is perfectly deterrent (i.e., that neither over- nor underdeters) so long as not all shareholders sell their shares during the period of fraudulent price inflation. This is so because the firm is run to maximize aggregate shareholder payoffs (this is, again, what current shareholders vote for, and also what corporate law dictates), and because so long as the punishment reaches at least one shareholder, the enforcer can make threatened penalties arbitrarily large until the expected penalty balances out against the gain from fraud.

Third, I examine the efficacy of a particularly important form of vicarious liability, the Rule 10b-5 fraud-on-the-market class action. I find that Rule 10b-5 does a remarkably good job at deterring fraud and compensating purchasers, given the incentives to commit fraud developed in the first part of the

1. It is a distinct question whether the presence of managerial agency costs would increase (or decrease) the level of fraud, which I do not address in this article. However, as I show in a work in progress (Spindler, 2010), decreases in agency costs can actually increase the likelihood of securities fraud, and the level of fraud may in fact be at a minimum where agency costs are very high.

2. In reality, one expects that managers' enthusiasm for maximizing current shareholder payoffs will be tempered concerns over self-interest, including the possibility of being fired, facing personal liability, and suffering reputational losses. While this is undoubtedly true to a degree, the interests of current shareholders are undoubtedly an important factor affecting managerial incentives, and the purpose of the instant article is to illustrate the tendencies that these incentives affect.

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article. Perhaps most surprisingly, I show that these desirable qualities hold even where the information available to the adjudicator (i.e., the court) is very limited: When the court can observe nothing except stock price movements, Rule 10b-5 still maintains full deterrence and compensation. In a richer informational environment where the court has some information about whether fraud was committed, and imposes fraud sanctions only where it is more likely than not that fraud occurred according to Bayes' law, deterrence is less than complete in that firms of low quality employ a mixed strategy of sometimes lying and sometimes not; and where courts have perfect information, 10b-5 is again perfectly deterrent and compensatory.

Finally, I use this model of securities fraud to examine the effect of some recent proposals for securities class action reform, such as capping damages, removing private incentives to sue by having the Securities and Exchange Commission (SEC) administer and collect sanctions, or imposing fines on the manager as opposed to the firm. As it turns out, arbitrary caps on 10b-5 damages will tend to have detrimental effects for both deterrence and compensation. Centrally administered sanctions require that the government possess a great deal of information about the firm in order to avoid over- or underdeterrence; in contrast, current remedies under 10b-5 are market driven and, to a great extent, automatically adjust to preserve deterrence even where courts have very limited information sets. And, where shareholders are free to contract with the manager, penalties imposed on the manager are ultimately borne by the firm and have the same demanding informational requirements as centrally administered sanctions to maintain proper deterrence.

Section 1.1 of this article provides a brief overview on the functioning of the fraud-on-the-market rule; Section 1.2 briefly surveys some influential criticisms of the rule. Section 2 presents a rational expectations model where managers signal private information to the market and may choose to tell the truth or not. Section 3 states some results concerning incentives to commit fraud and the effectiveness of vicarious liability in general. Section 4 then considers the functioning of 10b-5 liability based on different specifications of what the court can observe. Section 5 considers the effect of recent reform proposals such as damages caps, separating compensation from deterrence, and imposing penalties on managers. Section 6 discusses some potential extensions of the model, outlines directions for future research, and concludes.

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1.1. A Brief Overview of 10b-5 Fraud on the Market

Rule 10b-5 and Section 10b of the Securities Exchange Act of 1934 make actionable material misstatements or omissions in the sale or purchase of securities, with a private right of action granted to investors by the Supreme Court in 1971 in *Superintendent of Ins. v. Bankers Life & Cas. Co*. Subsequent developments of legal doctrine allow multiple plaintiff claims to be aggregated into class actions, and, as implemented in the Supreme Court case of *Basic v. Levinson* in 1988, the efficient capital markets hypothesis creates a market test for the non-scienter elements of fraud (causation, reliance, materiality, and damages).[3] This market test is whether a change in stock price occurred at the time that information reached the market that corrected the misstatement or omission.[4] That is, making out a 10b-5 fraud-on-the-market class action is largely a matter of conducting an event study on stock price movement around the time that the market learned of the fraud. Damages for each plaintiff are then the price drop of the corrective disclosure multiplied by the plaintiff's net change in position from the moment just before the fraud was committed to the moment just after the corrective disclosure occurred (this period is known as the "effective period" of the fraud).

An example will help to clarify to the operation of the rule. Suppose that at Time 0, the firm's shares are trading at $7. At Time 1, the firm makes a disclosure to the market, and the firm's stock price rises to $10. At Time 2, it is revealed to the market that the firm's disclosure at Time 1 was false, and the firm's stock price drops to $6. If an investor's holding of stock at just before Time 1 was fifty shares, and his or her holding of stock at just after Time 2 is seventy-five shares, the investor would be entitled to recover damages of $4 on each of twenty-five shares, for a total recovery of $100.

3. Scienter requires that the firm or its agents made the statement with the requisite intent to defraud (i.e., that they knew that the statement was untrue at the time of its making), although oftentimes in the corporate context this is more akin to a negligence standard since some agent of the firm generally knows of the misstatement, though not necessarily whether the misstatement is material.

4. Prior to the Supreme Court's *Dura Pharmaceuticals* decision of 2005, a plaintiff could make out a fraud-on-the-market claim with merely fraudulent price inflation, without having to show a stock price drop at the time of corrective disclosure. *Dura* appears to have made *ex post* declines a necessary element of a fraud-on-the-market claim. See Spindler (2007b).

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One can imagine more complicated scenarios where multiple frauds or corrective disclosures occur, but the basic story remains the same.

1.2. Some Criticisms of Fraud on the Market

The literature on 10b-5 fraud on the market has not been kind, and critics have questioned whether the rule serves any useful purpose of deterrence or compensation, or is merely a sink for litigation costs and runaway damages. In this subsection, I describe several of these arguments in brief.

1.2.1. Agency costs. Several scholars have taken up the increasingly popular position that the fraud-on-the-market rule is not a proper deterrent since it punishes innocent shareholders instead of the culpable executives who commit the acts of fraud. Critics of vicarious liability have made the point that to the extent that managers benefit from fraud while shareholders do not, punishing the firm collectively is not helpful (Arlen and Carney, 1992; Coffee, 2006). To the contrary, an important line of argument advanced initially by Arlen points out that vicarious liability may in fact deter the firm from attempting to root out fraudsters for fear of civil liability (Arlen, 1994; Arlen and Kraakman, 1997). While these commentators generally support private market solutions for combating fraud and other malfeasance (i.e., letting firms work things out themselves by scaling back fraud-on-the-market liability), others have extended this argument to conclude that fraud is a result of managerial agency, and to call for increased public enforcement against executives (Alexander, 1996; Grundfest, 2007; Langevoort et al., 2007). These more extreme views have been influential: Committee on Capital Markets Regulation (2006: p. 78) (so-called because of its support by then-Treasury Secretary Paulson) concluded that "the potential deterrent function of private securities litigation is debatable because virtually all the costs . . . are ultimately borne by the shareholders. Only in [a] rare case . . . do the costs fall on individual [ ]" employees of the corporation. An even more forceful statement on this front was contained in an open letter from several prominent securities law professors (Langevoort et al., 2007) to the SEC: "the current system does a bad job at deterrence because . . . settlements almost never come out of the pockets of the managers who allegedly executed the fraud."

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1.2.2. Pocket shifting and diversification. The most fundamental criticism of the compensatory function of the fraud-on-the-market mechanism is the argument that diversified investors do not benefit from securities liability because losses from fraud are diversifiable risk (Alexander, 1996: p. 1502; Booth, 2005: p. 1; Coffee, 2005, 2006; Fox, 2005: p. 529). The reasoning is that since a trader is just as likely to be on the winning side of a fraudulent transaction as the losing side, gains and losses ought to even out with a large number of trades. If that reasoning holds, then 10b-5 liability simply shifts money from one pocket of the investor to another, minus transaction costs. In the words of Committee on Capital Markets Regulation (2006), "[t]he recovery is largely paid by diversified shareholders to diversified shareholders and thus represents a pocket-shifting wealth transfer that compensates no one in any meaningful sense."

1.2.3. Litigation costs. Another issue regarding compensation is that of the transactions costs involved in securities class actions (Alexander, 1996; Coffee, 2005: p. 14–15, 2006; Grundfest, 2007). Lawyers' fees, including plaintiffs' lawyers' cut of any award or settlement, are a significant portion of any transfer between the firm and plaintiffs, and other costs such as distraction of management may be significantly higher. Incentives to litigate are widely thought to exacerbate these costs and that everyone (except perhaps for plaintiffs' lawyers) could be made better off by switching to a regime of public enforcement. Coffee (2006: 16–19) suggests that the plaintiffs' total litigation costs (considering that they are owners of the firm) could actually exceed plaintiff litigation recoveries, making the suit a net negative: It is dubious "whether the typical securities class action settlement actually produces any net recovery, particularly to diversified shareholders." Committee on Capital Markets Regulation (2006) echoed these sentiments, finding it "not clear that there is any positive recovery in the average securities class action" after taking into account litigation costs.

1.2.4. Strike suits and meritless litigation. There is then the question of whether, even if 10b-5 class actions would serve compensatory or deterrent functions given proper implementation, the mechanism implementing the recovery rule is somehow broken. A rather well-developed line of literature questions the merits of securities litigation (Alexander, 1991; Bohn and

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Choi, 1996; Perino, 2003; Choi, 2004), generally based upon empirical studies that have tried unsuccessfully to correlate incidence of securities settlements with some objective criteria of fraudulent behavior. Rather, litigation appears to follow almost inevitably on the heels of large share price declines, making 10b-5 a superfluous scheme of "insurance" for diversified investors (Alexander, 1991; Coffee, 2005: 5). This view has again been influential: The legislative record of the Private Securities Litigation Reform Act ("PSLRA") states that PSLRA was enacted to combat "routine filing of lawsuits against issuers of securities . . . whenever there is a significant change in the issuer's stock price, without regard to any underlying culpability of the issuer" [H.R. Rep. No. 369 (1995)].

1.2.5. Feedback effects. Finally, some have claimed that the 10b-5 measure of damages overcompensates plaintiffs (or at least overpunishes defendants) due to feedback effects since prospective liability is itself bad news that lowers share price and thereby further increases the amount of prospective liability (most strongly stated by Alexander, 1994, and Booth, 2006, with earlier but more agnostic statements by Easterbrook and Fischel, 1985: 638–39, and Arlen and Carney, 1992). If that is the case, then 10b-5 might be overdeterrent by construction, and hence chill useful disclosure of firm information. As Booth (2006) states, "[t]he prospect of payout by the defendant company causes its stock price to fall by more than it otherwise would . . . and triggers a positive feedback mechanism that has the effect of magnifying the potential payoff . . . [this] constitutes an excessive penalty." Alexander (1994) goes even further, claiming that 10b-5 damages are systemically overstated because share price declines incorporate not just the corrected information regarding the firm's cash flows but also a "litigation put" (a positive value associated with the plaintiffs' right to recover their investment in some cases).

