

# Optimal Deterrence When Shareholders Desire Fraud

JAMES C. SPINDLER\*

*This Article presents an economic model of corporate fraud arising from shareholder incentives. First, the model shows that a firm's current shareholders have a preference for higher reported values. Current shareholders are, in expectation, net sellers of the firm's shares; a higher reported value of the firm increases current shareholder returns in expectation.*

*Second, these preferences for inflationary misreporting translate into equilibrium misreporting behavior, which generates inefficiencies due to asymmetric information among secondary-market traders. Informed traders undertake inefficient research costs, noise traders demand a discount to trade, and selling shareholders face deadweight illiquidity costs.*

*Third, in general, some ex post penalty for misreporting can eliminate misreporting incentives and result in a unique truth-telling (that is, separating) equilibrium. This improves social welfare. With joint-welfare maximization among the firm's initial stakeholders and unlimited liability, it does not matter on whom the penalty is placed.*

*Finally, the specific mechanism of firm-level (or "vicarious") fines has desirable qualities from the perspective of administrative feasibility: the optimal fine is a simple function of observable market data. Compensation does not affect this formulation, yet compensation may be desirable in the event of incomplete deterrence because it reduces asymmetric information liquidity costs. The same liability formula applies for alternative targets of liability, such as the manager, and the approximate magnitude of the optimal fine remains the same; however, judgment-proof defendants and limited liability may militate toward firm-level fines.*

## TABLE OF CONTENTS

INTRODUCTION . . . . .	1073
I. PRIVATE SECURITIES LITIGATION AND ITS CRITICS . . . . .	1075
II. SHAREHOLDER INCENTIVES FOR FRAUD . . . . .	1078

---

\* Hart Chair in Corporate and Securities Law, University of Texas Law School; Professor, University of Texas McCombs School of Business. © 2019, James C. Spindler. For helpful comments, I would like to thank participants at the American Law and Economics Association annual meeting, the Fifth International Conference in Law and Economics, the USC Corporate Law and Social Science Workshop, and the Fifth Annual Corporate and Securities Litigation Conference.

A.	SHAREHOLDERS HAVE A PREFERENCE FOR FRAUD. . . . .	1079
B.	GENERALIZING SHAREHOLDER PREFERENCES. . . . .	1081
1.	Heterogeneous Initial Shareholders . . . . .	1081
2.	Primary Sales . . . . .	1083
III.	A MODEL OF EQUILIBRIUM FRAUD BEHAVIOR. . . . .	1084
A.	CURRENT SHAREHOLDERS AND CORPORATE GOVERNANCE. . . . .	1084
B.	A MODEL OF A REPRESENTATIVE-SHAREHOLDER-MANAGED FIRM. . . . .	1086
C.	THE MODEL SOLUTION: FRAUD IN EQUILIBRIUM. . . . .	1087
1.	The Purchasers' and Sellers' Trading Decisions. . . . .	1088
2.	The Manager's Reporting Decision . . . . .	1089
a.	<i>High-Type Firms</i> . . . . .	1089
b.	<i>Low-Type Firms</i> . . . . .	1090
IV.	LIABILITY CAN ELIMINATE FRAUD INCENTIVES . . . . .	1091
V.	OPTIMAL VICARIOUS LIABILITY AND COMPENSATION . . . . .	1092
A.	TO COMPENSATE OR NOT TO COMPENSATE . . . . .	1094
B.	DOES IT MATTER WHO BEARS <i>EX POST</i> LIABILITY?. . . . .	1095
	CONCLUSION . . . . .	1097
	APPENDIX: PROOFS . . . . .	1099
I.	PROOF OF PROPOSITION (3): THE EXISTENCE OF A DETERRENT FINE . . . . .	1099
A.	POOLING . . . . .	1099
B.	SEPARATION . . . . .	1100
II.	PROOF OF PROPOSITION (4): OPTIMAL VICARIOUS LIABILITY . . . . .	1101
A.	THE MARKET PRICING DECISION . . . . .	1101
B.	THE MANAGER'S CHOICE UNDER SEPARATION . . . . .	1102
C.	THE MANAGER'S CHOICE UNDER POOLING . . . . .	1102

## INTRODUCTION

What leads firms to misreport, and what should be done about it? This Article contributes to the literature in showing that the firm's current shareholders have incentives to engage in fraud.<sup>1</sup> If these incentives are not properly addressed, they lead to inflationary misreporting. Legal penalties can counter these shareholder incentives, deter fraud, and result in higher social welfare. In fact, private securities litigation, in which defrauded purchasers receive damages equal to their decline in share value, approximates the optimal deterrent penalty.

The proposition that shareholders may gain from fraud is relatively unappreciated by modern legal scholarship. An academic consensus maintains that fraud arises from managerial agency costs: disloyal corporate executives misreport to benefit themselves at the expense of the firm and its shareholders. According to this view, shareholders themselves do not desire fraud, and penalties imposed upon the firm or its shareholders do little good. This critique, reviewed in Part I, has been highly influential in attacking the current U.S. system of securities regulation, which relies primarily on private litigation against firms to deter fraud.

In contrast to such received wisdom, this Article establishes in Part II that the firm's current shareholders, as a whole, in fact desire higher reports of firm value, regardless of whether those reports are true. This is because the firm's current shareholders must be, as a matter of mathematical certainty, net sellers in the future: because they own the entire firm, any shares sold to outside purchasers must come from them as a group. Just as with sellers of other assets, the firm's owners desire a higher price, even if such higher price is obtained through misrepresentation.<sup>2</sup> This is true in the context of both primary sales—sales from the firm to purchasers—and secondary sales—sales from current shareholders to purchasers. Even where the firm is held by heterogeneous shareholders (such as a mix of long-term and short-term shareholders, as well as those who may purchase additional shares), aggregate shareholder preferences are qualitatively similar to the homogeneous shareholder case. Further, if these heterogeneous shareholders can engage in joint-welfare maximization, then shareholders' aggregate interests can be modeled as a single representative shareholder, who also has such inflationary preferences.

Part III then develops a game-theoretic model of secondary trading in the firm's shares where the price is affected by the firm's reporting decision, and shows that fraud results in equilibrium. The firm, when managed by a representative shareholder-manager, chooses to misreport when the firm is of low type (that is, low value or having low expected future cash flows), because doing so increases the price at which the firm's initial shareholders may sell their shares.

---

1. "Fraud," as used herein, is intended to mean, broadly, any sort of bias in reporting. As Cross and Prentice note, "[i]ssuers may engage in a wide range of opportunistic dishonesty, ranging from blatant lying to more subtle shading of the truth or convenient omission of important but negative information"—not all of which is readily subject to legal antifraud penalties. FRANK B. CROSS & ROBERT A. PRENTICE, *LAW AND CORPORATE FINANCE* 54 (2007).

2. Absent a penalty, of course. The subsequent argument derives an optimal deterrent penalty.

Truth-telling is unsustainable, and fraud is the unique equilibrium in pure strategies.<sup>3</sup> If the secondary market is populated by both informed traders (who can undertake research costs to learn the firm's true value) and noise traders (who can only abstain from trading if they believe they will fail to at least break even), this fraud equilibrium results in inefficient expenditures on research,<sup>4</sup> discounted trading prices, and illiquidity costs. Shareholders' incentives to misreport, if unchecked, lead to lower social welfare.

Part IV incorporates fines or liability into the model to show—in general<sup>5</sup>—that liability on (any of) the firm's *ex ante* stakeholders has the theoretical potential to correct shareholders' fraud incentives. So long as transfers made to defrauded purchasers are funded by no source external to the firm, an increase in fines lowers the returns of fraud: expected liability rises faster than does the expected gain from a higher trading price. An adequate level of fine makes the returns to fraud negative, which means that fines can deter fraud. Given joint-welfare maximization among corporate stakeholders, it does not matter on which of the initial stakeholders this liability falls.

Part V examines the particular liability mechanism of firm-level (or “vicarious”) liability, in which the firm itself is fined for misreporting.<sup>6</sup> Some portion of the fine may be transferred to defrauded purchasers as compensation. The model solution shows that vicarious liability can, indeed, result in optimal deterrence. The optimal fine is remarkably administratively feasible to implement: it is a function entirely of observable market metrics—the number of shares transacted and the decline in market price. The formula for the optimal fine, as a function of these market metrics, is unaffected by whether the fine is used to compensate defrauded purchasers, though there are potential benefits to compensation.<sup>7</sup>

Part VI concludes and discusses some implications of the results. Malign shareholder incentives present a potentially greater problem than managerial incentives due to their relative scale; therefore, they require larger penalties to deter. As it stands, our current system of fraud deterrence—based on private securities litigation—matches up well with the derived optimal.

---

3. That is, the players choose to lie, all the time. A mixed strategy equilibrium involves randomizing between actions: choosing to lie with only some probability and otherwise choosing to tell the truth.

4. Research expenditures are inefficient (or “deadweight”) in this model because they produce no informational gain over the case in which the firm reports correctly.

5. The general penalty model sets aside concerns over particular penalty mechanisms, such as the supposed “circularity” problem inherent in private securities litigation. For a full recounting of the genesis of the circularity critique and its evolution, see James C. Spindler, *We Have a Consensus on Fraud on the Market—And It's Wrong*, 7 HARV. BUS. L. REV. 67, 86–91 (2017).

6. This tracks the current system of private securities litigation, in which the firm is liable for its misstatements.

7. Compensation does affect the prices themselves, which can ameliorate liquidity problems, and it also reduces the incentives to undertake deadweight research costs.

## I. PRIVATE SECURITIES LITIGATION AND ITS CRITICS

The main deterrence mechanism for corporate fraud in the United States is private securities litigation under Rule 10b-5,<sup>8</sup> promulgated under the Securities Exchange Act of 1934.<sup>9</sup> So-called “fraud-on-the-market” class actions constitute more than half of federal class actions filed.<sup>10</sup> Such suits are relatively common in the life of a publicly traded company, with approximately one in ten facing a class action lawsuit in a five-year period.<sup>11</sup>

The fraud-on-the-market doctrine presumes that investors rely on a (somewhat<sup>12</sup>) informationally efficient market price when transacting their securities. If the publicly available information disclosed by the firm is materially incorrect, the market price will be inaccurate. This may give rise to a colorable claim for damages under the fraud-on-the-market theory, in which it is presumed that the investor relies upon the accuracy of the information on which the stock price is based. When that information is revealed to be incorrect and the stock price moves upon the revelation of the inaccuracy, the stock price movement provides evidence of most of the requisite elements of a fraud claim: if the price movement coincides with the revelation of fraud, causation is satisfied; the materiality of the inaccuracy, based on what reasonable investors care about, is demonstrated by the market price’s movement in conjunction with the revelation; and damages are simply (for a purchaser) the price at which the investor purchased less the firm’s stock price after the revelation of the fraud.<sup>13</sup> Reliance is presumed under the fraud-on-the-market doctrine, leaving only scienter and actual falsity (that is, was the statement actually not true in light of the total mix of information?) to be proven by extrinsic evidence.

