The Disclosure of Good versus Bad News: Evidence from the Biotech Industry

Luminita Enache
luminita.enache@tuck.dartmouth.edu
Dartmouth College

Lynn Li
lynnli@bu.edu
Boston University

Edward J. Riedl
eriedl@bu.edu
Boston University

August 2017

PRELIMINARY – PLEASE DO NOT QUOTE WITHOUT PERMISSION

Abstract: This paper examines how the type of news affects firms' voluntary disclosures. We exploit hand-collected product-level disclosures made by publicly-traded biotech firms, which provide evidence of drugs' progression through key regulatory milestones towards marketability. Of note, the disclosures allow us to distinguish firms' treatment of good news (i.e., when drugs progress towards marketability) versus bad news (i.e., when drugs are abandoned). We first document that firms increase disclosures following good news (e.g., consistent with incentives to maximize shareholder value), as well as following bad news (e.g., consistent with minimizing shareholder litigation costs). Critically, we then document that the increase in disclosure for good news is higher relative to that for bad news, suggesting that firms view the net benefits associated with disclosure of good news as stronger relative to those for bad news. These results are consistent across product-level regressions, firm-level specifications, and other robustness tests.

JEL classification: M41, L65

Keywords: proprietary costs, voluntary disclosure, good news, bad news, biotech industry, FDA

Acknowledgments: We thank participants at the Boston Accounting Research Colloquium at Boston College, and MIT, for helpful comments and suggestions, especially Ana Albuquerque, Amy Hutton, SP Kothari, Sugata Roychowdhury, Nemit Shroff, Susan Shu, Eva Sletten, Eric So, and Roderigo Verdi.

The Disclosure of Good versus Bad News: Evidence from the Biotech Industry

Abstract: This paper examines how the type of news affects firms' voluntary disclosures. We exploit hand-collected product-level disclosures made by publicly-traded biotech firms, which provide evidence of drugs' progression through key regulatory milestones towards marketability. Of note, the disclosures allow us to distinguish firms' treatment of good news (i.e., when drugs progress towards marketability) versus bad news (i.e., when drugs are abandoned). We first document that firms increase disclosures following good news (e.g., consistent with incentives to maximize shareholder value), as well as following bad news (e.g., consistent with minimizing shareholder litigation costs). Critically, we then document that the increase in disclosure for good news is higher relative to that for bad news, suggesting that firms view the net benefits associated with disclosure of good news as stronger relative to those for bad news. These results are consistent across product-level regressions, firm-level specifications, and other robustness tests.

1. Introduction

This paper examines the association between news and firms' voluntary disclosure. Prior research examines the strategic timing of disclosure to news (Skinner 1994; Kothari, Shu, and Wysocki 2009); we complement this literature by examining the contents of disclosure to news. Specifically, we exploit the unique features of the biotechnology industry—particularly, the standardized drug development process through the US Food and Drug Administration (FDA)—and examine product disclosure related to product news. The FDA provides the framework for a process of development for a drug from its discovery to commercial launch. This framework requires that drug development follow similar stages and procedures, allowing us to compare different products under development within and across firms. We observe each of the products a firm develops in each stage of development, and create three types of news: good news (when a product moves to the next stage of development); no news (when a product remains in the same stage of development); and bad news (when a product is cut by the firm).

Because the firm's survival is contingent upon the successful introduction of new products after FDA approval, information about the firm's product pipeline is particularly relevant to investors' decisions and competitors' operational decisions. Due to the significant potential benefits and costs of related disclosures, we expect biotechnology firms to be strategic in their method and content of voluntary disclosure. Our measurement of voluntary disclosure follows Guo, Lev, and Zhou (2004), which constructs a disclosure index for each individual product under development by the firm. The key information components of this index include five areas of information: product specification, target disease, clinical trials, future plans, and market information. We obtain all information from the firm's 10–K report. Of note, this allows us to derive product disclosure scores at the product level, as well as aggregated at the firm-level.

Using a sample of 85 biotechnology firms over 2005 to 2013, we conduct three primary tests. We first document that firms increase disclosures following good news; this is consistent with incentives firms face to maximize shareholder value. Second, we find that firms also increase disclosures following bad news; this appears consistent with incentives to minimize shareholder litigation costs. We note that the latter two results are not mutually exclusive, as firms can face multiple incentives. Finally (and most importantly), we document that the increase in disclosure for good news is higher relative to that for bad news. This suggests that firms view the net benefits associated with disclosure of good news as being stronger relative to those for bad news.

Our primary empirical analyses are conducted at the product level. To confirm the robustness of our results, we examine a number of alternative specifications. These include: conducting firm level analysis, by aggregating and averaging our product-level disclosure measures; and analyzing adjacent stages of product development (which include pre-clinical, Phase I, Phase II, Phase III, and FDA approval) separately for good news (i.e., progressing through these stages) and bad news (i.e., having a product eliminated from development). Of note, our findings are robust within each of these additional analyses.

This paper makes two primary contributions. First, our paper complements previous research in the biotechnology setting. Our paper most closely complements Guo, Lev, and Zhou (2004), which studies the determinants and consequences of disclosure for biotech firms in the initial public offering (IPOs) setting. The latter paper finds that the stage of product development, availability of patent protection, and venture capital backing are important determinants of disclosure, and that such disclosures lead to valuation benefits such as reduced bid–ask spreads and return volatility. Other research examines the value of financial and nonfinancial performance metrics in the biotechnology industry (Ely, Simko, and Thomas 2003; Guedj and Scharfstein 2004;

Guedj 2005; Hand 2005; Xu, Magnan, and André 2007; Callen, Gavious, and Segal 2010; Guo and Zhou 2014). We complement this research, by providing evidence of that such firms increase product level disclosures as the intensity of news (good or bad) increases. That is, our findings are consistent with managers actively adjusting disclosure levels conditional on the sign and nature of the news regarding their products.

Second, our paper complements the literature examining voluntary disclosure and news. Kothari, Shu, and Wysocki (2009) documents that managers delay the disclosure of bad news relative to good news. Skinner (1994, 1997) and Baginski, Hassell, and Kimbrough (2002) provide evidence that managers reveal bad news due to litigation risk. Managers may also release news to increase the value of option grants, sale of stock prices, or raising of the external capital (Frankel, McNichols, and Wilson 1995; Lang and Lundholm 2000; Yermack 1997; Aboody and Kasznik 2000). Our paper documents that, in the setting of the biotechnology industry, managers' proclivity to increase disclosure is greater in the context of good news relative to bad news. This is consistent with expectations that the expected benefits to enhanced disclosure—such as reduced information asymmetry and greater access to capital—appear to outweigh the expected costs.

Section 2 presents the prior literature and hypothesis development. Section 3 presents the research design. Section 4 presents the sample selection and descriptive statistics. Section 5 presents our main empirical analysis, and Section 6 presents robustness tests. Section 7 concludes.

2. Prior literature and Hypothesis Development

Voluntary disclosure reflects a number of potential benefits and costs to the firm. One primary benefit surrounds capital-market effects. In particular, managers' disclosure of private information can reduce firms' cost of capital (Diamond and Verrecchia 1991; Botosan 1997; Lambert, Leuz, and Verrecchia 2007; Easley and O'Hara 2004; Sengupta 1998; Dhaliwal, Li,

Tsang, and Yang 2011) by raising the price of stock relative to that for non-disclosing firms (Glosten and Milgrom 1985; Amihud and Mendelson 1986; Kim and Verrecchia 1994), and by reducing the information asymmetry between informed and uninformed investors, thus improving the firms' stock liquidity (Healy, Hutton and Palepu 1999; Healy and Palepu 2001; Core 2001; Balakrishnan, Billings, Kelly and Ljungqvist 2004). These benefits are posited to arise due to the relation between disclosure and cost of capital through the pricing of estimation risk and of information quality (Brown 1979; Barry and Brown 1984, 1985; Hughes, Liu, and Liu 2007; Lambert, Leuz, and Verrecchia 2007).

Prior literature suggests that managers are more forthcoming with good news to correct market perception than with bad news (Kasznik and Lev 1995). This phenomenon occurs to a greater extent when managers exercise stock options (Yermack 1997 and Aboody and Kasznik 2000), during secondary equity offerings (Frankel, McNichols, and Wilson 1995; Shivakumar 2000), and coincident with annual shareholders meetings (Dimitrov and Jain 2011). Similarly, Lang and Lundholm (2000) documents that managers release more good than bad news prior to raising capital. Related, Wasley and Wu (2006) examines managers' incentives to issue cash flow forecasts, finding these issuances signal good news and help meet investors' demand for cash flow information. Since compensation is tied to firm performance, the dissemination of good news can boost firm value, which in turn, can boost the wealth of the managers.

However, prior research argues for certain downsides associated with voluntary disclosure: most prominently, proprietary costs (Dye 1985; Wagenhofer 1990; Li 2010; Li 2013). Proprietary costs occur because disclosure can also benefit competing firms by providing information about investment risks and technological shocks. Voluntary disclosure can reduce the firm's competitive advantage by revealing economically-relevant information to its suppliers, competitors, regulators,

and employees (Verrecchia 1983; Dye 1985; Jones 2007). These proprietary costs can be significant, particularly for firms in industries characterized by innovation. Hence, any voluntary disclosure about innovation (such as R&D) increases proprietary costs (Verrecchia 1983, 2001; Dye 1985, 2001; Darrough and Stoughton 1990; Wagenhofer 1990). Therefore, we state our hypothesis in the null form:

H_1: Good news leads to changes in product disclosure.

Prior literature also identifies reasons for managers to voluntarily disclose bad news. First, Darrough and Stoughton (1990), Dontoh (1989), and Krieger (2017) show that managers reveal bad news to deter competition and discourage entry by competitors in their firms' product markets. Additionally, managers reveal bad news to mitigate litigation risk (Kasznik and Lev 1995; Skinner 1994, 1997; Trueman 1997; Baginski, Hassell, and Kimbrough 2002; Field, Lowry, and Shu 2005; Rogers and Van Buskirk 2009). Francis, Philbrick and Schipper (1994) and Skinner (1997) show that managers provide timely disclosure of adverse earnings news to reduce settlements amounts.

However, the disclosure of bad news can be costly to managers in several ways. This includes the potential for managers to receive reduced bonus payments and stock options, lowered managerial reputation, and (in the extreme) the loss of job. Accordingly, managers have incentives to withhold bad news, in the hopes that subsequent good news that will "nullify" the bad news (Teoh and Hwang 1991; Verrecchia 2001; Hermalin and Weisbach 2007). Therefore, we state our hypothesis in the null form:

H2: Bad news leads to changes in product disclosure.

