Performance Feedback and New Product Innovations: The Role of CEO Financial Orientation

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Abstract

A key insight of the behavioral theory of the firm (BTF) is that firms are sensitive to how they perform vs. their aspirations and how performance feedback shapes innovative behavior. The stylized responses to performance feedback (i.e., problemistic search below aspirations, uncertainty avoidance above aspirations) have been investigated within a broad range of innovative behaviors and industry settings but evidence from these studies is mixed: while some is in sync with the original predictions of the BTF, other evidence is not. We suggest that an important and so far overlooked factor in understanding the relationship of performance feedback and innovative behavior is that performance-aspiration gaps are observed and interpreted by key organizational decision makers such as CEOs with heterogeneous experiences and training. In particular, we connect the unique characteristics of financially-oriented CEOs to the key building blocks of the BTF (problemistic search, uncertainty avoidance, quasi-resolution of conflicts) to predict how that orientation is a key contingency in explaining new product initiations following performance feedback. We test our theoretical framework in the global bio-pharmaceutical industry between 2000 and 2013, combining data on over 3000 internal and external product development initiatives and over 600 CEO biographies using topic extraction techniques. Our results reveal that only when CEO financial orientation is high, the patterns predicted by the BTF hold. The paper thus provides important insights into the role of CEOs in how performance feedback shapes innovative behavior.
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ABSTRACT

A key insight of the behavioral theory of the firm (BTF) is that firms are sensitive to how they perform vs. their aspirations and how performance feedback shapes innovative behavior. The stylized responses to performance feedback (i.e., problemistic search below aspirations, uncertainty avoidance above aspirations) have been investigated within a broad range of innovative behaviors and industry settings but evidence from these studies is mixed: while some is in sync with the original predictions of the BTF, other evidence is not. We suggest that an important and so far overlooked, factor in understanding the relationship of performance feedback and innovative behavior is that performance-aspiration gaps are observed and interpreted by key organizational decision makers such as CEOs with heterogeneous experiences and training. In particular, we connect the unique characteristics of financially-oriented CEOs to the key building blocks of the BTF (problemistic search, uncertainty avoidance, quasi-resolution of conflicts) to predict how that orientation is a key contingency in explaining new product initiations following performance feedback. We test our theoretical framework in the global bio-pharmaceutical industry between 2000 and 2013, combining data on over 3000 internal and external product development initiatives and over 600 CEO biographies using topic extraction techniques. Our results reveal that only when CEO financial orientation is high, the patterns predicted by the BTF hold. The paper thus provides important insights into the role of CEOs in how performance feedback shapes innovative behavior.

Keywords: BTF, Financial Orientation, CEO, Product Innovation
INTRODUCTION

A key insight of the behavioral theory of the firm (BTF) is that firms are sensitive to how they perform vs. their aspirations and how performance feedback shapes innovative behavior (H. Greve, 2003b, p. 76). The BTF predicts that when firms perceive their actual performance below aspirations, they initiate problemistic search, such as starting new product initiatives (H. Greve, 2003a). Conversely, when firms perceive their performance above aspirations, they strive to preserve the “status quo” (uncertainty avoidance) and try to avoid conflict (quasi-resolution of conflict) (H. Greve, 1998). These stylized responses to performance feedback (i.e., problemistic search below aspirations, uncertainty avoidance above aspirations) have been investigated within a broad range of innovative behaviors and industry settings. However, evidence from these studies is mixed: while some is in sync with the original predictions of the BTF of problemistic search and uncertainty avoidance (Chen & Miller, 2007; H. Greve, 2003a), other research results are not (e.g., Desai, 2008; J. Eggers & Kaul, 2017; Gentry & Shen, 2013; H. R. Greve, 2011). These inconsistencies lead to the broad question as to under what conditions does performance feedback, ultimately, shape innovative behavior.

We suggest that an important and so far overlooked factor in understanding the relationship of performance feedback and innovative behavior is that performance-aspiration gaps are observed and interpreted by key organizational decision makers, in particular, chief executive offices (CEOs). Those CEOs are important as they formulate and implement a firm’s strategy and are responsible for allocating organizational resources and attention (J. P. Eggers & Kaplan, 2009; Li, Maggitti, Smith, Tesluk, & Katila, 2013; Ocasio, 2011; Simons, 1994). Cyert and March (1963) suggested early that the “training and experiences” of decision makers (such as CEOs) substantially influence the way organizations establish goals.
and take actions. Yet, the majority of BTF studies focused on innovation have not taken into consideration the unique role of CEOs in the interpretation and response to performance feedback.

In this paper, we systematically account for CEOs as key organizational decision makers who observe, interpret and respond to performance feedback. We acknowledge that CEOs are heterogeneous in their experience and training, which is known to shape how they observe and interact with their environment (Cyert & March, 1963; D. Hambrick & Mason, 1984). A key difference in that training and experience, which we emphasis in this paper, is a CEO’s financial orientation (FO), i.e., the extent to which a CEO has experience in financial concepts and metrics (Andrews & Welbourne, 2000, p. 96). With respect to a firm’s innovative actions, we focus on the initiations of new product innovations, which are a key strategic decision made with involvement from top management and CEOs (Li et al., 2013).

Our theoretical framework combines the literature on BTF and CEOs’ FO. We argue that, generally, financially-oriented CEOs are sensitive to short-term performance deviations and influence from stakeholders and prefer stability and predictability. We connect these characteristics to the key building blocks of the BTF (problemistic search, uncertainty avoidance, quasi-resolution of conflicts) to predict how a CEO’s FO is a key contingency in explaining new product initiations when performance falls below and above aspirations.

When performance is below aspirations, CEOs with a stronger FO are more likely to perceive their situation as unfavorable and thus will take swift action to increase the rate of new product initiations. In contrast, when performance is above aspirations, financially-oriented CEOs prefer to maintain the status quo and avoid conflicts with both internal and external stakeholders, which suggests a reduction in the rate of new product innovations. Overall, these arguments suggest that firms with strongly financially-oriented CEOs will correspond
more closely with the original patterns ascribed by the BTF of problemistic search, uncertainty avoidance and quasi resolution of conflict.