At the time of its adoption by the Supreme Court in 1988,<sup>14</sup> the fraud-on-the-market class action was lauded by academics as an innovative use of financial economic theory in capital markets regulation and enjoyed “near-universal support.”<sup>15</sup> Not long thereafter, however, critics attacked private securities litigation, and fraud on the market in particular, along several fronts. Perhaps most damning among these critiques were theoretical claims that private securities litigation

---

8. 17 C.F.R. § 240.10b-5 (2018).

9. Securities Exchange Act of 1934 § 10(b), 15 U.S.C. § 78j(b) (2012).

10. See COMM. ON CAPITAL MKTS. REGULATION, INTERIM REPORT 71 tbl.III.1 (2006).

11. See *id.* at 74 (citing ELAINE BUCKBERG, ET AL., NERA ECON. CONSULTING, RECENT TRENDS IN SHAREHOLDER CLASS ACTION LITIGATION: BEYOND THE MEGA-SETTLEMENTS, IS STABILIZATION AHEAD? (2006), [http://www.nera.com/content/dam/nera/publications/archive1/BRO\\_RecentTrends2006\\_SEC979\\_PPb-FINAL.pdf](http://www.nera.com/content/dam/nera/publications/archive1/BRO_RecentTrends2006_SEC979_PPb-FINAL.pdf)).

12. As Bebchuk and Ferrell have discussed, it is not necessary to accept market efficiency to accept the fraud-on-the-market doctrine. Lucian A. Bebchuk & Allen Ferrell, *Rethinking Basic*, 69 BUS. LAW. 671, 673–74 (2014).

13. To some extent, these elements may be shown by a price change upon the issuance of the incorrect information, although *Dura Pharmaceuticals, Inc. v. Bruodo*, 544 U.S. 336 (2005), imposes an economic loss element that requires some *ex post* price decline. See James C. Spindler, *Why Shareholders Want Their CEOs to Lie More After Dura Pharmaceuticals*, 95 GEO. L.J. 653, 663 (2007).

14. See *Basic Inc. v. Levinson*, 485 U.S. 224, 231 (1988).

15. Paul G. Mahoney, *Precaution Costs and the Law of Fraud in Impersonal Markets*, 78 VA. L. REV. 623, 624 (1992).

did not work, and that it could never work due to fundamental defects in the mechanism itself.<sup>16</sup> Particularly relevant to this Article is the agency theory critique, which views corporate fraud as the product of managerial agency costs.<sup>17</sup>

The modern agency critique holds that fraud on the market “is a product of agency costs between owners and managers.”<sup>18</sup> It presumes that, typically, shareholders do not manage the firm. Instead, they elect directors, who in turn appoint officers to manage the firm on their behalf. Anything that the firm does, such as misreporting, is done in actuality by the firm’s directors, managers, or other employees—not the shareholders. As to why managers would choose to intentionally misreport, agency theorists hypothesize that doing so maximizes the value of the managers’ compensation contracts in some way. According to Professor Coffee, “managers hide bad news because they fear loss of their jobs (either from a dismissal or a hostile takeover), and they overstate favorable developments or inflate earnings in order to maximize the value of their stock options and other equity compensation.”<sup>19</sup>

At the same time (though it does not necessarily follow from the manager’s incentives), the agency view holds that the firm’s shareholders do not themselves want the firm to commit fraud. In the words of Professors Arlen and Carney, “corporate agents commit Fraud on the Market in order to serve their own interests.”<sup>20</sup> They continue, “[w]e do not believe that shareholders want agents to commit

---

16. There is also a significant empirical body of work on whether the U.S. system of securities regulation is effective. These empirical projects, apart from limited instances of natural experiments, have typically lacked any clean identification strategy, and have failed to resolve any of the fundamental “welfarist” questions pertaining to U.S. securities law. In private securities litigation in particular, it is potentially impossible for observational studies to gauge the effect of deterrence. See James D. Cox & Randall S. Thomas, *Mapping the American Shareholder Litigation Experience: A Survey of Empirical Studies of the Enforcement of the U.S. Securities Law*, 6 EUR. COMPANY & FIN. L. REV. 164, 183 (2009) (surveying empirical work on securities litigation and noting that “[j]ust how much additional protection is embraced out of fear of the securities class action is at best speculative and indeterminate and, hence, beyond the empiricists’ reach”).

17. In a separate article, the author addresses two other important theoretical critiques: circularity and diversification. See James Cameron Spindler, *We Have a Consensus on Fraud on the Market—And It’s Wrong*, 7 HARV. BUS. L. REV. 67 (2017). The circularity critique holds that private securities litigation fails as a compensatory mechanism for defrauded purchasers because these purchasers stand on both sides of the class action claim. See *id.* at 92. In particular, defrauded purchasers stand to receive a recovery, but also (at least in part) fund that recovery, because they are also now owners of the firm that they are suing. See *id.* at 70.

The diversification critique does not attack private securities litigation directly, but rather argues that there is no point to attempting to deter or compensate securities fraud in the first place: shareholders “are as likely to gain from fraud as they are likely to lose from it,” such that expected losses from fraud are zero. *Id.* at 69. And where shareholders are diversified, actual fraud losses go to zero because of the law of large numbers. Or so goes the critique. See *id.* at 70. Both critiques are, however, incorrect. See *id.* at 95–96, 103–05 (finding that private securities litigation compensates plaintiffs, in opposition to the circularity critique, and that precaution costs are a deadweight loss to society that cannot be diversified away, in opposition to the diversification critique).

18. Jennifer H. Arlen & William J. Carney, *Vicarious Liability for Fraud on Securities Markets: Theory and Evidence*, 1992 U. ILL. L. REV. 691, 694. This piece by Professors Arlen and Carney is the seminal work in the area.

19. John C. Coffee, Jr., *Reforming the Securities Class Action: An Essay on Deterrence and Its Implementation*, 106 COLUM. L. REV. 1534, 1562–63 (2006).

20. Arlen & Carney, *supra* note 18, at 701.

fraud.”<sup>21</sup> Coffee likens the firm’s shareholders, in the aftermath of fraud, to “the victims of burglary” who are punished by the fraud on the market remedy “for their failure to take greater precautions.”<sup>22</sup>

In this vein, critics assert that private securities litigation against the firm must fail as a deterrent mechanism. Professor Grundfest, for instance, opines that private securities litigation creates only “wealth transfer[s] among . . . equally innocent and ignorant investors” and has “nothing to do with . . . optimal deterrence.”<sup>23</sup> An open letter from several prominent securities law professors to the SEC argued that “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.”<sup>24</sup> And the Committee on Capital Markets Regulation (also known as the Paulson Committee) concluded that “the potential deterrent function of private securities litigation is debatable because virtually all the costs . . . are ultimately borne by the shareholders.”<sup>25</sup> In the Committee’s estimation, it is a rare case where the costs fall upon the corporation’s employees.<sup>26</sup> This lack of deterrent effect appears to be accepted by a consensus of current academics.<sup>27</sup> The alternatives proposed by these commentators typically include some kind of enhanced personal liability for company executives and reduced liability for the company itself, as well as a shift away from private securities litigation to public enforcement by the SEC and federal prosecutors.<sup>28</sup>

There are, of course, a few questions about the agency theory of corporate fraud. Is it true that shareholders themselves get nothing out of misreporting if

21. *Id.*

22. Coffee, *supra* note 19, at 1562.

23. Joseph A. Grundfest, *Damages and Reliance Under Section 10(b) of the Exchange Act*, 69 BUS. LAW. 307, 313 (2014).

24. Letter from Donald C. Langevoort, Professor of Law, Georgetown Univ. Law Ctr., on behalf of five other law professors, to Christopher Cox, Chairman, Sec. & Exch. Comm’n (Aug. 2, 2007), <https://www.law.du.edu/images/uploads/corporate-governance/sec-governance-langevoort.pdf>.

25. COMM. ON CAPITAL MKTS. REGULATION, *supra* note 10, at 78.

26. *Id.*

27. See William W. Bratton & Michael L. Wachter, *The Political Economy of Fraud on the Market*, 160 U. PA. L. REV. 69, 74 (2011).

28. There are many proposals based on such critiques. See, e.g., Grundfest, *supra* note 23, at 386 (eliminating the private right of action); Howell E. Jackson & Mark J. Roe, *Public and Private Enforcement of Securities Laws: Resource-Based Evidence*, 93 J. FIN. ECON. 207, 208–09 (2009) (enhancing public enforcement); Donald C. Langevoort, *On Leaving Corporate Executives “Naked, Homeless and Without Wheels”: Corporate Fraud, Equitable Remedies, and the Debate Over Entity Versus Individual Liability*, 42 WAKE FOREST L. REV. 627, 630 (2007) (enhancing fines and jail for managers); Donald C. Langevoort, *Capping Damages for Open-Market Securities Fraud*, 38 ARIZ. L. REV. 639 (1996) (capping damages in certain private securities litigation); A.C. Pritchard, *Markets As Monitors: A Proposal to Replace Class Actions with Exchanges As Securities Fraud Enforcers*, 85 VA. L. REV. 925, 930 (1999) (devolving enforcement to the stock exchanges); Amanda M. Rose, *Better Bounty Hunting: How the SEC’s New Whistleblower Program Changes the Securities Fraud Class Action Debate*, 108 NW. U. L. REV. 1235, 1237 (2014) (enhancing whistleblower protections and rewards); Urska Velikonja, *The Cost of Securities Fraud*, 54 WM. & MARY L. REV. 1887, 1951–56 (2013) (implementing antifraud schemes designed to protect stakeholders other than shareholders).

that misreporting inflates the apparent value of their shares?<sup>29</sup> If not, why would shareholders (or their director designees) award compensation that encourages fraud? Even in the case that shareholders do not desire fraud, would firm-level liability actually lack deterrent effect?<sup>30</sup> Such questions have gone unasked in the legal academy. In what follows, this Article takes up the following question: Can shareholders benefit from fraud, and, if so, how can legal liability deter the fraud?

## II. SHAREHOLDER INCENTIVES FOR FRAUD

It has been little-appreciated that a firm's current shareholders should, in the absence of meaningful penalties, desire price inflation of the firm's shares. Typically, misreporting is blamed on disloyal managers and failures of corporate governance. In other words, fraud is the product of agency costs.<sup>31</sup>

However, it is entirely reasonable to suppose that the owner of an asset typically benefits from inflated prices. Consider, by way of analogy, the owner of an antique on which an appraisal is to be performed. The owner may benefit from an apparent increase in value—whether based on true or false information—because he may, at some point, sell the antique, and he will never be the buyer (at least not on net). Of course, it may be that a potential sale falls through and the owner does not sell the object, or perhaps the owner has no current plans to sell. But the point remains that if the owner has some chance of selling in the future and the appraisal affects the price he will receive, then he has some incentive to seek a higher appraisal value, whether by honest or dishonest means (assuming that there are no penalties for dishonesty).