1.2.6. Policy effects of 10b-5 criticisms. Taking some combination of these criticisms together, one can formulate any number of proposals for reform that would, on those terms, appear superior to private securities litigation. Alexander (1996), for instance, argues for a schedule of SEC administrative fines instead of private class actions. Langevoort (1996), finding 10b-5 overdeterrent and encouraging meritless suits, proposes a cap on damages against firms. Coffee (2005) and Mahoney (1996) favor

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strengthening pleading requirements to cut back on the incidence of suit. Grundfest (2007) prefers federal sanctions on individual executives, including jail terms, and Langevoort (2007) proposes mechanisms to leave malfeasant executives penniless. This is but a smattering of the various proposals that have surfaced in recent scholarship.

In any event, the critics seem to have been rather effective. The past two decades have seen a cutting-back of 10b-5, with reforms such as the PSLRA of 1995 and the Securities Litigation Uniform Standards Act of 1998 (which together tighten class and pleading requirements and in some cases limit damages) and Supreme Court decisions such as *Dura Pharmaceuticals* and *Tellabs* that have eroded the private right of action against the firm by increasing evidentiary burdens. And, many influential commentators are pushing for yet more along these lines; for example, Committee on Capital Markets Regulation (2006) recommended cutting back on private securities litigation for the sake of U.S. capital markets' competitiveness. At the same time, there has been a growing trend toward public enforcement, as well as non-indemnifiable liability risk for individual agents of the corporation. Among other things, Sarbanes Oxley provides for SEC collection of penalties, mandates particular governance structures such as board composition and relationships with auditors, imposes enhanced reporting and certification responsibilities for managers, beefs up extant regulators and creates new ones (such as the Public Company Accounting Oversight Board), and imposes up to 25-year jail terms on managers for even minor reporting or fiduciary violations that need not have a material effect upon the firm's operations or share price.

1.2.7. But are these critics correct? Though the above criticisms have been both popular in the academy and influential among regulators, are they correct? To investigate, I construct below a formal theoretical model of disclosure in a public firm. As the model shows, there is substantial reason to doubt these criticisms, and the current 10b-5 regime possesses some quite admirable qualities.

2. The Model: A Simple Signaling Game without Agency Costs

In this Section, I formulate a model of vicarious liability for securities fraud (and, in particular, the fraud-on-the-market rule) in a simple game where managers act in the best interests of the current shareholders of

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the firm (this is equivalent to shareholders running the firm directly or shareholders writing a complete but unobservable contract with the manager). This setup is meant to show explicitly how incentives for fraud exist, and how vicarious liability may help preserve truthful signaling, in a context where the manager maximizes shareholder welfare.

The model works as follows. In Period 1, the firm owns a risky project, about which the manager receives a private but noisy signal. The manager can then reveal this signal to the market, or he can lie about it (for instance, disclosing a high value when the true signal was low). The manager discloses so as to maximize aggregate shareholder payoffs. Shareholders then make a decision to either hold their shares or sell them at the prevailing market price. All shares sold are bought by new investors in a competitive and rational capital market. In Period 2, after the sale occurs, the firm realizes cash flows, and liability is assessed depending upon the level of cash flows as well as other factors (I consider various specifications of how and when liability might be assessed in Section 4). Liability, if any, is transferred to the purchasers. Based upon the expected liability, the economy comes to an equilibrium where the manager's disclosure is credible (a separating equilibrium) or noncredible (a pooling equilibrium).

2.1. The Economy

The economy in this model consists of a firm that owns a project, a manager, N shareholders who each own one of the firm's shares, a continuum of potential purchasers, and a liability mechanism that transfers wealth between the firm and purchasers.

2.1.1. The firm. At the start of Period 1, the firm has N shares outstanding, which are owned by N shareholders. The firm owns a nonrisky asset that is worth a constant ω per share (normalized to 0)[5] and a risky project that

5. The risk-free asset ω ensures that the firm will be solvent for a given level of share turnover. For simplicity of exposition, I normalize ω to 0 and allow the nonselling shareholder's payoff to be less than 0—bearing in mind that there is a maximum level of share turnover that can be supported. One interpretation of ω is that it is an element of returns that is not subject to the 10b-5 penalty and about which an informational asymmetry does not exist.

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produces cash flows of v in Period 2. Cash flows v are distributed uniformly on the interval [0, η], where η is either H (high) or L (low), $H > L$. The probabilities of $\eta = H$ and $\eta = L$ are common knowledge, and are denoted as $\Pr(H)$ and $\Pr(L)$, where $\Pr(L) = 1 - \Pr(H)$. Penalties assessed against the firm are paid pro rata by persons who own shares at the time the penalty is assessed in Period 2 (i.e., shareholders who have sold in Period 1 do not participate in funding the liability, but purchasers who bought in Period 1 do). Liability per share assessed against the firm is denoted as l; total liability is Nl.

2.1.2. Shareholders. Shareholders are risk-neutral investors; hence, utilities are simply payoffs. Each of the shareholders owns one share of the firm. In Period 1, each shareholder can choose to either sell or hold his or her share. (The analysis is unchanged if shareholders are allowed to purchase additional shares, as I show in Appendix). Shareholders who do not sell (henceforth, "nonselling shareholders") receive an expected payoff of $U_{\mathrm{N}} = E[v - \theta l]$, where v is the cash flow per share, l the measure of damages per share assessed under the fraud liability rule, and θ a function that determines whether fraud liability measure is imposed.[6] Selling shareholders ("selling shareholders") receive the payoff of $U_{\mathrm{S}_i} = p - c_i$, where p is the trading price of the firm's shares after the manager's disclosure and c_i the particular shareholder's cost of liquidating the share. The cost c_i may represent foregone returns, tax, transactions fees, or other costs of selling or of not holding the share; c_i may also be negative (for instance, if the shareholder has an immediate need for cash). This creates heterogeneity among shareholders, and allows for trading among investors and the distinction between long- and short-term investors.[7]

I assume that the distribution of c_i is common knowledge; shareholders realize their particular values c_i after the manager's disclosure but before making the decision of whether to sell. A shareholder will therefore choose to sell his or her share if $p - c_i > E[v - \theta l]$. The fraction of shareholders who choose to sell their shares in Period 1 is denoted as π. As a slight simplification, I only allow

6. For instance, $\theta = 1$ means the court finds the firm liable, $\theta = 0$ means it does not.

7. This is a fairly common assumption. See, for example, Greenwald and Stiglitz (1991).

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shareholders to sell or hold their shares, not to purchase; however, this does not affect the analysis, as the following lemma shows:

Lemma 1. A game where shareholders may buy, hold, or sell their shares may be rewritten as a game in which shareholders may only hold or sell.
Proof. See Appendix.

2.1.3. The manager. In Period 1, the manager receives a private signal η, which may be either H or L; since v is distributed uniformly on $[0, \eta]$, the manager's signal has predictive power. The manager then makes a disclosure η', which may be either truthful ($\eta' = \eta$) or not ($\eta' \neq \eta$).[8] In making his disclosure decision, the manager acts to maximize the sum of shareholders' *ex post* payoffs, which is what corporate law largely dictates.[9] This is equivalent to a complete and unobservable contract between the manager and shareholders, having the shareholders run the firm themselves (as if each had a vote), or awarding the manager a share of stock (if his *ex ante* propensity to sell is identical to that of the other shareholders). The manager thus takes into account the proportion π of shareholders who sell and who receive $p - E[c_i]$, and the proportion $1 - \pi$ who do not sell and who receive $E[v - \theta l]$. The manager's objective function is thus

$$\max_{\eta'} E\left[\pi(p - c_i) + (1 - \pi)(v - \theta l)|\eta\right],$$

where p, l, and θ are each functions of the manager's signal.

2.1.4. Purchasers. Purchasers are risk-neutral agents who can purchase one share of the firm's stock in Period 1. In Period 2, if the liability mechanism operates, each purchaser receives a transfer t, which represents his or her share of the fraud remedy. However, since each purchaser now owns a share of the

8. Henceforth for convenience I will denote high and low signals by H' and L', respectively.

9. This accords fairly well with U.S. corporate law. Hansmann and Kraakman (2001: p. 439, 441) describe the recent "dominance of a shareholder-centered ideology" in corporate law, even internationally, in which "managers of the corporation should be charged with the obligation to manage the corporation in terms of the interests of its shareholders … and the market value of the publicly traded corporation's shares is the principal measure of its shareholders' interests." On the divergence of interest between present and future shareholders, Schwarcz (2005) and Fried (2006) show how conflicts arise from the corporate law.

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firm, the purchaser also participates in funding the liability award; that is, each purchaser has his or her payoff reduced by l in the event of liability.[10]

Purchasers draw inferences from the manager's signal under the particular liability regime and break even in expectation given the manager's disclosure (i.e., the market efficiently prices the share given the available information). I will call this break-even condition the purchaser's individual rationality constraint (IR_P), which is expressed formally as

$$\alpha E[v + \theta(t - l)|H] + (1 - \alpha)E[v + \theta(t - l)|L] - p = 0. \quad (1)$$

The variable t is the transfer to the purchaser, l the liability per share, and θ the "adjudication function" (described immediately below), which equals 1 if the firm is found liable, and 0 if not. The term α is the purchaser's subjective probability of the firm's being of type H given the manager's signal. For instance, in the case where the manager's signal perfectly identifies the type of firm (i.e., separating equilibrium), $\alpha \in \{0, 1\}$. In the case where the manager's signal is noncredible (i.e., pooling equilibrium), the purchaser derives no new information from the signal and $\alpha = \Pr(H)$.

2.1.5. The liability mechanism. In Period 2, the firm realizes cash flows v per share from the risky project. Under the fraud-on-the-market cause of action, purchasers can make out a claim for damages only where the price has fallen below the price at which they purchased. Damages under Rule 10b-5 are equal to the price the purchaser paid minus the price postrevelation of the fraud: $p - p'$, where p is the purchase price and p' denotes the post-revelation share price. For a plaintiff purchaser, a fraud claim is only colorable where there has been a price decline, that is, $p - p' > 0$.[11] Even given a price decline, liability only operates where a court adjudges that fraud occurred. To capture the role of courts, I let θ be an adjudication function that equals 1 when the court imposes liability, and 0 when it does not. I capture

10. This is what is commonly referred to as the circularity of 10b-5 damages or "pocket shifting" since purchasers both receive transfers and fund payment of 10b-5 liability.

11. This is the definition of "economic loss" that the Supreme Court enunciated in *Dura Pharmaceuticals*.

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the necessity of price declines for liability by letting $\theta = 0$ whenever $p - p' \leq 0$.[12] For example, under a strict liability regime where the firm is liable for any price decline, $\theta = 1$ if $p - p' > 0$, and 0 otherwise.