We tested our theoretical framework in the global bio-pharmaceutical industry using a sample of 266 firms between the years of 2000 and 2013. In the bio-pharmaceutical industry, product innovations are central to firm survival and success (Bierly & Chakrabarti, 1996; Roberts, 1999), and the availability of high-quality, detailed data allowed us to clearly detect new product initiatives by each firm. Specifically, we tracked over 3000 internal and external new product development initiatives drawing on multiple data sources (ReCap, Pharmaprojects). We collected employment records of more than 600 CEOs (Boardex) and their professional biographies (Bloomberg Executive Profile & Biography) to capture a CEO’s financial orientation with the help of unsupervised text-mining topic extraction techniques (Kaplan & Vakili, 2015). Finally, we followed prior research, capturing below and above aspiration performance through accounting data from COMPUSTAT (Chen & Miller, 2007; Iyer & Miller, 2008).

Our results reveal the importance of CEO financial orientation when examining new product initiatives as a response to performance feedback. Supporting our hypotheses, we find that when CEO’s financial orientation is high and the firm has performed below aspirations, problemistic-type search unfolds as firms increase the initiation of new product innovations. However, when a CEO’s financial orientation is high and the firm has performed above aspirations, we observe uncertainty avoidance as firms decrease the rate of new product innovations. These results are consistent for both internal and external new product initiatives and robust to various alternative specifications.

To the best of our knowledge, our paper is one of the first to systematically connect the BTF and the literature on CEO characteristics to provide new insights into the relationship of performance feedback and innovative behavior. While prior studies in the
BTF have focused on the organization, its performance and innovative behavior (e.g., Chen & Miller, 2007; J. Eggers & Kaul, 2017; H. Greve, 2003a), we additionally account for the unique characteristics of CEOs who observe, interpret and react to performance feedback. Our results reveal that only when CEO financial orientation is high, the patterns predicted by the BTF (i.e., problemistic search, uncertainty avoidance, and quasi resolution conflicts) hold. Overall, this both supports and adds to Cyert and March’s (1963) original idea that top managers and key decision makers in organizations play a fundamental role in the formation of goals and taking action. Those results further suggest that the mixed empirical findings found in studies of the BTF could be the result of not accounting for who interprets performance aspiration gaps and who takes action.

The paper also adds to the literature on financial orientation. Most studies examining financial orientation suggest that such an orientation has somewhat of a negative effect on firm innovation (e.g., Asker, Farre-Mensa, & Ljungqvist, 2014; Bernstein, 2015; Bushee, 1998; Rahmandad, Henderson, & Repenning, 2016; Stein, 1989; Terry, 2015). The paper confirms this pattern for financially-oriented CEOs, but only when performance is above aspirations. However, the paper reveals that when performance falls below aspirations, financially-oriented CEOs will be more likely to increase the initiation of new product innovation. This suggests that, under certain conditions (i.e., below aspiration performance), financial orientation can be a catalyst for innovative actions.

Finally, the paper adds to the discussion of upper echelon theory that organizational context matters to the relationship of CEO or TMT characteristics and organizational decisions (D. C. Hambrick, 2007). Our paper suggests that when examining CEO and TMT characteristics, it is important to consider whether firms have performed above or below the aspiration point to gain a more precise understanding of CEOs’ decisions and actions.
In the following sections, we develop a more nuanced examination of how performance feedback affects new product initiatives and how this is shaped by heterogeneity with respect to the financial orientation of CEOs.

**THEORY**

**Performance Feedback & Innovation**

A broad stream of literature drawing on the Carnegie tradition describes organizations as goal-directed systems that use simple operating procedures and heuristics for decision making (Cyert & March, 1963; J. March & Simon, 1958).

Organizational goals are important as they set expectations with respect to the performance firms aspire to achieve. Based on the BTF, goals are the result of a bargaining process by coalitions (both internal and external stakeholders), which set aspirations as to how the firm has to perform (quasi-resolution of conflict) (Cyert & March, 1963; H. Greve, 1998; Levinthal & March, 1981; J. March & Simon, 1958). A tenet of the BTF is that a firm’s aspiration point acts as a ‘master switch’ determining organization actions (H. Greve, 2003b, p. 76). Managers compare achieved versus aspired performance and such performance feedback ultimately shapes how they behave (Cyert & March, 1963; H. Greve, 1998; Levinthal & March, 1981; J. March & Simon, 1958). As managers perceive their actual performance below aspirations, they initiate the problemistic search for solutions (e.g., in the form of product innovations) (H. Greve, 2003a). Conversely, when managers perceive firm performance above aspirations, they strive to preserve the “status quo” and to avoid taking more risk (uncertainty avoidance) (H. Greve, 1998).

Researchers have been particularly interested in applying BTF in the context of innovation and to explain how innovation-related behaviors (such as R&D activities, new product development and launch, technological search, patenting, and pursuit of radical
invention) are shaped by performance feedback. The stylized responses to performance feedback (i.e., problemistic search below aspirations, uncertainty avoidance above aspirations) have been investigated in a broad range of contexts including general risk-taking in organizations (Bromiley, 1991), R&D spending (Chen & Miller, 2007; H. Greve, 2003a), new product development (H. Greve, 2003a), acquisitions (Iyer & Miller, 2008), organizational change (H. Greve, 1998), and the pursuit of radical inventions (J. Eggers & Kaul, 2017). Yet, while some of these studies have confirmed the original predictions of BTF (Chen & Miller, 2007; H. Greve, 2003a), a few have also observed patterns that are not in sync with problemistic search and uncertainty avoidance (e.g., Desai, 2008; J. Eggers & Kaul, 2017; Gentry & Shen, 2013; H. R. Greve, 2011).

Given these conflicting findings, we explore Cyert and March’s original insight that the experience and training of key individuals inside the organization will shape how they observe, interpret and react to performance feedback (Cyert & March, 1963). The aforementioned studies of the BTF have, thus far, not considered the organizational decision makers who ultimately allocate resources and shape and make strategic decisions (D. C. Hambrick & Quigley, 2014). Therefore, a closer examination of the actual decision makers can shed light on how firms’ innovative actions are shaped by performance feedback.