Theoretical models predict that in the presence of disclosure frictions, managers will strategically disclose good news and withhold bad news (Dye 1985; Jung and Kwon 1988; Beyer et al. 2010). Dontoh (1989) shows that managers of firms in oligopolistic markets will disclose

both good and bad news given the trade-off between wanting to provide good news to stockholders and bad news to competitors.

In contrast, Yermack (1997) and Aboody and Kasznik (2000) show that managers accelerate bad news and/or withhold good news in the period immediately preceding option grant dates to lower the exercise price of the options. Kothari, Shu and Wysocki (2009) examine whether managers delay the release of bad news relative to the good news. Using the magnitude of the stock prices reaction to infer the timeliness of good and bad news disclosure, they find that career concerns motivate managers to withhold bad news up to a certain threshold but to quickly reveal good news to investors in subsequent events to allow them to "bury" the bad news (Verrecchia 2001; Hermalin and Weisbach 2007). Baginski, Campbell, Hinson, and Koo (2017) confirms Kothari et al. (2009) findings, and suggests that compensation contracts can be a mechanism through which firms might be able to mitigate the delay of bad news disclosure. Bertomeu, Marinovic, and Ma (2016) develop a theoretical model of voluntary disclosure in which a managers' information set is uncertain (Dye 1985; Jung and Kwon 1988). Their findings show that when firms face a disclosure friction they are more forthcoming with their news, otherwise they strategically withheld the information. Therefore, we state our hypothesis in the null form:

H3: The change in disclosure for good news differs from that for bad news.

To test these hypotheses, we choose the biotechnology industry as the setting for several reasons. First, this industry exhibits particularly high levels of competition, which have increased over time (Thakor and Lo 2016). For example, firms within the industry closely follow each other's products under development: Krieger (2017) finds that firms will terminate projects upon hearing news of competing firms' product failures. In addition, the average firm has a limited product portfolio, with only a handful of products under development (most of which do not

generate revenue). Collectively, the intense competition and concentrated product portfolios suggest that the potential proprietary costs associated with disclosures can be very high. Related, significant information asymmetries can exist between managers and outside investors regarding the firm's product portfolio, its development progress, and its market potential. These asymmetries are exacerbated due to the long cycles required to develop and bring these products to market. Products in the biotech industry average 10-12 years for a drug to reach the market, with 6-8 years in clinical trials (Dimasi, Hansen, and Grabowski 2003).[1] Thus, the product development process is among the longest of any R&D-intensive industries. Therefore, both the expected costs and benefits associated with disclosures in this industry—particularly surrounding the firm's products—are extremely high (Guo, Lev, and Zhou 2004; Aggarwal and Hsu 2014).

Finally, the product development process in this industry is subject to considerable standardization. A key driver of this standardization is the Federal Drug Administration (FDA), which is the primary gatekeeper that provides oversight and regulates each drug study to help assure the safety of the final product on the market. Thus, all drugs follow a similar process, going through preclinical testing to assess the toxicity levels and its effectiveness before moving onto the various clinical stages, denoted Phase I, Phase II, Phase III, and ultimately FDA approval—upon which the drug may be sold on the market. Appendix D details this process. The process is particularly helpful, as it provides a framework by which firms provide voluntary disclosures regarding their key products. Critically, it allows for clear, product-level calibration of news that is "good" (a product moving towards marketability) and news that is "bad" (a product failing to move towards marketability). As such, we argue this provides particularly strong empirical identification by which to assess firms' voluntary disclosures.

[1] For a review on the Drug Development Process and Approval please visit: http://www.fdareview.org/03_drug_development.php

3. Research Design

3.1 Product Disclosure Index

Our measure of proprietary cost is based on the disclosure index of Guo, Lev, and Zhou (2004). Specifically, we construct *Product Disclosure* for each biotechnology product by hand–collecting relevant information from the business section, Part I of the firm's 10–K. The disclosure index is derived from the following five categories:

(i) product specifications;
(ii) target disease;
(iii) clinical trials;
(iv) future development plans; and
(v) market information.

Product Specification captures information on the properties and effectiveness of the product under development, as well as a comparison of the product with other firms' products and the product's chemical–biological structure. *Target Disease* captures information on the intended use of the product: in particular, which disease it is intended for and additional usages of the product in treating other diseases. *Clinical Trials* captures information on the number of patients, patients' medical information, doses applied, methods of application, and treatment schedules. *Future Development Plans* captures any explicit intentions indicated by the firm for additional work on the product, such as extensions or alternative therapies it may be applied to. This can include the firm's future plans for further clinical trials, such as expected dates, number of participating patients, and duration and method of future clinical trials; as well as the firms' plans to form strategic alliances with other firms. *Market Information* captures the product's market potential: that is, the relevant patient base infected by the target disease, the number of cases occurring each

year, and the potential dollar volume of the market. Appendix B provides an example of each of the above disclosures.

Each category is assigned a score according to the information provided. The maximum summarized score across all the five categories is 30 (if the product is on a clinical phase of development or beyond—that is, phase I, II, III or an FDA review), and 22 (if the product under development is in the screening, IND or preclinical phase, based on the relevant FDA classification). To ensure the cross–section comparability of the product scores, we divide the scores of the preclinical products by 22 (the maximum score of the clinical trials category is 8) and the scores of the clinical products by 30. We hand–code the above information for a total number of 3,219 products under the various stages of development for our sample of 85 biotechnology firms. Appendix C1 details the components of the disclosure index; Appendix C2 illustrates the calculation of the index using the product MAXY–G34 (developed by Maxygen Inc.). Following our above description, we assign a score to the five categories; the product–level disclosure index is computed as the ratio of the disclosure score to the overall maximum possible disclosure score: thus, it ranges in value from 0 to 1.[2] We calculate the product–level disclosure score as follows. Consider a company that has five products under development of which three are in the preclinical phase and two are in the clinical phase. We calculate the average product disclosure score (*Product Disclosure*) for each of the products in the preclinical and clinical phases. We then compute a firm–year level *Product Disclosure* score, by averaging the disclosure scores for all products offered by a firm in each year.

[2] If a product has not entered the clinical trial stage, the clinical stage category of the disclosure index is omitted.

3.2 The Effect of Good News or Bad News on Product Disclosure

We test our first two hypotheses—whether good or bad news leads to changes in voluntary product disclosure—using the following regression:

$$\textit{Product Disclosure} = f(\textit{NewsType}, \textit{Clinical}, \textit{Patent}, \textit{Size}, \textit{M/B}, \textit{RD/Sales}, \textit{Leverage}, \textit{Cash/Assets})$$

The dependent variable is *Product Disclosure*, measured as described above. Our experimental variables include two proxies for good news and two proxies for bad news. We include two variables for good news: *GoodsNews_Clin* and *GoodNews_Levels. GoodNews_Clin* is a dichotomous variable that equals 1 if a product moves from preclinical into the clinical phase, and 0 if it moves within the preclinical stage. *GoodNews_Levels* is a variable that equals 0 if the product moves within the preclinical stage, 1 if a product moves from preclinical to Phase I, 2 if a product moves from Phase I to Phase II, 3 if a product moves from Phase II to Phase III, and 4 if a product moves from Phase III to receiving approval from the FDA. Following H_1, we predict that *GoodNews_Clin* and *GoodNews_Levels* are associated with *Product Disclosure*. Similarly, we include two variables for bad news: *BadNews_CutClin* and *BadNews_CutLevels*. *BadNews_CutClin* is a dichotomous that equals 1 if a product is cut in the clinical stage, and 0 if it is cut in the preclinical stage. *BadNews_CutLevels* is a variable that equals 0 if a product is cut at the preclinical stage, 1 if cut at Phase I, 2 if cut at Phase II, and 3 if cut at Phase III. Following H_2, we predict that *BadNews_CutClin and BadNews_CutLevels* are associated with *Product Disclosure*. All variables are defined in Appendix A.

We then include several control variables. First, we include *Patent*, which is an indicator variable that equals 1 if the product is disclosed as having patent protection, and 0 otherwise. Competitors require (in expectation) additional resources to distinguish their products from one that is under patent protection. Therefore, we expect patent protected products to have more

disclosure, due to lower anticipated proprietary costs. Next, we include *Size*, measured as the log of market value of equity. To the extent larger firms have more disclosures and exhibit consistent disclosure practices across all disclosure channels (Lang and Lundholm 1996, Raffournier, 1995; Hossain, Perera, and Rahman 1995), the predicted sign is positive. However, we note that these latter association are based on broader cross-sectional samples of firms generally of much larger size relative to our single industry sample of smaller firms. To the extent that smaller must compete more for capital, and thus are more likely to provide higher disclosures to do so, the predicted sign is negative. Next, we include *M/B*, the beginning of year market-to-book ratio. Growth firms have greater information asymmetry and agency costs (Smith and Watts 1992; Gaver and Gaver 1993), which can affect the information asymmetry between managers and investors. If higher growth firms disclose more proprietary information to help attract future investment into the firm, the predicted coefficient is positive. We also include *RD/Sales*, the ratio of a firm's research and development expenses scaled by beginning total sales. Firms with higher R&D likely have more proprietary information, as well as higher proprietary costs. Accordingly, we do not predict the sign of this coefficient. We also include *Leverage*, the firm's total debt scaled by beginning total assets. As firms with higher leverage demonstrate an ability to access capital from the debt market, the predicted coefficient is negative due to a lower need to disclose proprietary information. Finally, we include a proxy for cash constraint using *Cash/Assets*, cash divided by total assets. We expect firms with more financial constraints to increase their proprietary disclosure to attract financing. As firms with more cash are considered to be more financially constrained because they are inferred as not having access to the capital markets (Thakor and Lo 2016), we predict a positive coefficient for *Cash/Assets*.

3.3 The Effect of Good News Relative to Bad News on Product Disclosure

We test our third hypothesis—whether good news and bad news have different relative effects on disclosure—using the following regression specification:

$$\textit{Product Disclosure} = f\,(\textit{News}, \textit{Clinical}, \textit{Patent}, \textit{Size}, \textit{M/B}, \textit{RD/Sales}, \textit{Leverage}, \textit{Cash/Assets})$$

The dependent variable of *Product Disclosure*, as well as the control variables, are as defined above. Our experimental variable is *News*, defined to equal 1 if the firm discloses good news (i.e., that a product moves from a lower stage to a higher stage in the current year); 0 if the firm discloses no news (i.e., that a product remains at the same stage as the prior year); and –1 for bad news (i.e., that a product is cut during the current year). Following H_3, if firms provide greater product disclosure for good news relative to bad news, than the predicted coefficient on *News* is positive. Conversely, if firms provide greater disclosure for bad news relative to good news, than the predicted coefficient is negative.