The same principle applies to shareholders of a publicly traded firm. There may be uncertainty whether or when any particular shareholder will sell. Yet it must be true that the shareholders, as a group, will be net sellers of the firm; they own all of it, and anyone else's purchase must come from them. This obtains whether the firm is doing the selling and issuing more shares (known as a primary sale), or if the shareholders are selling their shares directly (secondary sales). It obtains even if there exist differences among the shareholders, with some more likely to sell than others (though how the differences are worked out may have important implications for what the firm may do). Ultimately, the shareholders stand in the position of sellers and have the incentives that sellers do—namely, to seek a higher price.

This section develops that intuition. First, it is shown that homogeneous shareholders—a case that, intuitively, may seem least likely to result in fraud because it exemplifies the paradigm of dispersed, powerless investors—have an

---

29. Professors Arlen and Carney anticipate such a question. See Arlen & Carney, *supra* note 18, at 701.

30. Another piece by this author examines a framework in which managers desire fraud (due to short time horizons) whereas shareholders do not and finds that vicarious liability results in at least second-best optimal deterrence. James Cameron Spindler, *Vicarious Liability for Managerial Myopia*, 46 J. LEGAL STUD. 161 (2017).

31. See Arlen & Carney, *supra* note 18, at 701, for an influential early claim along such lines.

unequivocal incentive to commit fraud. This incentive exists in both primary and secondary sales of securities. Second, heterogeneous shareholders are considered, and it is demonstrated that price inflation is joint-welfare maximizing among them; the ability to negotiate among shareholders implies that everyone can be made better off through price inflation.

#### A. SHAREHOLDERS HAVE A PREFERENCE FOR FRAUD

This section develops a simple economic model of a shareholder-owned firm and demonstrates the basic result that the firm's initial shareholders should ordinarily prefer price-inflating misreporting. In the model, the term "initial shareholders" means the shareholders who hold the shares at the beginning of the game.

There are four periods of play:  $t = 1, 2, 3, 4$ . The firm has one share outstanding, an equal fraction of which is owned by a measure 1 of initial shareholders. Because of their ability to diversify, all players are risk-neutral.<sup>32</sup>

In period 1, a signal (letting  $\eta'$  denote the signal) of the firm's "type" (denoted as  $\eta$ ) is publicly observed. Type is either high or low quality and determines the level of cash flows that the firm will ultimately generate. For concreteness, let high- and low-type cash flows be \$1 and \$0 per share, respectively.<sup>33</sup> The probability of the firm being of high type is common knowledge and publicly known,<sup>34</sup> and denoted as  $h$ ,  $0 < h < 1$ .<sup>35</sup>

In period 2, trading occurs. It is assumed that each shareholder has an identical and independent probability of selling her share in period 2, letting  $\pi$  denote the probability of selling. This assumption of homogeneity is later relaxed and does not affect the results.<sup>36</sup> The shares are purchased at price  $p_2$  by outside investors, called purchasers.<sup>37</sup> The price  $p_2$  is some function of the signal of quality. For example, if the market believes the signal to be credible, then  $p_2(\eta' = 1) = 1$ .

In period 3, the firm realizes cash flows corresponding to the type  $\eta$ . These cash flows are publicly observable and verifiable, and they indicate with certainty whether the period 1 signal was correct. A high-type firm generates cash flows of \$1, and a low-type firm generates cash flows of \$0. Further trading may take place, generating a market price  $p_3$ .

32. The assumption of risk-neutrality is justified among diversified shareholders, who hold a relatively small proportion of their wealth in each individual security.

33. One could also allow the firm to possess an asset or project of observable value  $A$ , such that even a low-type firm has some value such that its shares are worth trading. For clarity and simplicity, the author omits this consideration.

34. The common knowledge of the probability of high type reflects the market's expectations of a firm's future cash flows, which determines the trading price prior to the realization of the uncertain event (namely, whether the firm's cash flows will be high or low).

35. Nothing would change if there were multiple firms, each of which had an independent probability  $h$  of being of high type.

36. See *infra* Section II.B.

37. Subsequently, in Part III, potential purchasers are decomposed into informed traders and noise traders. Such a distinction does not affect the instant analysis of shareholder incentives.

In period 4, the firm's cash flows are distributed to the then-current holders of the firm's shares pro rata.

We can now demonstrate that the firm's shareholders always desire a higher report of value, as stated by the following proposition.

**Proposition (1)—Shareholders Desire Fraud:** The set of the firm's current shareholders (the "initial" shareholders) jointly desire inflationary misreporting. An informal proof follows.

By assumption, proportion  $\pi$  of the initial shareholders will sell their shares in period 2, but proportion  $1 - \pi$  will not. This means that every shareholder expects to be a net seller, because each shareholder has some positive probability of selling and some positive probability of holding. Those who sell receive the market price based on the signal of quality,  $p_2(\eta')$ . Those who do not sell will receive the firm's cash flows as ultimately realized, which depend upon the firm's type but not the signal. Thus, at period 1, each shareholder's expected payoff ( $U_1$ ) is:

$$(1) \quad U_1 = \pi p_2(\eta') + (1 - \pi)E[\eta]$$

The first term on the right-hand side of the equation is the expected payoff attributable to the likelihood of selling. The second term is the expected payoff attributable to the likelihood of retaining the share.

We can now pose the fundamental question: Would the initial shareholders be made better off with a high report of value, even if the firm is of low type? The answer is yes, they would. A higher signal of value can raise trading prices in period 2—and never lower them—while having no effect on the non-selling shareholders.

Assume first that the market views the signal credibly. In such a case, a signal of low type ( $\eta' = 0$ ) results in a low price ( $p_2 = 0$ ), whereas a high signal ( $\eta' = 1$ ) results in a high price ( $p_2 = 1$ ). The signal has no other effect on the initial shareholders' expected payoffs. Consequently, where the signal is credible, shareholders prefer a high report, even if the firm is of low quality.

Alternatively, suppose that the signal of high type is viewed as noncredible. Assume also that a low signal is taken as perfectly revealing of low type, so that  $p_2(\eta' = 0) = 0$ .<sup>38</sup> In such a case, a low signal results in a low price ( $p_2 = 0$ ). In contrast, a high signal carries no informational value and does not affect the market's forecast of the firm's value ( $p_2 = E[\eta]$ ). As before, the signal does not affect the payoffs when the shareholder does not sell, and the inflated signal payoff strictly is higher.

As a result, the initial shareholders do better from the higher reports in each case, whether those higher reports are true or false. What drives this result is that

---

38. If this were not the case, then the signal recipients simply could be, at a first cut, indifferent to the choice of signal, or could interpret a low signal as high, and vice-versa. It is a common convention to define off-the-equilibrium path behavior in signaling models like this to avoid indeterminate or unintuitive equilibria. In this case, interpreting a low signal as indicating low quality comports with the intuition that asset sellers typically do not artificially suppress the apparent value of the asset.

the firm's initial shareholders are net sellers in expectation—which must, as a matter of mathematics, be true.

This is a fundamental incentive of shareholders. The model is (as yet) agnostic as to how the reports of quality originate, but the point is that these incentives should persist in general, whatever the reporting mechanism. So one could imagine that the reports issue forth from the heavens, in which case shareholders might pray for higher reports. Or, more likely, the reports may come from a manager. In such a case, shareholders would certainly hope and may even encourage the manager to inflate her reporting. The reporting mechanism is taken up in Part III below.

Before getting to that, section II.B relaxes the assumption of homogeneous seller shareholders and shows that these inflationary incentives generalize.

#### B. GENERALIZING SHAREHOLDER PREFERENCES

The result that the firm's current shareholders prefer inflationary misreporting can be extended to additional important cases. These incentives persist even where shareholders are heterogeneous with regard to their time horizon: only some may sell in the future, whereas others may buy. Joint-welfare maximization leads to the same result as in the homogeneous shareholder case. Additionally, secondary trading presents no fundamental difference from primary sales of securities.

##### 1. Heterogeneous Initial Shareholders

Investors in the real world are not homogeneous and may hold substantially different time horizons. There exist both long-term investors, who buy and hold with a relatively low expectation of selling in the near future, and short-term investors, who move fluidly in and out of securities positions. Some investors may even expect to add to their long positions over time.

In such a world, predicting what the firm will do depends on knowing which set of shareholders, if any, exerts control over the firm. However, if shareholders have the ability to agree among themselves on a course of action—that is, if they can act collectively to maximize their own joint welfare—then there is, in fact, a clear result as to their collective preferences and a corresponding prediction as to the firm behavior they prefer. Heterogeneous shareholders jointly prefer fraud, and if the firm's governance is responsive to shareholder preferences,<sup>39</sup> we should expect firms to behave accordingly.

Consider the case where there are three shareholders: a short-term holder ( $U_S$ ), who expects to sell; a long-term holder ( $U_H$ ), who will never sell; and a buyer-shareholder ( $U_B$ ), who expects to be a net purchaser in the future. Their payoff functions are, respectively,

---

39. The assumption that firms act according to shareholder preferences is not trivial. Much of corporate law is taken up with cases where management appears to act disloyally, and with proposals to make management better hew to shareholders' interests. One thing the model here shows, among other things, is that such proposals (even if effective) are not necessarily beneficial.

$$(2) \quad U_S = \pi p_2(\eta') + (1 - \pi)E[\eta]$$

$$(3) \quad U_H = E[\eta]$$

$$(4) \quad U_B = E[\eta] + \gamma(E[\eta] - p_2(\eta'))$$

The variable  $\gamma$  in the buyer-shareholder's payoff function is the likelihood that the buyer-shareholder will purchase an additional share in the future. So long as outside purchasers are expected to purchase some shares of the firm, it must be the case that  $\gamma < \pi$ . Summing up these utilities, we obtain the joint-welfare function of the firm's initial shareholders:

$$(5) \quad \sum U_i = (\pi - \gamma)p_2(\eta') + (3 + \gamma - \pi)E[\eta]$$

Inspecting the first term on the right-hand side of [equation \(5\)](#), it is apparent that the shareholders' joint welfare is a positive function of the period 2 trading price ( $p_2(\eta')$ ), which itself is a positive function of the signal of quality. A high signal results in higher joint welfare. This joint-welfare result implies that, if shareholders can bargain among themselves and so reach a joint-welfare-maximizing form of corporate governance, then they will do so in a way that encourages price-inflating fraud.