The role of CEOs for Decision Making & Financial Orientation

The role of decision makers in organizations has always been at the heart of the BTF (Cyert & March, 1963; J. March & Simon, 1958). Cyert and March (1963, p. 26) emphasized early that goals emerge from key individuals or coalitions of individuals in an organization as they aimed “to specify organizational goals without postulating an ‘organizational mind’.”

Among such individuals, top managers and, in particular, CEOs have long been identified as one of “the dominant coalitions of the organization” (D. Hambrick & Mason, 1984, p. 193). CEOs both formulate and implement a firm’s strategy, which gives them a
strong influence on decision making within the organization (Calori, Johnson, & Sarnin, 1994; D. C. Hambrick & Quigley, 2014) and to what resources and attention within the organization are ultimately allocated (J. P. Eggers & Kaplan, 2009; Li et al., 2013; Ocasio, 2011; Simons, 1994).

While CEOs are fundamental to firms’ decision making, not all CEOs behave in the same way. In their seminal book, Cyert and March emphasized that “the way in which the environment is viewed and the communications about the environment that are processed through the organization reflect variations in training, experience, and goals of the participants [decision-makers] in organizations” (Cyert & March, 1963, p. 121). Relatedly, the upper echelon theory suggests that how decision makers manage administrative situations is contingent on those individuals’ experiences so that “if strategic choices have a large behavioral component, then to some extent they reflect the idiosyncrasies of decision makers” (D. Hambrick & Mason, 1984, p. 195).

A key characteristic of CEOs that has been linked to how they interpret their environment and make decisions is their financial orientation. Andrews and Welbourne (2000) proposed that a CEO’s “financial orientation” captures “the extent to which a CEO has experience in the financial concept of control and has learned to value and pay attention to market indicators and other traditional measures of short-term financial performance”.

The idea that CEOs differ in their financial orientation is not new. On one hand, research examining the composition of CEOs has shown that, over the last decades, finance personnel took over the highest echelon of large firms from manufacturing, entrepreneur, sales and marketing personnel (Fligstein, 1987). On the other hand, with an increasing emphasis on shareholder value ideology, firms sought managers that were increasingly “finance-oriented executives”, and “the relative success of their actions [e.g., mergers] caused other firms to pay attention to these tactics and eventually adopt them” (Fligstein, 1993, p.
228), with the goal of financially engineering their balance sheet and increasing their return on assets (Fligstein & Shin, 2007).

Recent research has confirmed that finance-oriented personnel have a profound influence on the highest echelons of organizations, i.e., boards of directors, CEOs, and board committees, and has emphasized the distinct way finance-oriented managers, and in particular CEOs, make decisions in organizations (Custódio & Metzger, 2014; Davidson, Xie, & Xu, 2004; Guadalupe, Li, & Wulf, 2014; Güner, Malmendier, & Tate, 2008; D. C. Hambrick, Misangyi, & Park, 2015; Song, 1982). Bertrand and Schoar (2003) found that CEOs with a MBA are less responsive to the availability of internal sources of funds but more responsive to the presence of growth opportunities, while, at the same time, engaging less in R&D. Similarly, Custódio and Metzger (2014) observed that financially expert CEOs with previous experience in the financial industry or in a financial role spend less on R&D.

Given the significant role of CEO in organizational decision making and the heterogeneity in experiences and orientations of CEOs, we next combine the BTF and the literature on CEOs’ financial orientation. In particular, we investigate the basic expectations of the BTF with respect to problemistic search (under below aspiration performance) and uncertainty avoidance (above aspiration performance), and consider a CEO’s financial orientation as a possible contingency.

**CEO’s FO & Performance Feedback**

**FO and below aspiration performance and new product initiatives**

The BTF predicts that the further performance falls below aspirations, the more likely it is that firms will engage in additional search and take innovative actions (Cyert & March, 1963; H. Greve, 2003a). However, sensitivity to performance below aspirations and problemistic search may be shaped by the financial orientation of the CEO. In particular,
CEOs with a stronger financial orientation may be more sensitive to negative financial performance feedback, leading them to increase new product initiations for the following reasons.

First, CEOs with a stronger financial orientation have been shown to cater more to short-term performance than to long-term performance variance (Fligstein & Shin, 2007; Narayanan, 1985). Financially-oriented CEOs attend to a greater extent to quantitatively measurable goals, which are an important antecedent of organizational search (Cyert & March, 1963). For example, CEOs with stronger financial orientations are more attentive to firms’ quarterly goals and metrics and have been shown to use more sophisticated techniques to control and monitor their organization’s performance indicators (Custódio & Metzger, 2014; Gore, Matsunaga, & Eric Yeung, 2011; Matsunaga, Wang, & Yeung, 2013). Hence, when falling behind their measurable financial performance indicators, financially-oriented CEOs will quickly perceive their situation as below aspirations, which has to be remedied. Conversely, CEOs with weaker financial orientation have more tolerance for short-term performance variances (Nelson, 1962). For such CEOs, performance below aspirations is less likely considered to be an immediate problem and, in the short run, may even be perceived as normality. It stands to reason that the stronger a CEO’s financial orientation, the more likely it is that they will perceive under-aspiration performance as a problem and engage in problemistic type search (Gavetti, Greve, Levinthal, & Ocasio, 2012, p. 10) such as starting new product initiatives to remedy the performance-aspiration gap.

Another important mechanism attributed to financially-oriented CEOs is their preference for predictability and their avoidance of substantial deviations from forecasts (Matsunaga et al., 2013). In principle, this suggests that these CEOs are more conservative and have a general preference for maintaining the status quo (Matsunaga et al., 2013). However, performance below aspirations distorts such stability and the only way to remedy
such a gap is to take action. Thus, the further performance is below aspirations, the greater our expectations that financially-oriented CEOs will become tolerant of making risky decisions as such actions would allow their firms to close the performance-aspiration gap (Bolton, 1993; Bromiley, 1991; H. Greve, 1998; Kacperczyk, Beckman, & Moliterno, 2015; Kahneman & Tversky, 1979; Miller & Leiblein, 1996). Conversely, CEOs with a lower financial orientation have a higher tolerance for uncertainty (Nelson, 1962), which suggests that they would not take immediate action as a response to performance falling below aspirations. Thus, not only do managers with stronger financial orientations perceive performance below aspiration as a problem, but they will also become more open towards taking risks in the form of new product development initiatives with the goal of re-establishing the previous status quo (Gaba & Joseph, 2013; H. Greve, 2003a).