4. Sample Selection and Descriptive Statistics

Our initial sample comprises public–listed biotechnology firms on the NYSE, NASDAQ and AMEX stock exchanges from January 1, 2005 through December 31, 2013. We randomly select about 10% of the available firms, due to the costs of hand-collection for our disclosure index. We restrict our sample to firms with products under development, excluding gene therapy, medical devices and research service companies. We retain firms that discontinue drug development for a few years due to the failure of clinical trials, provided they have product development in the other years. This leads to our final sample of 85 biotechnology firms with 3,219 product-year observations. We collect firm financial characteristics from Compustat database, and product level disclosures from firms' 10–K reports.

Table 1 presents the descriptive statistics for the overall sample (see Appendix A for variable definitions). The mean value of the dependent variable, *Product Disclosure*, is 0.275, indicating an actual disclosure of 27.5% from the maximum disclosure score of 100%. The variable also exhibits significant variation, with a standard deviation of 0.169. We disaggregate news into 3 types: good news (when products move from a lower level in a prior year to a higher level in the current year); no news (when products remain at the same level as prior year); and bad news (when a product is cut in the current year).

As previously discussed, we include two proxies for good news—*GoodNews_Clin* and *GoodNews_Levels*. The mean value of *GoodNews_Clin* is 0.941, indicating that 94.1% of the good news occurs within the clinical phase, and 5.9% is within the preclinical phase. The mean *GoodNews_Levels* is 2.079, indicating that most products are moving from Phase I to Phase II. Similarly, we have two proxies of bad news—*BadNews_CutClin* and *BadNews_CutLevels*. The mean of *BadNews_CutClin* is 0.669, indicating that 66.9% of the products are cut in the clinical phase, while 33.1% are cut in the preclinical phase. The mean for *BadNews_CutLevels* is 1.122, indicating that most products are cut in Phase I. For our variable *News*, the mean is –0.086, indicating that firms disclose more bad news than good news. Finally, we note that 76.3% of the products are in the clinical phase, and 60.3% report patent protection.

Table 2 presents the correlations. We find that *Product Disclosure* is positively correlated with good news, both for *GoodNews_Clin* at 0.060 and *GoodNews_Levels* at 0.173. *Product Disclosure* and bad news is also positively correlated—both for *BadNews_Clin* at 0.096 and *BadNews_Levels* at 0.178. These univariate correlations suggest that firms increase their disclosure regardless of whether they have good news or bad news. The correlation between *Product Disclosure* and *News* is 0.148, which suggests that product disclosure increases for good

news relative to bad news. Finally, we note that *Product Disclosure* is positively correlated with late stage products (*Clinical),* 0.166 and products that have patent protection (*Patent*), 0.343.

5. Empirical Analysis

5.1 The Effect of Good News or Bad News on Product Disclosure

Table 3 presents the results of our analyses examining the effect of good and bad news on firms' voluntary product disclosures. Columns (1) and (2) present the results for H_1 examining good news. In column (1), we find significantly positive coefficient on *GoodNews_Clin* (0.069, *t*–stat = 4.42). Similarly, when we partition goods news by its category using *GoodNews_Levels*, we again find a significantly positive coefficient (0.044, *t*-stat = 3.95). Together, these results indicate that voluntary product disclosure is increasing in good news. The results support H_1, and are consistent with firms anticipating that the benefits of disclosing proprietary information (such as reducing information asymmetries) exceed the costs (such as competitive effects).

Columns (3) and (4) then present the results for H_2, examining bad news. In Column (3), we find a significantly positive coefficient on *BadNews_CutClin* (0.052, *t*–stat = 4.90). Similarly, in Column (4), when we partition bad news by their category using *BadNews_CutLevels*, we again find a significantly positive coefficient (0.044, *t*–stat = 4.81). These results indicate that voluntary product disclosure also is increasing in bad news, and support H_2.

Across the four regressions, we find similar results for the control variables. In particular, we find that product disclosures are higher for firms having patent protection (*Patent*), consistent with this reducing the expected net costs associated with disclosure by providing protection from competitors. We find, somewhat surprisingly, a consistently negative association between size (*Size*) and product disclosure. This could be due to the specific sample of our analysis: our sample

firms are small (relative to the broad Compustat population). As smaller firms may have both greater needs for capital, as well as greater information asymmetries to overcome, this may lead smaller firms to provide greater disclosures. Finally, we find as predicted consistently positive coefficients on cash (*Cash/Assets*), indicating that firms that have greater financial constraints increase their disclosure.

5.2 The Effect of Good News Relative to Bad News on Product Disclosure

We next examine H_3: how disclosure *differs* for good news relative to bad news. Again, our key proxy (*News*) is defined as 1 for good news, 0 for no news, and –1 for bad news. Table 4 presents the results. In Column (1), we find a significantly positive coefficient on *News* (0.045, *t*–stat = 9.18), suggesting that relative to no news, firms increase their disclosure by 0.045 when the news is good and decrease their disclosure by 0.045 when the news is bad. In Column (2), we include whether a product is in clinical stage (*Clinical*) and is patent protected (*Patent*), to provide additional controls for other product level effects that can lead to increased disclosure. As expected, the coefficients on both *Clinical* (0.076, *t*-stat = 6.62) and *Patent* (0.067, *t*-stat = 5.06) are significantly positive, consistent with greater disclosure for products in late stage development and with patent protection. More importantly, we continue to find that the coefficient on *News* remains significantly positive (0.031, *t*–stat = 5.87). Finally, we use two alternative measures for the stage of products. In Column (3), we use a dichotomous variable, *Stage2Post*, which equals 1 if the product is in FDA Phase II and above, and 0 if in Phase I and below. In Column (4), we use the stage of the product, *Stage_Code*, which takes the value of 1 for Discovery, 2 for Research, 3 for IND, 4 for Development, 10 for Phase I, 20 for Phase 2, 30 for Phase III, 40 for FDA, 50 for Marketed. Of note, we continue to find that the coefficient on *News* is significantly positive across

both regressions. Regarding control variables, we continue to find a consistent negative association between *Size* and product disclosure; the remaining control variables are (generally) insignificant.

6. Sensitivity Analyses

We conduct four sets of sensitivity analyses to assess the robustness of our results. First, we focus on good news only, assessing how product disclosure changes by examining adjacent stages of product development. We then conduct a second set of analyses focusing on good news, examining the effects for firm changing from no product revenue to reporting product revenue. Third, we examine bad news, assessing how product disclosure changes by examining adjacent stages of product development as performed above. Finally, we conduct firm level analyses.

6.1 Product Disclosure and Good News: Stages of Product Development

First, we examine how the disclosure changes between each level for goods news; that is, by comparing effects across adjacent groups. Specifically, we disaggregate the good news into five groups: moving within the preclinical stage, moving to Phase I, moving to Phase II, moving to Phase III, and then moving to FDA approval. Table 5 presents the results. First in Column (1), we examine the effect on disclosure between Phase I and preclinical phase; thus, *NextPh1vsPre* is an indicator variable that equals 1 if a product moves into Phase I, and 0 if a product moves up a level within the preclinical stage. The coefficient on *NextPh1vsPre* is –0.036 and not statistically significant (*t*–stat = –1.34); thus, we fail to find evidence of different disclosure levels between the preclinical phase and Phase I. Second in Column (2), we examine the effects on disclosure when products reach Phase II relative to Phase I; thus, *NextPh2vsPh1* is an indicator variable that equals

1 if a product moves into Phase II, and 0 if a product moves to Phase I. The coefficient on *NextPh2vsPh1* is significantly positive (0.115, *t*-stat = 5.44), suggesting firms increase disclosure at Phase II relative to Phase I. Third in Column (3), we examine the effects on disclosure when products reach Phase III relative to Phase II; *NextPh3vsPh2* is an indicator variable that equals 1 if a product moves into Phase III, and 0 if a product moves to Phase II. Again, we find a significantly positive coefficient on *NextPh3vsPh2* (0.064, *t*–stat = 2.53). Finally in Column (4), we examine the effects on disclosure when products reach market relative to Phase III; thus, *NextMktvsPh3* is an indicator variable that equals 1 if a product is approved by the FDA, and 0 if a product moves to Phase III. Of note, we now find a significantly <u>*negative*</u> coefficient on *NextMktvsPh3* (–0.101, *t*–stat = –3.97). Thus, we find that the increase in disclosure for good news occurs in the movement from Phase I to Phase II, and from Phase II to Phase III. In contrast, firms appear to reduce disclosure associated with good news once a product reaches marketability (i.e., is approved by the FDA).

6.2 Product Disclosure and Good News: Product Revenue

Next, we conduct our analysis at the firm level and use another measure of good news—when firms begin to disclose product revenue. To better understand the causal implications of product revenue on product disclosure, we restrict our sample to firms that initially reported no product revenue to reporting product revenue; this leads to an (expected) drop in observations (to about 100 firm-years). We then estimate the following regression specification at the firm-level:

Product Disclosure = f(*Post Product Revenue, Prop Clinical, Prop Patent, Number of Products, Size, M/B, RD/Sales, Leverage, Cash/Assets, HP Index*).

Post Product Revenue is an indicator variable that equals 1 for years in which firms begins to report product revenue, and 0 when the firm does not report any revenue. All other variables are as previously defined.

Table 6 Columns (1) and (2) present the results. We find that the coefficient on *Post Product Revenue* is negative but insignificant (–0.026) in Column (1).). We include the proportion of products that are in clinical stage and beyond (*Prop Clinical*) and proportion of products that have patent protection (*Prop Patent*) in Column (2) as additional control variables. We now find a significantly negative coefficient on *Post Product Revenue* (–0.031, *t*-stat = 1.87). Thus, we provide some evidence that after a firm begins to report product revenue, their product disclosure is reduced. Figure 1 graphically presents these results, revealing that the product disclosure remains constant for two years following product revenue, and then declines in years 3 and 4.

To provide further confirmatory evidence, we conduct these analyses now using the dependent variable of *LogFileSize* to proxy for firms' <u>*overall*</u> disclosures. The results are presented in Columns (3) and (4). In contrast, the coefficient on *Post Product Revenue* is significantly positive in both Column (3) (1.037, *t*–stat = 3.34) and in Column (4) (0.989, *t*–stat = 3.10). This indicates that after firms begin to report product revenue, overall disclosure increases (in marked contrast to the above findings of a decrease in product disclosures). This result is consistent with the time trend that firms report more disclosure as the length of 10–K has increased (Loughran and McDonald 2014).

