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Drivers of R&D investment: The interaction of behavioral theory and managerial incentives ☆

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ABSTRACT

This research explores the interaction of behavioral theory and agency theory, investigating their joint effects on firm-level R&D investment. Based on the logic of organizational routines driving R&D investment, we rely on the effects of organizational slack, performance relative to aspirations and distance from bankruptcy as the foundation for our research model. We argue that managerial incentives moderate the relationships between these behavioral theory variables and R&D investment, albeit in contrasting directions. Specifically, we hypothesize that stock option pay positively moderates these relationships while managerial stock ownership has a negative moderating effect. Using panel data for 573 publicly-traded manufacturing firms, we find support for several of our hypotheses, highlighting the interdependence of these two perspectives on R&D investment.

1. Introduction

Investments in research and development (R&D) represent one way for firms to search for innovations that may strengthen existing product-market positions, and/or provide opportunities to enter new product-market domains (He & Wong, 2004; Katila & Ahuja, 2002), thereby improving performance. Behavioral theory (Cyert & March, 1963) suggests that a firm may invest in R&D in response to its performance relative to its aspirations, the degree of organizational slack it possesses, and its distance from bankruptcy. Scholars have found strong support for such arguments (e.g., Chen, 2008; Chen & Miller, 2007; Greve, 2003a; Singh, 1986).

The agency theory perspective suggests that R&D spending may also be influenced by managerial incentives (Cheng, 2004; Makri, Lane, & Gomez-Mejia, 2006; Ryan & Wiggins, 2002). The different risk-bearing properties associated with stock ownership and option pay can motivate either risk aversion or risk-seeking choices by managers. The implications of this difference are especially important given that R&D projects themselves often entail significant risk. R&D projects tend to be long-term in nature with uncertain and distant payoffs (Lee & O'Neill, 2003), and may not lead to viable products (Levinthal & March, 1993). Thus, the propensity to invest in R&D can be influenced by the nature of managerial incentives.

The behavioral agency model (BAM) integrates elements of both of the aforementioned perspectives. BAM focuses on the loss aversion of managers in the decision-making process, highlighting the importance of organizational context and individual problem framing to explain when managers may exhibit risk-averse vs. risk-seeking behavior (Wiseman & Gomez-Mejia, 1998). Thus, according to BAM, the willingness of managers to make R&D investments can be influenced by managerial incentives (e.g., Cheng, 2004; Larraza-Kintana, Wiseman, Gomez-Mejia, & Welbourne, 2007; Makri et al., 2006; Ryan & Wiggins, 2002; Wu & Tu, 2007) as well as key organizational and individual reference points. Wu and Tu (2007) rely on BAM to offer initial insights into the effects of organizational slack and firm performance on the CEO stock option pay-R&D investment relationship.

The objective of this study is to further examine the interaction of the behavioral and agency theory viewpoints towards a more comprehensive understanding of firm-level R&D investment. We suggest that the interaction effects between these two perspectives at times are complementary in driving R&D investment, while at other times they may counteract one another. Specifically, our baseline model identifies the impact of attainment discrepancy, organizational slack and distance from bankruptcy on firm-level R&D spending, following behavioral theory arguments. Hypotheses are then developed that examine the moderating effects of stock option pay and managerial stock ownership on these baseline relationships, focusing on managerial risk bearing and the differential effects of these two incentives. We use a panel data set of 573 manufacturing firms over 7 years (2001–2007) to examine these interaction effects.

Our study provides a more comprehensive understanding of the drivers of firm innovation activity. We extend the work of Wu and Tu (2007) in two ways. First, we include managerial stock ownership,

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performance relative to target, and distance from bankruptcy in a more complete model of R&D investment. Second, we consider the incentives of the top management team since complex decisions, such as investing in R&D, often involve other members of the team in addition to the CEO.

The remainder of the paper proceeds as follows. First, we provide an overview of the existing literature that examines the links between behavioral theory and R&D investment. Next, we discuss the influence of managerial incentives on R&D investment, highlighting the similarities and differences between stock ownership and option pay. We then develop our hypotheses, identifying the moderating role of managerial incentives on the behavioral theory-R&D investment relationships. Our research design and the results of our analysis follow. Finally, we conclude with a discussion of the implications of our findings.

2. Theory and hypotheses

The behavioral theory of the firm (Cyert & March, 1963) portrays the firm's decision process as managers relying on the firm's standard operating procedures to make decisions in the face of uncertainty. Investment decisions, such as R&D expenditures, are based on prior patterns and processes (Gavetti, Greve, Levinthal, & Ocasio, 2012). However, key contextual factors, including organizational slack, performance relative to aspirations, and the threat of bankruptcy, can influence firms to deviate from these routines. This perspective forms the foundation of our arguments. We assume that behavioral theory explanations of R&D investments form the main effects in our model given the heavy reliance on organizational routines to make such investment decisions. We then propose that agency theoretic arguments moderate the effects of the behavioral theory constructs on R&D investments, suggesting that managerial incentives may alter firm decision routines due to managerial risk bearing.