We can express the postrevelation trading price p', liability l, and transfer t, in terms of the other variables of the model. First, note that the operation of damages under 10b-5 is to award to defrauded purchasers a transfer t from the firm equal to the difference between the purchase price and the share price after the fraud is revealed, $p - p'$. Second, it must be the case that the transfer and the liability totals must balance (i.e., what the firm pays, the purchasers receive). Finally, the price of the share once the fraud is revealed, p', adjusts in an efficient market to take into account the realized cash flow net of the expected liability. We then have the following:

$$\text{Damages:}\quad t = p - p' \tag{2}$$

$$\text{Balanced budget:}\quad l = \pi t$$

$$\text{Postliability price:}\quad p' = v - l$$

This allows us to formulate the following proposition regarding the compensatory nature of damages under the fraud-on-the-market regime:

Proposition 2 Perfect compensation: when the specific remedy of 10b-5 liability (i.e., $t = p - p'$; $l = \pi t$) is anticipated by the market, purchasers are made just as well off, and no better, than they were at the time of the purchase. This occurs even though "feedback effects" make the price decline upon the revelation of fraud $(p - p')$ exceed the difference between purchase price and resulting cash flows $(p - v)$.

Proof. One starts by combining the identities of Equation (2) and rearranging:

12. Note that 10b-5 does allow damages from fraudulent price deflation, as where the managers disclose falsely low value to be able to purchase stock for themselves on the cheap. I do not consider those cases here, in part because they do not occur as often as price inflation and because, when they do, it is under a different model of shareholder interaction than the instant one. For instance, Arlen and Carney (1992) report that only 8.7% of securities fraud-on-the-market cases involve allegations of fraudulent price deflation and that a significant portion of that 8.7% comprise management or controlling shareholder buyouts. While those are still important cases to consider, they are beyond the scope of this article.

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$$l = \frac{\pi}{1-\pi}(p - v) \tag{3}$$

$$t = \frac{1}{1-\pi}(p - v)$$

Hence, the liability per share exceeds the shortfall of cash flows versus purchase price by a factor of $\pi/(1-\pi)$.[13] Transfers per purchaser are higher than liability per share since the number of purchasers can never exceed the number of shares, such that $t - l$, the purchaser's net recovery from 10b-5, must always be positive.

Solving for the postrevelation share price, $p' = \frac{1}{1-\pi}(v - \pi p)$. Note that the postrevelation share price is declining in p and is decreasing in π. From this, we can see that the decline in share price will exceed by a factor of $(1-\pi)^{-1}$ the difference between the disclosed price p and the project's realized cash flows v—that is, that there is indeed a "feedback effect" as noted by Booth (2006) and others: $p - p' = (1-\pi)^{-1}(p - v)$.

However, one can show that this feedback effect results in perfect compensation to the purchasers. In the event of 10b-5 liability, the purchaser receives a share of the firm's cash flows, funds the liability, receives the transfer, and pays the purchase price: $U_P = v - l + t - p$. Substituting in, then, for l and t, one finds that in the event of 10b-5 liability, the purchaser receives $U_P = 0$. That is, the purchaser enjoys full *ex post* compensation.

Remark 3. Feedback effects: the above contradicts the conjecture of Alexander (1994) and Booth (2006) that feedback effects make 10b-5 damages systemically too great.

A related question is what happens to *ex post* payoffs where the firm incurs costs from litigation. As it turns out, there is no effect on plaintiff compensation when the firm bears the costs, as the next proposition illustrates.

Proposition 4 Litigation costs: foreseeable costs of litigation that are borne by the firm do not affect the purchaser's full recovery. Costs of litigation borne by the purchasers do make the purchaser's recovery less than complete.

Proof. Suppose that litigation costs the firm ε, and that these costs are foreseeable once the firm's fraud is revealed (i.e., it is known whether the firm will

13. I previously noted this result in Spindler (2007b), comparing *ex ante* and *ex post* fraud remedies.

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ultimately be held liable or not by the court). The market takes these costs into account in valuing the share, and the post liability share price is $p' = v - l - \varepsilon$. As before, the transfer is calculated by the court as $t = p - p'$, and liability $l = \pi t$. Putting these together we get $l = \frac{\pi}{1-\pi}(p - v + \varepsilon)$. The purchaser's net payoff with litigation costs is $U_P = v - l - \varepsilon + t - p$. Substituting in for l and t, we see that $U_P = 0$. That is, when the 10b-5 remedy is assessed, the remedy makes the defrauded purchaser whole *ex post*, inclusive of litigation costs borne by the firm.

Plaintiffs' attorneys' fees as a function of the transfer t do, however, affect purchaser compensation. Suppose that $\varepsilon(t) = \varepsilon \cdot t$, where ε is some fraction between 0 and 1. That would mean that a plaintiffs' attorney takes the fraction ε out of each transfer dollar each purchaser receives. In such a case, the purchaser's net payoff is $U_{\mathrm{P}} = v - l + (1 - \varepsilon)t - p = -\varepsilon\frac{p-v}{1-\pi} < 0$.

Remark 5. To the extent that plaintiff compensation is less than complete due to plaintiff attorney costs, one could, of course, fix this by making firms responsible for plaintiffs' attorneys' fees as well. Thus, the criticisms that 10b-5 or vicarious liability are inherently undercompensatory—and may even be a net negative to purchasers, as Coffee (2006) has claimed—cannot be justified on the basis of litigation costs and attorney fees alone.

2.1.6. Beliefs and the shareholder decision to sell. Shareholders choose to sell when the payoff from selling exceeds the expected payoff from holding the share. This depends, among other things, on the level of liquidation penalty the shareholder would incur from selling the share. Specifically, shareholder i will sell if $U_{S_i} = p - c_i > U_{\mathrm{N}} = E[v - \theta l]$. Thus, there exists some cutoff threshold c^* above which shareholders choose to hold, and below which shareholders choose to sell. Rearranging, $c^* = p - E[v - \theta l]$.

The cutoff c^* must always be greater than zero since the price p will take into account the right of recovery for purchasers of the share, such that p will exceed the expected value of the share's future cash flows, $E[v]$. Substituting in for l, the cutoff is

$$c^* = p\left(\frac{1 - \pi + \pi E[\theta]}{1 - \pi}\right) - E\left[v\left(\frac{1 - \pi + \pi\theta}{1 - \pi}\right)\right].$$

Note that the cutoff c^* is increasing in π. This means that as the proportion of shareholders who sell increases, the cutoff below which one chooses to

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sell also increases. A shareholder's beliefs about what other shareholders believe in terms of selling behavior matters: If everyone else is going to sell, then the shareholder should sell, too, since being the last one holding the bag carries a very large penalty.[14] If $\pi = 1$, then $l = t$, and separating equilibrium is unsustainable (purchasers are merely suing themselves, so there is no longer any meaningful antifraud deterrent). For a separating equilibrium to result, there must not only be an adequate distribution of liquidation costs, but shareholders must have appropriate beliefs about the behavior of their fellow shareholders given that distribution. More specifically, for any level of π, there is a distribution of finite liquidation costs c_i that will support equilibrium if shareholders believe that π is the actual level of shareholder selling.[15]

On a different point, the distribution of c_i may affect the manager's decision making: A higher price raises c^*, which means that shareholders are going to incur more liquidation costs than they otherwise would (i.e., a higher price leads to more wasteful churning). This constitutes an additional incentive to the manager to disclose low. While this effect may not be large, it significantly complicates the math. I therefore make a simplifying assumption on the distribution of c_i, namely, that if $c_i < c^*$, then $c_i \leq 0$.

14. This is a rational panic scenario, where the belief that other agents are panicking makes it rational to panic oneself (for instance, in a bank run, given that other depositors are withdrawing their deposits, running on the bank is the rational thing to do).

15. Suppose, for example, that $\eta = 1$ and $\theta = 1$. For measure 0.1 of shareholders, let $c_i = 0$, while for measure 0.9, $c_i = 0.6$. If beliefs are that $\pi = 0.1$, then $c^* \approx 0.56$, and indeed, under these beliefs exactly 0.1 of shareholders would choose to sell. However, given that same distribution of c_i, shareholders could instead believe that $\pi = 1$, in which case $c^* = \infty$, and all shareholders choose to sell. Thus, both $\pi = 0.1$ and $\pi = 1$ are possible in a rational expectations equilibrium, depending upon the beliefs of shareholders. I do not show the analysis here, but the cutoff c^* is unchanged letting $\omega > 0$; that is, c^* is not a function of ω. This means that, as a percentage of expected firm value, the requisite liquidation costs are a decreasing function of ω. While requisite liquidation costs may seem improbably high in relation to just $E[v]$ (in this example, $c^* > E[v]$), they are much more realistic in comparison to $E[\omega + v]$, which may be arbitrarily large. One interesting possibility is that if c_i is an increasing function of ω, then shareholders can always commit to not completely selling out by contributing more capital to the firm.

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2.2. Summary Timeline

Summing up the above, the game proceeds in the following steps:

(1) The manager (who maximizes *ex post* aggregate shareholder welfare) receives a private but noisy signal of the firm's value, $\eta \in \{H, L\}$, where the cash flow per share of the firm's risky project v is uniformly distributed on the interval $[0, \eta]$.

(2) The manager issues a report regarding firm value, $\eta\prime$, which may be true $(\eta\prime = \eta)$ or not $(\eta\prime \neq \eta)$.

(3) Shareholders learn c_i (their personal liquidation cost), after which shareholders may choose to sell their shares.

(4) Price p is determined in a competitive capital market where purchasers break even in expectation. Purchasers purchase all shares offered by selling shareholders.

(5) Cash flow v is publicly realized.

(6) Fraud may be publicly revealed, whether liability is assessed θ is publicly realized, as is postrevelation stock price $p\prime$.

(7) Liability l and transfers t, if any, are assessed and made.

2.3. Equilibrium

The manager chooses a report $\eta\prime$ to maximize shareholder payoffs,

$$\max_{\eta'} E[\pi p + (1 - \pi)(v - \theta l)|\eta], \tag{4}$$

subject to the purchasers' break-even (individual rationality) constraint,

$$\text{IR}_\text{P} : \alpha E[v + \theta(t - l)|H] + (1 - \alpha)E[v + \theta(t - l)|L] - p \geq 0,$$

where α is the purchaser's updated Bayesian probability that the manager's private signal was H. If, in equilibrium, high- and low-value firms disclose identically (a "pooling equilibrium"), the signal contains no information. In that case, purchasers learn nothing new from the disclosure, and so $\alpha = \Pr(H)$. In contrast, if, in equilibrium, high-value firms disclose H and low-value firms disclose L (a "separating equilibrium"), purchasers are fully informed of firms' underlying quality. With separation, $\alpha = 1$ if $\eta' = H$, and $\alpha = 0$ if $\eta' = L$.

In order for a separating equilibrium to occur, it must be the case that the manager prefers to signal so as to reveal truthfully his or her information.