Thus, in the presence of joint-welfare maximization among the initial shareholders, the game is essentially unchanged from the homogeneous shareholder case. One could rewrite [equation \(5\)](#) as:

$$(6) \quad \sum U_i/3 = \pi_z p_2(\eta') + (1 - \pi_z)E[\eta], \text{ where } \pi_z = (\pi - \gamma)/3$$

That is, the aggregate joint-welfare function of heterogeneous shareholders is of the exactly the same form as in the homogeneous shareholders' case.<sup>40</sup> The game is the same whether the initial shareholders are homogeneous or heterogeneous, and a game with heterogeneous shareholders may be rewritten as a game with a single representative shareholder.

Notably, the fraud incentive result is highly general: the current set of shareholders always jointly desires fraud. This suggests a problem: so long as the firm's corporate governance allows the current shareholders to maximize their joint self-interest (which is a plausible definition of functional corporate governance), then these incentives may lead to fraud.<sup>41</sup> This intuition is taken up in Part III, which shows that fraud is the predictable equilibrium behavior.

40. Recall from [equation \(1\)](#) that the homogeneous case is given by  $U_i = \pi p_2(\eta') + (1 - \pi)E[\eta]$ .

41. This intuition leads to the question of whether we should favor one group of shareholders over another, such as long-term shareholders. To some extent, such favoritism is reflected in recent attempts at reform, such as Dodd-Frank, which privilege long-term performance-based compensation for corporate executives. *See, e.g.*, Listing Standards for Recovery of Erroneously Awarded Compensation,

## 2. Primary Sales

As it turns out, initial shareholder incentives are unchanged whether it is shareholders or the firm itself that is selling shares. Where the firm sells shares, the proceeds that it receives from the purchasers accrue to the benefit of the initial shareholders: those proceeds can either be distributed or used to fund additional projects (whose proceeds will ultimately be distributed). The initial shareholders do better when the proceeds are higher, the fraction of the firm sold is lower, or both. The converse of shareholder dilution occurs when primary sales at too low a price dilute incumbent shareholders' interest in the firm.

More formally, consider a model similar to the one above. In period 1, there is a signal of the firm's quality. In period 2, the firm sells a variable fraction  $f$  of the firm to a set of purchasers in return for a fixed payment of  $K$ . In period 3, cash flows are realized, and in period 4 the firm distributes cash flows pro rata to all of its owners.

In period 4, the initial shareholder will receive the  $1 - f$  share of the firm's cash flows  $\eta$  and other assets (cash of  $K$ ). The initial shareholders' payoffs are then:

$$(7) \quad U_1 = (1 - f)(E[\eta] + K)$$

For the purchasers to break even in expectation, the price that they pay must satisfy the condition that the implicit price of the firm equals the expected value conditional on the report:  $K / f = E[\eta | \eta']$ . Substituting  $K = f * E[\eta | \eta']$  into the payoff function, we obtain:

$$(8) \quad U_1 = (1 - f)(E[\eta] + f * E[\eta | \eta'])$$

If a low report is taken as a revelation of low quality,<sup>42</sup> and a high report is either taken as true or disregarded, then it must be that the firm's implicit price is greater for a high report than for a low one ( $E[\eta | 1'] > E[\eta | 0']$ ). Repeating the same analysis in the secondary sale case above, one can again conclude that the initial shareholders prefer the high signal under either separation (truth-telling) or pooling (fraud). Thus, fraudulent inflation of the signal is desirable overall from the initial shareholders' perspective given either the separating or pooling equilibrium. What holds true in the secondary sale case holds true in the primary sale case as well. Indeed, one can note that [equation \(8\)](#) is a positive linear combination of the firm's expected cash flows ( $E[\eta]$ ) and the price of the firm as a

---

Securities Act Release No. 9861, Exchange Act Release No. 75,342, Investment Company Act Release No. 31,702, 80 Fed. Reg. 41,144 (proposed July 14, 2015) (SEC's proposed "clawback" rule, implementing section 954 of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010). However, as Professor Fried has shown, favoring long-term shareholders can lead to inefficient outcomes, where long-term shareholders destroy value to expropriate short-term shareholders. *See generally* Jesse M. Fried, *The Uneasy Case for Favoring Long-Term Shareholders*, 124 *YALE L.J.* 1554 (2015). Indeed, one could demonstrate a general result that favoring and granting control to a one shareholder constituency leads to inefficiencies where that constituency can expropriate the others in a costly fashion. Such inefficiencies disappear (by construction) when shareholders can contract to a joint-welfare-maximizing outcome, but this leaves the fraud-incentive result, as above.

42. *See supra* text accompanying note 38.

function of the report ( $E[\eta|\eta']$ )—which is the same form as in the secondary sale case, in [equation \(1\)](#).

### III. A MODEL OF EQUILIBRIUM FRAUD BEHAVIOR

The preceding discussion focused solely on shareholder incentives. It did not consider whether shareholders' preference for fraud translates into actual misreporting of outcomes, or under what conditions such outcomes may occur. This requires some consideration of the governance structure within the firm, as well as the strategic behavior of actors within the firm and the marketplace. This Part shows that in a signaling game where the firm is managed by a shareholder representative, the equilibrium result is fraud.

One necessary assumption of this model is that the shareholders, the firm, or both do not credibly commit *not* to undertake fraud.<sup>43</sup> After all, behind the veil of ignorance, shareholders may well be better off in a world in which fraud does not occur. Is it plausible to assume that shareholders or their manager–designees are unable to or, in any event, do not provide such a commitment?<sup>44</sup> To address this question, section III.A presents a thumbnail sketch of modern corporate governance, and discusses two characteristics that make the lack of such commitment at least plausible, if not likely. First, shareholders and their director–designees retain significant discretion to punish or reward management *ex post*. Second, the law itself maintains some bias in favor of current shareholders that arguably makes maximization of current shareholder payoffs the norm.

Section III.B then presents a model of a firm managed by a shareholder representative (the “representative shareholder–manager” or “manager”). Section III.C solves the model and shows that fraud is the unique equilibrium outcome in pure strategies.

#### A. CURRENT SHAREHOLDERS AND CORPORATE GOVERNANCE

Suppose that a corporation is run by a robot. Further, suppose that the shareholders can program that robot for every possible eventuality and then make public the code. In such a world, it would be possible to perfectly commit the firm, *ex ante*, to act in any desired fashion in any possible eventuality. This would, of

43. It is almost a tautology to say that if one credibly commits not to undertake an act, then the resulting equilibrium does not comprise that act. In the signaling model developed below, the representative shareholder–manager (who does not have the ability to publicly and credibly pre-commit) cannot choose the equilibrium but can only choose a best response within the equilibrium that is sustained by the actions of all the players. Although the shareholders (as well as the other game participants) may be jointly better off in a hypothetical non-fraud equilibrium, the point of collective action models, such as the Prisoners' Dilemma, is that such a desirable outcome may not be sustainable as an equilibrium.

44. Some prior work finds that even where such a commitment is possible, shareholders would not make it due to a joint-production problem. For example, stock compensation encourages both productive effort and fraud, such that even shareholders who do not desire fraud would still tolerate it to achieve higher production. See Eitan Goldman & Steve L. Slezak, *An Equilibrium Model of Incentive Contracts in the Presence of Information Manipulation*, 80 J. FIN. ECON. 603, 621–22 (2006); Spindler, *supra* note 30, at 165.

course, include actions such as engaging in, or abstaining from, inflationary misreporting. The market could have total confidence that a firm would never misreport, even if it were *ex post* optimal for the firm, provided that the manager-robot's code proscribed such action.

As yet, unfortunately, this is not the state of corporate governance. Humans—without observable operating algorithms—run business firms. In particular, in the paradigmatic large corporation held by dispersed shareholders, shareholders govern the firm by electing or replacing directors at set intervals of one or more years. The directors, in turn, appoint the firm's top executives and determine compensation for the executives and themselves. This compensation typically includes equity-based compensation with a mix of both long- and short-term incentives. The compensation plans may be detailed and set certain fixed targets (such as achieving a specified level of stock price for equity incentives to vest), but they virtually always contain some degree of discretion on the part of the board to adjust compensation and to fire, replace, or promote managers.<sup>45</sup> The shareholders themselves retain discretion over renewing or replacing incumbent directors.

The incentives of the firm's directors and executives also include fiduciary duties, under which they are obligated to act in the firm's best interests. Although Delaware caselaw treats the firm as the beneficiary of the management's fiduciary duties,<sup>46</sup> benefits to the firm are often regarded interchangeably with benefits to the firm's shareholders. Excepting insolvency, shareholders are the residual claimants of the firm<sup>47</sup> and thus, according to law and economics orthodoxy, have the proper incentives to maximize value. Typically, a firm's manager may undertake risk-increasing activities, even at some loss of overall enterprise value, because the enhanced risk accrues to the benefit of the firm's equity holders. Creditors, who are expropriated by such an action, typically are limited to their contractual rights. In the context of a sale of the firm, the firm's management has the responsibility to seek the highest price, notwithstanding the expense to purchasers-cum-future shareholders. If management believes that bidder *A*, who offers a higher purchase price, has a worse long-term plan than bidder *B*, who offers a lower purchase price, prominent caselaw indicates that management is obligated to go with bidder *A*.<sup>48</sup> Recent reports on activist investors suggest an enhanced focus on short-term results, seen as legally unobjectionable. In contrast, the converse—entrenching management so that they are immune to such shareholder pressures—receives more scrutiny. That said, distinctions in the law between long- and short-term interests are muddled, and one can point to other

---

45. For instance, Apple's executive compensation disclosures show a mix of long- and short-term compensation, as well as significant discretion afforded to the board of directors to award bonuses and to renew or renegotiate compensation. Apple Inc., Proxy Statement 24–42 (Schedule 14A) (Dec. 28, 2015), <https://www.sec.gov/Archives/edgar/data/320193/000119312516422528/d79474ddef14a.htm> [<https://perma.cc/BS3N-4FG6>].

46. See, e.g., *N. Am. Catholic Educ. Programming Found., Inc. v. Gheewalla*, 930 A.2d 92, 101 (Del. 2007).

47. See *id.*

48. See, e.g., *Revlon, Inc. v. MacAndrews & Forbes Holdings, Inc.*, 506 A.2d 173, 184 (Del. 1986).

cases and contexts in which management is allowed to ignore short-term stock price where management favors long-term plans or, more recently, where management believes that short-term prices are incorrect.<sup>49</sup>

What modeling assumptions can be drawn from this sketch of corporate governance? First, the ability to pre-commit to a particular governance strategy is limited. Executives are not pre-programmed robots, and executive compensation contracts (themselves not transparent) are not complete algorithms. Directors and shareholders retain discretion to reward and punish. In addition, the incentives of executives and directors are similar to those of shareholders: because of their performance-based compensation, executives and directors are effectively shareholders, though, given their position, shareholders of a different stripe. There is no reason to believe that they could not or would not engage in the sort of joint-welfare-maximization exercise among heterogeneous shareholders discussed Part II. Finally, the common law's fiduciary duties arguably impose a bias toward the firm's current shareholders as well.<sup>50</sup> For these reasons, the manager of a firm may have incentives that are roughly aligned with those of the aggregate body of shareholders, as described in [equation \(5\)](#) in section II.B. Further, the manager may engage in joint-welfare maximization with those shareholders. This assumption will follow in the model below.