Finally, CEOs do not make decisions in isolation but are influenced by social structures both inside the firm and external to the organization (Feldman & March, 1981; Laverty, 1996). CEOs with a stronger financial orientation are known to strongly attend to stakeholders and coalitions inside and outside the organization (Custódio & Metzger, 2014; Fligstein, 1993; Fligstein & Shin, 2007). For example, those with a financial orientation are often in sync with shareholder value optimization, which makes them more attentive to analyst forecasts and market expectations (Matsunaga et al., 2013). This suggests that financially-oriented CEOs may have a greater interest in avoiding conflicts with both external and internal stakeholders than do those with less of a financial orientation. However, performance falling below aspirations is difficult to conceal from stakeholders and a source for conflict (Bushee, 1998). The problem is exacerbated, as CEOs are held accountable for any performance-aspiration gaps (Benner & Ranganathan, 2012; Bushee, 1998; Haunschild & Sullivan, 2002). To avoid conflict and demonstrate actions financially-orientated CEOs are thus more likely to undertake immediate action to remedy those gaps.
Combining our arguments, we hypothesize that a CEO with a stronger financial orientation is more likely to perceive a performance below aspiration as an unfavorable outcome and therefore take swift action to increase the rate of new product initiations. In other words, firms with strongly financially-oriented CEOs will correspond more closely with traditional BTF arguments, in which underperformance is associated with expanded search activity, risk taking, and quasi-resolution of conflicts.

Hypothesis 1. The greater a CEO’s financial orientation, the stronger the relationship between below aspiration performance and new product initiations.

FO and above aspiration performance

The BTF predictions regarding positive performance feedback are twofold. On one hand, firms that surpass their aspirations avoid making more risky decisions and try to maintain the status quo, both of which suggest less innovative activity (Gentry & Shen, 2013; H. Greve, 2003a). On the other hand, firms that perform above aspiration have an opportunity to accumulate slack resources and engage in an opportunistic type of search, suggesting an increase in innovative activity (Iyer & Miller, 2008; Klueter & Monteiro, 2016; Nohria & Gulati, 1996). However, once again, these relationships may be contingent on the financial orientation of the CEO.

First, consistent with the short-termist behavior of financially-oriented CEOs, we expect such CEOs to focus on controlling and planning and keeping results predictable (Bertrand & Mullainathan, 2003; D. C. Hambrick, Geletkanycz, & Fredrickson, 1993), i.e., to minimize the need to court uncertain futures (Gavetti et al., 2012). While financially-oriented CEOs will be aware of performance above aspiration, such positive gaps will not trigger problemistic search. BTF predicts that aspirations are adjusted more quickly upward than downward (Bromiley, 1991), which allows financially oriented CEOs to retain the status quo. In contrast, when financial orientation is low, CEOs may consider a more long-term
perspective, which can lead them to engage in opportunistic type of search (i.e., search for solutions to next and future problems) when performance has exceeded aspirations (Klueter & Monteiro, 2017). It stands to reason that the stronger a CEO’s financial orientation, the more likely they will try to settle for the newly achieved status quo.

Moreover, the extent of financial orientation also will determine the type of activities firms will pursue when performing above aspiration. Extant research has suggested that performance above aspiration can lead to opportunistic type of search because of the abundance of internal slack (Iyer & Miller, 2008; Levinthal & March, 1981; Nohria & Gulati, 1996). However, where resources are ultimately allocated may depend on the financial orientation of the CEO. Existing literature has shown that CEOs with a stronger financial orientation emphasize shareholder value creation, which increases their propensity to pay out profit to shareholders (Custódio & Metzger, 2014). When the organizations of such CEOs perform above aspiration, they may use the possible slack accumulated from above aspiration performance to pay out in the form of dividends in favor of new product initiatives.

Finally, performance above aspiration strengthens internal coalitions (Bushee, 1998), reducing a need to address conflict. When financially-oriented CEOs’ companies hit stock market expectations, both external and internal stakeholders will reduce pressure on these CEOs (Bushee, 1998); hence, they feel less pressure to search for a solution and take on risk. Indeed, new product initiatives may lead to internal product competition and revenue cannibalization (Arora, Gambardella, Magazzini, & Pammolli, 2009), which financially-oriented CEOs would tend to avoid, as they prefer to maintain a truce between coalitions. In such cases, above aspiration performance may lead to inactivity (Audia, Locke, & Smith, 2000) as financially-oriented CEOs would be satisfied with the achieved results, avoiding risky actions that can cause conflicts.
Overall, we expect that CEOs with a stronger financial orientation are more likely to decrease the rate of new product initiatives as they exceed their performance aspiration point, at least when compared to CEOs with a weaker financial orientation. This suggests that firms with strongly financially-oriented CEOs will correspond more closely with traditional BTF arguments concerning above aspiration performance leading to uncertainty avoidance and quasi-resolution of conflicts, while CEOs with less of a financial orientation more likely will engage in an opportunistic-type search in the form of new product initiatives.

_Hypothesis 2. The greater a CEO’s financial orientation, the weaker the relationship between above aspiration performance and new product initiations._

Figure 1 provides an overview of the two hypotheses.

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**METHOD**

**Setting: The global bio-pharmaceutical industry**

The bio-pharmaceutical industry offers an appropriate setting to test our hypotheses the influence of the financial orientation of CEOs on the link between performance feedback and new product initiatives.

