THE CONSEQUENCES OF GOVERNANCE FAILURE FOR INNOVATION

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ABSTRACT

This study explores the consequences of governance failures for innovation by investigating the relationship between negative restatement disclosures and subsequent investments in both firm-level research and development and project-level exploration. Unpacking this relationship helps us to further understand the effects of failure on not only the performance and reputation of a firm, but also on its ability to innovate and respond to entrepreneurial opportunities in the external environment. While the changes in managerial risk taking after a governance failure cannot be observed directly, we see their effects on downstream innovation activities. At the firm-level, we find that negative restatement disclosures, especially those alleging fraud, reduce subsequent investments in research and development as would be predicted by a threat rigidity response among top executives. At the project-level, we find that negative restatement disclosures increase investments in innovation through funding more exploratory projects as would be predicted by a failure trap response among functional leaders. We conclude by discussing the implications of these findings for both accounting and management research.

INTRODUCTION

"I'm very conscious – as are my colleagues – of the danger that in becoming overzealous about governance we risk slowing Tyco down."
Eric Pillmore, Senior Vice President of Corporate Governance at Tyco International Ltd. in the aftermath of a financial statement fraud

What are the consequences of financial statement fraud for innovation within the firm? As organizations seek to repair their reputations after a fraud or some other governance failure, do they risk becoming "overzealous" and impeding the speed and innovativeness of the firm as Mr. Pillmore warns in the opening quote (2003)? These concerns echo findings from research on threat rigidity, a management theory describing how managers respond to failure by centralizing decision making, foregoing long-term planning, and curtailing risky investments (Desai, 2008; Staw, Sandelands, & Dutton, 1981). On the other hand, research on the failure trap phenomenon (e.g., Levinthal & March, 1993) suggests that firms facing uncertain futures after such failures become even more risk seeking, placing big bets on their most innovative ideas to try to secure a turnaround.

While the consequences of financial statement fraud have been explored previously in the literature – for instance, fraud and its effect on corporate reputation and legitimacy (Karpoff, Lee, & Martin, 2008; Karpoff & Lott, 1993), performance (Baucus & Baucus, 1997), stock returns (e.g., Beneish, 1999; Dechow, Sloan, & Sweeney, 1996), executive turnover (Arthaud-Day et al., 2006; Desai, Hogan, & Wilkins, 2006; Palmrose & Scholtz, 2004), boards of directors (Cowen & Marcel, 2011; Marcel & Cowen, 2014; Srinivasan, 2005), and auditor reputations (Irani, Tate, & Xu, 2015) – little is known about whether such governance failures affect an organization's propensity to innovate. Understanding this relationship is crucial, however, if these organizations hope to repair not only their reputations but also the capacity to respond to entrepreneurial opportunities in the external environment and thereby enable the long-term

success of the organization (Doz, 1996; Huff, Huff, & Thomas, 1992; Floyd & Lane, 2000; Johnson, 1988).

This study seeks to extend the current literature on the consequences of financial statement fraud and contribute to the literature on managerial risk taking by exploring the connections between negative financial restatement disclosures and subsequent investments in innovation. We examine this relationship at multiple levels of analysis to represent different domains of managerial risk taking using two samples. In sample one we examine publicly traded firms in the manufacturing industry to determine if negative financial restatement disclosures of any type predict a decline in firm-level innovation (measured as subsequent investments in research and development) and if restatement disclosures due to fraud affect innovation differently than other causes of restatement (e.g., rule change, error, or material weakness). In sample two we dig deeper to explore the effects of restatement within the pharmaceutical sector by analyzing whether negative financial restatement disclosures affect innovation in terms of both firm-level research and development spending and project-level investments in exploratory drug development projects.

We find results generally consistent with our expectations. At the firm-level, we find mixed evidence that negative restatement disclosures diminish the organization's subsequent investments in innovation. Within our manufacturing sample, firms disclosing a negative restatement of any type spent significantly less on research and development, but within our pharmaceutical sample this relationship was not significant. Within both samples, however, negative restatement disclosures related to fraud caused significant reductions in research and development spending. We argue that this decline may be interpreted as evidence of the threat rigidity response to failure, whereby top executives signal their commitment to stronger

governance by retreating to safer, more conservative activities following the shame, embarrassment, and uncertainty associated with the public announcement of a negative restatement, especially one involving allegations of fraud. At the project-level, we predict and find the opposite response to these same failure disclosures. Even while overall research and development spending declined after a fraud event, the functional leaders charged with distributing these reduced funds tended to favor riskier, exploratory drug projects as would be predicted by the failure trap hypothesis. We theorize that being more distant from the causes and consequences of the failure, functional leaders are less concerned for their personal reputations and thus more inclined to take on risk in order to secure the survival of their organization.

Our contributions are three-fold. First, we examine a previously unexplored but strategically significant consequence of governance failure, especially one involving fraud. Our results indicate that negative restatement disclosures have a significant impact on subsequent investments in innovation even while controlling for other explanations for these changes. Moreover, we offer a rare examination of these changes at multiple levels of analysis. By examining the connections between innovation and restatement at both the firm-level and the project-level, we can unpack the differences in managerial risk propensity that arise among different domains of decision making (top executives vs. functional leaders) in response to these governance failures. Our findings expand both the accounting and the management literatures by offering new insights on how organizations and managerial risk taking are shaped by restatement events.

The remainder of our paper is organized as follows: We develop our hypotheses regarding managerial risk taking and investments in innovation in response to governance failures by reviewing research from the fields of management and psychology. We then describe

our methods and our data sets and review the results of our analysis. We conclude by discussing the implications of these findings and providing directions for future research.