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This must be true both where the manager receives a high signal H (the high-value firm) and where the manager receives the low signal L (the low-value firm). Formally, these constraints are:

$$\mathrm{IC_L} : E[\pi p_\mathrm{L} + (1-\pi)(v-\theta l)|L \cap L'] \\ \geq E[\pi p_\mathrm{H} + (1-\pi)(v-\theta l)|L \cap H']$$

$$\mathrm{IC_H} : E[\pi p_\mathrm{H} + (1-\pi)(v-\theta l)|H \cap H'] \\ \geq E[\pi p_\mathrm{L} + (1-\pi)(v-\theta l)|H \cap L'].$$

The first constraint, $\mathrm{IC_L}$, is the incentive compatibility constraint for a low-value firm, which requires that a low-value firm will not prefer to mimic a high-value firm (which receives the high-value firm price, p_H). That is, expected payoffs are higher given low quality (L) and a low signal (L') than given low quality and a high signal (H'). The second constraint, $\mathrm{IC_H}$, is the incentive compatibility constraint for a high-value firm, which requires that a high-value firm will not prefer to mimic a low-value firm. These constraints will be satisfied or not depending upon, in particular, the adjudication function θ, as described in Section 4.

3. Deviant Corporate Governance and Vicarious Liability

Here, I will state some general results concerning the effectiveness of vicarious liability as a deterrent. The first is that incentives for securities fraud exist even where the manager perfectly represents the interests of shareholders, maximizing aggregated shareholder payoffs. The intuition for this result is that the set of current shareholders, who control the firm's corporate governance, are going to be net sellers of the firm's securities and hence have an interest in overstating the firm's value.

Proposition 6 Deviant corporate governance: absent liability, fraud is ex post optimal among the set of shareholders.

Proof. Recall from Section 2.1.2 that the *ex ante*–expected utility of the selling shareholder is $U_{\mathrm{S}_i} = p$, and that of the nonselling shareholder is $U_\mathrm{N} = E[v - \theta l]$. If there is no liability, $\theta l = 0$, and $U_\mathrm{N} = E[v]$. From this, one can see that selling shareholders do better, and nonselling shareholders do no worse, where the price of the share p is higher. Aggregate shareholder payoffs will be $\pi p - (1-\pi)E[v]$, which is a strictly positive function of

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price p. Thus, shareholders would choose to set p as high as possible, all else being equal.

What this is saying is that shareholders are no different from the seller in any sort of commercial transaction, who prefers a higher price to a lower one. Given a manager who maximizes aggregate shareholder payoffs, firms will tend to commit fraud. Note that this result is in accord with Arlen and Carney's (1992) empirical finding that the vast majority of frauds involve price inflation; the cause of this fraud is not, however, agency costs, as Arlen and Carney (1992) suggest. In the real world, then, we would expect that shareholders would tend to contract with managers—or impose other systems of corporate governance—that lead to overstatements of value.

Corollary 7. Noncredibility without liability: absent liability, a pooling equilibrium is the only possible equilibrium.

What happens when there exists no liability? Shareholders prefer to disclose fraudulently, and both low and high firms will disclose high. However, purchasers know that they can no longer attach any credibility to shareholder disclosures, and a pooling equilibrium results where the price that purchasers will pay is the prior-weighted expected value of the firm: $p = \Pr[H] \cdot \frac{1}{2}H + \Pr[L] \cdot \frac{1}{2}L$.[16] While the instant model has nothing to say about efficiency per se, pooling is likely to be inefficient as it can result in adverse selection, suboptimal investment in projects, and supraoptimal investments in information.[17] The next proposition states that some level of vicarious liability can always serve to properly deter fraud:

Proposition 8 Effectiveness of Vicarious Liability: If at least one shareholder does not sell ($\pi < 1$), then there exists some level of vicarious liability such that separation is an equilibrium outcome.

Proof. This is apparent from an examination of the incentive compatibility constraints IC_L and IC_H. Rearranging and combining these constraints, in a separating equilibrium it must be the case that

16. One must also consider what happens when purchasers observe disclosure that is off the equilibrium path, namely, if a firm discloses $\eta\prime = L$. If purchaser beliefs are that disclosure of low either indicates low quality or conveys no information, then the pooling equilibrium is stable.

17. Discussion of the costs of price inaccuracy and illiquidity can be found in Kahan (1992) and Spindler (2011).

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$$E[\theta l|L\cap H'] - E[\theta l|L\cap L'] \geq \frac{\pi}{1-\pi}(p_{\mathrm{H}} - p_{\mathrm{L}}) \geq E[\theta l|H\cap H'] - E[\theta l|H\cap L'].$$

Substituting in from the $\mathrm{IR_P}$ constraint that $p_\eta = E[v + \frac{1-\pi}{\pi}\theta l|\eta\cap\eta']$, this condition may be rewritten as

$$E[\theta l|L\cap H'] - E[\theta l|H\cap H'] \geq \frac{\pi}{1-\pi}(E[v|H] - E[v|L]) \geq E[\theta l|L\cap L'] - E[\theta l|H\cap L'].$$

This condition is easily met, in theory if not in practice, since the regulator can fix the fraud penalty at a high level and the nonfraud penalty at a low level (for instance, let $E[\theta l|L\cap H'] = E[\theta l|H\cap L'] = \infty$, and $E[\theta l|H\cap H'] = E[\theta l|L\cap L'] = 0$).

Intuitively, vicarious liability can deter fraud because the manager cares about the aggregate welfare of the firm's shareholders. So long as at least one shareholder does not sell ($\pi < 1$), the regulator can inflict an arbitrarily large penalty upon the firm in the event of fraud, which is borne by the nonselling shareholder.

Remark 9. Pocket shifting fallacy: Propositions 2 and 8 together contradict the claim that vicarious liability of the firm to purchasers merely shifts dollars among shareholders' pockets, made by Booth (2005), The Economist (2006), and Langevoort et al. (2007), among others. There is a divergence of interest between current shareholders and purchasers, which makes some fraud deterrent necessary to allow separation to occur, and the compensatory transfer of vicarious liability can make purchasers whole.

One limitation upon the result of Proposition 8 is that it assumes that the regulator has very good information (there is neither Type 1 nor Type 2 error in the realization θ). Hence, this does not tell us about whether a particular vicarious liability scheme, such as 10b-5, is implementable and effective given what a real-world court can observe. Whether the specific 10b-5 remedy is implementable in a fashion that deters fraud is the focus of the next section.

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4. Efficacy of the 10b-5 Remedy under Limited Verifiability

As shown in Proposition 8, vicarious liability has the potential to create a separating equilibrium. Whether it actually does so depends upon the particular liability rule used. Ultimately, any process for finding liability will be limited by what the court can observe. So, for instance, if the court observes everything, including the manager's private knowledge, perfect enforcement is possible. But in the more plausible case that the court cannot observe everything, the court must work with what it has. I consider three particular classes of adjudication functions defined by what the court might or might not be able to observe.

First, I consider adjudication functions where the court can observe only the transaction price p, the resulting share price p', and the proportion of shares sold π. These are the most eminently feasible set of adjudication functions since they require nothing more from the court than subtracting p' from p and assessing that, multiplied by the number of plaintiffs' shares, against the firm. I show that under strict liability (where firms are always liable for declines), separation does indeed occur. The intuition for this result is that strict liability is effectively a warranty of the firm's disclosure: The difference between the cost of providing the warranty for the high- and low-type firms is the same as the low-type firm's gain from lying. This means low firms have no incentive to lie. And, the reason that strict liability is not overdeterrent to high-type firms is that they receive an actuarially fair price for the warranty that they provide, such that in equilibrium the price of both high- and low-type firms is above the value of expected cash flows.

Second, I consider the possibility that the court can also observe the firm's signal η' and the prior probabilities $\Pr[H]$, and also draw inferences about the reporting strategies that firms follow (Bayesian updating).[18] Since strict liability ensures separation, it is unsurprising that separation can occur where the court has received additional information. I show, however, that making adjudications based upon a "preponderance of the evidence" (i.e., a more than 50% likelihood of fraud) results in only partial separation, where low firms employ a mixed strategy of sometimes lying and sometimes not. The

18. Whether the court can observe the firm's signal in a meaningful sense is questionable; translating a firm's disclosure into a price or a ranking requires the court to undertake analysis of the firm's fundamentals, a task for which the court is not generally qualified.

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intuition for this result (which is not unique to 10b-5—see Friedman and Wickelgren, 2006) is that a Bayesian court cannot be fully deterrent: If fraud is never committed, the Bayesian court will never assign liability, which makes fraud an optimal strategy.

Third, I consider the possibility that the court can observe everything. Not surprisingly, this leads to perfect enforcement and perfect separation. In such a case, other liability regimes, such as infinite penalties for fraud, would work just as well.

4.1. Minimal Verifiability: Prices

4.1.1. Strict liability: $\theta = 1$. One criticism of fraud-on-the-market litigation has been that it amounts to a scheme of insurance, where firms are made liable for insuring the price of their shares; this is generally thought to be bad (see Coffee, 2005).[19] While such a scheme of strict liability is counter, perhaps, to the scienter requirements of the law, it is easy to show that, whatever its other demerits, it still yields a separating equilibrium.

Proposition 10 Effectiveness of strict liability: even if courts can only observe prices, p and p', separation is still attainable by letting $\theta = 1$ for $p' < p$, $\theta = 0$ otherwise (i.e., strict liability for share price declines).

Proof. To model the effect of a strict liability rule, where the firm is liable for any decline in share price, let $\theta = 1$ if $p' < p$; that is, the firm is liable to purchasers whenever the share price declines. From Equations (2) and (3), $p' < p \Leftrightarrow v < p$. If separation were to occur, the prices are calculated from the following form of the purchaser's break-even constraint:

$$\mathrm{IR_P} : E[v + \theta(H')(t - l)|\eta = \eta'] - p_\eta = E[v + \theta(p_\eta - v)|\eta = \eta'] - p_\eta = 0$$

$$\int_0^{\eta} v \frac{f(v)}{F(\eta)} dv + \int_0^{\min\{p_\eta,\eta\}} \theta\Big(p_\eta - v\Big) \frac{f(v)}{F(\eta)} dv - p_\eta = 0$$
$$\Leftrightarrow p_\eta = \eta.$$

19. In Spindler (2007a), I note that strict liability in the initial public offering (IPO) context destroys value as it prohibits the transfer of risk from risk-averse entrepreneur to risk-neutral investor. The IPO context is different from secondary trading since the latter involves investors on both ends of the transaction, both of whom are diversified and effectively risk neutral.

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That is, purchasers are willing to pay the maximum of the firm's potential cash flows, η, since under a fully compensatory regime, they would always get back whatever they pay.[20] One must then check to make sure that these prices satisfy the manager's incentive compatibility constraints. Starting with the low type's incentive compatibility constraint, IC_L, and making use of the identity from Equation (3) that $l = \frac{\pi}{1-\pi}(v-p)$ and that the $E[v]$ on each side of the inequality cancel out:

$$\begin{aligned} IC_L : & E[\pi p_L - (1-\pi)(v-\theta l)|L \cap L'] \\ & \geq E[\pi p_H + (1-\pi)(v-\theta l)|L \cap H'] \end{aligned}$$

$$\pi p_L - \pi \int_0^{\min\{p_L,L\}} (p_L - v)\frac{f(v)}{F(L)}dv \geq \pi p_H - \pi \int_0^{\min\{p_H,L\}} (p_H - v)\frac{f(v)}{F(L)}dv$$

$$\Leftrightarrow L - \frac{L}{2} \geq H - \left(HL - \frac{L^2}{2}\right)\frac{1}{L} \Leftrightarrow \frac{L}{2} \geq \frac{L}{2},$$

which means that the low-type firm will always weakly prefer to report its true type.