#### B. A MODEL OF A REPRESENTATIVE-SHAREHOLDER-MANAGED FIRM

The model builds on that presented in section II.A, with the addition of a reporting mechanism and a marketplace of potential purchasers. The firm is managed by a shareholder representative, who is assumed to perfectly represent the shareholders in aggregate. In period 1, the manager privately observes the firm's type ( $\eta$ ), which, as before, may be high or low. The manager then makes a report of the firm's type ( $\eta'$ ). The manager chooses the report to maximize his own wellbeing, which, as a representative shareholder, maximizes the wellbeing of the shareholders in aggregate.

In period 2, trading occurs. A portion ( $\pi$ ) of the initial shareholders experience an exogenous liquidity event,<sup>51</sup> such that they face cost  $C_i$  if they fail to fully liquidate their shares.<sup>52</sup> There are two purchasers:<sup>53</sup> a noise

49. See, e.g., *Air Prods. & Chems., Inc. v. Airgas, Inc.*, 16 A.3d 48, 56 (Del. Ch. 2011).

50. Corporate fiduciary law does impose a duty not to engage in illegal acts. An agent who violates the law may be liable to the corporation for any damages imposed. This applies to fraud. However, agent liability is premised on the condition that the firm itself suffers damages, as it would under a system of antifraud liability.

51. An exogenous liquidity event is a need for cash that requires the liquidation of assets. This event is not otherwise related to the model. Examples include college funds and unexpected hospital bills.

52. The requirement of full liquidation to avoid liquidity costs eliminates the possibility that markets would partially clear by a non-discounted sale to only informed investors. This outcome does not affect the model dynamic that risk of fraud leads to liquidity costs. However, it does complicate the analysis.

53. The model assumes only one informed trader to prevent the more complicated dynamic of informed traders competing against each other. This assumption does not affect the overall results

trader<sup>54</sup> and an informed trader, each of whom can purchase up to measure ( $\pi$ ) of stock. Because demand can potentially exceed supply, rationing occurs if both purchasers elect to purchase. In particular, bids are randomly filled until either the bids or the allotment are exhausted. The price is assumed to be set automatically as the highest price at which the market will clear, subject to the selling shareholders' willingness to sell and the purchasers' willingness to purchase.

Both purchasers are rational and can observe the manager's report, but they do not observe the firm's type. The informed trader can privately expend cost  $C_r$  to perform research on the firm's value. This effort represents research into the firm's actual value. If the informed trader researches, he observes the firm's type ( $\eta$ ). The informed trader can then choose to bid at the market price or abstain from purchasing. The noise trader receives no information apart from the manager's signal, and simply chooses to bid at the market price or to abstain from trading based on his break-even constraint.

In period 3, cashflows are publicly realized, and therefore, there is no longer any asymmetric information about the firm. More trading may take place at market price  $p_3$ .

In period 4, the firm's cashflows are distributed pro rata to the firm's then-current shareholders—to the initial shareholders who did not sell and to the purchasers who purchased. Cashflows are equal to  $\eta$ , which may be either 1 or 0.

### C. THE MODEL SOLUTION: FRAUD IN EQUILIBRIUM

In this section, the model is solved by backward induction, showing that the subgame-perfect equilibrium outcome is the firm engaging in fraud and purchasers undertaking deadweight precaution costs.<sup>55</sup> The solution to the model is summarized by Proposition (2).

**Proposition (2)—Fraud in Equilibrium:** Absent some antifraud penalty, the unique equilibrium-reporting behavior is to always report high type, whether it is true or false.

The proof of Proposition (2) comprises the rest of this section. Intuitively, the equilibrium outcome of fraud occurs because the *ex post* payoffs to the initial shareholders are always higher when the manager lies about low-firm type. At worst, the firm's report of high type is viewed as uninformative—there is, by assumption, no liability for fraud—and the market prices the firm at its unconditional expected value minus a discount to protect the uninformed traders. In

---

because there would still be wasteful precaution costs undertaken in equilibrium, along with an illiquidity discount to ensure that the market clears.

54. Noise traders are traders who are unable to gain any information about the firm apart from the disclosed signal of firm type. Unlike informed traders, noise traders are unable to undertake research to better discern the firm's value.

55. Deadweight precaution costs are wasteful expenditures or activities that do not have social value. For the informed trader, this consists of spending time and money on research. For the noise trader, it is abstaining from the trading market. Although research may have some social value if it renders stock prices more efficient (such value is commonly thought to include more efficient capital allocation), in this model such research is wasteful because price efficiency could be obtained through equilibrium truthful disclosure by the firm.

effect, the outcome is the same as if there was no report in the first place. At best, the market believes the high report and pays a high price which unambiguously benefits the initial shareholders. In contrast, a report of low type is taken as credible and results in a low price. From the perspective of maximizing initial shareholder payoffs, this reporting practice is undesirable.

### 1. The Purchasers' and Sellers' Trading Decisions

In period 2, the purchasers must decide whether to purchase the offered shares. In addition, the informed potential purchaser—an informed trader—must decide whether to invest in research, which, despite costing  $C_r$ , allows the informed potential purchaser to observe the firm's type.

The purchasers' participation constraints (that is, its break-even conditions) require that either the informed trader or the noise trader is willing to purchase the entire allotment of shares. If the informed trader does not elect to research the firm's type, then the informed trader is effectively identical to the noise trader. They will both bid at the market price and in expectation will obtain half the payoff of the allotment. This is given by the following:

$$(9) \quad U_n = 1/2E[\eta|\eta'] - 1/2p_2(\eta') \geq 0$$

If the informed trader performs research, she will purchase the share only when the firm's type is high ( $\eta = 1$ ). In such a case, the allotment  $\pi$  of shares is purchased by either the informed or noise trader, with each taking half the shares in expectation.<sup>56</sup> If the firm's type is low ( $\eta = 0$ ), the informed trader who researches will abstain from purchasing, and the entire allotment goes to the uninformed trader.<sup>57</sup> The informed trader will research in equilibrium if the expected payoff from doing so is greater than the expected payoff from trading as a noise trader.<sup>58</sup> Formally:<sup>59</sup>

$$(10) \quad U_r = 1/2Pr(1|1')(1 - p_2(1')) + 1/2Pr(0|1')(0) - C_r > U_n$$

Because the noise trader expects to be rationed in expectation if the firm is of high type and to purchase the whole allotment where the firm is of low type, the noise trader's payoff in an equilibrium where the informed trader researches is lower. Specifically, letting  $U_{nr}$  denote the expected payoff to the noise trader where the informed trader is expected to research, we have:

56. Following Kevin Rock's model of the "winner's curse" in securities offerings, bids are randomly filled until either the bids or the allotment are exhausted. This means that, given the parameters of this model, the uninformed trader's bid is, in expectation, only half-filled when shares are underpriced and completely filled when shares are overpriced. See generally Kevin Rock, *Why New Issues Are Underpriced*, 15 J. FIN. ECON. 187 (1986).

57. See *id.* at 198.

58. If research is expensive relative to the gains from having superior information, the informed trader may rationally decide to forego research, save her money, and play the game like an uninformed noise trader.

59. To make the notation less cumbersome, I will henceforth write  $Pr(\eta = 1|\eta' = 1)$  as  $Pr(1|1')$ , and so on.

$$(11) \quad U_{nr} = \frac{1}{2}Pr(1|1')(1 - p_2(1)) + Pr(0|1')(0 - p_2(1))$$

For the market to clear, the noise trader must be willing to enter a bid for the entire allotment of shares being sold. Setting [equation \(11\)](#) to be greater than or equal to zero provides the requisite pricing discount for markets to clear:

$$(12) \quad p_2(1) \leq Pr(1|1') / (Pr(1|1') + 2Pr(0|1'))$$

A final market clearing condition is that the initial shareholders with liquidity events are willing to sell at the discounted market price. This requires that the illiquidity cost be greater than or equal to the illiquidity discount:

$$(13) \quad C_i \geq E[\eta] - p_2(1)$$

Thus, [equations \(12\)](#) and [\(13\)](#) determine the price (if any) at which the shares will be transacted in period 2 when informed traders are expected to perform research in equilibrium.

A couple of preliminary observations and assumptions are in order. First, unless [equation \(10\)](#) holds—meaning that the informed trader is willing to undertake research—there is no cost in the model arising from a misreporting equilibrium. If [equation \(10\)](#) is not satisfied, undertaking research—a dead-weight cost—is not cost-effective for informed traders, and there is then no information asymmetry among market participants. Conversely, if [equation \(10\)](#) is satisfied, then one of two things happens: the initial shareholders offer the shares at a discount and the informed traders undertake dead-weight research costs, or the initial shareholders are unwilling to offer the shares at the requisite discount and instead endure illiquidity costs. In the analysis that follows, it is assumed that [equations \(10\)](#) and [\(13\)](#) are both satisfied such that research is a credible threat and initial shareholders are willing to sell at the market-clearing discount determined by [equation \(12\)](#).

## 2. The Manager's Reporting Decision

In period 1, the manager learns the firm's type. The manager then makes a report of the firm's type to the market. To solve for the manager's optimal response, one must consider the manager's choice under each possible state of the world—high and low type. One must also consider whether the manager's signal is taken as credible or noncredible; said another way, whether the equilibrium is one of separation (truth-telling) or pooling (lying).

### *a. High-Type Firms*

Consider the manager's disclosure decision if the firm's type is high ( $\eta = 1$ ). In an equilibrium where the market believes the manager's report, the representative-shareholder's payoffs are maximized with a report of high type ( $\eta' = 1$ ). This enables the selling shareholders to receive a high price. If the manager were to disclose low type, selling shareholders would receive the low price of  $p_2 = 0$ .

Thus, the payoffs to the selling shareholders are strictly lower with a low report. The payoffs to the non-selling shareholders are unaffected by the manager's disclosure.