6.3 Product Disclosure and Bad News: Stages of Development

We next turn our attention to the association between bad news and disclosure, paralleling our analyses of good news. In particular, we first define *CutPh1vsPre* as an indicator variable

equaling 1 if a product is cut in Phase I, and 0 if a product is cut during the preclinical stage. Table 7 Column (1) reveals the coefficient to be significantly positive (0.017, *t*–stat = 2.56), indicating that firms increase their disclosure for products that are cut during the FDA Phase I more than preclinical phase. Next, we define *CutPh2vsPh1* as an indicator variable equaling 1 if a product is cut in the Phase II, and 0 if a product is cut in Phase I. In Column (2), the coefficient is again significantly positive (0.067, *t*–stat = 6.58), indicating that firms increase their disclosure for products that are cut during the FDA Phase II more than Phase I. Finally, we define *CutPh3vsPh2* as an indicator variable equaling 1 if a product is cut in the Phase III, and 0 if a product is cut in Phase II. Column (3) again reveals a significantly positive coefficient (0.060, *t*–stat = 1.81), indicating that firms increase their disclosure for products that are cut during the FDA Phase III more than Phase II. Overall, these results show that firms increase their disclosure as products are cut at later stages.

6.4 Product Disclosure and News: Firm-Level Analysis

Finally, we revisit H_3 by examining how disclosure differs for good news relative to bad news aggregating our data at the firm level. As previously, our *News* variable is 1 for good news, 0 for no news, and –1 for bad news. Table 8 presents the results, which are similar to those presented in the main analysis of Table 4. In particular, in Column (1) we continue to find a significantly positive coefficient on *News* in the base regression of (0.045, *t*-stat = 7.92). We find similar results in Column (2), when we include the proportion of product in the clinical stage (*Prop Clinical*) and the proportion of products that are patent protected (*Prop Patent*) (coefficient on *News* = 0.033, *t*-stat = 5.24). We also find similar results in Column (3), where we use *Prop Stage2Post*, defined as the proportion of products in FDA Phase II and beyond, as well as in

Column (4), where we use the average of the stage of the product, *Avg Stage Code*. Overall, we conclude that our findings in support of H_3 appear robust to using firm–level analyses.

7. Conclusion

This paper examines how good and bad news affect firms' voluntary disclosures. We use the biotechnology industry as our setting, analyzing 85 publicly-traded firms over the period 2005–2013. This industry is useful, as it is characterized by firms with concentrated drug product portfolios, products with long development times, considerable information asymmetries between the firms and investors, as well as potentially high costs from proprietary disclosure. Of further note, drug development follows a standardized process dictated by the FDA; this allows clear identification of "good" news (progression towards marketability) and "bad" news (no longer developing a drug) events. Following Guo, Lev, and Zhou (2004), we employ a disclosure measure capturing firms' voluntary provision of key elements of their products, including information about the product specifications, target disease(s), clinical trials, future development plans, and market information. Of note, these disclosures occur at a product level, allowing a product-level disclosure metric and analyses (in contrast to the typically firm-level analyses of prior research). Thus, we maintain that this setting provides a very strong empirical identification.

We provide three key empirical findings. First, we document that product disclosures are increasing in firms' good news: as good news increases (i.e., as a drug gets closer to marketability), disclosures increase. However, there is nuance to this insight: additional analyses reveal that disclosure actually decreases once a product achieves marketability. Second, we also document that product disclosures are increasing in firms' bad news: as bad news increases (i.e., a drug is dropped due to failing a later stage test), disclosure increases. These latter results provide evidence

on the absolute associations between signed good and bad news and their respective effects on firms' voluntary disclosure decisions. Third, we assess the relative effects of good versus bad news on voluntary disclosures. Most prior research assessing the effect of signed news of firms voluntary disclosures suffers from limitations of (i) focusing the analyses at a firm level (wherein good and bad news must necessarily be aggregated and netted) and (ii) challenges to the empirical proxies, with news that is inferred from observed market outcomes (e.g., stock returns) or firm-level measures subject to measurement error and/or alternative interpretations. Our use of a product-level measure, with clearly identifiable good and bad news outcomes, mitigates the latter concerns. We find that good news leads to relatively higher voluntary disclosures than bad news. This is consistent with management viewing the expected net benefits associated with increased disclosure surrounding good news to be higher relative to those associated with bad news.

REFERENCES

Aboody, D., and R. Kasznik. 2000. CEO stock option awards and the timing of corporate voluntary disclosures. *Journal of Accounting and Economics* 29(1): 73-100.

Admati, A. and P. Pfleiderer. 1988. A theory of intraday patterns: Volume and Price Variability. *Review of Financial Studies* 1 (1): 3–40.

Aggarwal, V. and D. Hsu. 2014. Entrepreneurial exits and innovation. *Management Science* 60 (4): 867–887.

Ali, A., Klasa, S., and E. Yeung. 2014. Industry concentration and corporate disclosure policy. *Journal of Accounting and Economics* 58 (2–3): 240–264.

Ajinkya, B., Bhojraj, S., and P. Sengupta. 2005. The association between outside directors, institutional investors, and the properties of management. *Journal of Accounting Research* 43 (3): 343–376.

Amihud, Y. and H. Mendelson. 1986. Asset pricing and the bid–ask spread. *Journal of Financial Economics* 17 (2): 223–249.

Balakrishnan, K., Billings, M. K., Kelly, B., and A. Ljungqvist. 2004. Shaping liquidity: on the causal effects of voluntary disclosure. *Journal of Finance* 69(5): 2237-2278.

Barry, C. and S. Brown. 1984. Differential information and the small firm effect. *Journal of Financial Economics* 13 (2): 283–294.

Barry, C. and S. Brown. 1985. Differential information and security market equilibrium. *Journal of Financial and Quantitative Analysis* 20 (4): 407–422.

Baginski, S., J. Hassell, and M. Kimbrough. 2002. The effect of legal environment on voluntary disclosure: Evidence from management earnings forecasts issued in US and Canadian markets. *The Accounting Review* 77 (1): 25–50.

Baginski, S.P., J.L., Campbell, L.A., Hinson, and D.S. Koo. 2017. Do career concerns affect the delay of bad news disclosure? *The Accounting Review*, forthcoming.

Bena, J. and K. Li. 2014. Corporate innovation and mergers and acquisition. *Journal of Finance* 69 (5): 1923–1960.

Berger, P. and R. Hann. 2007. Segment profitability and the proprietary and agency costs of disclosure. *The Accounting Review* 82 (4): 869–906.

Bertomeu, J., I., P. Ma and I. Marinovic. 2016. How often do managers withhold information?, working paper available at SSRN http://dx.doi.org/10.2139/ssrn.2741778

Botosan, C. 1997. Disclosure level and cost of equity capital. *The Accounting Review* 72(3): 323-349.

Beyer, A., D. Cohen, T. Lys, and B. Walther. 2010. The financial reporting environment: Review of recent literature. *Journal of Accounting and Economics* 50 (2–3): 296–343.

Brown, S. 1979. The Effect of Estimation Risk on Capital Market Equilibrium. *Journal of Financial and Quantitative Analysis* 15(2): 215–220.

Callen, J., I. Gavious, and D. Segal. 2010. The complementary relationship between financial and non–financial information in the biotechnology industry and the degree of investor sophistication. *Journal of Contemporary Accounting and Economics* 6 (2): 61–76.

Chan, S., J. Kensinger, and J. Martin. 1992. The market rewards promising R&D—and punishes the rest. *Journal of Applied Corporate Finance* 5 (2): 59–66.

Copeland, T. and D. Galai. 1983. Information effects on the bid–ask spread. *Journal of Finance* 38 (5): 1457–1469.

Core, J. E. 2001. A review of the empirical disclosure literature: discussion. *Journal of Accounting and Economics* 31(1-3): 441-456.

Danzon, P., A. Epstein, and S. Nicholson. 2007. Mergers and acquisitions in the pharmaceutical and biotech industries. *Managerial and Decision Economics* 28 (4–5): 307–328.

Darrough, M. 1993. Disclosure policy and competition: Cournot vs. Bertrand. *The Accounting Review* 68 (3): 534–561.

Darrough, M. and N. Stoughton. 1990. Financial disclosure policy in an entry game. *Journal of Accounting and Economics* 12 (1–3): 219–243.

Dedman, E. and C. Lennox. 2009. Perceived competition, profitability and the withholding of information about sales and the cost of sales. *Journal of Accounting and Economics* 48 (2–3): 210–230.

Dhaliwal, D., O. Li, A. Tsang, and Y. Yang. 2011. Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review* 86 (1): 59–100.

Diamond, D. and R. Verrecchia. 1991. Disclosure, liquidity, and the cost of capital. *Journal of Finance* 46 (4): 1325–1359.

DiMasi, J. A., H., Grabowski, and R. Hansen. 2016. Innovation in the pharmaceutical industry: New estimates of R&D costs. *Journal of Health Economics* 47: 20–33.

Dimasi, J. A., R.H., Hansen, and H. G., Grabowski. 2003. The price of innovation: new estimates of drug development costs. *Journal of Health Economics* 22(2): 151-185.

Dimitrov, J. and P.C. Jain. 2011. It's showtime: Do manager report better news before annual shareholder meetings? *Journal of Accounting Research* 49(5): 1193-1221.

Dontoh, A. 1989. Voluntary disclosure. *Journal of Accounting, Auditing and Finance* 4(4):480-511.

Dye, R. 1985. Disclosure of non–proprietary information. *Journal of Accounting Research* 23 (1): 123–145.

Dye, R. 2001. An evaluation of ''essays on disclosure'' and the disclosure literature in accounting. *Journal of Accounting and Economics* 32 (1–3): 181–235.

Easley, D. and M. O'Hara. 2004. Information and the cost of capital. *Journal of Finance* 59 (4): 1553–1583.

Ely, K., P. Simko, and L. Thomas. 2003. The usefulness of biotechnology firms' drug development status in the development of research and development costs. *Journal of Accounting, Auditing and Finance* 18 (1): 163–196.

Field, L., M. Lowry, and S. Shu. 2005. Does disclosure deter or trigger litigation. *Journal of Accounting and Economics* 39 (3): 487–507.

Francis, P., D., Philbrick, and K. Schipper. 1994. Shareholder litigation and corporate disclosures. *Journal of Accounting Research* 32(2): 137-164.

Frankel, R., McNichols, M., and G. P. Wilson. 1995. Discretionary disclosure and external financing. *The Accounting Review* 70(1): 135-150.

Gal–Or, E. 1985. First mover and second mover advantages. *International Economic Review* 26 (3): 649–653.

Gaver, J. and K. Gaver. 1993. Additional evidence on the association between the investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Accounting and Economics* 16 (1–3): 125–160

Glosten, L. and P. Milgrom. 1985. Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics* 14 (1–3): 71–100.

Guedj, I. 2005. Ownership vs. contract: How vertical integration affects investment decisions in pharmaceutical R&D. Working Paper.

Guedj, I. and D. Scharfstein. 2004. Organizational scope and investment: Evidence from the drug development strategies and performance of biopharmaceutical firms. Working paper.

Guo R., Lev B., and N. Zhou N. 2004. Competitive costs of disclosure by biotech IPOs. *Journal of Accounting Research* 42 (2): 319–355.