HYPOTHESIS DEVELOPMENT

Restatements as Failures of Corporate Governance

Numerous studies in both the accounting and management literatures demonstrate the negative consequences of financial restatement. Companies that restate their financials experience negative stock returns ranging from -2% to -11% around the announcement date (Akhigbe, Kudla, & Madura, 2005; Arthaud-Day et al., 2006; Desai et al., 2006; Hennes, Leone, & Miller, 2008; Palmrose, Richardson, & Scholz, 2004). Restatements involving financial misrepresentation increase the range of these losses to between -9% and -25% (Beneish, 1999; Dechow et al., 1996; Karpoff et al., 2008; Karpoff & Lou, 2010). Restatements also raise the cost of capital for companies (Farber, 2005; Hribar & Jenkins, 2004) and increase the likelihood of shareholder lawsuits (Lu, 2004). Beyond these immediate financial consequences, firms that restate earnings also diminish their corporate image and reputations (e.g., Akhigbe et al., 2005; Palmrose et al., 2004).

Pfarrer *et al*. (2008b) describe financial restatements as "corporate governance problems" that should be addressed by both formal measures, such as increased regulations and legal sanctions against both firms and their top executives, and informal measures, such as changing standard operating norms within an industry. This framing of restatements as problems or failures of corporate governance highlights the important role that boards of directors and top executives play in both preventing and responding to these events. Not surprisingly then, top executives frequently lose their jobs following a financial restatement (Arthaud-Day et al., 2006; Desai et al., 2006) and nearly half of all directors leave their boards after revelations of financial

improprieties (Srinivasan, 2005). Further research into the causes of board turnover after fraud has revealed evidence consistent with a "cleaning house" hypothesis; that is, director turnover is a signal of the boards' efforts improve governance and increase organizational legitimacy in the wake of a scandal (Marcel & Cowen, 2014).

Despite these advances in our understanding of the consequences of restatement, both the accounting and the management literatures are relatively silent about how these events affect decision makers' risk propensities and their subsequent investments in innovation. And yet, as evidenced by the opening quote about Tyco in the wake of its financial statement fraud, practitioners do worry about how governance failures will impact the innovation potential of the firm. To further explore the ways in which managerial risk propensities might be shaped by failure events, we turned to the psychology and management literatures. Scholars from these fields offer two competing theories for how decision makers are affected by failure events, which we summarize here and use to develop our hypotheses about the connections between governance failure and innovation.

Managerial Responses to Failure: Threat Rigidity Theory

Managerial responses to failure have most frequently been explored using the lens of threat rigidity theory. Threat rigidity theory proposes that external threats to the organization cause managers to restrict information processing activities and increase control, and that these reactions make the organization more reliant on well-learned, dominant response patterns (Staw et al., 1981). In his review of the threat rigidity literature, Desai summarized the implications of failure for risk taking as follows: "…organizations centralize decision making, forego long-term planning, divert slack resources to cover operating expenses, and curtail risky investments or activities," (2008: 595). Desai adds that managers avoid risk alternatives after the failure, either

because they are constrained in their search or because they deliberately choose safer options (2008; see also Audia & Greve, 2006). The implications of the threat rigidity response for innovation as a particular form of risk taking have not been broadly explored in the literature, but McGrath (2001) finds that exploratory activities are more effective when projects operate with higher degrees of autonomy. Since a typical threat rigidity response is to decrease managerial autonomy by increasing supervision and control, innovation activities may be less frequent and less successful in this risk constrained environment.

The literature on managerial responses to internally imposed threats, which is how one might describe a governance failure, is not as well developed. However, recent work by Pfarrer, *et al*. (2008a) provides a useful framework for considering how organizations may respond to such situations. These authors posit that the organization goes through four stages of reintegration following revelations of corporate misconduct: discovery, explanation, penance, and rehabilitation. For the purposes of this paper, the last stage, where the discourse between the organization and its stakeholders is focused on the changes that have been made by the organization to minimize the chances of the failure occurring again, is particularly relevant. During this stage, the organization may change its leadership, reward structures, and codes of conduct to demonstrate its commitment to new standards of behavior. These attempts to rehabilitate the organization reflect a threat rigidity response to failure in that they strengthen the control environment and display stronger governance.

In the short-run, the threat rigidity response following a governance failure appears to benefit the organization. Research shows that companies focused on corporate governance following a financial statement fraud have superior stock price performance; however, analyst following and institutional holdings remain unchanged, suggesting that over the long-run

credibility may still be a problem for these firms (Farber, 2005). We extend these findings to suggest that innovation may also be a problem for these firms. Specifically, we propose that top executives experiencing governance failures will exhibit the threat rigidity response and curtail investments in "risky" activities, including those that are associated with long-run innovation – namely, investments in research and development. Although the relationship between governance failure and innovation has not been studied previously, one study of privately held Chinese firms finds that cheating firms made significantly fewer patent applications than non-cheating firms (REDACTED), thus indicating that fraud may indeed have negative consequences for innovation.

- *Hypothesis 1: At a firm level, a governance failure will be associated with a decline in investments in innovation.*
- *Hypothesis 1a: At a firm level, governance failures due to fraud will reduce investments in innovation whereas governance failures not caused by fraud will not have a significant impact on innovation.*

Managerial Responses to Failure: The Failure Trap Phenomenon

Threat rigidity theory is not the only theoretical model available for understanding managerial responses to failure, however. Other researchers have proposed that managers may *increase* their risk propensity after a failure event. Levinthal and March (1993) observed that managers who have experienced failure in the past are driven to "frenzies of experimentation, change, and innovation by a dynamic of failure," (Levinthal and March 1993: 105). March (1981), in reference to the work of Hermann (1963) and Mayhew (1979), elaborates on this "failure trap" phenomena as follows:

> …organizations facing bad times will follow riskier and riskier strategies, thus simultaneously increasing their chances of survival and reducing their life expectancy. Choices that seek to reverse a decline, for example, may not maximize expected value. As a consequence, for those that do not survive, efforts to survive will have speeded up the process of failure (567).