Turning to the high type's incentive compatibility constraint, IC_H,

$$\begin{aligned} IC_H : \pi p_H - \pi \int_0^{\min\{p_H,H\}} (p_H - v)\frac{f(v)}{F(H)}dv \\ \geq \pi p_L - \pi \int_0^{\min\{p_L,H\}} (p_L - v)\frac{f(v)}{F(H)}dv \Leftrightarrow \end{aligned}$$

$$H - \frac{H}{2} \geq L - \left(L^2 - \frac{L^2}{2}\right)\frac{1}{H} \Leftrightarrow (H-L)^2 \geq 0,$$

which is always true, meaning that the high-type firm will always prefer to report its true type.

20. In fact, purchasers would be willing to pay up to ∞. However, if there is an infinitesimal expected cost to paying a higher price (e.g., a plaintiffs' lawyers' fee of one penny), the limit of what purchasers will pay goes to η as that cost goes to 0.

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Thus, a scheme of price insurance results in full separation. It is, in other words, an adequate deterrent to fraud. It is also fully compensatory: Purchasers of shares, who would otherwise lose out due to the inflated purchase price of the shares, are completely compensated by the liability and transfer scheme. On the other side of the coin, shareholders gain *ex ante* exactly zero from fraud: Their expected gain from selling at a fraudulent price $(E[\pi(p-v)])$ is exactly offset by the expected loss from fraud in the event that they do not sell $(E[(1-\pi)(\theta\frac{\pi}{1-\pi}(p-v))])$.

It is worth noting that this is a readily implementable scheme of liability: A court simply assigns liability based on share price movements. Transaction costs would be very low, since if the burden of proof is simply to point to a share price drop, it seems reasonable to suppose that legal fees and court costs would be minimal. However, it is true that under strict liability, litigation is constantly occurring: Here, even with separation, the probability that the realized cash flows are less than the transaction price $p_{\mathrm{H}}=H$ or $p_{\mathrm{L}}=L$ is 1 since the firm prices its shares at the upper limit of its potential cash flows.

Remark 11. The prevalence of litigation—even “meritless” litigation—is not necessarily indicative of a failed disclosure regime, as suggested by Alexander (1991), Bohn and Choi (1996), Perino (2003), Choi (2004), and Congress [H.R. Rep. No. 369 (1995)]. Rather, as here, litigation may occur, and liability be assigned, even though fraud is perfectly deterred.

Remark 12. Proposition 10 runs counter to Coffee’s (2005: 5) claim that 10b-5 is a useless scheme of “insurance” for diversified investors, and Alexander’s (1991) claim that “nonmeritorious” suits must negate deterrence. Rather, such a scheme allows credible disclosure, perfectly deterring fraud owing to the differential in expected penalties, while also allowing secondary market liquidity in that πN shareholders are allowed to sell.

4.2. Moderate Verifiability: Prices, Priors, and Strategies

4.2.1. Likelihood ratio cutoff strategy. The discussion so far has assumed that courts or administrators know very little: only prices. One might suppose, however, that courts have (or can get) a little more information: if courts can formulate a prior of firm quality and can observe the firm’s signal and cash flows, then it is possible to draw some inference about whether it is more likely than not that fraud was committed. The court would set a cutoff

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level v^* of cash flows such that any cash flow below v^* results in a determination of liability if the firm reported H, while any result at or above v^* does not. As it turns out, this scheme of liability will be somewhat effective in reducing fraud: If low-type firms are sufficiently prevalent, the court will impose a nontrivial threshold of cash flows v^* that induces low-type firms to randomize their reporting behavior, as described in the following proposition.

Proposition 13 Cutoff strategy and partial deterrence: if courts assign 10b-5 liability when it is more likely than not that fraud occurred, there are two possible outcomes depending on the prevalence of high types relative to low types. If $\Pr(H) < \frac{H}{H+L}$, *the court will assess liability whenever cash flows are weakly less than* $v^* = L$ *and low-type firms will mix their reporting strategies with probability of fraud* $\sigma \leq 1$. *If* $\Pr(H) \geq \frac{H}{H+L}$, *the court never assigns liability for any cash flow greater than* $v^* = 0$ *and low-type firms always lie.*

Proof. To determine whether the firm is liable, the court asks whether it is more likely than not that the report of H was false given the actual cash flow v, that is,

$$\Pr[L|v \cap H'] > 1/2. \tag{5}$$

If the court applies Bayes' rule, the probability that a firm is of low type given that it has disclosed that it is of high type and realized a particular cash flow v is

$$\Pr[L|H' \cap v] = \Pr[H' \cap v|L]\Pr[L]/\Pr[H' \cap v].$$

The court takes into account the low firm's likelihood of lying: the low-type firm reports H' fraction σ of the time, and L' fraction $(1-\sigma)$ of the time (i.e., $\Pr[H'|L] = \sigma$). To compute this value, first note that the numerator term $\Pr[H' \cap v|L]$ is equal to the probability that a low firm reports high times the probability than a low firm that reports high generates a cash flow of v:

$$\Pr[H' \cap v|L] = \Pr[H'|L] \cdot \Pr[v|H' \cap L]$$

$$= \Pr\left[H'^{|}L\right] \cdot \Pr[v|L]$$

$$= \sigma \cdot L^{-1}$$

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The second equality results from the fact that the reporting strategy of the firm does not affect cash flows v.

The denominator term $\Pr[H' \cap v]$ is equal to the probability of a high report times the probability of cash flow $v : \Pr[H'] \cdot \Pr[v|H']$. One can calculate $\Pr[H']$ since we know that low firms lie with probability σ and high firms always tell the truth:

$$\Pr[H'] = \Pr[H'|L] \cdot \Pr[L] + \Pr[H'|H] \cdot \Pr[H]$$

$$= \sigma \cdot \Pr[L] + 1 \cdot \Pr[H].$$

The likelihood of cash flows v given a high report H' is:

$$\Pr[v|H'] = \Pr[L]\Pr[H'|L]\Pr[v|H' \cap L] + \Pr[H]\Pr[H'|H]\Pr[v|H]$$

$$= \Pr[L]\sigma L^{-1} + \Pr[H]H^{-1}.$$

Putting this all together, the probability that the high reporting firm is actually a low-type firm given cash flow v is then:

$$\Pr[L|v \cap H'] = \frac{\underbrace{\sigma \cdot L^{-1}}_{\Pr[H' \cap v|L]} \cdot \Pr[L]}{\underbrace{(\sigma \cdot \Pr[L] + \Pr[H])}_{\Pr[H']} \cdot \underbrace{(L^{-1}\sigma\Pr[L] + H^{-1}\Pr[H])}_{\Pr[v|H']}} \text{ for } v \leq L$$

$$\ldots \text{ or } = 0 \text{ for } v > L.$$

Note that v is not an argument of the probability function, except for whether v is greater or less than L; if $v > L$, the firm must have been a high-type firm and the probability of fraud is 0. This means that the cutoff v^* at which the court determines liability must be either L or 0. Suppose first that the cutoff is 0: In such a case, the low firm always lies since there is never any liability for doing so; $\sigma = 1$ and

$$\Pr[L|v \cap H'] = \frac{L^{-1} \cdot \Pr[L]}{(\Pr[L] + \Pr[H]) \cdot \left(L^{-1}\Pr[L] + H^{-1}\Pr[H]\right)} \leq \frac{1}{2}$$

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$$\Leftrightarrow \Pr[H] \geq \frac{H}{H+L}.$$

That is, if the probability of the firm being of high type is sufficiently large, then it is always more likely than not that the firm reporting high is, in fact, of high type. In that case, $v^* = 0$ and $\sigma = 1$ in a pooling equilibrium.

Suppose, however, that $\Pr[H] < \frac{H}{H+L}$. If the court used $v^* = 0$ as its cutoff, low firms would always lie, and the probability of fraud given a high report and $v < L$ would be greater than 1/2. Thus, $v^* = 0$ is not an equilibrium and the court's cutoff strategy would have to be $v^* = L$, which amounts to a regime of strict liability for low-type firms and which (as we have seen above) makes low-type firms indifferent to lying. In such a case, low firms can play a mixed strategy, meaning that σ, the probability of lying, takes on any value σ such that $\Pr[L|v \cap H'] > 1/2$.

$$\Pr[L|v \cap H'] = \frac{\sigma \cdot L^{-1} \cdot \Pr[L]}{(\sigma \cdot \Pr[L] + \Pr[H]) \cdot \left(L^{-1}\Pr[L]\sigma + H^{-1}\Pr[H]\right)} > 1/2.$$

We have a mixed strategy equilibrium, then, where $\sigma \in (q, 1]$, where q is the solution to the above quadratic, and $v^* = L$.

What does this result tell us? First of all, the 10b-5 remedy works to sustain a mixed separating equilibrium in a setting where courts are Bayesian updaters. Second, even where a court has available to it more information, cash flows and price declines are still important evidence in determining whether or not fraud has been committed.[21] This means that correlation between price declines and lawsuits is to be expected under a well-functioning antifraud rule; it is not necessarily evidence of meritless litigation.

Remark 14. Even where securities lawsuits are decided on "the merits," price declines are still an important (and potentially decisive) piece of evidence in determining liability.

Finally, it is interesting to note that a preponderance of the evidence rule (which is perhaps more intuitively fair than strict liability) does not do as good a job of deterrence as does strict liability. This is a particular form of the result

21. This would be true even in a more complicated model where the court gets a noisy signal of the firm's type, which it uses to update its prior expectation: the realized cash flow v still contains important information.

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of Friedman and Wickelgren (2006), which is that a Bayesian court can never fully deter crime. Where a court employs a preponderance of the evidence standard, there will still be some incidence of fraud and litigation, perhaps significantly so depending upon the parameter values of the model. This happens because the court, which is a Bayesian updater, will never assess liability where firms play strict separating strategies, which leads low firms to lie.

4.3. Full Verifiability: Perfect Enforcement

Perhaps unsurprisingly, if courts never make errors of adjudication, 10b-5 is perfectly deterrent.

Proposition 15 Perfect enforcement: where the court can verify the accuracy of the manager's signal [i.e., $\theta(H', L) = 1$, 0 otherwise], 10b-5 is perfectly deterrent.

Proof. Suppose that courts are able to verify the manager's private signal η and that the rule is to impose liability whenever a low-type firm claims to be of high type. If that is the case, then IR_P yields separated prices of $p_H = H/2$ and $p_L = L/2$, since, if everyone tells the truth, there is never any successful litigation; thus, a purchaser's payoff is just the expected cash flows of the firm, $E[v] = \eta/2$.