Guo R. and N. Zhou. 2014. Innovation capability and post–IPO performance. University of Illinois at Chicago Working Paper.

Jung, W-O., and Y.K. Kwon. 1988. Disclosure when market is unsure of information endowment of managers. *Journal of Accounting Research* 26(1): 146-153.

Hadlock, C. and J. Pierce. 2010. New evidence on measuring financial constraints: Moving beyond the KZ Index. *Review of Financial Studies* 23 (5): 1909–1940.

Hand, J. 2005. The value relevance of financial statements in the venture capital market. *The Accounting Review* 80 (2): 613–648.

Harford, J. 2005. What drives merger waves? *Journal of Financial Economics* 77 (3): 529–560.

Hayes, R. and R. Lundholm. 1996. Corporate disclosure policy and analyst behavior. *The Accounting Review* 71 (4): 467–492.

Healy, P.M., Myers, S., and C. Howe. 2002. R&D accounting and the trade–off between the relevance and objectivity. *Journal of Accounting Research* 40 (3): 677–710.

Healy, P. M., Hutton, A. P., and K. G. Palepu. 1999. Stock performance and intermediation changes surrounding sustained increases in disclosure. *Contemporary Accounting Research* 16(3): 485-520.

Healy, P.M. and K. Palepu. 2001. Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics* 31 (1–3): 405–440.

Hermalin, B.E., and M.S. Weisbach. 2007. Transparency and corporate governance. NBER working paper no. 12875. http://www.nber.org/papers/w12875.pdf

Higgins M. and D. Rodriguez. 2006. The outsourcing of R&D through acquisition in the pharmaceutical industry. *Journal of Financial Economics* 80 (2): 351–383.

Hossain, M., Perera, M., and A. Rahman. 1995. Voluntary disclosure in the annual reports of New Zealand companies. *Journal of International Financial Management and Accounting* 6 (1): 69–87.

Hribar, P. 2004. Discussion of competitive costs of disclosure by biotech IPOs. *Journal of Accounting Research* 42 (2): 357–364.

Hughes, J., Liu, J., and J. Liu. 2007. Information asymmetry, diversification, and the cost of capital. *The Accounting Review* 82 (3): 705–729.

Jones, D. 2007. Voluntary disclosure in R&D–intensive industries. *Contemporary Accounting Research* 24 (2): 489–522.

Kasznik, R. and B. Lev. 1995. To warn or not to warn: management disclosures in the face of an earnings surprise. *The Accounting Review* 70 (1): 113-134.

Kim, O. and R. Verrecchia. 1994. Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics* 17 (1–2): 41–67.

Kothari, S.P., S., Shu, and P. Wysocki. 2009. Do managers withhold bad news? *Journal of Accounting Research* 47(1): 241-276.

Krieger, J. 2017. Trials and terminations: Learning from competitors' R&D failures. MIT Working Paper.

Krippendorf, K. 1980. Content Analysis: An Introduction to Its Methodology. Sage Publications, London, UK.

Lambert, R. 2001. Contracting theory and accounting. *Journal of Accounting and Economics* 32 (1–3): 3–87.

Lambert, R., Leuz, C., and R. Verrecchia. 2007. Accounting information, disclosure, and cost of capital. *Journal of Accounting Research* 45 (2): 385–420.

Lang, M. and R. Lundholm. 1996. Corporate disclosure policy and analyst behavior. *The Accounting Review* 71 (4): 467–492.

Lang, M. and R. Lundholm. 2000. Voluntary disclosure and equity offerings: reducing information asymmetry or hyping the stock? *Contemporary Accounting Research* 17(4): 623-662.

Lang, M and E. Sul. 2014. Linking industry concentration to proprietary costs and disclosure: Challenges and opportunities. *Journal of Accounting and Economics* 58 (2–3): 265–274.

Leuz, C. and P. Wysocki. 2016. The economics of disclosure and financial reporting regulation: Evidence and suggestions for future research. *Journal of Accounting Research* 54 (2): 525–622.

Li, E., 2013. Revealing future prospects without forecasts: The case of accelerating materialcontract filings. *The Accounting Review* 88 (5): 1769–1804.

Li, X., 2010. The impacts of product market competition on the quantity and quality of voluntary disclosures. *Review of Accounting Studies* 15 (3): 663–711

Loughran, T. and B. McDonald. 2014. Measuring readability in financial Disclosure. *Journal of Finance* 69 (4): 1643–1671.

Merkley, K. 2014. Narrative disclosure and earnings performance: evidence from R&D Disclosures. *The Accounting Review* 89 (2): 725–757.

Newman, P. and R. Sansing. 1993. Disclosure policies with multiple users. *Journal of Accounting Research* 31 (1): 92–112.

Prencipe, A. 2004. Proprietary costs and determinants of voluntary segment disclosure: evidence from Italian listed companies. *European Accounting Review* 13 (2): 319–340.

Raffournier, B. 1995. The determinants of voluntary financial disclosure by Swiss listed companies. *European Accounting Review* 4 (2): 261–280.

Rogers, J. and P. Stocken. 2005. Credibility of management forecast. *The Accounting Review* 80 (4): 1233–1260.

Rogers, J. and A. Van Buskirk. 2009. Shareholder litigation and changes in disclosure behavior. *Journal of Accounting and Economics* 47 (1): 136–156.

Ross, S. 1979. Disclosure regulations in financial markets: implications of modern finance theory and signaling theory. *Key Issues in Financial Regulation*. 177-201.

Schrand, C. and R. Verrecchia. 2005. Information disclosure and adverse selection explanations for IPO underpricing. University of Pennsylvania Working Paper.Skinner, D. 1994. Why firms voluntarily disclose bad news. *Journal of Accounting Research* 32 (1): 38–60.

Sengupta, P. 1998. Corporate disclosure quality and the cost of debt. *The Accounting Review* 73(4): 459-474.

Shivakumar. L., 2000. Do firms mislead investors by overstating earnings before secondary equity offerings? *Journal of Accounting and Economics* 29(3): 339-371.

Skinner, D. 1994. Why firms voluntarily disclosure bad news. *Journal of Accounting Research* 32(1): 38-60.

Skinner, D. 1997. Earnings disclousres and stockholder lawsuits. *Journal of Accounting and Economics* 23 (3): 249–282.Smith, C. and R. Watts. 1992. The investment opportunity set and corporate financing, dividend and compensation policies. *Journal of Financial Economics* 32 (3): 263–292.

Teoh, S. H., and C.Y. Hwang. 1991. Nondisclosure and adverse disclosure as signals of firm value. *Review of Financial Studies* 4(2): 283-313.

Thakor, R. and A. Lo. 2016. Competition and R&D financing decisions: Evidence from the biopharmaceutical industry. MIT Working Paper.

Trueman, B. 1997. Managerial disclosures and shareholder litigation. *Review of Accounting Studies* 2(2): 181-199.

Verrecchia, R. 1983. Discretionary disclosure. *Journal of Accounting and Economics* 5: 365–380.

Verrecchia, R. 2001. Essays on disclosure. *Journal of Accounting and Economics* 32 (1–3): 97–180.

Verrecchia, R. and J. Weber. 2006. Redacted disclosure. *Journal of Accounting Research* 44 (4): 791–814.

Wagenhofer, A. 1990. Voluntary disclosure with a strategic opponent. *Journal of Accounting and Economics* 12 (4): 341–364.

Wang, I. 2007. Private earnings guidance and its implications for disclosure regulation. *The Accounting Review* 82 (5): 1299–1332.

Wasley, C.E., and J. S. Wu. 2006. Why do managers voluntarily issue cash flow forecasts? *Journal of Accounting Research* 44(2): 389-429.

Yermack, D., 1997. Good timing: CEO stock option awards and company news announcements. *Journal of Finance* 52(2): 449-476.

Xu, B., M. Magnan, and P. André. 2007. The stock market valuation of R&D information in biotech firms. *Contemporary Accounting Research* 24 (4): 1291–1318.

APPENDIX A: Variable Definitions

VARIABLES	DESCRIPTION
Product Disclosure	An index of five information categories: product specifications, target disease, clinical trials, future development plans, and market information. The measure is scaled to vary between 0 and 1.
GoodNews_Clin	A dichotomous that equals 1 if a product moved to clinical stage and 0 if it moved within the preclinical stage.
GoodNews_Levels	A variable that equals 0 if the product moved within the preclinical stage, 1 if a product moved from preclinical to Phase I, 2 if a product moved from Phase I to Phase II, 3 if a product moved from Phase II to Phase III, and 4 if a product moved from Phase III to receiving approval from the FDA.
BadNews_CutClin	A dichotomous that equals 1 if a product is cut in the clinical stage and 0 if a product is cut in the preclinical stage.
BadNews_CutLevels	A variable that equals 0 if a product is cut at the preclinical stage, 1 if cut at Phase I, 2 if cut at Phase II, and 3 if cut at Phase III
News	A variable that equals 1 if the firm disclosed good news, that is a product has moved from a lower stage to a higher stage in the current year; 0 if the firm disclosed no news, that is, a product remained at the same stage as the prior year; and –1 for bad news, that is, if the product was cut during the current year.
Clinical	A dichotomous that equals 1 if a product is in the clinical stage and 0 if it is in the preclinical stage.
Patents	A dichotomous that equals 1 if a product is disclosed to be patent protected and 0 otherwise.
Post2_Stage	A dichotomous that equals 1 if a product is in FDA Phase 2 or after and 0 otherwise.
Stage_Code	A variable that equals 1 for Discovery, 2 for Research, 3 for IND, 4 for Development, 10 for Phase I, 20 for Phase 2, 30 for Phase III, 40 for FDA, 50 for Marketed.
Size	Log of market value of equity (prcc_f x csho).
M/B	Market value of equity (prcc_f x csho) plus book value of assets minus book value of equity minus deferred taxes (at – ceq –txdb) scaled by beginning–of–year total assets (at).
RD/Sales	Ratio of research and development expense (*xrd*) to beginning–of–year total sales (*revt*).
Leverage	The sum of short–term debt (dlc) and long–term debt (dltt) scaled by beginning–of–year total assets (at).
Cash/Assets	Cash and short–term investment (che) scaled by beginning–of–year total assets (at).

LogFileSize	Log of the file size (megabytes) of 10–K from the SEC EDGAR "complete submission text file" (Loughran and McDonald 2014).
Post Product Revenue	A indicator variable equaling one if a firm discloses product revenue, and zero otherwise.
Prop Clinical	The ratio of products in clinical stage relative to all products in the pipeline
Prop Patents	The ratio of products with patent protection relative to all products in the pipeline

APPENDIX B: Example of Product Disclosure

This appendix illustrates product disclosures, using the drug Pimavanserin from Acadia Pharmaceuticals. All disclosures are directly quoted from the firm's 2012 Annual Report.