Thus, the extant research suggests conflicting theories for how managerial risk taking will be shaped by governance failures – one body of research suggests that managers will become more rigid and conservative while another suggests that they will become riskier. A recent exploration of this paradox suggests that the conflicting results may be due to the moderating influences of organizational experience, legitimacy, and age-related inertia (Desai, 2008). We suggest that these differences in responses to failure may also be attributable to different domains of decision making. At the firm-level, we argue that top executives are more likely to invoke a threat rigidity response to governance failures. The actions of these executives are both more transparent to stakeholders and more closely linked to the causes of restatement, thus giving them greater incentives to curtail risk taking and thereby signal their commitment to stronger governance. At the project-level, however, we argue that functional leaders are more likely to invoke the failure trap response to a governance failure. Being more distant from the causes and consequences of the failure, functional leaders will be less concerned for their personal reputations. Facing both an uncertain future and reduced funding, these functional leaders will be more inclined to take on risk in order to secure the survival of their organization and seek out the most innovative projects that promise the greatest rather than the most certain return on investment.

- *Hypothesis 2: At a project level, a governance failure will be associated with increased investments in innovation.*

In sum, we argue that the effect of a governance failure on managerial risk propensity will vary depending upon the domain of the decision maker. Whereas top executives may become more risk averse as they attempt to signal their commitment to safer, more conservative activities, functional leaders may become more risk seeking as they attempt to realize greater payoffs. While these changes in managerial risk taking cannot be observed directly, we may see their effects on downstream innovation activities. At the firm-level, the threat rigidity response among top executives should reduce investments in innovation (e.g., overall research and development spending). At the project-level, however, the failure trap response among functional leaders should increase investments in innovation (e.g., funding for more exploratory projects).

METHODOLOGY

Research Design and Empirical Setting

We argue that governance failures will shape the risk taking propensities of managers across multiple decision making domains within an organization and thus impact the organization's investments in innovation. Isolating and identifying the relationship between governance failure and innovation thus requires a multilevel, empirical approach. To this end, we analyzed two separate samples, which we describe as sample one and sample two below. We begin with a firm-level analysis of the manufacturing sector that attempts to broadly answer the question of whether or not there is a link between negative restatements and top executives' investments in innovation. We selected the manufacturing sector, because it contains a broad range of sub-industry groups ranging from food products to pharmaceuticals to electrical equipment, and thus it provides a variety of environmental contexts against which to test our hypotheses.

We also delve more deeply into the relationships between negative restatements and innovation by analyzing both the firm-level and the project-level effects of governance failure within the pharmaceutical industry. At the firm-level, we again measure the effects of negative restatements on top executives' investments in innovation. At the project-level, we also measure the effects of negative restatements on functional leaders' investments in exploratory drug development projects. We chose the pharmaceutical industry for our multi-level analysis for two reasons. First, the pharmaceutical industry is the most research and development (R&D) intensive of all industries (Jaruzelski, Loehr, & Holman, 2011), making the impact of changes in overall investments in innovation highly salient decisions for functional leaders. There is no lack of research investigating the importance of these activities to an organization's knowledge base and innovation efforts (e.g., Lavie & Rosenkopf, 2006; March, 1991; Rothaermel & Deeds, 2004). Within pharmaceutical firms, exploration is critical to a firm's ability to identify a new technological or therapeutic direction and has long-term financial performance implications. For example, a firm's ability to develop a blockbuster drug in a certain therapeutic category depends not only on its capability within that specific treatment area, but also, given the significant lead time associated with drug development, the firm's initial decision to explore in a new therapeutic area (Achilladelis & Antonakis, 2001). Project-level information in this industry is also both relatively well-defined and publicly available due to regulatory requirements.

Data

To investigate the relationship between governance failure and innovation, we rely on three data sources. For governance failure information, we used financial restatement data from Audit Analytics (www.auditanalytics.com), a data resource that tracks and categorizes financial restatement by their effect on the financials (positive or negative) and the reason for restatement,

which could include accounting rule (GAAP/FASB) application failures, financial fraud and other misrepresentations, errors, or other significant issues and material weaknesses in internal controls. Our use the Audit Analytics database is supported by prior research (e.g., (Lobo & Zhao, 2013; Huang et al., 2007) which suggests this source is more complete than either the SEC or GAO databases, and it excludes technical restatements (e.g., restatements for mergers, discontinued operations, changes in accounting principle), which by their nature do not suggest a governance failure on the part of the firm. We exclude positive restatements and focus on negative restatements, since negative restatements are more likely to affect managers' reputations and thus change their risk taking propensities.

For innovation information, we used two data sources. We gathered information on firm-level research and development spending and other financial measures used as controls in both studies from Compustat, a database of financial and disclosure information on both active and inactive publicly-traded companies managed by Standard & Poor's. For sample two, we gathered information on project-level investments in innovation using PharmaProjects (http://citeline.com/products/pharmaprojects/), a unique, multi-level dataset containing information on drug development projects across a wide range of both public and private pharmaceutical and biotechnology firms from around the globe. Within this dataset, each drug development project at each company is categorized according to its phase of development, its pharmacology (the mechanism or compound), and its therapy area.

To construct sample one, we extracted the financial records for all publicly traded manufacturing firms in the Computstat database according to the company's Standard Industrial Code (SIC) classification (Manufacturing SIC 2000 – 3999) following the US Census approach for the years 1994 through 2013. This extract produced a sample of 6,369 publicly-traded

manufacturing firms. We then matched these firms by name and CIK code to the Audit Analytics database of negative restatements to identify the year in which a negative restatement was disclosed, if any, and the reason for the restatement (e.g., fraud, error, accounting rule application failure, material control weakness, or other). Of the 6,369 manufacturing firms in sample one, 2,167 (34%) had at least one negative restatement during the period 1994 through 2013 with 66 of these restatements due to allegations of fraud.