In an equilibrium where the market does not believe the manager's report, the manager's report of high type will not be believed even if it is true. Thus, the report of high type will result in the discounted price of [equation \(12\)](#).<sup>60</sup> In contrast, were the manager to report low type, the selling shareholders would receive the low price of  $p_2 = 0$ . As before, the payoffs to the selling shareholders are strictly lower with a low report, and the non-selling shareholders' payoffs are not affected by the manager's report.<sup>61</sup>

### *b. Low-Type Firms*

A similar analysis obtains in the case where the manager learns that the firm's type is low. The payoffs to the non-selling shareholders are unaffected by the disclosure, whereas the selling shareholders' payoffs are strictly higher with a high type report.<sup>62</sup>

Formally, pooling is an equilibrium strategy for the manager who learns that the firm is of low type if:

$$(14) \quad \pi p_2(1') + (1 - \pi)E[\eta] > \pi p_2(0') + (1 - \pi)E[\eta]$$

60. This assumes, as above, that equations (10) and (13) are satisfied; this means that research is an equilibrium behavior and that initial shareholders are still willing to sell at the discounted price. If equation (10) does not hold, then there is no liquidity discount. If equation (10) holds but equation (13) does not, then, assuming the manager reports high type, the selling shareholders will not sell, will bear liquidity cost  $C_i$ , and will enjoy the firm's high cashflows of one. These shareholders are better off in this case than if the manager disclosed low type, which would lead the shareholders to sell for zero. Hence, the separating (truth-telling) equilibrium still obtains.

61. One could imagine that the well-intentioned manager might attempt to keep the initial shareholders from selling out at this price, which is too low given his private knowledge. Such actions, however, are not part of this game. This could potentially describe other situations where the manager prevents a sale of the company at a short-term price that the manager believes is too low. In the merger and takeover context, for instance, management may have a veto over such sales, such as through the requirement that management adopt a plan of merger, or via various takeover defenses such as the poison pill. In the instant case of secondary-market trading, the selling decision rests with the initial shareholders and the model does not allow the manager to communicate private knowledge to the firm's initial shareholders.

62. As before, this assumes that equations (10) and (13) are satisfied. If equation (10) holds there is research and, hence, a liquidity discount. But if equation (13) does not hold and selling shareholders are unwilling to bear the liquidity discount, then the analysis is somewhat different, though a similar result obtains.

In this case, the manager's high type report leads selling shareholders not to sell. Selling shareholders endure liquidity cost  $C_i$  and then receive the firm's cashflows of zero. The selling shareholder would be made better off if the manager reported low type due to saved liquidity costs. Hence, pure pooling (lying) is not an equilibrium outcome, nor is pure separation (truth-telling), because no liquidity discount occurs in a separating equilibrium and the selling shareholders would be made better off by defection to pooling. Instead, a mixed equilibrium occurs in which the manager lies with probability  $< 1$ , such that the liquidity discount is small enough to induce the selling shareholders to sell. Although the incidence of fraud is lower, fraud still occurs with positive probability.

Because non-selling-shareholder payoffs in [equation \(14\)](#) cancel out—they are unaffected by the reporting decision—the pooling equilibrium condition is rewritten as:

$$(15) \quad p_2(1') > p_2(0')$$

This is always true, given the assumption that a low-type report is taken as credible. Hence, a strategy of pure-pooling behavior is an equilibrium.

One can also show formally that separation (truth-telling) is not an equilibrium behavior given the manager's knowledge that the firm is of low type. The condition for separation to be maintained is:

$$(16) \quad \pi p_2(0') + (1 - \pi)E[\eta] > \pi p_2(1') + (1 - \pi)E[\eta]$$

This reduces to:

$$(17) \quad p_2(0') > p_2(1')$$

This condition is never satisfied, and pooling is the unique pure-strategy equilibrium. The share will be transacted at a liquidity discount. Noise traders will break even in expectation, whereas informed traders will enjoy positive expected information rents. Social welfare is reduced by the amount of the research cost,  $C_r$ . This relative diminution of social welfare is apparent from consideration of what would happen if the firm disclosed truthfully in equilibrium: there would be no benefit to the informed trader for research, no benefit to the noise trader for abstaining from trading, the market price would be efficient, trading would proceed smoothly, and markets would clear.

#### IV. LIABILITY CAN ELIMINATE FRAUD INCENTIVES

The prior section demonstrated that, absent antifraud liability, the unique pure-strategy equilibrium occurs when the manager always misrepresents firm type when the firm type is low. This result is undesirable because it creates deadweight costs from illiquidity, such as research costs of informed traders and illiquidity costs of initial shareholders when markets fail to clear. This is a form of the Prisoners' Dilemma, where the inability to commit to not defect results in an inefficient outcome.

This Part considers a potential solution to the problem: *ex post* liability for fraud. There are several potential targets of this liability: the manager, the firm itself, the selling shareholders, or the non-selling shareholders. Any of these targets could work. Provided that there exists the ability to maximize joint welfare among the various shareholders and the manager, there is no a priori reason to believe that the target of liability matters. Accordingly, the discussion in this Part makes no assumptions about where the liability lies. Rather, the discussion assumes that joint-welfare maximization implies that the firm's initial shareholders, in aggregate, bear the expected cost of any such liability. Further, to keep the

discussion broadly applicable, the model below makes no limiting assumptions about how the liability is used once assessed—it could be used to compensate purchasers, burned by the government, or anything in between.

Building on the model, suppose that at period 4, liability of  $l$  is assessed against the firm's initial shareholders if misreporting has occurred. Some fraction  $\theta$ ,  $0 \leq \theta \leq 1$ , of that liability may be transferred to purchasers of the firm's shares. The outcome of the model is summarized by the following proposition.

**Proposition (3)—The Existence of a Deterrent Fine:** There exists a level of fine  $l$  for misreporting that, when imposed on any of the firm's initial stakeholders, is sufficient to make separation the unique equilibrium in pure strategies.

The formal proof is given in Appendix Part I (equations 25–33). The proof requires that the liability assessed on the firm's initial shareholders exceeds the positive effect that the liability could have on the aggregate stock purchase price. In the event that the liability is not used to compensate purchasers, the effect on stock price is zero; this is trivial to demonstrate. The closest case is one in which the full measure of liability is transferred to purchasers. In such an instance, the increase in price would reflect the transfer ( $l$ ) weighted by the probability of the transfer occurring; the probability must be less than one because fraud does not occur if the firm's type is actually high. However, when making the choice of whether to misreport, the firm's manager knows if the firm is of low type. If it is of low type, the liability occurs with certainty. Therefore, the expected negative impact of the fine is  $l$ , whereas the positive effect on stock price is something less than  $l$ . At a sufficiently high level of liability, the firm's initial shareholders are better off not committing fraud. In that case, the manager will report truthfully.

## V. OPTIMAL VICARIOUS LIABILITY AND COMPENSATION

This Part considers a particular fraud liability mechanism: firm-level liability, or “vicarious” liability. Firm-level fines are notable, in part, because they are the prevalent mechanisms of antifraud liability in the U.S. securities law regime. They are also relatively easy to implement because the firm is readily identified and may be more able to satisfy monetary judgments.<sup>63</sup> However, as many commentators have noted, firm-level fines in the fraud context have the peculiar quality of forcing defrauded purchasers to fund some portion of the liability.

This Part solves for the optimal level of fine to place on the firm to deter misreporting. The solution is a function of the number of shares transacted and readily observable market prices. This Part also considers the effect of compensation of defrauded purchasers. Compensation does not affect the formula for the optimal fine as a function of market prices, though it does affect market prices. Overall, firm level fines appear to function well as a deterrent, and the current system of private securities litigation tracks the optimal penalty.

---

63. The problem of judgment-proof targets is that they may lack the means to pay or are otherwise immune from payment—as is usually the case with equity holders of a limited liability entity. Judgment-proof targets tend to undercut the potential deterrent and compensatory functions of liability.

The model proceeds as before, except with a particular liability mechanism placed on the firm *ex post* and a compensating transfer made to defrauded purchasers. After the realization of the firm's cashflows and revelation of fraud, liability of  $l$  is assessed against the firm in period 4. Because this liability is assessed against the firm after sales have been made, defrauded purchasers bear a portion of the liability. Mitigating this, the model allows some fraction  $\theta$  of liability to be used to fund per-share transfers of  $t$  to the plaintiff class.

Consequently, the model indicates that *ex post* liability on the firm promotes optimal deterrence.

**Proposition (4)—Optimal Vicarious Liability:** In a firm run by a representative shareholder–manager, optimal deterrence can be achieved through an *ex post* fine placed on the firm. The optimal fine is a function of observable market metrics: the number of shares sold multiplied by the decline in stock price upon the revelation of the fraud.

$$(18) \quad l = \pi(p_2 - p_3)$$

A detailed version of the proof is provided in Appendix Part II (equations 34–45). In sum, the manager's reporting decision considers the overall welfare of the initial shareholders, a fraction  $\pi$  of whom sell and receive the market price  $p_2$ , and a fraction  $(1 - \pi)$  of whom do not sell and incur liability if the report is inflated. If the manager observes a low signal of value, she must decide whether the increase the selling shareholders receive with respect to market price ( $p_2(1) - p_2(0)$ ) is greater than the liability that the non-selling shareholders endure when the fraud is discovered ( $l$ ). This provides a formulation for the optimal liability level in terms of period 2 price inflation. Whereas the hypothetical, uninflated period 2 price of the firm is not observable ( $p_2(0)$ ), the period 3 price is a function of the uninflated period 2 price and the impending liability ( $p_2(0) - l = p_3$ ). This allows the liability to be expressed in terms of observable market metrics, as in the proposition.

Even though the selling shareholders escape liability, the non-selling shareholders do not, and the manager's desire to maximize the aggregate welfare of the initial shareholders requires her to balance the gains of the sellers against the losses of the non-sellers. Purchasers bearing a fraction of the liability does not frustrate the deterrent effect of the fine: what matters is that some of the fine is borne by the initial shareholders. Accordingly, a sufficiently high level of fine will deter misreporting.

One attractive aspect of this form of liability is that the optimal penalty is easy to determine and implement. All that a court need do is count the number of shares transacted, and then multiply this by the decrease in price upon the revelation of the fraud. The resulting dollar amount is assessed against the firm, without regard to the composition of current owners. This measure sufficiently internalizes gains from fraud upon the firm.

## A. TO COMPENSATE OR NOT TO COMPENSATE

Compensation has no effect on the optimal deterrent formula. From full compensation to zero compensation, the formula remains the same in terms of market prices. Deterrence is thus separable from compensation. Even if it were true that private securities litigation fails to compensate, with the entire proceeds instead siphoned off by class action lawyers, it would not undermine the deterrence function or affect the way in which it is optimally implemented.