Product Specification: Pimavanserin is a new chemical entity that we discovered and have advanced to Phase III development as a potential first–in–class treatment for Parkinson's disease psychosis. Pimavanserin is a small molecule that can be taken orally as a tablet once–a–day. Pimavanserin selectively blocks the activity of the 5–HT2A receptor, a drug target that plays an important role in psychosis. . . . Currently, there are no therapies approved to treat Parkinson's disease psychosis in the United States. Parkinson's disease patients are currently treated with dopamine replacement therapies such as levodopa, commonly referred to as L–dopa, which is metabolized to dopamine, and dopamine agonists, which are molecules that mimic the action of dopamine. . . .Pimavanserin offers an innovative non–dopaminergic approach to treating Parkinson's disease psychosis. We believe that Pimavanserin has the potential to be the first safe and effective drug that will treat the psychosis in patients with Parkinson's disease without compromising motor control, thereby significantly improving the quality of life for these patients.

Target Disease: We have selected Parkinson's disease psychosis as our lead indication for Pimavanserin and we are focused on advancing our Phase III program toward registration for this indication. We believe that Pimavanserin also has the potential to address a range of other neurological and psychiatric indications that are underserved by currently marketed antipsychotics. . . . By combining Pimavanserin with a low dose of an antipsychotic drug such as risperidone, a commonly prescribed atypical antipsychotic drug that is now generic, we believe that the optimal relationship between 5–HT2A receptor blockade and partial dopamine receptor blockade can be achieved.

Clinical Trials: We are currently conducting several clinical trials in our Phase III program with Pimavanserin for Parkinson's disease psychosis, including a pivotal Phase III study, referred to as the –020 Study, designed to evaluate the efficacy, tolerability and safety of Pimavanserin as a treatment for patients with Parkinson's disease psychosis. The –020 Study is a multi–center, double–blind, placebo–controlled trial expected to enroll about 200 patients at clinical centers located in North America. Patients are randomized to two study arms and receive oral doses of either 40 mg of Pimavanserin or placebo once–daily for six weeks. Patients also continue to receive stable doses of their existing dopamine replacement therapy used to manage the motor symptoms of Parkinson's disease. . . .A total of over 200 patients have now been treated with Pimavanserin for over one year and our longest single–patient exposure is greater than seven years. We believe that our experience to date suggests that long–term administration of Pimavanserin is generally safe and well tolerated in this fragile, elderly patient population….we announced top–line results from a multi–center, double–blind, placebo–controlled Phase II trial with Pimavanserin in patients with Parkinson's disease psychosis. The trial met the primary endpoint, which was to demonstrate that administration of Pimavanserin did not result in deterioration of the motoric function of these patients as measured by the UPDRS. Pimavanserin was generally safe and well tolerated in the study.

Future Development Plans: We have completed a Phase II trial with Pimavanserin as a co–therapy in schizophrenia and have established a protocol for a future Phase II feasibility study to explore the potential of Pimavanserin as a treatment for Alzheimer's disease psychosis. In the future, we intend to use our Phase III Parkinson's disease psychosis program as a foundation to develop and commercialize Pimavanserin for these and other potential neurological and psychiatric indications independently or in collaboration with strategic partners.

Market Information: Our product candidates address diseases that are not well served by currently available therapies and that represent large potential commercial market opportunities. Parkinson's

disease is the second most common neurological disorder after Alzheimer's disease. According to the National Parkinson Foundation, about one million people in the United States and from four to six million people worldwide suffer from this disease. Parkinson's disease is more common in people over 60 years of age, and the prevalence of this disease is expected to increase significantly as the average age of the population increases.

APPENDIX C1: Measurement of Product Disclosure Index

I. Product Specifications

1. How does the product work?	(3, 2, 1, or 0 points for three, two, one, or no sentences)
2a. Why is it better than previous products?	(2 = name mentioned; 1 = no name mentioned; 0 = no discussion)
2b. Why is it better than competing products?	(2 = name mentioned; 1 = no name mentioned; 0 = no discussion)
3. What is the chemical/biological structure?	(2 = chemical compound; 1 = general discussion; 0 = not mentioned)

Subtotal I = total scores of (1 + max(2a, 2b) + 3)

II. Target Disease

1. What kind of diseases does the product treat?	(2 = disease name mentioned; 1 = disease name not mentioned; 0 = no discussion)
2. What are other possible uses of the drug?	(2 = disease name mentioned; 1 = disease name not mentioned; 0 = no discussion)

Subtotal II = total scores of (1 + 2)

III. Clinical Trials

1. Number of patients	(1 = given; 0 = absent)
2. Patients information (with what diseases)	(1 = given; 0 = absent)
3. Doses (amounts) used in the clinical trial	(1 = given; 0 = absent)
4. Method used in the clinical trial	(1 = given; 0 = absent)
5. Treatment schedule (duration or frequency)	(1 = given; 0 = absent)
6. Trial results	(3 = detailed pro/cons, numbers; 2 = general, numbers; 1 = brief, no numbers; 0 = none)

Subtotal III = total scores of (1 + 2 + 3 + 4 + 5 + 6)

IV. Future Plans

1a. Any plan to try the product on new diseases?	(2 = disease name mentioned; 1 = no name mentioned; 0 = no discussion)
1b. Any plan to use with other products?	(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)
2. Future plan for clinical trials	
2a. Planned date	(1 = mentioned; 0 = not mentioned)
2b. Number of patients for the planned trial	(1 = mentioned; 0 = not mentioned)
2c. Patient info/disease for the planned trial	(1 = mentioned; 0 = not mentioned)
2d. Duration	(1 = mentioned; 0 = not mentioned)
2e. Method	(1 = mentioned; 0 = not mentioned)
3. Possible alliance	(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)

Subtotal IV = total scores of (max(1a, 1b) + 2a + 2b + 2c + 2d + 2e + 3)

V. Market Information

1. Number of patients affected by the disease (1 = mentioned; 0 = not mentioned)
2. Number of incidents (market size) (1 = mentioned; 0 = not mentioned)

Subtotal V = total scores of scores (1 + 2)

***Overall disclosure score* = sum of Subtotals I–V**

***Scaled disclosure score* = overall disclosure score divided by**

- **30 for products either in or beyond the clinical trials phase**
- **22 for products that did not reach clinical trials**

This appendix demonstrates the measurement of the Product Disclosure Index variable. Disclosures are measured over five categories: product specifications; target disease; clinical trials; future plans; and market information. The variable is scaled to vary between 0 and 1.

APPENDIX C2: Example of Product Disclosure Index

Company	MAXYGEN
Product	MAXY–G34
Development stage	Phase II
Disclosure index (from the Business section, Part I, of 10–K)	Score contents
I. Product Specifications	
1. How does the product work? *(3 = three sentences; 2 = two sentences; 1= one sentence; 0 = none)*	1. Helps the body make blood cells.
2a. Why is it better than previous products? *(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)*	2. MAXY–G34 reduces the duration of neutropenia when compared with the currently marketed products (Neulasta and Neupogen).
2b. Why is it better than competing products? *(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)*	2. MAXY–G34 protects patients from chemotherapy and radiation therapy–related infections, shortens the duration of hospital stays, and helps keep patients on schedule for their cancer treatments.
3. What is the chemical structure in addition to its chemical name? *(2= name mentioned; 0 = not mentioned)*	0. Not mentioned.
***Subtotal I = total scores of (1 + max (2a, 2b) + 3)*:**	**3 (out of a maximum of 7)**
II. Target Diseases	
1. What kind of diseases does the product treat? *(2 = disease name mentioned; 1 = disease name not mentioned; 0 = not mentioned)*	2. Neutropenia.
2. What are the other possible uses? *(2 = disease name mentioned; 1 = disease name not mentioned; 0 = not mentioned)*	0. Not mentioned.
***Subtotal II = total scores of (1 + 2)*:**	**2 (out of a maximum of 4)**
III. Clinical Trials	
1. Number of patients *(1= mentioned; 0 = not mentioned)*	1. 47
2. Patients information (with what disease) *(1 = name mentioned; 0 = not mentioned)*	1. Patients with breast cancer who have failed at least one potentially curative treatment regimen.
3. Doses (amounts) used in the clinical trial *(1 = mentioned; 0 = not mentioned)*	1. 5 to 100 µg/kg was given.
4. Method (via what kind of media) used in the clinical trial *(1 = mentioned; 0 = not mentioned)*	1. Subcutaneous injection.

5. Treatment schedule (duration or frequency) *(1 = given; 0 = absent)*	1. Single dose MAXY–G34 therapy being administered per three–week chemotherapy cycle with each patient receiving six cycles of docetaxel.
6. Results *(3 = detailed discussion; 2 = general discussion; 1 = brief discussion; 0 = no discussion)*	2. Results of the Phase I clinical trial indicate that the drug MAXY–G34 was generally safe and well tolerated through the study.
***Subtotal III = total scores of (1 + 2+ 3 + 4 + 5 + 6)*:**	**7 (out of a maximum of 8)**
IV. Future Development Plans	
1a. Is there any plan to try the product on new diseases? *(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)*	2. Hemophilia.
1b. Is there any plan to try the product with other products? *(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)*	0. Not mentioned.
2. Future plan for clinical trials	
2a. Planned date *(1 = mentioned; 0 = not mentioned)*	1. 2008.
2b. Number of patients for the planned trial (what disease) *(1 = mentioned; 0 = not mentioned)*	0. Not mentioned.
2c. Patient information for the planned trial (what disease) *(1 = mentioned; 0 = not mentioned)*	1. Breast cancer patients.
2d. Duration *(1= mentioned; 0 = not mentioned)*	0. Not mentioned.
2e. Method *(1 = mentioned; 0 = not mentioned)*	0. Not mentioned.
3. Alliance *(2 = name mentioned; 1 = no name mentioned; 0 = not mentioned)*	2. Entered into a strategic alliance with Roche.
***Subtotal IV = total scores of [max (1a, 1b)+2a . . .2e + 3)*:**	**6 (out of a maximum of 9)**
V. Market Information	
1. Number of patients affected by the disease (1 = mentioned; 0 = not mentioned)	0. Not mentioned.
2. Number of incidents (market size) (1 = mentioned; 0 = not mentioned)	0. Not mentioned.
***Subtotal V = total scores of (1 + 2)*:**	**0 (out of a maximum of 2)**
***Overall disclosure score* = sum of Subtotals I–V:**	**18 (out of a maximum of 30)**
***Scaled disclosure score* = overall disclosure score divided by 30 because MAXY–G34 is in clinical trials phase:**	**0.60 (out of a maximum of 1.00)**

APPENDIX D: Stages in the Development of a New Biotechnology Product (drug)

Drug development refers to a series of processes that are followed before a drug is brought to market. It is complex, expensive, and spread over 10 to 12 years (Babiarz, 2008). The Food and Drug Administration (FDA) establishes the guidelines for drug development. Based on these guidelines, the processes can be divided into two phases: preclinical and clinical.