To construct sample two, we began with the PharmaProjects dataset for the period 1995 through 2005, which reports on 85,374 drug development projects for 2,197 pharmaceutical and biotechnology firms worldwide. Because PharmaProjects includes both public and private firms, we narrowed our sample to only the 598 publicly traded firms in the PharmaProjects dataset that filed one or more annual reports with the SEC during the period 1995 through 2005. We then matched these firms by name and CIK code to the Audit Analytics database of negative restatements to identify the year in which a negative restatement was disclosed, if any, and the reason for the restatement (e.g., fraud, error, accounting rule change, material control weakness, or other). Of the 598 publicly traded pharmaceutical firms in our PharmaProjects dataset, 109 (18%) had at least one negative restatement during the period 1995 through 2005 with only 2 of these restatements due to allegations of fraud. We gathered information on firm-level research and development spending and other financial measures used as controls to construct the pharmaceutical sample primarily from Compustat. To maintain the sample size, we supplemented missing Compustat data with hand-collected financial information taken directly from SEC 10-K filings.

Measures

A description of each of the variables in sample one and two is provided in Table 1.

--INSERT TABLE 1 HERE--

Firm-level Innovation. Research and development (R&D) activities are critical factors for innovation and the long-term success of the organization (Cohen & Levinthal, 1990). Likewise, R&D intensity (R&D expenditures divided by a size control) has been found to be good proxy for the innovative focus of an organization, because it is at the discretion of executives and fluctuates with firm performance and aspirations (Gentry & Shen, 2013). We thus measured firm-level innovation as a firm's R&D intensity (*R&D Int*), which here is calculated as the research and development expense of the organization in a given year divided by the firm's total assets (Cohen & Klepper, 1992; Rothaermel & Hill, 2005). We performed a logarithmic transformation on this variable to normalize its distribution.

Project-level Innovation. Within an organization, managers choose between projects of an exploratory or an exploitative nature. March (1991: 71) explained that "exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution." Much like R&D expenditures, funding for exploratory projects is discretionary. Research shows that investments in drug development projects are driven by a number of factors to include competitiveness in the industry, overall R&D spending, and past development of a "blockbuster drug," which encourages managers to exploit extensions of the blockbuster rather than exploring in new, more innovative areas. We also know that functional leaders within the pharmaceutical industry make decisions about funding for exploitative vs. exploratory drug development projects using tools such as discounted cash flow analysis or real options analysis and metrics such as R&D spend, time spent in each phase of development, human capital, distribution of projects from incremental to

radical, and the ratio of outside to inside sourced ideas (Ding et al., 2014). The effects of governance failures on these drug development decisions have not yet, to our knowledge, been studied.

Wuyts *et al.* (2004) define radical innovations in the pharmaceutical industry as drug development projects that incorporate a substantially different core technology and provide significantly greater customer benefits than previous drugs. Drawing on this work, we identified exploratory projects (Σ *Explore Projects*) in each year for each firm in the PharmaProjects database as those projects that represented a new therapeutic area for the firm. Specifically, we counted an individual drug development project as "exploratory" if the firm had 24 or fewer months of drug development experience in that particular drug's therapeutic area. Beyond this two year window, we assumed that a particular drug development project was no longer new and innovative. Support for this two year window measure of exploration comes from research showing that firms must spend between 2 and 2.5 years to get a new drug into Phase 1 of the FDA review process (Girotra, Terwiesch, & Ulrich, 2007). The average firm in our sample launched only 2.9 exploratory drug development projects over the entire 11 year sample period, with the most exploratory firm launching 81 and the least just 1 exploratory project.

Governance Failure. There are several measures of governance failure that might have been used in the study, including product recalls and environmental accidents. Following Pfarrer *et al*. (2008b), we selected negative financial restatements as our measure for governance failure in this analysis, because financial reporting relies almost exclusively on control processes and executive decisions that are *internal* to the organization, whereas product recalls and environmental accidents are more likely to involve external factors, including failures within supply-chain networks and shared responsibilities with third-parties.

Following the classifications provided by Audit Analytics, we created two measures of negative restatement for each firm in each year across both of our samples. First, we created a binary measure (*Negative Disclosure*), which indicates whether a firm in a given year disclosed that it would restate its financials and that this restatement would have a negative impact on its financial results. Note that this measure thus designates when this governance failure became public knowledge both inside and outside of the firm, which we hypothesize will trigger changes in managerial risk propensity across multiple domains of decision making. Second, we created two count measures addressing the severity of the governance failure by aggregating the number of negative restatements disclosed by a firm in given year attributable to fraud (*Σ Fraud Disclosures*) and those attributable to non-fraudulent causes (*Σ Non-Fraud Disclosures*), such as material weaknesses, error, rule misapplication, and other causes. These count measures are used in our additional tests as described in the results section below. Given the small size of our pharmaceutical sample in sample two and the relative lack of fraud events in this sample (only 2 firms out of 598), we addressed the severity of governance failure in this sample with a count measure that aggregates the number of restatements of any type that a firm disclosed in a given year (*Σ Negative Disclosures*).

Controls. A number of key variables were included in the regressions to attempt to control for alternative explanations from the ones we put forth. To illustrate that any effect we may find related to R&D intensity is not due to decision-making momentum or path dependency, we controlled for prior period R&D intensity *(R&D Int$_{t-1}$)*. To avoid potential collinearity concerns with our dependent variable, we did not include a direct measure for firm size in our models. Effects for firm size are thus included in prior period R&D intensity, which is calculated as research and development expense over total assets.