Since the high-type firm never faces any penalty if it reports high, but enjoys a higher price for doing so, the high-type firm never lies.

If the low-type firm discloses truthfully, it is never liable. Any time that the low-type firm reports falsely, it faces $\theta = 1$ in the event that cash flows fall short of p_H.

$$\begin{aligned} IC_L : \pi p_L + (1-\pi)L^{-1}\int_0^L v dv \\ \geq \pi p_H + (1-\pi)\left[\int_0^L vL^{-1}dv - \int_0^{\min\{p_H, L\}} \frac{\pi}{1-\pi}(p_H - v)L^{-1}dv\right]. \end{aligned}$$

If $p_H < L$, then the IC_L^H constraint is always strictly satisfied. If $p_H > L$, then the IC_L^H constraint is weakly satisfied. Thus, under a regime of perfect enforcement, 10b-5 functions to perfectly deter fraud.

5. Some Proposed Reforms

As shown above, fraud is perfectly deterred under both strict liability and perfect enforcement, and partially deterred under a preponderance of the

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evidence standard with a Bayesian court. In this section, I examine the potential effects of several proposed reforms. I take as the baseline case the strict liability case, as critics appear to be most concerned with the prospect of liability for mere price drops (e.g., Coffee, 2005).

What I can show is that several of these proposals—administrative fines, damages caps, and personal liability for managers—are likely to erode the good qualities of 10b-5: the ability to deter fraud and compensate victims with a minimum of information available to the court. Similarly, separation will fail where damages are arbitrarily capped. I show, however, that separation may still occur under imperfect strict liability where firms incur litigation costs. I also show that where 10b-5 is replaced with a noncompensatory system of fines, to reach a separating equilibrium requires that the court has access to much more information than under 10b-5.

5.1. Administrative or Noncompensatory Fines

One proposal has been to reduce the incentives of plaintiffs to sue by removing the compensatory function from securities lawsuits. Instead, the SEC (or some other regulatory body) would administer fines and keep the money for some other purpose. In such a case, separation does not occur because prices are depressed to the point where the low firm does better disclosing high, as this allows the firm's shareholders the ability to capture more of the potential upside of their firm. As it turns out, 10b-5's deterrent and compensatory effects are interrelated: removing the compensatory nature of the 10b-5 mechanism underdeters fraud and results in pooling.

Proposition 16 If the fines from a strict liability regime are not used to compensate purchasers, 10b-5 also loses its deterrent quality.

Proof. Suppose that liability is assessed in the same way, by subtracting *ex post* price from *ex ante* price and multiplying by the number of shares transacted: $t = p - p'$, $l = \pi t$, except that purchasers' *ex post* payoff is now $P_{\mathrm{P}} = v - l - p_{\eta}$. That is, they do not receive the liability transfer t; instead, the government keeps it. In this counterfactual case, incidentally, the critics' claim would be correct that purchasers suffer from liability assessed against the firm.

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Using the IR_P constraint to figure prices and substituting in with $l = \frac{\pi}{1-\pi}(p - v)$ from the above, we have

$$\eta^{-1}\int_0^{\eta} v dv - \eta^{-1}\int_0^{p}\theta\frac{\pi}{1-\pi}\Big(p_\eta - v\Big)dv - p_\eta = 0$$

$$\Rightarrow p_\eta = \eta\cdot\frac{\sqrt{1-\pi}-(1-\pi)}{\pi}.$$

Note that the price is decreasing in π, with a minimum of $p_\eta = 0$ when $\pi = 1$ and $\lim_{\pi\to 0} p_\eta = \frac{1}{2}\eta$. Price will always be depressed below the expected value of the firm's cash flows.

In order to have a separating equilibrium, the incentive compatibility constraints of both the high and low firms must be satisfied. Starting with the low firm,

$$IC_L : \pi p_L - \pi L^{-1}\int_0^{p_L}(p_L - v)dv \geq \pi p_H - \pi L^{-1}\int_0^{\min\{p_H, L\}}(p_H - v)dv.$$

By working through this inequality, we can see that the low firm never chooses to report truthfully. In the case where $p_H > L$, rearrangement and substitution of the inequality yields that the firm reports truthfully only if $p_L - \frac{1}{2}L - \frac{1}{2}p_L^2 L^{-1} \geq 0$, which can never be true since $\lim_{\pi\to 0} p_\eta = \frac{1}{2}\eta$.

In the case where $p_H < L$, rearrangement yields that the low firm will disclose truthfully only where $p_H + p_L \geq 2L$, which can also never be true since $p_H > p_L$ and by assumption $p_H < L$. Thus, there is never separation where the government does not use the liability l to compensate purchasers.

What this example shows, then, is that the compensatory function of 10b-5 is inextricably intertwined with the deterrent function. By taking the transfer t away from the purchaser, deterrence (in the form of a separating equilibrium) has been frustrated: The depressed *ex ante* purchase price means that the low firm has more to gain, and less to lose, from falsely reporting than it did where the compensatory nature of 10b-5 affected share prices *ex ante*. Intuitively, a low-type firm faces the prospect of receiving less than the actual value of its cash flows should it disclose its type as low because the likelihood of administrative sanction acts as a tax. In order to capture as much of its upside potential as possible, the firm will wish to disclose its

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type as high. Since all the firm must do in the event that $p' < p_H$ is to pay back the shortfall in an actuarially fair fashion, it is at least indifferent to the prospect of receiving the fine.

5.2. Reducing Expected Penalties: Incidence of Suit and Damages Caps

Another set of proposals to reform securities litigation would reduce expected penalties for fraud, either by capping damages or erecting procedural hurdles to litigation that would tend to make a finding of liability more unlikely. One would expect the purchase price to be lower since purchasers will know they will not be compensated completely for their losses. This, as well as the reduced expected sanction for fraud, leads to underdeterrence and pooling.

Proposition 17 Reduced incidence of suit (imperfect strict liability): in the strict liability setting where $\theta < 1$ ("imperfect strict liability"), 10b-5 no longer deters fraud.

Proof. The purchaser's IR_P constraint again gives a quadratic term that we can solve to obtain p_η for the separating case where $\theta < 1$.

$$IR_P : \int_0^\eta v \frac{f(v)}{F(\eta)} dv + \int_0^{p_\eta} \theta \left(p_\eta - v\right) \frac{f(v)}{F(\eta)} dv - p_\eta = 0 \qquad (6)$$

$$\Rightarrow p_\eta = \eta \cdot k, \text{where } k \equiv \frac{(1 - \sqrt{1-\theta})}{\theta} \in \left(\frac{1}{2}, 1\right) \text{for } \theta \in (0, 1).$$

The term k is always less than 1, which implies that p_η is always less than η. We then check to see if this p_η satisfies the IC_L constraint.

$$IC_L : p_L - \int_0^{\min\{p_L, L\}} \theta(p_L - v) \frac{f(v)}{F(L)} dv \geq p_H - \int_0^{\min\{p_H, L\}} \theta(p_H - v) \frac{f(v)}{F(L)} dv.$$

There are two possible variants of this constraint that must be considered. First, if $p_H > L$, the condition is

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$$\frac{\theta}{L}\left[\int_0^L (p_H - v)dv - \int_0^{p_L} (p_L - v)dv\right] \geq p_H - p_L$$

$$\Leftrightarrow \frac{\frac{(1-\sqrt{1-\theta})}{\theta} - \frac{1}{2}\theta - \frac{1}{2}\theta\left(\frac{\left(1-\sqrt{1-\theta}\right)}{\theta}\right)^2}{\frac{(1-\sqrt{1-\theta})}{\theta}(1-\theta)} = \frac{1}{2}k^{-1} \geq H/L.$$

Since $H/L > 1$, this can never be true for the range of $\theta \in (0, 1)$, since k^{-1} must always be less than 2.

We can then check whether IC_L is satisfied where $p_H \leq L$. If $p_H < L$, the condition is

$$p_L - \frac{\theta}{L}\int_0^{p_L} (p_L - v)dv \geq p_H - \frac{\theta}{L}\int_0^{p_H} (p_H - v)dv$$

$$\Leftrightarrow \frac{1}{2}L^{-1}\theta(p_H + p_L) \geq 1.$$

Since $p_H, p_L < L$, the above is true only if $\theta \geq 1$, which is a contradiction. Thus, if θ is a fixed constant that is less than 1, there is no separating equilibrium since the low-value firm always gains from reporting H.

This shows that arbitrarily limiting recoveries from the strict liability baseline has the effect of undermining deterrence. Because the expected recovery is lower, purchasers are led to pay a lower price. And, both because the price is lower and expected penalties are lower, the 10b-5 sanctions will fail to deter.

The same result follows for a price cap on class action damages, a reform that has been proposed by some including Langevoort (1996). Supposing that courts limit damages in some cases to a maximum amount, such that the purchaser enjoys full recovery for some level of cash flows $v > \bar{v}$ such that $l = l(v)$ but that damages are capped such that the liability assessment $l = l(\bar{v})$ for any $v < \bar{v}$. The analysis proceeds as above—the cap lowers the purchase price and lowers expected liability—and leads to the similar result of underdeterrence. It is unsurprising that since strict liability perfectly internalizes fraud, any arbitrary departure therefrom will have distortive effects upon firm behavior.

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5.2.1. Imperfect strict liability with a litigation penalty. In reality, litigation is not costless. Firms are required to pay attorneys to defend them, managerial time and effort is diverted, and plaintiffs' attorneys may take a sizeable chunk of any award or settlement that is assigned. Because of the large litigation costs that we observe in real life, some observers have questioned the compensatory function of the fraud-on-the-market mechanism, as well as the ability of such a system to provide useful deterrence against fraud (e.g., Coffee, 2006). Indeed, it is apparent that where litigation costs are sufficiently large, firms may avoid litigation, including disclosing a fraudulently low report [i.e., $\eta'(H) = L$]. But a moderate level of litigation penalty may not always be such a bad thing. As shown above in Section 2.1.5, foreseeable litigation costs borne by the firm do not affect the compensatory nature of the fraud-on-the-market remedy. I show in this subsection that litigation penalties may support separation where it would not have otherwise existed.

Proposition 18 Some combination of imperfect strict liability (i.e., $\theta < 1$) and a litigation penalty (i.e., an arbitrary fine leveled upon the firm in addition to damages) can result in separation and deter fraud. However, such a scheme requires significant knowledge on the part of the regulator to implement correctly (in particular, the levels of θ, H, and L).