Compensation, however, does offer salutary effects regarding administrative efficiency and liquidity. First, compensation makes administration of the anti-fraud rule arguably easier, because it removes the requirement that the court determine the number of shares sold. Because the aggregate transfer must equal the aggregate liability ( $\pi t = l$ ), the optimal liability, outlined in Proposition (4), may be rewritten in terms of the transfer to each plaintiff's share:

$$(19) \quad t = p_2(1) - p_3(0)$$

Thus, with full compensation, all that is required of the court is to award each defrauded purchaser  $t$  per share (and  $t$  is simply the decrease in stock price). In contrast, barring compensation, there are no plaintiff claims. The court or regulator would then have to assess measures of share turnover to properly calculate liability.<sup>64</sup>

Second, compensation can improve the liquidity of the market if there is less than full deterrence. Suppose that deterrence of fraud is incomplete; perhaps there is accidental misreporting, or that fraud goes unpunished (type two error). In such a case, purchasers still face price uncertainty, which gives rise to incentives to invest in research on the part of informed traders. This, in turn, creates the risk of expropriation of information by the noise traders, which implies that there will either be a discount below actuarially fair value or a risk of markets failing to clear. Either way, resources are wasted on research, illiquidity costs are incurred, or both.

Compensation can remedy such problems. Because they will receive some transfer  $t$  in the event of a fraudulent report, noise traders will bid at a higher price in period 2. In other words, noise traders require a lower discount to be induced to trade. This is apparent in that the period 2 trading price ( $p_2$ ) is positive in the level of compensating transfer ( $\theta$ ), as shown in [equation \(36\)](#).<sup>65</sup> The increase in price may be beneficial through one of two channels. First, a price increase may disincentivize informed traders from research because of diminishing returns as purchase price increases. This is apparent from a comparison of the informed payoffs (in which the informed traders opportunistically abstain from purchase when the firm is of low type, but expend research costs), versus the payoff when everyone is uniformly uninformed. As  $p_2(1')$  rises, eventually the informed trader

64. Share turnover is an imperfect metric if shares are sold and repurchased during the effective period of the fraud by the same shareholder.

65. See *infra* Appendix II.A.

will eventually refrain from research due to diminished returns, and will instead act as a noise trader.

$$(20) \quad U_r = \frac{1}{2}Pr(1|1') (1 - p_2(1')) + \frac{1}{2}Pr(0|1') * 0 - C_r > U_n = 0$$

The second channel through which a higher price improves outcomes is through the effect on the selling shareholders' liquidity costs. The selling shareholder will hold the share and incur illiquidity costs of  $C_I$  if the discount is greater than those costs. Formally, demonstrated by [equation \(13\)](#), shares are held if the following is true:  $E[\eta] - p_2(1') > C_I$ . These illiquidity costs are deadweight losses. Increasing the trading price can push the selling shareholder past the threshold at which she prefers to sell her share.

#### B. DOES IT MATTER WHO BEARS *EX POST* LIABILITY?

Given concerns over the poor behavior of corporate executives, it is reasonable to inquire whether it is feasible or preferable to impose fines on executives. As it turns out, fines on the manager are both theoretically coherent and administratively feasible. Neither the basic formulation of the optimal fine nor the ease with which it is administered are substantially altered. Manager liability however, leads to a substantial practical problem: because the requisite magnitude of the manager-based fine is approximately the same as the magnitude of the firm-level fine, the manager is likely to be judgment-proof.

The analysis that follows assumes that liability is placed upon the manager, but it also applies to liability placed on other parties with whom the firm has the ability to engage in *ex ante* joint-welfare maximization regarding reporting, such as insurers, auditors, or a particular shareholder.

Supposing that the manager faced a potential fine for committing fraud—an act that, as shown above, is beneficial to the shareholders, absent liability—it would stand to reason that the firm and the manager would engage in joint-welfare-maximizing contracting. In its simplest form, the firm would agree to indemnify the manager for the liability, if and when it is incurred. This results in exactly the same game as described above: the firm pays the fine because it holds the manager harmless, and everything proceeds as before.

Complications arise when rulemakers attempt to prevent the firm from bearing such a fine—for instance, the Securities and Exchange Commission (SEC) limits the ability of firms to indemnify executives, and fiduciary law prohibits the disclaimer of agent liability for matters such as committing fraud. If *ex post* indemnification is prohibited, then the firm and manager may shift to *ex ante* compensation, in which the manager receives an upfront payment of  $w$  in return for agreeing to manage the firm in the best interests of the initial shareholders. The basic contour of such compensation  $w$  is that it makes the manager as well-off, in expectation, as she would be absent the liability burden. Assuming risk-neutrality of the manager,<sup>66</sup> this implies  $w = Pr(l)l$ . Aggregating the welfare of the

---

66. This assumption is certainly not true, but it simplifies the analysis.

firm's shareholders and manager, the wage  $w$  cancels out, yielding the following objective function:

$$(21) \quad \text{Max}_{\eta'} = \pi p_2(\eta', l, t, \theta) + (1 - \pi)E[\eta] - I_l * l$$

The variable  $I_l$  is an indicator variable equal to 1 if the manager misreports high type. The form of [equation \(21\)](#) is different from the objective [equation \(37\)](#)<sup>67</sup> in the vicarious liability analysis—if the firm directly bears liability, and  $\pi$  shareholders escape liability, the liability is instead borne by the defrauded purchasers. Rearranging [equation \(21\)](#) yields the optimal liability condition, which is:

$$(22) \quad l = \pi(p_2(1') - p_2(0'))$$

Because  $p_2(0')$ —the price of the firm at period 2 had the manager disclosed correctly—is not directly observable, we must instead rely on the period 3 price,  $p_3$ , which is observable. When the firm does not bear the liability the realization of liability does not affect period 3 price; hence  $p_3(0) = p_2(0)$ . The optimal liability is thus expressed in terms of market prices and trading volume as:

$$(23) \quad l = \pi(p_2(1') - p_3(0))$$

Under a scheme of complete compensation ( $\theta = 1$ ), the appropriate per-share transfer is:

$$(24) \quad t = p_2(1') - p_3(0)$$

There are a few notable aspects to this solution. First, it is the same as the solution for firm-level liability in terms of market prices (the price levels, however, are different). It is as easy to implement as firm-level liability and presumably sits well within the competence of courts to administer. Though the model here contemplates a fine situated upon the manager, such a scheme of liability works when targeting any actor who engages in *ex ante* joint-welfare maximization with the firm and its shareholders.

However, other practical problems do affect the choice of target. First, when the magnitude of the optimal fine on the manager is roughly the same as the optimal fine on the firm there may be problems with judgment-proof defendants. As with firm-level fines, the level of fine must internalize the gains to the firm from misreporting; the manager, however, is unlikely to have resources to pay a fine that is premised on firm-wide gains. That is, though millions of shares may be changing hands at significantly inflated prices, a fine based on such a measure will often be beyond the manager's solvency. Where judgment-proof defendants truncate the fine, deterrence and compensation are no longer possible.

All that said, to the extent that reformers desire to place the burden of antifraud liability on actors other than the firm itself, the model here demonstrates that the

---

67. See *infra* Appendix II.A.

optimal penalty, in terms of market metrics, does not change. This suggests that whatever shape future reforms take, the penalties imposed will have to follow the same basic formula to maintain deterrence.

#### CONCLUSION

This Article has shown that a firm's shareholders, as a general proposition, have incentives to favor price-inflating misreporting. If such incentives are not countered through some offsetting penalty such as liability, then the expected equilibrium behavior is for firms to engage in fraud. This Article derived an optimal penalty mechanism and showed the optimal fine to be a simple, administratively feasible formula based on readily observable market metrics. Further, the optimal penalty level tracked the measure of damages in real-world private securities litigation, which suggests that private securities litigation may be approximately optimal from a deterrence perspective.

Compensation does not affect the deterrence function, though compensation does have an impact on actual market prices and the strategic decisionmaking of market participants. Compensation lowers the risk of expropriation that noise traders face, raising prices. This lowers the returns to informed trading and the incentives of informed traders to undertake deadweight research costs. It also lessens the likelihood that markets fail to clear and thereby lowers illiquidity costs.

From a theoretical perspective, it does not matter on which of the firm's initial stakeholders (including the manager) the liability is placed *ex post*, so long as the initial stakeholders have the ability to engage in joint-welfare-maximizing behavior. The converse of this, however, is that, regardless of who bears the liability, the requisite deterrent penalty is always of the same approximate magnitude. Because this magnitude is large (it must take into account the firm-wide gains to shareholders from price inflation), there are practical reasons, such as judgment-proofness, to believe that imposing such large penalties on individual managers is impractical or unfeasible.

There are several practical implications of these results. Chief among them is that corporate fraud may be a more pernicious problem than the prevailing agency theory suggests. In the agency theory of corporate fraud, managers misreport to benefit themselves; thus, relatively small adjustments to the compensation contract, such as those administered through regulatory penalties, are required to counteract fraud incentives. In contrast, under the theory presented in this Article, fraud derives from shareholder incentives, and the potential gains from fraud are on the order of the firm's market capitalization. Penalties must be large, and this may limit the effectiveness of certain punishment mechanisms, such as individual liability for corporate executives.

Second, there are potentially negative effects of corporate governance reforms that empower shareholders. To the extent that agency costs exist (for example, suppose corporate managers simply do not care about shareholders and rather prefer a comfortable and predictable corporate existence), resolution of those

agency costs may result in more fraud, lower social welfare, or both.<sup>68</sup> A shareholder-run capital market, without proper deterrence mechanisms, would be neither fraud-free nor welfare-maximizing. More work is needed to integrate the roles of firm corporate governance and firm reporting. To the extent there are limits on the ability to contract between shareholders and managers, what are those limits, and what do those imperfect but second-best optimal contracts portend for reporting incentives? Economic models can help answer such questions, though unfortunately the securities law literature tends to eschew formal economic analysis.

Finally, the theory presented here tends to support the status quo system of private securities litigation. In particular, status quo penalties appear to be approximately correct for purposes of fraud deterrence. The principle of compensation, in which plaintiff purchasers recover the liability as a transfer, also has ameliorative, welfare-improving effects in the event of less than complete deterrence. Calls to restrict or abandon our current system of private securities litigation may be premature.

---

68. Such a model is presented in a contemporaneous paper. *See generally* Spindler, *supra* note 30.

## APPENDIX: PROOFS

## I. PROOF OF PROPOSITION (3): THE EXISTENCE OF A DETERRENT FINE

The proof consists of showing that liability will eliminate a pooling equilibrium and sustain a separating equilibrium.