One could also argue that changes in R&D spending may be due to a decline in the slack resources available to the firm following a governance failure rather than a change in managerial risk propensity. Thus, we included a measure of prior period slack resources in the form of working capital intensity (*WCAP Int*$_{t-1}$) calculated as working capital divided by sales. Because of the relatively small size of the pharmaceutical sample in sample two and collinearity concerns amongst our control variables, for our project-level hypothesis tests we instead control for prior period R&D expense (*R&D*$_{t-1}$) and prior period working capital (*WCAP*$_{t-1}$) directly rather than using intensity measures.

We also controlled for prior period performance (*Net Income*$_{t-1}$), because a company's financial performance could affect both managerial risk propensities and the rate of restatement. Managers in lower performing firms may perceive that they have less to lose and thus develop higher risk propensities. Performance could also affect the restatement rate in that lower performing firms are under greater pressure to "cook the books" or do whatever it takes to meet market expectations (e.g., Arthaud-Day et al., 2006). Firms that are exceeding performance expectations are also at higher risk of restatement (e.g., Mishina et al., 2010; Baucus & Near, 1991; Harris & Bromiley, 2007).

To further control for exogenous institutional effects that could influence managerial risk propensities and the rate of restatement through imitation, we created dummy variables to represent the different manufacturing sub-industry groups based on the first two digits of the company's SIC classification (*Sector*) for sample one and dummy variables to represent three different types of pharmaceutical sub-industry groups for sample two using the company classifications provided by PharmaProjects – namely, pharmaceutical firms (*Pharma*), biotechnology firms (*Biotech),* and all other firms (*Other).* This sub-industry dummy variable

also allows for a fixed-effects analysis, which corrects for the effects of non-independent errors that can occur when data is grouped or clustered. Finally, we include a dummy variable measure for the geographic location of the firm (*USA Firm, Non-USA Firm*) to control for variance in managerial risk taking propensity that may reflect differences in cultural norms from country to country.

Models and Estimation Procedures

In order to test our hypotheses, we ran a number of models using two different estimation procedures. To clarify which models relate to which hypothesis, we used a dot notation where 1 = manufacturing panel and 2 = pharmaceutical panel (e.g., H1.1 is using the manufacturing panel to test hypothesis 1 whereas H1.2 is using the pharmaceutical panel to test hypothesis 1).

Models used to test Hypothesis 1 (Firm-level Threat Rigidity Hypothesis)

To test firm-level effects of negative restatement disclosures on research and development intensity in both the manufacturing and pharmaceutical panels, we use generalized least squares regression and robust standard errors. We chose to use the random-effects model so we could estimate the variables that are constant with the firm. Firm and year-specific notation was excluded from the model description except where the independent variables were lagged as noted.

(H1.1)

$$R\&D\ Int = \alpha_0 + \alpha_1 Negative\ Disclosure_{t-1} + \alpha_2 R\&D\ Int_{t-1} + \alpha_3 WCAP\ Int_{t-1} + \alpha_4 NetIncome_{t-1} + \alpha_5 USA + \alpha_6 SECTOR + \alpha_7 YEAR + \varepsilon$$

(H1.2)

$$R\&D\ Int = \theta_0 + \theta_1 Negative\ Disclosure_{t-1} + \theta_2 R\&D\ Int_{t-1} + \theta_3 WCAP\ Int_{t-1} + \theta_4 NetIncome_{t-1} + \theta_5 USA + \theta_6 PHARMA + \theta_7 BIOTECH + \theta_8 YEAR + \varepsilon$$

Model used to test Hypothesis 2 (Project-level Failure Trap Hypothesis)

To test project-level effects of negative restatement disclosures on the number of exploratory drug development projects in the pharmaceutical panel, we assume that new exploration projects will arrive according to the Poisson probability distribution where

$$P\big(Y(ft)\big) = \tau_{ft}^{Y(ft)} e^{-\tau(ft)} / Y(ft)!$$

and τ_{ft} is the expected value of a Poisson distribution, in this case the expected number of new exploration projects (Σ *Explore Projects*) introduced by firm (*f*) in year (*t*). Therefore, *Y(ft)* is the actual number of such projects introduced. Following Hausman *et al*. (1984), the parameter of τ_{ft} of the above specified distribution function is estimated using the following specification:

$$\ln\big(\tau(ft)\big) = \delta_0 + \sum_{j=1}^{n} \delta_j X_{jft} + \sum_{k=1}^{q} \delta_k X_{kt}$$

where X_{jft} represents the value of the firm characteristic *j* (*Negative Disclosure*$_{t-1}$*, R&D* $_{t-1}$*, WCAP*$_{t-1}$*, Net Income* $_{t-1}$*, USA, Pharma or Biotech*) for firm (*f*) in year (*t*), which in this case *n* is the number of such characteristics (5). Likewise, X_{kt} represents the value of the nonfirm-specific variables (*year*). This equation was estimated using ML in Stata with robust standard errors.

Our decision to use the Poisson model was based on several factors, the primary being that the dependent variable (the sum of explore projects in a given year) assumes small, discrete values and frequently takes on a zero value. As such, it is impossible for the error terms in the regression to follow a normal distribution, as is assumed in OLS, and to a lesser extent Tobit models. Likewise, the data does not suffer for over dispersion, indicating that Poisson is a better estimator than negative binomial models (Cameron & Trivedi, 1986).

RESULTS

Before running the regression models, we first assessed the bivariate correlations for the variables the two studies as shown in table 2 for the manufacturing panel and table 3 for the pharmaceutical panel. The bivariate correlations do not indicate any significant unpredicted correlations between the independent variables. Supporting this conclusion, we found no variance inflation factor in the models greater than 10 (Cohen, et al. 2003).