In the preclinical phase, after a chemical compound is discovered that can potentially treat a disease, its chemical makeup, stability, and solubility are assessed. Before testing the compound on humans, its safety, toxicity, pharmacokinetics, and metabolism also are considered. Furthermore, an assessment is made for the dosage and schedule of its administration. Tests are conducted using in vitro methods (e.g., with isolated cells) or with laboratory animals. The company submits to the FDA the results of the preclinical testing and the proposed plan for clinical testing. If the FDA approves the plan, then the company files an investigational new drug (IND) application for human testing.

In the clinical phase, testing has three phases. In Phase I, the drug is tested on 20 to 80 healthy volunteers to assess its side effects and how the drug is metabolized and excreted. In Phase II, the drug is tested on 50 to 300 patients to assess the effectiveness and its short-term side effects. In Phase III, the safety and effectiveness of the drug is assessed on up to 3,000 patients using different dosages and in combination with other drugs. Thereafter, the company submits the test results as well as the proposed manufacturing process to the FDA to seek approval for marketing the new drug.

TABLE 1
Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
Product Disclosure	0.275	0.169	0.000	0.867
GoodNews_Clin	0.941	0.235	0.000	1.000
GoodNews_Levels	2.079	1.120	0.000	4.000
BadNews_CutClin	0.669	0.471	0.000	1.000
BadNews_CutLevels	1.122	1.008	0.000	3.000
News	–0.086	0.595	–1.000	1.000
Clinical	0.763	0.425	0.000	1.000
Patent	0.603	0.489	0.000	1.000
Size	6.685	2.105	2.142	11.655
M/B	4.497	4.034	0.207	29.820
RD/Sales	89.655	976.365	–78.714	25044.200
Leverage	0.190	0.528	0.000	10.293
Cash/Assets	0.790	0.780	0.012	10.330

This table presents descriptive statistics for our variables, including the mean, standard deviation, minimum, and maximum values for the combined sample. All variables are defined in Appendix A.

TABLE 2
Correlations

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Product Disclosure	[1]	1.000											
GoodsNews_Clin	[2]	0.060	1.000										
GoodsNews_Levels	[3]	0.173	0.465	1.000									
BadNews_CutClin	[4]	0.096	.	.	1.000								
BadNews_CutLevels	[5]	0.178	.	.	0.814	1.000							
News	[6]	0.148	.	.	.	.	1.000						
Clinical	[7]	0.166	1.00	0.465	0.988	0.814	0.184	1.000					
Patent	[8]	0.343	0.094	0.173	0.286	0.231	0.094	0.298	1.000				
Size	[9]	–0.395	0.132	0.262	0.249	0.279	0.025	0.226	–0.068	1.000			
M/B	[10]	–0.036	–0.042	–0.036	–0.099	–0.096	–0.013	–0.014	–0.014	0.139	1.000		
RD/Sales	[11]	0.037	0.014	0.050	0.025	–0.031	0.004	0.008	0.008	–0.044	–0.030	1.000	
Leverage	[12]	–0.082	–0.013	0.121	–0.010	0.008	–0.013	0.010	–0.068	0.126	0.310	0.028	1.000
Cash/Assets	[13]	0.136	–0.154	–0.177	–0.200	–0.194	–0.005	–0.095	0.095	–0.210	0.675	–0.028	0.422

This table reports the correlations for our variables over the period 2005–2013. All variable definitions can be found in Appendix A.

TABLE 3
The Effect of Good News and Bad News on Product Disclosure

Variables	**Good News (H_1)**		**Bad News (H_2)**	
	(1)	(2)	(3)	(4)
Goodnews_Clin	**0.069*** **			
	(4.42)			
Goodnews_Levels		**0.044*** **		
		(3.95)		
BadNews_CutClin			**0.052*** **	
			(4.90)	
BadNews_CutLevels				**0.044*** **
				(4.81)
Patent	0.090***	0.070***	0.043***	0.034***
	(6.52)	(3.93)	(3.29)	(2.64)
Size	–0.023***	–0.030***	–0.019***	–0.022***
	(–3.22)	(–4.47)	(–4.41)	(–5.22)
M/B	0.001	0.002	–0.003	–0.003
	(0.25)	(0.48)	(–0.89)	(–0.70)
RD/Sales	0.001	–0.001	0.001	–0.001
	(0.01)	(–0.52)	(0.21)	(–0.26)
Leverage	–0.047	–0.055	–0.023**	–0.022*
	(–1.08)	(–1.48)	(–2.15)	(–1.86)
Cash/Assets	0.046*	0.049*	0.034*	0.032
	(1.72)	(1.96)	(1.73)	(1.42)
Constant	0.314***	0.344***	0.290***	0.308***
	(5.87)	(6.53)	(7.14)	(8.23)
Observations	391	391	645	615
Adjusted-R^2	0.2201	0.2796	0.1619	0.2151

This table presents the results from examining news on firms' voluntary product disclosures. The dependent variable is *Product Disclosure*, a measure of the firm's voluntary product level disclosures. Columns (1) and (2) present the good news measures: *Goodnews_Clin* and *Goodnews_Multi*, respectively. *Goodnews_Clin* is a dichotomous variable that equals 1 if a product moves to clinical stage, and 0 if it moves within the preclinical stage. *Goodnews_Levels* is a variable that equals 0 if the product moves within the preclinical stage, 1 if a product moves from preclinical to Phase I, 2 if a product moves from Phase I to Phase II, 3 if a product moves from Phase II to Phase III, and 4 if a product moves from Phase III to receiving approval from the FDA. Columns (3) and (4) present the bad news measures: *BadNews_CutClin* and *BadNews_CutLevels*. *BadNews_CutClin* is a dichotomous that equals 1 if a product is cut in the clinical stage, and 0 if a product is cut in the preclinical stage. *BadNews_CutLevels* is a variable that equals 0 if a product is cut at the preclinical stage, 1 if cut at Phase I, 2 if cut at Phase II, and 3 if cut at Phase III. All variables defined in Appendix A. Standard errors are clustered at the firm and year level. *t*-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 4
The Effect of Good News Relative to Bad News on Product Disclosure

Variables	**Dependent Variable: *Product Disclosure***			
	(1)	(2)	(3)	(4)
News	**0.045*** **	**0.031*** **	**0.028*** **	**0.029*** **
	(9.18)	**(5.87)**	**(5.42)**	**(4.90)**
Clinical		0.076***		
		(6.62)		
Stage2post			0.098***	
			(7.82)	
Stage Code				0.003***
				(3.59)
Patent		0.067***	0.063***	0.068***
		(5.06)	(4.70)	(4.96)
Size	–0.030***	–0.027***	–0.029***	–0.027***
	(–6.42)	(–6.04)	(–6.47)	(–6.05)
M/B	0.001	0.001	0.001	0.001
	(0.33)	(0.19)	(0.28)	(0.09)
RD/Sales	–0.001	–0.001*	–0.001	–0.001
	(–0.55)	(–1.73)	(–1.60)	(–1.23)
Leverage	–0.022**	–0.015	–0.017	–0.018
	(–2.50)	(–1.56)	(–1.61)	(–1.64)
Cash/Assets	0.016	0.015	0.015	0.017
	(1.19)	(0.97)	(0.87)	(1.06)
Constant	0.470***	0.358***	0.380***	0.362***
	(13.85)	(11.14)	(11.27)	(10.01)
Observations	3,219	2,847	2,846	2,847
Adjusted-R^2	0.1877	0.2440	0.2862	0.2496

This table presents the results from examining the effect of good news versus bad news on firms' voluntary product disclosures. *News* is variable that equals 1 if the firm discloses good news (i.e., that a product moves from a lower stage to a higher stage in the current year); 0 if the firm discloses no news (i.e., that a product remains at the same stage as the prior year); and –1 for bad news (i.e., that a product is cut during the current year). All variables defined in Appendix A. Standard errors are clustered at the firm and year level. *t*-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 5
Sensitivity Analyses: The Effect of Good News on Product Disclosure
Examining Adjacent Stages of Development

Variables	**Dependent Variable: *Product_Disclosure***			
	(1)	(2)	(3)	(4)
NextPh1vsPre	**–0.036**			
	(–1.34)			
NextPh2vsPh1		**0.115*** **		
		(5.44)		
NextPh3vsPh2			**0.064** **	
			(2.53)	
NextMktvsPh3				**–0.101*** **
				(–3.97)
Patent	0.079***	0.067***	0.033	0.085***
	(3.37)	(3.59)	(1.64)	(5.06)
Size	–0.033***	–0.034***	–0.033***	–0.026***
	(–3.38)	(–4.61)	(–4.65)	(–4.47)
M/B	0.007	0.007	0.007	0.004
	(0.99)	(1.48)	(1.35)	(1.02)
RD/Sales	–0.036**	–0.001***	–0.001***	–0.000
	(–2.21)	(–5.63)	(–3.30)	(–1.33)
Leverage	–0.027	–0.029	–0.080	–0.041
	(–0.43)	(–0.56)	(–1.25)	(–0.92)
Cash/Assets	–0.030	–0.012	0.084**	0.031
	(–0.80)	(–0.48)	(2.46)	(1.18)
Constant	0.440***	0.403***	0.465***	0.475***
	(5.56)	(8.04)	(10.20)	(8.36)
Observations	155	264	220	437
Adjusted-R^2	0.2521	0.3404	0.3901	0.2515

This table presents the results from sensitivity analyses examining how different phases are associated with voluntary product disclosures. *NextPh1vsPre* is a dichotomous variable that equals 1 if a product moves to the Phase I, and 0 if a product moves up a level within the preclinical stage. *NextPh2vsPh1* is a dichotomous variable that equals 1 if a product moves to the Phase II, and 0 if a product moves to Phase I. *Next Ph3vsPh2* is a dichotomous variable that equals 1 if a product moves to the Phase III, and 0 if a product moves to Phase II. *NextMktvsPh3* is a dichotomous variable that equals 1 if a product is approved by the FDA, and 0 if a product moves to Phase III. All variables defined in Appendix A. Standard errors are clustered at the firm and year level. *t*-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 6
Sensitivity Analyses: Effect of Good News on Product Disclosure Examining the Occurrence of Product Revenue