2.1. Behavioral theory determinants of R&D investment

2.1.1. Organizational slack

Slack refers to such excess resources as underutilized overhead and financial reserves (Cyert & March, 1963; Levinthal & March, 1981). In the context of innovation, slack resources include R&D facilities, R&D employees, and time for R&D activities, as well as the financial resources that can be used to fund R&D projects. Higher levels of slack provide a buffer for the organization, offering some protection against uncontrollable change and downside risk. With this cushion, managers may be more comfortable deploying such resources towards experimentation and innovation (March, 1981; Nohria & Gulati, 1996). Conversely, organizational flexibility is reduced and strategic options are limited when firms have little slack (Miles, 1982). Behavioral theory thus posits a positive relationship between organizational slack and innovation (Damanpour, 1991; Nohria & Gulati, 1996; Singh, 1986), as well as R&D investment (Chen & Miller, 2007; Greve, 2003a).

2.1.2. Attainment discrepancy

Attainment discrepancy refers to the difference between firm performance and aspirations as judged by managers (Lant, 1992). Attainment discrepancy is unfavorable when performance falls short of aspirations, triggering problemistic search to solve the performance shortfall (Cyert & March, 1963). The performance shortfall is likely to spur firms to deviate from the status quo. Thus, R&D investment will be increased if problemistic search directed toward technology and product development can help to solve the performance problem. In terms of attainment discrepancy, for firms performing below aspirations (higher levels of attainment discrepancy), managers would be likely to pursue risky R&D investments to try to close performance gaps. Conversely, the likelihood of engaging in organizational change declines when attainment discrepancy is deemed favorable or low (Greve, 1998). Firms tend to maintain current routines and limit investments in innovation when performance exceeds aspirations (Levinthal & March, 1981). Scholars have found support for this relationship between performance relative to aspirations and risky investments (e.g., Palmer & Wiseman, 1999; Wiseman & Bromiley, 1996), including R&D investments (Chen & Miller, 2007; Greve, 2003a, 2003b).

2.1.3. Distance from bankruptcy

The distance from bankruptcy represents a second reference point with implications for R&D investment (Chen & Miller, 2007). Based on the "threat-rigidity" view (e.g., Staw, Sandelands, & Dutton, 1981), firms tend to limit investments and tighten financial controls when survival is threatened. In addition, when bankruptcy is imminent firms avoid new activities, conserve resources by streamlining current operations, and avoid risky investments and activities that are not essential to survival (March & Shapira, 1987, 1992). Consequently, due to the risky nature of R&D, firms limit or curtail investments in new technology and innovation when close to bankruptcy. Conversely, risk taking is likely to increase when firms are less threatened by bankruptcy (Chen & Miller, 2007; Miller & Chen, 2004).

In sum, behavioral theory posits a positive effect of organizational slack, attainment discrepancy, and distance from bankruptcy on R&D investment. These relationships form the baseline or direct effects in our research model. We now proceed to a brief overview of the agency theory perspective, and the influence of managerial incentives on R&D investment.

2.2. Influence of managerial incentives on R&D investments

Agency theory (Jensen & Meckling, 1976) suggests that by aligning managerial incentives with the interests of stockholders, managers will act according to stockholder interests, making decisions and investments that can lead to an increase in the value of the firm's equity. Equity ownership and stock option pay can motivate managers to seek out new investment opportunities that often involve greater risk (Gaver & Gaver, 1995). A central assumption in this logic is that bigger risks are associated with bigger returns (Core, Guay, & Larcker, 2003).

Different types of managerial incentives may have different effects on risk-taking actions (e.g., Sanders, 2001; Wright, Ferris, Sarin, & Awasthi, 1996; Wright, Kroll, Krug, & Pettus, 2007). In addition, managerial incentives have been shown to have strong effects on R&D investment (Cheng, 2004; Larraza-Kintana et al., 2007; Makri et al., 2006; Ryan & Wiggins, 2002). However, when substantial amounts of managerial wealth are at risk by linking it to potentially volatile stock prices, risk aversion may dominate incentive alignment. In such situations, managers may take actions to reduce the performance variability of the firm, thereby reducing the risk to managerial wealth and employment (e.g., Sanders, 2001; Wright, Kroll, Lado, & Van Ness, 2002; Wright et al., 1996).

In the following subsections, we discuss the similarities and differences between two important types of incentives, managerial stock ownership and option pay. In general, scholars suggest that these forms of variable compensation should elicit risky investments by focusing managerial attention on the upside potential of such investments (Wright et al., 2007). However, the focus of managerial attention may be different depending on which type of incentive is employed. Thus, these differences provide the impetus for offering a full set of opposing moderating effects for stock ownership and option pay in this study.

2.2.1. Effects of managerial stock ownership

In theory, managerial stock ownership should encourage managers to adopt a longer-term mindset (Gaver & Gaver, 1995). Research suggests, however, that the propensity to make such investments likely depends on the level of ownership (Wright et al., 2002). Low to moderate levels of stock ownership are not likely to pose too much of a threat to a manager's personal wealth. Thus, the focus of managerial attention is likely to be on the upside potential of such holdings, which may entice a manager to make risky investments which may involve longer-term