Since the earning potential of older drugs diminishes once patents expire, biopharmaceutical firms must create product innovations in the form of new therapeutic drugs (Bierly & Chakrabarti, 1996; Roberts, 1999). The industry is generally characterized by rapid technological change and the need to innovate as new technologies (e.g., gene expression, gene sequencing) and new therapeutic approaches (e.g., monoclonal antibodies, stem cells) emerge rapidly (Gilsing & Nooteboom, 2006). The product (drug) development process also follows a highly regulated regimen with well-documented dedicated steps; that allows us to systematically track product innovation initiatives.
Sample

We focused on all public firms active in therapeutic innovations in the biopharmaceutical industry between 2000 and 2013. Limiting the sample to public firms was necessary, as we had to unambiguously identify the CEO in a given year. We used the database Boardex, which tracks the evolution of CEOs within different firms over time (with data starting in 2000). The BoardEx database contains biographical information (demographical, education, work experience, and non-profit activities) on most board members and senior executives of over 800,000 organizations around the world but predominantly focuses on publicly listed firms. Further, public firms are required to report financial data, which we needed to detect performance aspirations and actual performances (Chen & Miller, 2007), and that were extracted from COMPUSTAT. In addition, we required that firms had engaged in at least one product innovation between 2000 and 2013 to compare firms with the same innovation strategies.¹ To that end, we used PharmaProjects and Recap to identify those firms. ReCap is a comprehensive database covering the interorganizational agreements in the bio-pharmaceutical industry (F. T. Rothaermel, 2001; Schilling, 2009), and PharmaProjects covers the internal product development pipeline of bio-pharmaceutical firms (Kapoor & Klueter, 2015). We linked all publicly listed firms available in Boardex and tracked internal and external product development initiatives in the form of a compound in development in the aforementioned databases.

Combining all databases allowed us to generate a firm-level panel dataset, in which we tracked each firm in a given year from 2000 to 2013 (or the respective period they were listed on the stock market) and that includes executive data (Boardex), financial data (COMPUSTAT) and product development initiatives (PharmaProjects and Recap). Following the related literature (Chen & Miller, 2007; Gentry & Shen, 2013) in extracting firm data, we

¹ For example, firms focusing solely on generics (i.e., copies of existing innovations) were excluded from the sample.
limited our sample to firms that had a total revenue of more than $10 million. This limitation also helped us to exclude those firms that are R&D specialists (Chen & Miller, 2007) or startups, which only burn cash without as yet generating any revenues through their R&D activities (Gopalakrishnan, Scillitoe, & Santoro, 2008; Jacobs, 2002). Moreover, we excluded those CEOs whose professional biographies could not be found on Bloomberg Executive Profile & Biography. The primary dataset included 371 firms and 676 CEOs; after dropping the abovementioned firms and CEOs, the full dataset contained 266 firms (with 422 different CEOs), and 1807 firm-year observations from 2000 to 2013.

**Dependent Variables**

**New product initiatives.** We focused exclusively on the initiation of new product development. In the pharmaceutical industry, an important decision firms have to make is whether to put a technology into clinical testing as this requires substantial resource commitments (both personnel and money), as well as bringing regulatory scrutiny (Girotra, Terwiesch, & Ulrich, 2007). Once a drug is in clinical trial, the firm can begin testing it on humans, which is the first regulatory step in the drug development process. The beginning of clinical trials, thus, indicates that a firm will commit substantial resources towards a new product innovation (see Figure 2).

Firms can develop these compounds internally through their own R&D units or insource them externally through licensing deals (or collaborations). Therefore, we distinguished between two forms of new product initiations: internal and external. To capture internal drug development initiatives, we used Pharmaprojects, which tracks each drug development project at each stage of development (Hoang & Rothaermel, 2010; Kapoor & Klueter, 2015; Macher & Boerner, 2012). We coded the initiation of clinical trials in the year for which we found evidence of clinical trials in Pharmaprojects or when Pharmaprojects
reported a phase change into clinical trials. The variable Internal New Product Initiatives (INPD) is a yearly count variable of therapeutic treatments in Pharmaprojects.²

--- Insert Figure 2 about here --

In a similar vein, for external new product development initiatives, we counted all new product initiatives that firms had insourced from external partners. Following prior studies (Klueter, Monteiro, & Dunlap, 2017; F. Rotheaermel & Deeds, 2004; Schilling, 2009), we used Recap to identify external and product development sourcing activities. ReCap indicates which firm is the technology provider and which is sourcing the product innovation. We excluded pure research related to technology sourcing, as the intention of such initiatives is the creation of a new product (see robustness tests). In contrast to internal R&D initiatives, external product innovations, however, can be sourced at more advanced stages (e.g., already in an advanced stage of clinical trials). The variable External New Product Initiatives (ENPD) is a yearly number of deals in which firms sourced external product innovations.

Independent Variables

**Performance relative to aspirations.** The behavioral theory of the firm suggests that decision makers set aspiration points as a function of their organization’s past performance—historical aspiration points — or the performance of comparable others, i.e., social aspiration points (Cyert & March, 1963; J. G. March & Shapira, 1987, 1992). Following prior research, we separated the two sources of aspirations (Bromiley & Harris, 2014) and focused our main analysis on historical aspiration points in our theory, the reason being that we are examining heterogeneous responses to performance feedback by uncovering a key mechanism, i.e., CEOs’ financial orientation. A CEO’s financial orientation is an individual-level cognitive attitude with a strong internal focus. Indeed, CEOs’ compensation is often related to performance benchmarked versus historic aspirations (such as sales growth or benchmark

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² As previously explained, we did not consider generic products as being new product innovations.
RoS) (Matsunaga & Park, 2001; Murphy, 1999). We focused on historical aspiration in our main analyses, while we tested for the effect of social aspiration (i.e., performance versus peers) in our robustness tests.

We followed established practice (H. Greve, 1998, 2003a) and calculated historical aspirations using the recursive measure, which weights previous performance and previous aspiration levels to form current aspiration levels (Lant, 1992; Levinthal & March, 1981). We generated historical aspirations using the formula $Self_{A_{t-1}} = \alpha Self_{A_{t-2}} + (1 - \alpha)P_{t-2}$, where $Self_{A_{t-1}}$ denotes the historical aspiration level at time $t$, $P_{t-1}$ is the performance of the firm at time $t - 2$ measured via return on assets (RoA) (Bromiley & Harris, 2014; H. Greve, 2003a; Iyer & Miller, 2008; Lim & McCann, 2013), $Self_{A_0}$ is defined only by the performance for the first year of the data, and the coefficient $\alpha$ is a real number between zero and 1 and denotes the level of inertia in the aspiration level updating process. The appropriate value of $\alpha$ was determined by trying all values of 0.1 to 0.9 for the increments of 0.1, until the best-fitting model was found (H. Greve, 2003a). The closer the values of $\alpha$ to 1, we expect that the aspiration level adjusts more slowly to recent performance levels (H. Greve, 1998, 2003b). We estimated models for each decimal of $\alpha$ and a value of 0.8 provided the best model fit.