--INSERT TABLES 2 & 3 HERE--

We note several interesting correlations regarding the relationship between restatement, performance, and innovation. Specifically, both panels reflect a general positive relationship between performance and restatement. To further unpack this finding, table 3 illustrates a generally positive correlation between fraud restatement disclosures and performance but a negative relationship between non-fraud related restatement disclosures and performance. In addition, the negative and significant relationship between fraud and non-fraud restatement disclosures gives support to our assertion that these different types of restatement stem from fundamentally different causes.

Manufacturing Panel: Firm-Level Threat Rigidity Tests

Tables 4 illustrates the findings for our firm-level hypothesis (H1.1) within the manufacturing sample. We used hierarchical regression analysis to test whether a model using prior period negative restatement disclosure measures explains additional variance in R&D intensity as compared with a control model. All variables were standardized before analysis to allow for comparisons among the study variables. Hypothesis 1 states that *at the firm level, a governance failure will be associated with a decline in investments in innovation.* In the manufacturing panel we find support for this hypothesis, as the coefficient in model 2 (α_1) for

prior period negative disclosure is negative and significant at the $p<0.001$ level. This model also explains significantly more variance in R&D intensity than our control model ($R^2 = 0.32$, $p \leq 0.05$).

--INSERT TABLE 4 HERE—

Additional Tests

It seems likely that the threat rigidity response would be more pronounced in cases where the restatement is related to allegations of fraud, because top executives will be even more concerned about rebuilding their reputations for good governance. To explore whether this threat rigidity response depends upon the reason for the restatement, model 3 regresses the sum of fraud disclosures and the sum of non-fraud disclosures in the prior period on R&D intensity. We find that prior period disclosures of restatements for fraudulent causes have a significant, negative impact on R&D intensity whereas prior period disclosures of restatements for other reasons do not. Specifically the co-efficient for sum of fraud disclosures (β_1 in model 3) is negative and significant at the $p<0.01$ level. This model also explains significantly more variance in R&D intensity ($R^2 = 0.34$, $p \leq 0.01$).

Pharmaceutical Panel: Firm-Level Threat Rigidity Tests

Table 5 illustrates the findings for our firm-level hypotheses (H1.2) within the pharmaceutical sample. To replicate the findings from sample one, we again used hierarchical regression analysis to test whether a model using negative restatement disclosure measures explains additional variance in R&D intensity as compared with a control model. All variables were standardized before analysis to allow for comparisons among the study variables. In the pharmaceutical panel we do not find support for hypothesis 1, as evidenced by the lack of significance of θ_1 in model 5.

--INSERT TABLE 5 HERE—

Additional Tests

To explore whether the threat rigidity response might be evident in cases where the restatement is related to allegations of fraud, as was found in our manufacturing sample, model 6 regresses the sum of fraud disclosures and the sum of non-fraud disclosures in the prior period on R&D intensity. Here we do find support for the threat rigidity hypothesis in that the co-efficient for prior period disclosures of fraud restatements (γ_1 in model 6) is negative and significant at the p<0.001 level. This model also explains significantly more variance in R&D intensity than our control model ($R^2 = 0.09$, $p \leq 0.05$). Taken together, these findings suggest that fraud disclosures have a negative impact on subsequent innovation investments at the firm-level and support the notion that governance failures associated with fraud evoke a threat rigidity response in top executives.

Pharmaceutical Panel: Project-Level Failure Trap Tests

Table 6 illustrates the findings for our project-level hypothesis (H2) within the pharmaceutical sample. Our project-level analysis unpacks the effects of governance failures on the decision making of functional leaders as opposed to top executives. Here we predict that governance failures will spur innovation as functional leaders, more distantly affected by the reputational consequences of these failures, seek to realize the greatest returns with their more limited resources. In support of this hypothesis, we find that the coefficient for a prior period negative restatement disclosure ($\delta_{j)}$ on the number of exploratory drug development projects in model 8 is both positive and significant at the p<.05 level. This model also explains significantly more variance in new exploratory projects ($p \leq 0.01$).

--INSERT TABLE 6 HERE—

Additional Tests

Due to the small size of our project-level sample and the relatively few numbers of fraud disclosures in this sample, we were unable to explore whether this observed change in risk propensity at the project-level is sensitive to the cause of the restatement (e.g., fraud vs. non-fraud). However, we did regress the aggregate number of negative restatement disclosures in the prior period on the number of exploratory drug development projects as a proxy for the severity of governance failure. As reported in model 9, we find that the coefficient for the sum of prior period negative disclosures is positive and significant at the $p<.05$ level. This model also explains significantly more variance in new exploratory projects ($p \leq 0.01$) as compared with model 8. Taken together, these findings suggest that negative disclosures have a positive impact on innovation activities at the project-level and support the notion that functional leaders exhibit a failure trap response in their project selection after the announcement of a governance failure.

DISCUSSION & CONCLUSION

This study explored the consequences of governance failures for innovation by studying the relationship between negative restatement disclosures, especially those alleging fraud, and subsequent investments in firm-level research and development and project-level exploration. Although the consequences of restatement and fraud have been studied previously, few scholars have explored the potential effects of these governance failures on innovation. Unpacking this relationship helps us to further understand the effects of failure on not only the performance and reputation of a firm, but also on its ability to innovate and respond to entrepreneurial opportunities in the external environment.

To examine this relationship, we drew upon two competing theories explaining how managerial risk taking propensity is shaped by failure from the management literature. Threat

rigidity theory (Staw et al., 1981) predicts that governance failures will curtail risk taking and decrease investments in innovation whereas the failure trap phenomenon (March, 1981) predicts that governance failures will increase risk taking promote investments in innovation. We argued that both effects may result from governance failures. Whereas top executives become more risk averse as they attempt to signal their commitment to safer, more conservative activities following a governance failure, functional leaders instead become more risk seeking as they attempt to realize greater payoffs with their more limited resources.

