Accounting Conservatism in R&D Investment: Balancing innovation efficiency with managerial risk-taking incentives

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Abstract: This proposal aims to investigate the potential role of accounting conservatism in balancing innovation efficiency with managerial risk-taking incentives, particularly in the context of R&D investment. Building on the foundational model of Laux and Ray (2020), which posits that conservative financial reporting enhances not only investment efficiency but also improves quality of innovation, this study extends the scope to include an examination of the effects of managerial risk-taking incentives (vega) on R&D investment and the quality of innovation. The hypotheses suggest that while high vega may lead to overinvestment in R&D, it can be effectively counterbalanced by accounting conservatism, thereby upholding efficient investment decisions. The goal of this research is to illuminate how accounting conservatism and managerial incentives interact, and to understand their joint impact of conservatism and vega on organizational innovation and investment strategies.

Keywords: accounting conservatism; risk-taking incentive; R&D investment efficiency; innovation efficiency

I. INTRODUCTION

This research proposal focuses on exploring the role of accounting conservatism in the efficiency of R&D investments and corporate innovation. Accounting conservatism, as defined by Basu (1997), involves verifiability standards for incorporating both positive and negative news in accounting reports. While conservatism naturally inclines towards prudence and risk avoidance, potentially inhibiting innovation (Chang et al., 2015), this study aims to delve deeper into its impact in the context of new investments.

Innovation, often stemming from the pursuit of risky but profitable ventures, necessitates an environment conducive to risk-taking. However, Laux and Ray (2020) suggest that in the realm of new investment decisions, accounting conservatism could enhance investment efficiency and the quality of innovation. This is achieved by balancing the need to encourage managerial effort with the necessity of maintaining investment efficiency. Through this lens, conservatism serves as a tool for overseeing managerial investment decisions, as suggested by Ball and Shivakumar (2005), and mitigates the tension between stimulating effort and ensuring prudent investment.

While a conservative accounting approach might reduce the overall volume of investment, it is posited that the reduction is primarily related with inefficient investments. Consequently, the innovations that do emerge under this accounting system are likely to be of higher quality, resulting from more judicious and carefully considered investment decisions. Laux and Ray (2020) suggest that efficient investment, fostered by conservative accounting practices, would lead to more exploratory innovation, accurately reflecting the true success of new investment ventures.

This proposal seeks to investigate how managerial risk-taking incentives (vega) influence R&D investment efficiency and explorative innovation and to examine the impact of accounting conservatism on this relationship. If it is demonstrated that accounting conservatism

mitigates the adverse effects of vega on R&D investment efficiency and promotes explorative innovation, the role of accounting conservatism could be extended into the domain of innovation. This would uncover a positive aspect of accounting conservatism on innovation that has not been empirically demonstrated in previous studies.

Structured from the model of Laux and Ray (2020), this proposal seeks to underscore the strategic use of accounting conservatism in guiding managerial risk-taking behaviors towards more efficient innovation practices. The proposal is organized as follows: Section 2 elaborates on the model adapted from Laux and Ray (2020), incorporating it into the flow of the proposed research. Section 3 outlines the development of the hypotheses. Section 4 describes the basic research design. Although this research is in its initial stages and currently lacks empirical analysis, the intention is to further refine and develop these ideas.

II. MODEL

Timeline of new investment and innovation

Laux and Ray (2020) detail the sequence of a manager's decision-making regarding new investments. Initially, the board establishes the accounting framework and sets the incentive contract. The manager then expends effort towards developing new investment ideas, taking a costly and unobserved action to increase the likelihood that an idea is viable. After this effort, the manager privately observes the success probability of the investment idea and determines whether to proceed with the investment or to continue with business as usual.

The accounting system subsequently generates a public report, which provides insight into the firm’s long-term cash flows. Accounting conservatism plays a crucial role in this model, particularly in relation to investment decisions. The degree of conservatism is associated with the threshold that determines investment choice. My research builds upon this framework by incorporating the aspect of innovation, as illustrated in Figure 1.