In sync with BTF studies, we operationalized below- and above-aspiration performance through the use of spline function (e.g., Chen & Miller, 2007; H. Greve, 2003a; Mishina, Pollock, & Porac, 2004). This entails splitting the sample at zero to create splines for above- and below-aspiration performance. The spline for above-historical aspiration performance, $AA_t = P_{t-1} - Self_{A_{t-1}}$, consisted of the values greater than zero, whereas below-historical aspiration performance, $BA_t = P_{t-1} - Self_{A_{t-1}}$, consisted of the values less than zero.
**CEO financial orientation.** To compute the financial orientation of CEOs, we manually extracted professional biographies of all CEOs in our sample from the Bloomberg Executive Profile & Biography. These biographies are obtained from firms’ 10-K reports\(^3\) (item10-“Directors, Executive Officers and Corporate Governance”), which must be filed with the U.S. Securities and Exchange Commission (SEC) and have a standard format.\(^4\) On June 27, 2002, the SEC issued an order requiring the CEO and CFO of public firms to certify under oath the accuracy and completeness of their respective companies’ SEC reports (U.S. Securities and Exchange Commission, 2002). According to this order, the CEO and CFO must each personally certify that the company’s most recent Form 10-K neither contained an untrue statement of a material fact nor omitted a material fact necessary to make the statements in the report not be misleading. Hence, while firms have a strong incentive to fully showcase their directors in their reports to send a positive signal to the stock markets, they [legally] cannot oversell their CEO’s biographies, either by making an untrue statement or by omitting a fact. Thus, these professional biographies are accurate representations of CEOs’ background and experiences.

We measured Financial Orientation of CEOs by content analysis of each CEO’s professional biography in our sample, following a topic modeling method that is an unsupervised content analyses algorithm (DiMaggio, Nag, & Blei, 2013; Kaplan & Vakili, 2015). The advantage of this approach is that unlike other categorization methods in which researchers need to use pre-established categories or to develop with ex-post classification systems, the data can speak for themselves, thus allowing the researcher to automatically uncover the latent topics in an existing corpus (Kaplan & Vakili, 2015). The topic model algorithm delivers two outputs; the first is a list of topics, and the second is a list of

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\(^3\) Or similar public reports in other countries.

\(^4\) We asked S&P Global Market Intelligence, the data provider of the Bloomberg Executive Profile & Biography, about the source of these biographies and they confirmed that they used SEC filings.
documents (in our case, CEOs’ biographies) with a vector of topics weighted by their importance (in our case, the proportion of the document related to each topic) to the document (Kaplan & Vakili, 2015). Each CEO’s biography was processed with the topic extraction feature of the content analysis software program, WordStat\(^5\), which uncovers the hidden thematic structure of a text collection using an unsupervised text mining technique.\(^6\)

The resulting extracted topics constitute ten topics (see Figure 3) and, among them, the “FINANC” topic corresponds to our measure of CEOs’ financial orientation (FO), which contains words such as FINANCI, FINANC, ACCOUNT, INVESTOR, INVEST. The variable Financial Orientation (FO) is a continuous number between 0 and 1, which measures the proportion of a CEO’s biography that corresponds to the FINANC topic.\(^7\)

--- Insert Figure 3 about here ---

**Control Variables**

**Slack.** Following Singh (1986) and Chen and Miller (2007), we chose the current ratio (current assets divided by current liabilities) and working capital to sales ratio as proxies for available slack. We standardized and summed these variables to form a composite slack index.

**Distance to bankruptcy.** Following Chen and Miller (2007), we used Altman's (1983) Z as a measure of distance from bankruptcy. Altman's Z is calculated as (1.2 x working capital divided by total assets) + (1.4 x retained earnings divided by total assets) + (3.3 x income before interest expense and taxes divided by total assets) + (0.6 x market value

\(^5\) WordStat has previously been used as a content analysis software in organizational research (e.g., Crilly & Sloan, 2013; Latham, 2009).

\(^6\) Technically speaking, such an extraction is achieved by computing a word per document frequency matrix. Once this matrix is obtained, a factor analysis with Varimax rotation is computed in order to extract a small number of factors. All words with a factor loading higher than a specific criterion are then retrieved as part of the extracted topic.

\(^7\) Another factor that emerged was science orientation, which we describe in our control variables.
of equity divided by total liability) + (1.0 x sales divided by total assets). The lower Z value, the closer a firm is to bankruptcy.

**CEO science orientation.** Another factor that emerged from our topic modeling analysis and that corresponds closely to the reality of bio-pharmaceutical industry is the science orientation (SO) of CEOs. While science-oriented CEOs have been appraised as having a deep understanding of the nature of research and innovation in biopharmaceutical industry (Cuatrecasas, 2006; Henney, 1998), they have also been criticized for their tendency to use the mantra, “science (drug development) is risky” as a universal response to all failure (Sadeghi-Nejad, 2012). The key words indicative of a science orientation were DR, PHD, SCIENTIF, PROFESSOR, RESEARCH, AUTHOR, PATENT, SCIENTIST. Science orientation as financial orientation is a continuous variable between 0 and 1.

**Change of CEO.** To control for the effect of CEO change, a flag variable was defined, which equals one in the year when a firm changed the CEO and remains zero otherwise.

**Other Controls.** Apart from the abovementioned control variables, firm size is controlled for by taking the natural logarithm of total sales; an individual firm’s R&D intensity is controlled for by taking the ratio of R&D expenses to sales; and the total size of the CEO’s biography was controlled for via the total number of words used in the document. Industry R&D intensity is controlled for to account for the industry average search behavior, and industry sales growth is controlled for to account for market demand prospects that may influence investment decisions.