Variables	Dependent Variable: *Product Disclosure*		Dependent Variable: *LogFileSize*	
	(1)	(2)	(3)	(4)
Post Product Revenue	–0.026	–0.031*	1.037***	0.989***
	(–0.93)	(–1.87)	(3.34)	(3.10)
Prop Clinical		0.123**		0.410
		(2.25)		(1.28)
Prop Patent		0.084***		0.164
		(3.54)		(0.47)
Number of Products	–0.004	–0.005	–0.031**	–0.029**
	(–0.93)	(–1.41)	(–2.46)	(–2.43)
Size	0.018	0.029*	0.031	0.076
	(1.06)	(1.65)	(0.17)	(0.35)
M/B	–0.001	–0.006	0.029	0.008
	(–0.18)	(–0.86)	(0.64)	(0.14)
RD/Sales	0.072**	0.060*	0.232	0.073
	(2.19)	(1.95)	(0.83)	(0.30)
Leverage	–0.019	–0.006	–0.072	–0.003
	(–0.96)	(–0.29)	(–0.44)	(–0.01)
Cash/Assets	–0.011	0.004	–0.086	–0.024
	(–0.32)	(0.11)	(–0.39)	(–0.08)
HP Index	0.020	0.027	–0.562	–0.507
	(0.79)	(0.73)	(–1.22)	(–0.88)
Constant	0.252***	0.088**	12.538***	12.128***
	(4.73)	(2.06)	(27.50)	(17.44)
Observations	109	101	108	100
Adjusted-R^2	0.1125	0.3978	0.5124	0.5272

This table presents results from sensitivity analyses examining the effect of initiating product revenue on firms' voluntary disclosure. The sample is firms that switch from reporting no product revenue to reporting product revenue. We regress both disclosure about products (*Product Disclosure*) and the size of the firm's 10–K disclosure as reported in the SEC Edgar database (*LogFileSize*). *Post Product Revenue* is a dichotomous variable that equals 1 once firm begins to report product revenue, and 0 when it did not. All variables defined in Appendix A. Standard errors are clustered at the firm and year level. *t*-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 7
Sensitivity Analyses: The Effect of Bad News on Product Disclosure
Examining Adjacent Stages of Development

Variables	**Dependent Variable: *Product Disclosure***		
	(1)	(2)	(3)
CutPh1vsPre	**0.017****		
	(2.56)		
CutPh2vsPh1		**0.067*****	
		(6.58)	
CutPh3vsPh2			**0.060***
			(1.81)
Patent	0.025**	0.025	0.061***
	(2.08)	(1.35)	(3.37)
Size	–0.023***	–0.029***	–0.019***
	(–4.70)	(–6.81)	(–3.35)
M/B	0.000	0.002	–0.005
	(0.06)	(0.37)	(–0.64)
RD/Sales	0.000	–0.000	–0.000
	(0.04)	(–0.90)	(–1.35)
Leverage	–0.019	–0.036	–0.051
	(–1.37)	(–1.18)	(–1.13)
Cash/Assets	0.020	0.003	0.040
	(0.97)	(0.09)	(0.83)
Constant	0.321***	0.387***	0.361***
	(6.87)	(9.50)	(8.37)
Observations	422	358	233
Adjusted-R^2	0.1571	0.2598	0.2017

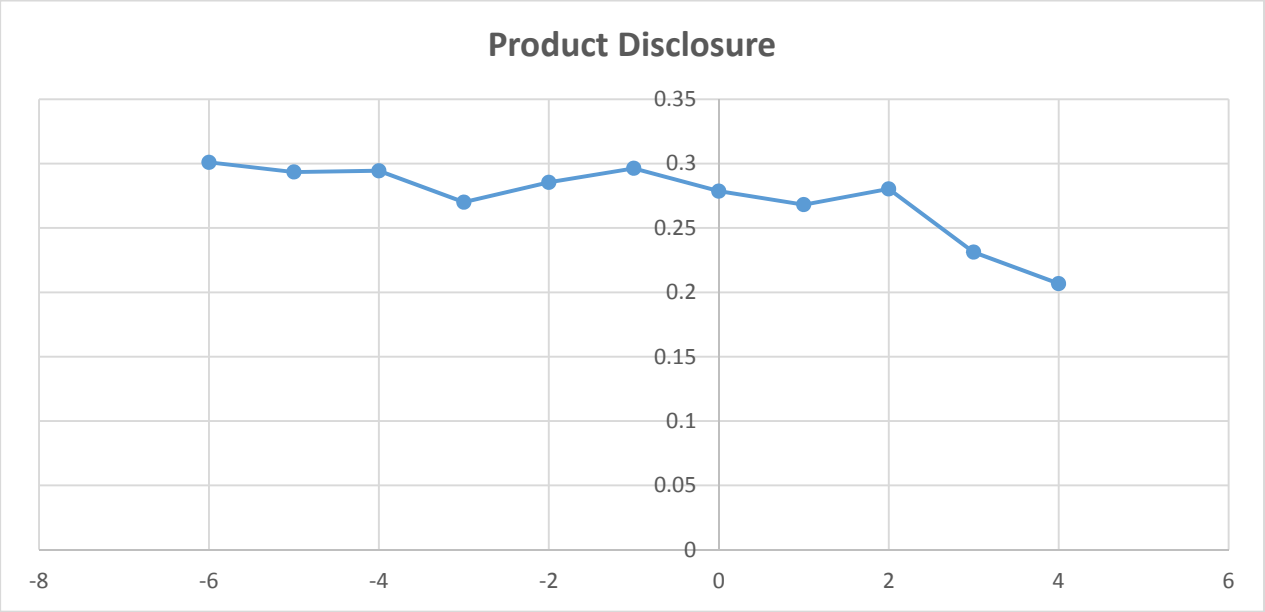
This table presents the results from sensitivity analyses examining bad news on firms' voluntary product disclosures at the firm–level. *CutPh1vsPre* is an indicator variable equaling 1 if a product is cut in Phase I, and 0 if a product is cut during the preclinical stage. *CutPh2vsPh1* is an indicator variable equaling 1 if a product is cut in the Phase II, and 0 if a product is cut in Phase I. *CutPh3vsPh2* is an indicator variable equaling 1 if a product is cut in the Phase III, and 0 if a product is cut in Phase II. All variables defined in Appendix A. Standard errors are clustered at the firm and year level. *t*-statistics are shown in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

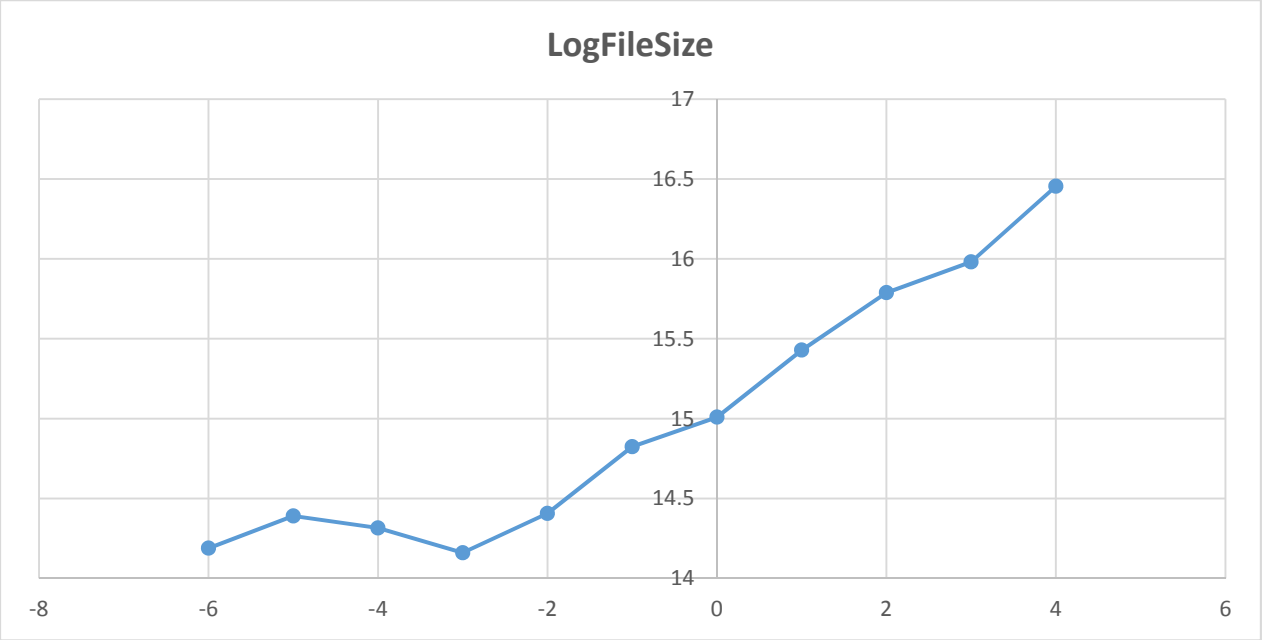
TABLE 8
Sensitivity Analyses: Assessing the Effect of Good News Relative to Bad News on Product Disclosure at the Firm–Level

Variables	**Dependent Variable: *Avg_Scaled_Disclosure***			
	(1)	(2)	(3)	(4)
News	**0.045*** (7.92)**	**0.033*** (5.24)**	**0.029*** (4.24)**	**0.031*** (4.06)**
Prop Clinical		0.060** (2.45)		
Prop Stage2post			0.107*** (5.41)	
Avg Stage Code				0.003*** (3.33)
Prop Patent		0.073*** (5.10)	0.061*** (3.91)	0.074*** (5.60)
Size	–0.025*** (–4.68)	–0.022*** (–4.58)	–0.026*** (–5.74)	–0.023*** (–4.80)
M/B	0.000 (0.13)	0.001 (0.41)	0.002 (0.85)	0.001 (0.41)
RD/Sales	–0.001 (–0.16)	–0.001 (–0.87)	–0.001 (–0.73)	–0.001 (–0.55)
Leverage	–0.020*** (–2.73)	–0.013* (–1.96)	–0.017** (–2.34)	–0.017** (–2.45)
Cash	0.013 (1.41)	0.009 (0.87)	0.008 (0.73)	0.011 (1.06)
Constant	0.454*** (13.81)	0.340*** (10.29)	0.362*** (11.42)	0.344*** (10.37)
Observations	910	846	845	846
R–squared	0.1505	0.2022	0.2610	0.2177

This table presents the results from examining news on firms' voluntary product disclosures at the firm–level. *News* is variable that equals 1 if the firm discloses good news (i.e., that a product moves from a lower stage to a higher stage in the current year); 0 if the firm discloses no news (i.e., that a product remains at the same stage as the prior year); and –1 for bad news (i.e., that a product is cut during the current year). All variables defined in Appendix A. *t*-statistics are shown in parentheses. Standard errors are clustered at the firm and year level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

FIGURE 1
Product Revenue and Disclosure





This figure presents the association of product revenue on disclosure for a sample of firms that reported no product revenue to reporting product revenue. We regress both disclosure about products (*Product Disclosure*) and the size of the firm's 10–K disclosure as reported in the SEC Edgar database (*LogFileSize*). *Post Product Revenue* is a dichotomous variable that takes the value of one once the firm begins to report product revenue, and zero when it does not.