Proof. Suppose that $\theta < 1$ (a partial strict liability scheme, which, as shown above, would not ordinarily result in separation) and that a per-share litigation penalty of $\varepsilon > 0$ is incurred by the firm when it is successfully sued. Since there is full recovery inclusive of the litigation costs borne by the firm, this means that the purchaser's break-even constraint IR_P is unchanged from the prior case, so that $p_\eta = \eta \cdot k$, where k is defined as above: $k \equiv \frac{(1-\sqrt{1-\theta})}{\theta}$. Since $\theta < 1 \Rightarrow p_\eta < \eta$ [as shown in Equation (6)], the low firm's incentive compatibility constraint is

$$\begin{aligned}\mathrm{IC_L} : p_{\mathrm{L}} - \int_0^{p_{\mathrm{L}}} \theta(p_{\mathrm{L}} - v + \varepsilon)\frac{f(v)}{F(L)}dv \\ \geq p_{\mathrm{H}} - \int_0^{\min\{p_{\mathrm{H}},L\}} \theta(p_{\mathrm{H}} - v + \varepsilon)\frac{f(v)}{F(L)}dv.\end{aligned}$$

If $p_{\mathrm{H}} < L$, this becomes

$$L^{-1}\theta\left[\left(p_{\mathrm{H}}\right)(p_{\mathrm{H}} + \varepsilon) - \frac{1}{2}p_{\mathrm{H}}^2 - \frac{1}{2}p_{\mathrm{L}}^2 - \varepsilon p_{\mathrm{L}}\right] \geq p_{\mathrm{H}} - p_{\mathrm{L}} \qquad (7)$$

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$$\Leftrightarrow \underbrace{\varepsilon \cdot L^{-1}\theta(p_{\mathrm{H}} - p_{\mathrm{L}})}_{E[\Delta \text{ litigation penalty}]} \geq \underbrace{p_{\mathrm{H}} - p_{\mathrm{L}}}_{\Delta \text{ revenue}} - \underbrace{L^{-1}\theta\frac{1}{2}(p_{\mathrm{H}}^2 - p_{\mathrm{L}}^2)}_{E[\Delta \text{ liability}]}$$

$$\Leftrightarrow \varepsilon \geq \frac{L}{\theta} - \frac{1}{2}(p_{\mathrm{H}} + p_{\mathrm{L}}).$$

If $p_{\mathrm{H}} > L$, the ICL constraint is

$$p_{\mathrm{L}} - L^{-1}\theta\int_0^{p_{\mathrm{L}}}(p_{\mathrm{L}} - v - \varepsilon)dv \geq p_{\mathrm{H}} - L^{-1}\theta\int_0^{L}(p_{\mathrm{H}} - v - \varepsilon)dv$$

$$\underbrace{\varepsilon \cdot L^{-1}\theta(L - p_{\mathrm{L}})}_{E[\Delta \text{ litigation penalty}]} \geq \underbrace{p_{\mathrm{H}} - p_{\mathrm{L}}}_{\Delta \text{ revenue}} - \underbrace{L^{-1}\theta\left[Lp_{\mathrm{H}} - \frac{1}{2}L^2 - \frac{1}{2}p_{\mathrm{L}}^2\right]}_{E[\Delta \text{ liability}]}$$

$$\varepsilon \geq \frac{L}{\theta(L - p_{\mathrm{L}})}\left(p_{\mathrm{H}} - p_{\mathrm{L}} - \frac{1}{L}\theta\left(Lp_{\mathrm{H}} - \frac{1}{2}L^2 - \frac{1}{2}p_{\mathrm{L}}^2\right)\right).$$

Since $p_\eta = \eta \cdot k$, these two conditions become

$$(1) \quad p_{\mathrm{H}} < L \Rightarrow \varepsilon \geq \left[L - \underbrace{(1 - \sqrt{1-\theta})}_{\in(0,1)}\left(\frac{H+L}{2}\right)\right]\theta^{-1}$$

$$(2) \quad p_{\mathrm{H}} > L \Rightarrow \varepsilon \geq \frac{(H-L)\cdot k - \theta(Hk - \frac{1}{2}L - \frac{1}{2}Lk^2)}{\theta(1-k)}.$$

As there is a penalty being levied on disclosing a higher value, we need also to check the incentive compatibility constraint of the high-type firm since for a large enough ε, firms would prefer to disclose a lower value in order to avoid costly litigation. Turning to the high-type firm's incentive compatibility constraint, $\mathrm{IC_H}$, knowing that, under partial price insurance $p_{\mathrm{H}} < H$ and $p_{\mathrm{L}} < H$,

$$p_{\mathrm{H}} - \frac{\theta}{H}\int_0^{p_{\mathrm{H}}}(p_{\mathrm{H}} - v + \varepsilon)dv \geq p_{\mathrm{L}} - \frac{\theta}{H}\int_0^{p_{\mathrm{L}}}(p_{\mathrm{L}} - v + \varepsilon)dv$$

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$$\Leftrightarrow \varepsilon \le \frac{H}{\theta} - \frac{1}{2}k(H+L).$$

So, for $p_{\mathrm{H}} < L$, we have that separation occurs where

$$\varepsilon \in \left[\frac{L}{\theta} - \frac{1}{2}k(H+L), \frac{H}{\theta} - \frac{1}{2}k(H+L)\right] \tag{9}$$

and it is apparent [by adding $\frac{1}{2}k(H+L)$ to both bounds] that a level of litigation penalty exists such that separation will occur. For $p_{\mathrm{H}} > L$, we have separation where

$$\varepsilon \in \left[\frac{(H-L)\cdot k - \theta\left(Hk - \frac{1}{2}L - \frac{1}{2}Lk^2\right)}{\theta(1-k)}, \frac{H}{\theta} - \frac{1}{2}k(H+L)\right]. \tag{10}$$

This second interval exists for all $\theta \in (0,1)$.[22]

This result shows that even for a scheme of imperfect strict liability [i.e., $\theta \in (0,1)$], there exists a range of litigation penalties that ensures separation; outside of this range ensures pooling. This means that litigation penalties borne by the firm can actually be either helpful or hurtful in the securities class action context since they can provide an extra deterrent to both fraudulently high and truthfully high reporting.

5.3. Manager Penalties (no compensation)

Since a criticism of the 10b-5 remedy has been that managers are responsible for fraud and that therefore penalties should be levied upon managers rather than firms, one might ask what would happen if we abandoned the 10b-5 remedy in favor of a schedule of managerial penalties only. With complete contracting, the

22. We can see this by operating upon the inequality

$$\frac{(H-L)\cdot k - \theta\left(Hk - \frac{1}{2}L - \frac{1}{2}Lk^2\right)}{\theta\cdot(1-k)} \le \frac{H}{\theta} - \frac{1}{2}k\cdot(H+L)$$

$$\Leftrightarrow \quad H\,(2k \underbrace{-1 - k\theta - \frac{1}{2}k^2\theta}_{-}) + L\,(\underbrace{\frac{1}{2}\theta + \frac{1}{2}k\theta - k}_{-}) \le 0,$$

which is always true for $\theta \in (0,1)$.

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manager will be indemnified for any fines that he or she is required to pay (the sum of which I take to be $J \cdot N$), such that there is a cost to each share of J. Since there is no offsetting transfer of the fine to purchasers, these sanctions will in fact affect purchaser recoveries, in that purchasers really are worse off where the manager is punished.

Lemma 19. In a complete contracting setting, personal sanctions upon the manager will be either ex post indemnified or ex ante compensated by the firm.
Proof. Since contracting is complete, the manager's incentive compatibility constraint will not bind. Only the manager's individual rationality constraint will bind, meaning that the firm must make the manager whole (either *ex ante* or *ex post*) in relation to any fines imposed upon him or her.

Remark 20. One interesting quality is that *ex ante* compensation would have no deterrent effect on what the firm does. Because the costs of fraud are sunk upfront, shareholders will always do better *ex post* if the manager does commit fraud. This makes indemnification preferable from a regulatory standpoint.

Assuming then that indemnification is allowed (indemnification would also be more efficient from the firm's perspective if the manager is risk averse), one can show that fines imposed upon the manager can have the effect of deterring fraud if the level of fine is set right.

Proposition 21 Penalties imposed upon the manager can deter fraud if the level of fine J is such that $J \in [\frac{1}{2}H(\sqrt{\frac{1+\pi}{1-\pi}} - 1), \frac{\pi}{1-\pi}H]$, *which requires that the regulator observe* H, L, *and* π *in setting the fine.*
Proof. Assuming $\theta = 1$, the IR_P constraint is:

$$\eta^{-1}\int_0^{\eta} v dv - \eta^{-1}\int_0^{p_\eta} J dv - p_\eta = 0 \tag{11}$$

$$\Rightarrow p_\eta = \frac{1}{2}\eta \cdot \frac{\eta}{J+\eta}.$$

Note that prices are depressed below the value of the cash flows in this case since the purchasers have a net negative expected payoff from the fine J.

Because of the complexity of the p_η formulation, it will be more instructive to temporarily normalize L to 0. The low firm's incentive compatibility constraint IC_L is

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$$0 \geq \pi p_{\mathrm{H}} - (1-\pi)J.$$

Plugging in for p_{H} from Equation (11), we get that $\mathrm{IC}_{\mathrm{L}}^{\mathrm{H}}$ is satisfied only if

$$J \geq \frac{1}{2}H\left(\sqrt{\frac{1+\pi}{1-\pi}} - 1\right). \tag{12}$$

The high firm's incentive compatibility constraint $\mathrm{IC}_{\mathrm{H}}^{\mathrm{L}}$ is

$$\pi p_{\mathrm{H}} + (1-\pi)H^{-1}\left[\int_0^H v dv - \int_0^{p_{\mathrm{H}}} J dv\right] \geq (1-\pi)H^{-1}\int_0^H v dv \tag{13}$$

$$\Leftrightarrow J \leq \frac{\pi}{1-\pi}H.$$

From Equations (12) and (13), separation will occur only if $J \in [\frac{1}{2}H(\sqrt{\frac{1+\pi}{1-\pi}} - 1), \frac{\pi}{1-\pi}H]$.

There are a few notable things about this outcome. First, purchasers are made worse off *ex post* by the imposition of the manager fines *J*. Second, prices p_η are depressed below the expected value of the firm's cash flows in order to satisfy the purchasers' *ex ante* break-even constraint; this therefore acts a tax upon capital. Third, even if the fine *J* is allowed to be variable, courts (or whoever is administering the fine) must have at their disposal quite a lot of information in order to ensure a separating equilibrium: the court must know L, H, and π. Postrevelation declines in price will not be informative: The decline in share price is $p - p' = \frac{1}{2}\eta \cdot \frac{\eta}{J+\eta} - v + J$, which leaves the court with two unknowns and one equation, so conditioning the fine *J* on the degree of price drop will not work. Either too high or too low a fine causes the breakdown of the separating equilibrium, and it is doubtful that a court or administrator with limited information could keep fines within the necessary bounds.

6. Conclusions and Future Research

6.1. Extensions

There are several directions along which one may expand this analysis. It remains to be shown how 10b-5 functions when managerial moral hazard and limited contracting are included; for instance, where the manager's effort is unobservable and may be induced with performance-based

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compensation that tends to also produce, potentially, fraud.[23] There is also no welfare effect of fraud in this model—fraud only results in a transfer from one party to another—and while precaution costs or capital allocation is likely affected by the ability of firms to communicate credibly with the markets, there is no definitive way to quantify such losses.