**Model**

Given our dependent variables (internal and external new product initiatives) are count variables, we tested our hypotheses using fixed-effects Poisson regression with robust standard errors (STATA: xtpoisson, fe robust). These quasi maximum likelihood models tend
to be superior to negative binomial models as the latter do not fully account for firm-fixed effects (Allison & Waterman, 2002; Cameron & Trivedi, 2013). Throughout the analysis, we controlled for firms’ invariant characteristics and year’s effect in all our models.

Hypotheses 1 and 2 test as to whether the extent of the financial orientation of CEOs elicits different search behaviors, depending on whether firms perform below or above aspirations. To test these hypotheses, we estimated the following model:

\[ y_{i,j,t} = \beta_i + \beta_t + \beta_1 X_{ind,t} + \beta_2 X_{i,t-1} + \beta_3 X_{j,t-1} + \beta_4 AA_{i,t-1} + \beta_5 BA_{i,t-1} + \beta_6 FO_{j,t-1} + \beta_7 AA_{i,t-1} \times FO_{j,t-1} + \beta_8 BA_{i,t-1} \times FO_{j,t-1} + \epsilon_{i,j,t} \]  

(1)

Where i indexes firm, j indexes CEO, and t indexes time. The dependent variable, \( y_{i,j,t} \), designates a firm's new product initiatives (INPD for hypothesis 1 and ENPD for hypothesis 2) in period t with CEO j. The model includes indicator variables for firm-specific and period effects (\( \beta_i \) and \( \beta_t \)). \( X_{ind,t} \), \( X_{i,t} \), and \( X_{j,t} \) are respectively vectors of industry characteristics including industry search average and sales growth, firms’ characteristics including R&D spending, slack, distance to bankruptcy and size, and CEOs’ characteristics, including science orientation, length of their biography, and CEO change flag. \( AA_{i,t-1} \) and \( BA_{i,t-1} \) represent the above-historical aspiration performance and the below-historical aspiration performance component of relative performance variable. \( FO_{j,t-1} \) designates the financial orientation of CEO j at time t-1, and its interactions with above- and below-historical aspiration variables are our main variables of interest. The use of lagged independent variables reflects the temporal ordering in our causal arguments. \( \epsilon_{i,j,t} \) is the error term.
RESULTS

Main findings

Table 1 provides the summary statistics for the 1087 observations in our database covering the years 2000 to 2013. The correlation between the aspiration measures is modest (0.13), which is similar to previous research (Chen & Miller, 2007). As expected, financial orientation and science orientation are negatively correlated (-0.17).

--- Insert Table 1 about here ---

Table 2 and Table 3 show the fixed-effects panel regression results for models based on Equation 1 regressed on two dependent variables ENPD (external new product initiatives) and INPD (internal new product initiatives). The first column is the base line model (Model 1) and only includes control variables, while the final column shows the coefficients for the full model corresponding to Equation 1.

---Insert Table 2 about here ---

In our unique context and as shown in Model 2, we do not find strong baseline evidence for problemistic search (the coefficient for below aspiration performance is not significant). Common to BTF studies, above aspiration performance also shows no effect. Interestingly, while we did not theorize about the direct effect of CEO’s financial orientation on the rate of new product initiatives, the positive and marginally significant (1.76, p < .10) coefficient for CEO’s financial orientation in Model 3 of Table 2 suggests that there is a positive correlation between the financial orientation of a CEO and decision to initiate a new product innovation. Thus, the more financially oriented a CEO, the more active they are in the initiation of new product development activities. Such a relationship cannot be detected for the CEO’s science orientation.

Models 4 and 5 test the interaction hypotheses. As predicted in H1, we find that, for external new product development, there is, indeed, an interaction effect of below aspiration
performance and CEO’s financial orientation. The interaction term is negative and statistically significant (-5.23, p < .001). This suggests a strong tendency for problemistic search for financially-oriented CEOs, the further performance is below aspirations (see Model 5 in Table 2). Give that our models are non-linear, we next examine our results graphically in Figure 4. The marginal plots of the interaction show that CEOs with high FO are more likely to increase the rate of their external new product initiatives than will CEOs with low FO in response short to below historical aspiration performance. This graphical analysis suggests further support for Hypothesis 1.

In Model 4, we interact financial orientation with above aspiration performance. The coefficient for the interaction is negative and statistically significant (-12.36, p < .05). This suggests a reduction in new product development initiatives when highly financially-oriented CEOs encounter an above aspiration performance, which is in sync with Hypothesis 2. Once again, we examine the interaction graphically in Figure 4. The margin plot demonstrates that, consistent with Hypothesis 2, financially-oriented CEOs are more likely to decrease the rate of their external new product initiatives as compared to CEOs with low FO in the scenario of above aspiration performance.

--- Insert Figure 4 about here ---

Model 6 of Table 2 shows the full model, including both interactions, and continues to support both hypotheses.

--- Insert Table 3 about here ---

Next, we test our results using internal new product development as dependent variable. The patterns observed in Table 3 are very similar to those seen in external new product development. The fact that our results hold using two different (albeit related) dependent variables gives us further conviction in the consistency of our results and that, in the context of new product development, CEO’s financial orientation is an important
contingency for performance feedback. Again, we examine the interaction graphically (Figure 5) and find patterns that are very consistent with the prior findings.

--- Insert Figure 5 about here ---

**Robustness and Supplemental analysis**

We conducted several supplemental analyses to probe the robustness of our results (including social aspiration) and different operationalization of our key variables. The patterns of the results once more confirm our predictions. Finally, we performed the same analysis using the scientific orientation of CEOs as moderator. For this variable, however, we do not find similar patterns of moderations suggesting that our results are unique to financial orientation.

**DISCUSSION**

The question of how performance feedback shapes innovative behavior remains one of the key areas of inquiry for the BTF. One the one hand the BTF provides strong and stylized predictions as to how firms would respond to below and above aspiration performance and key mechanisms of problemistic search, uncertainty avoidance and quasi resolution of conflict (Cyert & March, 1963; H. Greve, 1998, 2003a; Levinthal & March, 1981). On the other hand multiple innovation studies have found patterns not in sync with the original predictions of the BTF (e.g., Desai, 2008; J. Eggers & Kaul, 2017; Gentry & Shen, 2013; H. R. Greve, 2011). In this paper, we try to reconcile these inconsistencies by taking into consideration that performance feedback is observed and interpreted by managers inside the organization. These managers are heterogeneous in their experience and training, which may explain how they differently perceive and react to performance feedback.