While these changes in managerial risk taking cannot be observed directly, we see their effects on downstream innovation activities. At the firm-level, we find that negative restatement disclosures, especially those alleging fraud, reduce subsequent investments in research and development as would be predicted by a threat rigidity response among top executives. This threat rigidity response may help executives cope with the reputational and psychological effects of failure in the short-run, but over the long-run the organization could struggle to compete as this risk averse response depletes future innovation resources (Lavie & Rosenkopf, 2006; March, 1991; Rothaermel & Deeds 2004). At the project-level, we find that negative restatement disclosures increase investments in innovation (i.e., funding more exploratory projects) as would be predicted by a failure trap response among functional leaders.

The implications of these findings are significant. Research on organizational efforts to regain legitimacy after failure suggests that if an organization can show remorse for past mistakes and demonstrate a commitment to enhancing its governance structure, the organization's reputation may recover (Pfarrer et al., 2008a). Johnson & Johnson's swift and far-reaching response to the Tylenol tampering scandal of 1982 is often cited as an example of how organizations can successfully regain legitimacy after experiencing failure (Paine, 1994).

Johnson & Johnson may be the exception, rather than the rule, however. This organization had an outsider to blame for the recall and continued to innovate even as it weathered the storm of this failure event. What happens when a company faces a failure that is largely the result of its own doing, a failure with ties back to aggressive risk taking in the organization? The existing strategy literature offers little guidance about how organizations manage this risk taking challenge and what the consequences are for organizations that fail to do so.

Past research has shown that financial misrepresentation damages an organization's reputation and its legitimacy, but these new findings show that the effects of internal governance failure run deeper. Understanding the dependencies between risk taking in organizations and failure is important, because as organizations grow in size and scope, they expose themselves to greater public scrutiny, thus amplifying the effects of strategic decisions made during and after such crises. We know that organizations that fail to invest in the future, to innovate and grow, eventually suffer losses in competitive position and long-run profitability (March 1991; Teece 1996). Likewise, managers that fall prey to the failure trap may not realize the expected value of their investments and reduce the life expectancy of the firm (March, 1981). At some point, the threat rigidity response, which is intended to ensure organizational legitimacy, or the failure trap response, which is intended to ensure organizational competitiveness, could themselves become a threat to survival.

Several limitations of this study merit acknowledgement. The current analysis could be expanded to control for changes in credit quality to isolate responses caused by post failure event funding constraints from the behavioral drivers of changes in risk propensity. Our study also lacks control measures to isolate the effects of governance structures, such as board independence, on innovation. We also cannot discern how far the risk taking pendulum has

swung with either the threat rigidity or failure trap response. Perhaps the threat rigidity response shows that companies are not becoming dangerously conservative after a governance failure, but rather that they are shifting their risk taking behavior to follow a more prudent course. Likewise, the failure trap response at the project level may provide a much needed boost to innovation that counter-balances the threat rigidity response at the firm level. Further qualitative investigation of these responses may help illuminate these nuances.

Despite these limitations, this study is important in that it connects managerial perspectives on risk taking with governance failure and shows the broader impacts of this relationship at multiple levels in the organization. Our understandings of corporate innovation, competitive advantage, and even survival rates may be enhanced by this analysis in that it shows the far reaching consequences of governance failures. Much has been written about the external loss of trust in the organization following a restatement event, but this study suggests that a loss of trust and confidence within the organization may result, as well. Understanding the interaction of these strategic and psychological factors should open the door for new insights into the concept of risk taking and its challenging relationship with corporate performance.

Further study of the consequences of governance failure on innovation can explore the depth and breadth of its effects on the organization, including any correlations with survival rates. We may find that the threat rigidity response continues until stakeholders begin to question the organization's future, at which point pressures to survive and regain competitive advantage should spur renewed risk taking (March & Shapira, 1992; Miller & Chen, 2004). Thus, further study could provide new insights into the differences long-term innovation, performance, and survival among companies that experience governance failures.

TABLES

Table 1. Variable Descriptions

Variable	Description
R&D Int	Research and development intensity (R&D expense / total assets)
Σ Explore Projects	sum of exploratory drug development projects as categorized by development time in therapy area in a given year
Negative Disclosure	1 if firm had one or more disclosures of a negative restatement in a given year, else 0
Σ Fraud Disclosures	sum of disclosures of restatements due to fraud in a given year
Σ Non-Fraud Disclosures	sum of disclosures of restatements due to other causes (e.g., error, rule misapplication, material weakness) in a given year
Σ Negative Disclosures	sum of disclosures of negative restatements for any cause in a given year
$R\&D\ Int_{t-1}$	prior period R&D intensity (R&D expense / total assets)
$WCAP\ Int_{t-1}$	prior period working capital intensity (WCAP / net sales)
$R\&D_{t-1}$	prior period R&D expense
$WCAP_{t-1}$	prior period working capital
$Net\ Income_{t-1}$	prior period net income
Sector	dummy variable for manufacturing sub-industry group as defined by first two digits of SIC code
Pharma	dummy variable for pharmaceutical sub-industry group as defined by company classification in PharmaProjects
Biotech	dummy variable for biotechnology sub-industry group as defined by company classification in PharmaProjects
Other	dummy variable for all other sub-industry groupings as defined by company classification in PharmaProjects
USA Firm	dummy variable for location of company in the USA

Table 2. Bivariate Correlations and Descriptive Statistics – Manufacturing Sample

	mean	std dev	1	2	3	4	5	6
1. Negative Disclosure	0.024	0.510						
2. Σ Fraud Disclosures	0.022	0.146	-0.081					
3. Σ NonFraud Disclosures	1.050	0.325	0.047	-0.468				
4. R&D Int	0.001	0.297	0.053	-0.013	-0.005			
5. WCAP Int	-0.010	0.019	0.152	0.005	-0.017	-0.022		
6. Net Income	-0.092	1.391	0.068	0.014	-0.003	-0.001	0.186	
7. US firm	0.991	0.093	-0.053	0.014	-0.027	0.003	-0.031	-0.011