## A. POOLING

Suppose the representative shareholder–manager observes that the firm is of low quality and that the manager knows that a pooling equilibrium exists (that is, her report of high quality will be disregarded). Equation (14) (discussed in section III.C.2) indicated that the representative shareholder–manager will falsely report if the net payoff from doing so (on the left-hand side) exceeds the payoff from reporting truthfully (the right-hand side):

$$(25) \quad \pi p_2(1') + (1 - \pi)E[\eta] > \pi p_2(0') + (1 - \pi)E[\eta]$$

Suppose further that if fraud occurs, the firm (or any subset of its initial shareholders, or any persons who may engage in *ex ante* joint-welfare maximization with the firm's shareholders) is fined amount  $l$  in period 3. Writing the per-share and total fine as  $l$  (recalling that there is measure 1 of shares outstanding) and assuming that the fine is assessed only when the manager falsely reports high type, the manager's fraudulent reporting condition becomes the following:

$$(26) \quad \pi p_2(1', l) + (1 - \pi)E[\eta] - E[l] > \pi p_2(0') + (1 - \pi)E[\eta]$$

Equation (26) shows that the fine enters into the manager's calculus in two ways. First, the fine is borne by the firm's initial shareholders in aggregate (the third term on the left-hand side). Second, the expectation of a fine affects the period 2 price that will be paid by the traders where the manager reports high type (in the low-type report). This effect is not known without putting more structure on the fine. If the fine is simply absorbed by the government or otherwise wasted, the effect on price is presumably zero at best, or even negative;<sup>69</sup> on the other hand, if the fine is used to recompense defrauded purchasers, then the effect on price may be positive.

If an increase in the fine always decreases the left-hand side relative to the right-hand side of equation (26), and such decrease does not go to zero, then it must be the case that there exists some sufficiently high level of  $l$  such that equation (26) is not satisfied. A sufficiently high level of  $l$  means that the manager will no longer engage in a pure pooling strategy. Taking the derivative of equation (26) with respect to the level of fine  $l$ , the left-hand side is  $\pi dp_2/dl - 1$ , whereas the derivative of the right-hand side is zero. Thus, if the left-hand side derivative is less than zero, and does not go to zero in the limit, then a fine eliminates the

---

69. This would be the case if the fine were placed on the firm after the fraud were discovered, and no part of the fine used to compensated purchasers.

pure pooling equilibrium. Rearranging marginal utility to the representative shareholder for an increase in fines yields:

$$(27) \quad dU_1/dl = \pi dp_2/dl - 1$$

So long as [equation \(27\)](#) is always sufficiently negative, then it must be the case that a sufficiently high fine will eliminate pooling as an equilibrium outcome. This condition holds so long as the total compensation paid to the defrauded purchasers is less than or equal to the total liability assessed against the firm. The purchasers receive a transfer of  $t$  per share; the aggregate transfer is therefore  $\pi t$ . Additionally, to fund the transfer,  $1 - \pi$  non-selling shareholders bear a fine of  $l$ . If the entire aggregate fine is used to fund the aggregate transfer to the purchasers, this implies the following equivalence:

$$(28) \quad \pi t = l$$

$Pr(l)$  denotes the likelihood of the purchaser receiving the transfer. In such a case, her expected payoff from the fine/transfer mechanism is  $Pr(l)t$ . Substituting in from [equation \(28\)](#), we can rewrite this net payoff from the fine/transfer ( $\Delta U_{nr}(l)$ ) as:

$$(29) \quad \Delta U_{nr}(l) = Pr(l)l/\pi$$

[Equation \(29\)](#) represents the component of price  $p_2$  that derives from the level of fine. Taking the derivative with respect to  $l$  then yields:

$$(30) \quad dp_2/dl = Pr(l)/\pi$$

Plugging this into [equation \(27\)](#) shows that the condition for a sufficient vicarious fine requires:

$$(31) \quad dU_i/dl = Pr(l) - 1$$

Thus, from [equation \(31\)](#), the initial shareholders' marginal expected utility of the fine is strictly negative and linear in the level of fine. This means that a sufficiently high fine on the firm can eliminate the pooling equilibrium.

#### B. SEPARATION

A similar argument demonstrates that a vicarious fine of sufficiently high magnitude can maintain separation. Returning to the separation condition under the existence of a fine (a modified version of [equation \(16\)](#)), for the manager to be willing to tell the truth about low quality, the expected payoff from truth-telling (the left-hand side) must be greater than a defection out of equilibrium to lying (the right-hand side):

$$(32) \quad \pi p_2(0') + (1 - \pi)E[\eta] > \pi p_2(1', l) + (1 - \pi)(E[\eta] - l)$$

The imposition of the fine has no effect on the truth-telling payoff (the fine is never assessed given a low report), but it is assessed for a high report, and it may increase the price paid in period 2 given a high report. The marginal return to the initial shareholders from an increasing fine where the manager falsely reports high is given by:

$$(33) \quad dU_i/dl = \pi dp_2/dl - 1$$

Although [equation \(33\)](#) is identical to [equation \(27\)](#) in the pooling case, the effect of the fine upon price is different because the defection represents out-of-equilibrium behavior—the purchasers are not expecting it. Therefore, the marginal effect upon price is zero, and the initial shareholders’ marginal return to the fine is simply  $dU_i/dl = -1$ . This is linear and strictly negative, which implies that a sufficiently high fine can maintain the separating equilibrium.

## II. PROOF OF PROPOSITION (4): OPTIMAL VICARIOUS LIABILITY

The proof proceeds by backward induction. First, the decisions of the market purchasers are considered and the market-clearing price is derived. Then, the manager’s decision under separating and pooling equilibria are solved.

### A. THE MARKET PRICING DECISION

The aggregate transfer is  $\pi t$  (because  $\pi$  shares will be transacted, with a transfer of  $t$  per share), which implies the following equivalence:

$$(34) \quad \pi t = \theta l$$

In a separating equilibrium, the fine is never assessed, the transfer is never paid, and therefore the price is not affected. The period 2 price thus takes the manager’s disclosure as credible:  $p_2(1) = 1$ . In a pooling equilibrium, the manager always lies if the firm is of low-type, the fine is assessed with probability  $Pr(0|1') = 1 - h$ , and the effect on price is determined by the noise trader’s break-even constraint:

$$(35) \quad U_{nr} = 1/2Pr(1|1')(1 - p_2(1)) + Pr(0|1')(t - l - p_2(1)) = 0$$

Note that it must be that  $t - l - p_2(1) \leq 0$ . If it were not, the noise trader would do better than break even, and the informed trader would never research and instead employ the noise trader strategy of always bidding on the offered shares.

The price determined by [equation \(35\)](#) will thus be a function of the transfer and liability scheme in place. Rearranging and substituting for  $t$  provides the following statement of the period 2 market price:

$$(36) \quad p_2(1') = \frac{PrPr(1') + 2Pr(0|1')(\frac{\theta - \pi}{\pi})l}{PrPr(1') + 2Pr(0|1')}$$

With this pricing behavior in mind, the representative shareholder–manager’s problem is to choose the report  $\eta'$  to maximize aggregate shareholder payoffs:

$$(37) \quad \text{Max}_{\eta'} = \pi p_2(\eta') + (1 - \pi)(E[\eta] - I_l * l)$$

The term  $I_l$  is an indicator variable equal to 1 if the manager falsely reports that the firm is of high type.

#### B. THE MANAGER’S CHOICE UNDER SEPARATION

When the manager decides whether to defect from a separating equilibrium, there is no effect of the transfer/liability mechanism on period 2 price because the market is expecting only truth-telling and does not value the existence of an insurance policy for fraud. The period 2 prices are thus  $p_2(0', l, t) = p_2(0)$ ,  $p_2(1', l, t) = p_2(1)$ . From [equation \(37\)](#), the manager’s condition for refraining from defection is then:

$$(38) \quad \pi p_2(0) + (1 - \pi)E[\eta = 0] \geq \pi p_2(1) + (1 - \pi)(E[\eta = 0] - l)$$

Rearranging terms, we find the expression for the requisite fine in terms of market prices:

$$(39) \quad l \geq (p_2(1) - p_2(0)) * \pi / (1 - \pi)$$

This is therefore the requisite level of liability required to maintain a separating equilibrium. Is the fine administratively feasible? It presents some difficulties because although  $p_2(1)$  is observable from the trading market,  $p_2(0)$  (the correct price of the firm if the manager had not defected) is not. However, the observable, post-revelation-of fraud-trading price in period 3 ( $p_3$ ) is a function of both the period 2 correct value and the expected liability to be levied upon the firm. Specifically,

$$(40) \quad p_3(0) = p_2(0) - l$$

Substituting [equation \(40\)](#) into [equation \(39\)](#) and rearranging yields the following expression for the requisite liability.

$$(41) \quad l \geq \pi(p_2(1) - p_3(0))$$

These market prices are readily observable. A court or regulator must still determine the net number of shares sold by the initial shareholders during the effective period of the fraud ( $\pi$ ).

#### C. THE MANAGER’S CHOICE UNDER POOLING

Under a pooling equilibrium, the market discounts the manager’s high report. In addition, the shares will trade at a discount relative to unconditional expected value to induce noise traders to bear the risk of expropriation by the informed traders (as described above in [equations \(9\)](#) through [\(12\)](#)). Under an antifraud

liability regime with a fine of  $l$ , transfer of  $t$ , and aggregate transfer of  $\pi t = \theta l$ , we can write the manager's problem of whether to defect from the pooling equilibrium as:

$$(42) \quad \pi p_2(1', l, t, \theta) + (1 - \pi)(E[\eta] - l) \leq \pi p_2(0') + (1 - \pi)E[\eta]$$

If the inequality is satisfied, the manager would choose to report truthfully. The manager's decision is subject to the purchasers' pricing constraint. In the case that informed traders undertake research, pricing constraint is:

$$(43) \quad U_{nr} = 1/2Pr(1|1')(1 - p_2(1')) + Pr(0|1')(t - l - p_2(1')) = 0$$

Rearranging [equation \(42\)](#), the requisite liability level to allow pooling (in terms of market prices) is the same as under separation:

$$(44) \quad l \geq (p_2(1', l, t, \theta) - p_2(0')) * \pi / (1 - \pi)$$

As in the separation case, the unobservable correct price, had the manager told the truth ( $p_2(0')$ ) may be rewritten in terms of the market price after the fraud is revealed ( $p_3$ ):

$$(45) \quad l \geq \pi(p_2(1', l, t, \theta) - p_3(0, l))$$

[Equation \(45\)](#) presents the requisite liability for eliminating pooling as an equilibrium. Notably, the requisite liability  $l$  is the same, in terms of market prices, as in the separating case. Note, however, that the prices themselves often differ in the separating and the pooling cases. Although the  $p_2$  and  $p_3$  terms are themselves functions of the level of liability and transfer, it is directly observable in the form of the market price. This result is independent of the fraction  $\theta$  of the fine  $l$  that is used to fund transfers  $t$  to defrauded purchasers—that is, the requisite liability for fraud deterrence is given by the same simple formula involving observable market prices, without regard to the level of compensation paid to purchasers.