Using financial orientation as a key characteristic of CEOs, we show that who interprets and takes action matters in terms of innovative behavior as a response to performance

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8 Results are available from the authors.
feedback. In particular, we incorporate the literature on both CEOs and top management (e.g., Desai, 2008; J. Eggers & Kaul, 2017; Gentry & Shen, 2013; H. R. Greve, 2011; D. Hambrick & Mason, 1984; Ocasio, 2011) with BTF (Cyert & March, 1963; D. Hambrick & Mason, 1984; Ocasio, 2011) and connect CEO characteristics (short-termism, tendency to preserve status quo, attention to stakeholders) to the patterns ascribed by the BTF (problemistic search, uncertainty avoidance, quasi resolution of conflict). We suggest and illustrate that only when CEO financial orientation is high, the stylized responses predicted by the BTF (i.e., problemistic search, uncertainty avoidance, and quasi resolution conflicts) hold. More generally, this implies that CEO characteristics are a critical dimension to understanding how firms respond to performance feedback and that, as per the original idea of Cyert and March (1963), the studies of the BTF need to take into account the unique traits of key decision makers found in organizations.

Contributing to the literature on financial orientation (e.g., Asker et al., 2014; Bernstein, 2015; Bushee, 1998; Rahmandad et al., 2016; Stein, 1989; Terry, 2015), we reveal that financial orientation does not per se inhibit innovative behavior. When performance is below aspiration, we observe that financial orientation can be a catalyst for innovative actions as managers try to quickly recover from the performance gap and as well as swiftly attend to the concerns voiced by stakeholders. However, when performance is above aspiration, we observe the typical pattern of preserving the newly achieved status quo and avoiding conflict by reducing innovation activity by financially-oriented managers. Thus, considering if managers find themselves in situations above or below aspiration performance is critical to explaining how financially-oriented managers ultimately take innovative actions.

For practitioners, our study allows a better understanding of the reasons certain types of managers would engage in innovative actions under specific conditions (above and below aspiration performance). This is particularly relevant for boards that observe and monitor the
top management team in organizations and who must frequently engage in strategic discussions as to when to propose new product initiatives.

Our study has a number of limitations, which should provide ample opportunities for future research. First, we opted for the most commonly used financial metrics, RoA, as our main performance indicator (Asker et al., 2014; Bernstein, 2015; Bromiley & Harris, 2014; e.g., Bushee, 1998; H. Greve, 2003a; Iyer & Miller, 2008; Lim & McCann, 2013; Rahmandad et al., 2016; Stein, 1989; Terry, 2015). However, future studies could test alternative performance specifications and possibly include multiple goals in their model.

Relatedly, we only focus on financial orientation as a key characteristic of CEOs that serves to shape how they interpret and react to performance feedback. However, CEOs differ on many dimensions (Bromiley & Harris, 2014; H. Greve, 2003a; D. Hambrick & Mason, 1984; Iyer & Miller, 2008; Lim & McCann, 2013), which may influence innovative behavior following performance feedback. We have already included a CEO’s science orientation as a control and in our robustness tests but other dimensions (e.g., entrepreneurial orientation (D. Hambrick & Mason, 1984; Lumpkin & Dess, 1996; Wiklund & Shepherd, 2003), customer orientation (Deshpandé, Farley, & Webster Jr, 1993; Lumpkin & Dess, 1996; Wiklund & Shepherd, 2003), CEOs’ narcissism (Chatterjee & Hambrick, 2007; Deshpandé et al., 1993), CEOs’ overconfidence (Galasso & Simcoe, 2011; Malmendier & Tate, 2005)) may shape the response to performance feedback. Future research could add dimensions to our theoretical model to further strengthen our understanding of the role of CEO characteristics in performance feedback and innovation. Additionally, considering a wider range of CEO characteristics may provide opportunities to connect them with different performance goals. For example, it could be that financially-orientated CEOs are more sensitive to financial performance, while science-oriented CEOs are more focused on scientific goals. This should be explored and clarified in future studies.
Finally, an important concern about our measure of CEO’s FO (and, in general, our analyses of CEOs’ effect) is the probability of endogenous CEO-firm matching (Custódio & Metzger, 2014; Galasso & Simcoe, 2011; Malmendier & Tate, 2005). While we control for CEO change and general firm orientations by firm-fixed effect, there might be unobserved firm heterogeneity that simultaneously explains the matching between firms and financially-oriented CEOs (Bertrand & Schoar, 2003; Custódio & Metzger, 2014). Thus, we were careful not to theorize and test the direct effect of CEO financial orientation on new product initiations. However, while a matching between CEOs and firms is certainly possible, this should not influence the moderating effect of CEOs’ financial orientation on the interpretation of performance feedback.

Overall, the paper sheds light on the important question of how performance feedback shapes innovative behavior and introduces CEO financial orientation as an important contingency. By connecting the broad research streams of top management characteristics, BTF and innovation, the paper also opens new opportunities for future studies to build on these connections.
REFERENCES


FIGURES & TABLES

Figure 1 Schematic Theoretical Model

Figure 2 Innovation Value Chain in the Bio-Pharmaceutical Industry

Figure 3 Results of topic extraction via WordStat 7 software

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Figure 4 Interaction of Performance Relative to historical Aspirations and CEO’s FO on ENPD

Figure 5 Interaction of Performance Relative to historical Aspirations and CEO’s FO on INPD
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Table 1 Summary Statistics and Correlation Matrix
Table 2 Fixed-effect Poisson Equation Results (DV=External New Product Initiatives)

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<th>(4) FO#AA</th>
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Year FE: YES | YES | YES | YES | YES
Log likelihood: -1363 | -1362 | -1358 | -1355 | -1355 | -1352
Chi-square: 88.52 | 91.57 | 101.8 | 105.2 | 165.6 | 155.4

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1
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Robust standard errors in parentheses
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