Table 3. Bivariate Correlations and Descriptive Statistics – Pharmaceutical Sample

	mean	std dev	1	2	3	4	5	6	7	8
1. Σ Explore Projects	3.517	1.000								
2. Negative Disclosure	0.034	0.182	-0.016							
3. Σ Negative Disclosures	0.036	0.195	-0.013	0.900						
4. R&D	474,989	62,781	-0.009	-0.015	-0.015					
5. Net Income	308,526	32,635	0.021	0.014	0.014	-0.623				
6. WCAP	(546,269)	51,163	0.006	-0.016	-0.016	0.605	-0.565			
7. USA firm	0.893	0.309	-0.098	-0.041	-0.036	0.051	-0.059	0.034		
8. Pharma	0.454	0.498	0.020	0.008	0.017	-0.112	0.100	-0.082	-0.106	
9. Biotech	0.337	0.473	-0.082	0.018	0.011	-0.051	0.046	-0.021	0.064	-0.650

Table 4. GLS Regression on R&D Intensity for Manufacturing Sample - Firm Level

	Model 1			Model 2			Model 3		
R&D Int	**beta**		**s.e**	**beta**		**s.e**	**beta**		**s.e**
Constant	-4.373		(0.547)	-0.925		(0.643)	-3.169		(0.559)
Controls									
R&D Int_{t-1}	0.929	***	(0.301)	2.913	***	(0.481)	2.906	***	(0.480)
WCAP Int_{t-1}	-0.004		(0.006)	0.717	***	(0.182)	0.714	***	(0.181)
Net $Income_{t-1}$	-0.028	***	(0.008)	-0.078		(0.045)	-0.075		(0.045)
USA firm	1.476	***	(0.403)	0.861	**	(0.419)	0.847	**	(0.408)
Sector	**Included**			**Included**			**Included**		
Year	**Included**			**Included**			**Included**		
Independent Variables									
Negative $Disclosure_{t-1}$				-0.002	***	(0.000)			
Σ $Fraud\ Disclosures_{t-1}$							-0.385	***	(0.150)
Σ $Non\text{-}Fraud\ Disclosures_{t-1}$							-0.104		(0.100)
$\mathbf{R^2}$	0.271			0.318			0.344		
Improvement over Base (ΔR^2)				0.047	**		0.073	***	
* $p < .1$; ** $p < .05$; *** $p < .01$; Standard errors are in parentheses							n = 33,761 obs.		

Table 5. GLS Regression on R&D Intensity for Pharmaceutical Sample - Firm Level

	Model 4			Model 5			Model 6		
R&D Int	**beta**		**s.e**	**beta**		**s.e**	**beta**		**s.e**
Constant	-1.973		(0.193)	-0.974		(1.511)	-1.360		(0.114)
Controls									
R&D Int_{t-1}	0.029		(0.023)	-0.064		(0.177)	0.030		(0.023)
WCAP Int_{t-1}	0.090		(0.057)	0.626		(1.750)	0.091		(0.057)
Net $Income_{t-1}$	-0.069	**	(0.035)	-0.271	***	(0.077)	-0.070		(0.035)
USA firm	0.636	***	(0.166)	0.636	***	(0.167)	0.634	***	(0.166)
Pharma Firm	-0.028		(0.134)	0.040		(0.470)	-0.041		(0.135)
Biotech Firm	0.231		(0.130)	0.586		(0.422)	0.212		(0.132)
Year	**Included**			**Included**			**Included**		
Independent Variables									
Negative $Disclosure_{t-1}$				0.096		(0.303)			
Σ $Fraud\ Disclosures_{t-1}$							-0.587	***	(0.043)
Σ $Non\text{-}Fraud\ Disclosures_{t-1}$							-0.003		(0.077)
$\mathbf{R^2}$	0.040			0.091			0.092		
Improvement over Base (ΔR^2)				0.051	**		0.052	**	
* $p < .1$; ** $p < .05$; *** $p < .01$; Standard errors are in parentheses						n = 2,214 obs.			

Table 6. Poisson Estimation of Explore Projects for Pharmaceutical Sample - Project Level

	Model 7		Model 8		Model 9	
Σ Explore Projects	**beta**	**s.e**	**beta**	**s.e**	**beta**	**s.e**
Constant	1.354	(0.125)	1.336	(0.126)	1.337	(0.126)
Controls						
$R\&D_{t-1}$	-0.001	(0.025)	0.000	(0.025)	0.000	(0.025)
$WCAP_{t-1}$	-0.001	(0.024)	0.000	(0.024)	0.000	(0.024)
Net $Income_{t-1}$	-0.017	(0.026)	-0.017	(0.026)	-0.016	(0.026)
USA firm	-0.286 ***	(0.103)	-0.286 ***	(0.103)	-0.286	(0.103)
Pharma Firm	-0.143	(0.085)	-0.139	(0.085)	-0.139	(0.085)
Biotech Firm	-0.242 ***	(0.091)	-0.242 ***	(0.091)	-0.244	(0.091)
Year	**Included**		**Included**		**Included**	
Independent Variables						
Negative $Disclosure_{t-1}$			0.191 **	(0.095)		
Σ Negative $Disclosures_{t-1}$					0.188 **	(0.091)
Log likelihood	-3528.9		-3526.9		-3526.8	
Chi Square	129.3		133.1		133.3	
Improvement over Base ($\Delta\chi 2$)			3.8 ***		4.0 ***	

* $p < .1$; ** $p < .05$; *** $p < .01$; Standard errors are in parentheses

n=1,712

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