One could place the game in a repeated setting to explore the extent to which repeat play and reputation might limit securities fraud. Intuitively, there is some reason to be skeptical of the mitigating effects of reputation. Reputation in the sense of revealed type does not apply to this model as there is no type to be revealed, and reputation in the sense of self-enforcing equilibria seems unlikely to work in that there are few, if any, meaningful repeat players in a liquid, anonymous securities market. Purchasers of securities are more likely, it would seem, to wish to pass the fraud off on subsequent purchasers, rather than to punish the manager at some cost to themselves.

Finally, there appear to be some weaknesses in the way that 10b-5 functions. More shareholder selling creates problems, exacerbating the likelihood of insolvency as well as the likelihood of a race for the exits (why this latter appears not to happen in reality is an interesting question). It also exacerbates problems of judgment proofness, where the firm may not be able to satisfy the penalties required to maintain deterrence.

6.2. Conclusion

While the basic model could be extended in various ways, the implications of the parsimonious version presented here are noteworthy. The model I present in this article runs counter to much of the conventional wisdom regarding the causes of corporate fraud, the role of vicarious liability, and the efficacy of 10b-5 class actions. I show that fraud may arise from shareholder incentives since shareholders are, in aggregate, sellers of the firm's shares and thus may prefer corporate governance that tends to

23. I take up these issues in a subsequent work, "Endogenous Compensation in a Firm with Disclosure and Moral Hazard," which explores the relationship between agency costs, compensation, and securities fraud. One finding is that where agency costs are very high, the incidence of fraud may be lower as shareholders choose not to award performance-based compensation to the manager.

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inflate the firm's price. For this brand of fraud, I show that vicarious liability is a proper form of deterrence mechanism. In particular, I show that 10b-5 functions well in terms of both deterrence and compensation, and requires very little in terms of verifiability (i.e., what the court can observe) in order to operate. In contrast, the proposed substitutes—damages caps, SEC-administered fines, and manager penalties—may perform worse and often require that the court or regulator has much more information at its disposal. This model is therefore a direct challenge to the extant criticisms of 10b-5 and to the commonly heard proposals for its replacement or limitation.

Appendix

ALLOWING SHAREHOLDERS TO BE BUYERS AS WELL AS SELLERS

Suppose that shareholders can hold more than one share and that they may choose to buy an additional share. We can write the proportions (probabilities) of selling, holding, and buying as $\pi_{\mathrm{s}}, \pi_{\mathrm{h}}$, and π_{b}, respectively. Shareholders who purchase an additional share receive the transfer from that additional share when fraud liability is assessed, and pay the liability on both the old and the new shares.

Proposition 22 Shareholders are always net sellers: even if shareholders can purchase an additional share of stock, assuming that total liability and transfers must balance, the manager's problem of maximizing aggregate shareholder payoffs can be expressed as a problem where shareholders only sell or hold shares.

Assuming that the manager maximizes aggregate shareholder payoffs, and suppressing c_i, the manager's objective function is

$$\max_{\eta'} \pi_{\mathrm{s}} p_{\eta'} + \pi_{\mathrm{h}} E[v - \theta l|\eta] + \pi_{\mathrm{b}} E[v - \theta l|\eta] + \pi_{\mathrm{b}} E[v - \theta l + \theta t - p_{\eta'}|\eta].$$

That is, a shareholder who buys an additional share has the payoffs of both a nonselling shareholder and a purchaser. If transfers balance liabilities (i.e., $l = \pi_s t$), the expression becomes

$$\max_{\eta'} \pi_{\mathrm{s}} p_{\eta'} + \pi_{\mathrm{h}} E[v - \theta l|\eta] + \pi_{\mathrm{b}} E[v - \theta l|\eta] + \pi_{\mathrm{b}} E\left[v + \frac{1 - \pi_{\mathrm{s}}}{\pi_{\mathrm{s}}} \theta l - p_{\eta'}|\eta\right].$$

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Note that v is not a function of η' and therefore does not affect the manager's maximization problem. Rewriting without v, the expression is

$$\max_{\eta'} \pi_s p\eta' + \pi_h E[-\theta l|\eta] + \pi_b E[-\theta l|\eta] + \pi_b E[\frac{1-\pi_s}{\pi_s}\theta l - p\eta'|\eta].$$

Reallocating terms, this becomes

$$\max_{\eta'}(\pi_s - \pi_b)p_{\eta'} + \left(\pi_h + \pi_b - \left(1-\pi_s\right)\frac{\pi_b}{\pi_s}\right)E[-\theta l|\eta].$$

Utilizing the fact that $\pi_h + \pi_b = 1 - \pi_s$, we have

$$\max_{\eta'} \underbrace{(\pi_s - \pi_b)}_{+} p_{\eta'} + \underbrace{(\pi_h + \pi_b)\left(1 - \frac{\pi_b}{\pi_s}\right)}_{+} E[-\theta l|\eta].$$

Note that the coefficients of both terms are positive. This follows since it must be that $\pi_s \geq \pi_b$ in order for markets to clear: the number of sellers has to equal the number of buyers, and purchasing shareholders are only a subset of all purchasers. Thus, this is a weighted average of payoffs. Letting $\tilde{\pi} \equiv \frac{\pi_s - \pi_b}{(\pi_s - \pi_b) + (\pi_h + \pi_b)(1 - \frac{\pi_b}{\pi_s})}$, and putting back in the v terms, this may be rewritten as

$$\max_{\eta'} \tilde{\pi} p_{\eta'} + (1 - \tilde{\pi})E[v - \theta l|\eta],$$

which is equivalent to a manager's maximization problem where shareholders may only sell or hold.

References

Alexander, Janet. 1991. "Do the Merits Matter? A Study of Settlements in Securities Class Actions," 43 *Stanford Law Review* 497–598.

———. 1994. "The Value of Bad News in Securities Class Actions," 41 *UCLA Law Review* 1421–69.

———. 1996. "Rethinking Damages in Securities Class Actions," 48 *Stanford Law Review* 1487–1537.

Downloaded from http://aler.oxfordjournals.org/ at University of Texas at Austin on November 9, 2011

Arlen, Jennifer. 1994. “The Potentially Perverse Effects of Corporate Criminal Liability,” 23 *Journal of Legal Studies* 833–67.

Arlen, Jennifer, and William J. Carney. 1992. “Vicarious Liability for Fraud on Securities Markets: Theory and Evidence,” 1992 *University of Illinois Law Review* 691–734.

Arlen, Jennifer, and Reinier Kraakman. 1997. “Controlling Corporate Misconduct: An Analysis of Corporate Liability Regimes,” 72 *New York University Law Review* 687–779.

Bohn, James, and Stephen Choi. 1996. “Fraud in the New Issues Market: Empirical Evidence on Securities Class Actions,” 144 *University of Pennsylvania Law Review* 903–82.

Booth, Richard. 2005. “Who Should Recover What for Securities Fraud?” Available at: http://www.law.harvard.edu/faculty/hjackson/pdfs/WHOWHAT.pdf (accessed March 1, 2008).

———. 2006. “The End of Securities Fraud Class Actions?” 29 *Regulation* 46–51.

Choi, Stephen. 2004. “The Evidence on Securities Class Actions.” 57 *Vanderbilt Law Review* 1465–1525.

Coffee, John C. 2005. “Causation by Presumption? Why the Supreme Court Should Reject Phantom Losses and Reverse Broudo.” 60 *Business Lawyer* 533–48.

———. 2006. “Reforming the Securities Class Action: An Essay On Deterrence and Its Implementation.” 106 *Columbia Law Review* 1534–86.

Easterbrook, Frank, and Daniel Fischel. 1985. “Optimal Damages in Securities Cases,” 52 *University of Chicago Law Review* 611–52.

Fox, Merritt. 2005. “Demystifying Loss Causation,” 60 *Business Lawyer* 507–32.

Fried, Jesse. 2006. “Corporate Law’s Current Owner Bias.” Available at: http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1183&context=blewp (accessed March 1, 2008).

Friedman, Ezra, and Abraham L. Wickelgren. 2006. “Bayesian Jurors and the Limits to Deterrence,” 22 *Journal of Law, Economics, and Organization* 70–86.

Greenwald, Bruce, and Joseph Stiglitz. 1991. “Information, Finance, and Markets: The Architecture of Allocative Mechanisms,” NBER Working Paper No. 3652.

Grundfest, Joseph. 2007. “The Class Action Market,” *The Wall Street Journal.* February 7, 2007. A15.

Hansmann, Henry, and Reinier Kraakman. 2001. “The End of History for Corporate Law,” 89 *Georgetown Law Journal* 439–68.

Kahan, Marcel. 1992. “Securities Laws and the Social Costs of ‘Inaccurate’ Stock Prices,” 41 *Duke Law Journal* 977–1044.

Langevoort, Donald. 1996. “Capping Damages for Open Market Securities Fraud,” 38 *Arizona Law Review* 639–64.

———. 2007. “On Leaving Corporate Executives Naked, Homeless and without Wheels: Corporate Fraud, Equitable Remedies, and the Debate over Entity versus Individual Liability,” 42 *Wake Forest Law Review* 627–61.

Downloaded from http://aler.oxfordjournals.org/ at University of Texas at Austin on November 9, 2011

Langevoort, Donald C., James D. Cox, Jill Fisch, Michael A. Perino, Adam C. Pritchard, and Hilary A. Sale. 2007. “Open Letter to the Honorable Christopher Cox, Chairman, SEC.” August 2, 2007. Available at: http://www.the10b-5daily.com/archives/Chairman%20Cox%20SEC%20Letter.pdf (accessed August 1, 2011).

Mahoney, Paul. 1996. “Precaution Costs and the Law of Fraud in Impersonal Markets,” 78 *Virginia Law Review* 623–70.

Perino, Michael A. 2003. “Did the Private Securities Litigation Reform Act Work?,” 2003 *University of Illinois Law Review* 913–77.

Schwarcz, Steven. 2005. “Temporal Perspectives: Resolving the Conflict between Current and Future Investors,” 89 *Minnesota Law Review* 1044–90.

Committee on Capital Markets Regulation. 2006. “Committee on Capital Markets Regulation, Interim Report.” November 30, 2006. Available at http://www.capmktsreg.org/pdfs/11.30Committee_Interim_ReportREV2.pdf (accessed August 1, 2011).

Spindler, James C. 2007a. “IPO Liability and Entrepreneurial Response,” 155 *University of Pennsylvania Law Review* 1187–1228.

———. 2007b. “Why Shareholders Want Their CEOs to Lie More after Dura Pharmaceuticals,” 95 *Georgetown Law Journal* 653–91.

———. 2010. “Endogenous Compensation in a Firm with Disclosure and Moral Hazard.” Working Paper. Available at: http://ssrn.com/abstract=1481300 (accessed August 1, 2011).

———. 2011. “Integrity and Innovation in the Public Capital Markets: A Survey of the Securities Law Literature,” in Litan, Robert, ed., *Handbook of Law & Innovation*. Cheltenham, UK: Elgar Press.

Weiss, Milberg. 2006. “The Boot’s on the Other Foot,” *The Economist*. May 25. 35.

Downloaded from http://aler.oxfordjournals.org/ at University of Texas at Austin on November 9, 2011