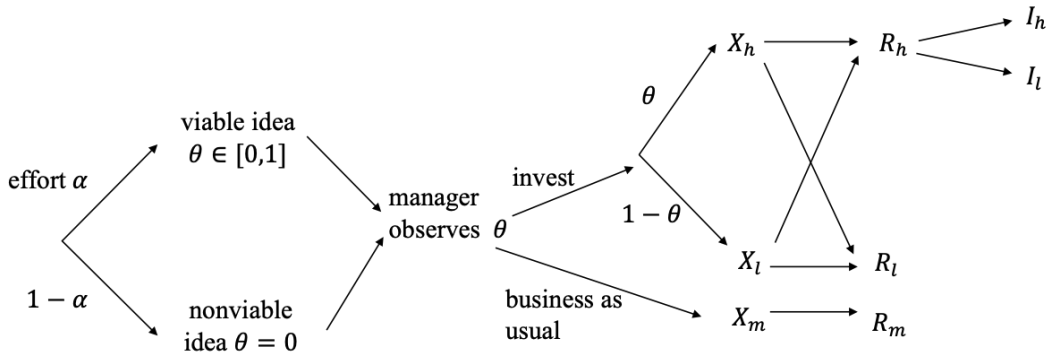

Figure 1. Timeline of the model

In the timeline shown in Figure 1, the degree of accounting conservatism affects the investment threshold and the level of innovation. In this model, innovation is defined as the exploration of new technologies and inventions that emerge from decisions to invest in new projects. The effort level of the manager, denoted as α, lies within the range [0,1]; θ represents the success probability of the investment idea; X_h, X_l, X_m are high, low, and usual future cash flows respectively, with X_h and X_l resulting from the new investment and X_m occurring if business continues as usual; R signifies a report informative of future cash flows; I represents the resultant innovation after the new investment, with I_h indicating explorative innovation.

Definition of conservatism

Basu (1997) defines accounting conservatism as a concept involving distinct levels of verifiability required for the measuring and reporting of good and bad news in accounting reports. Gigler et al. (2009) regard accounting conservatism as a principle of measurement used by accountants and auditors. In their perspective, conservatism is typically incorporated into accounting measurements through the firm's judgments, such as the recognition of revenues and expenses.

Following Gigler et al. (2009), Laux and Ray (2020) define the degree of conservatism as the strictness of the criteria required for issuing a favorable report. In their model, conservatism is conceptualized as a threshold c. This threshold represents the set of conditions that must be satisfied for a favorable report to be issued. The conservatism threshold is crucial in identifying the true success of a new investment. As illustrated in the figure below, an increase in c towards e_2 implies that reported earnings exceeding c are likely reflective of the actual success of a new investment. Therefore, in this framework, accounting conservatism serves as a vital tool for validating the true success of new investment.

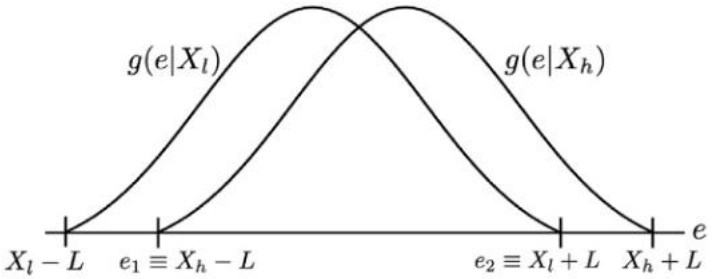

Figure 2. Probability density of earnings conditional on future cash flow; e = X + ε, ε~ [-L,L]

Managerial incentives for new investment

Laux and Ray (2020) propose that managerial compensation structures are designed to be contingent on the profitability of new investments. Managers are incentivized to pursue innovative projects over maintaining current business. The investment threshold, denoted as θ_T, signifies the critical point where the payoffs for innovation and continuing with business as usual intersect. Managers will opt for innovation when anticipated profits, denoted by θ, exceed θ_T. Conversely, if expected profitability does not reach this threshold, managers may eschew investment.

Figure 3.b describes how an increase in incentive levels can lower θ_T, resulting in a steeper compensation curve where profitability (θ) is plotted against incentives. This could potentially lead to overinvestment. However, Laux and Ray (2020) argue that an enhancement in accounting conservatism can counteract this trend by preserving θ_T, avoiding a substantial reduction in managerial effort. This balancing impact is depicted in Figure 3.c.

This study aims to delve deeper into the interaction between accounting conservatism and innovation quality, with a particular focus on how conservatism contributes to the efficiency of innovations. A more comprehensive discussion follows.

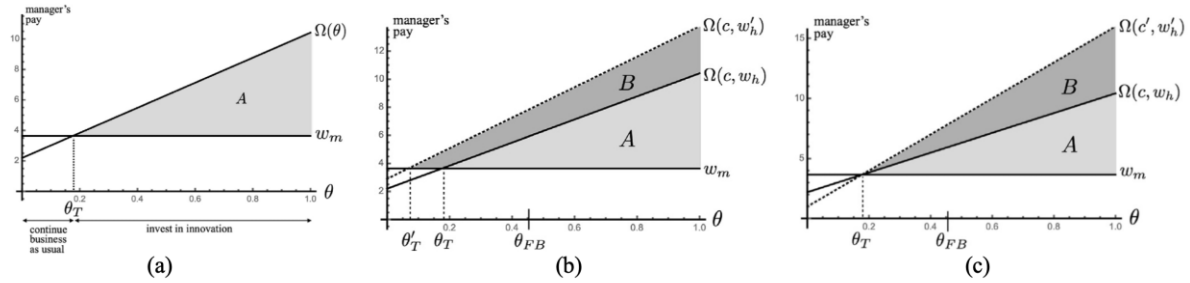

Figure 3. Managerial incentives and investment threshold

Conservatism and innovation efficiency

Laux and Ray (2020) argue that accounting conservatism can alleviate the tension between inducing effort and maintaining investment efficiency. To merely reduce overinvestment, the board might consider lowering incentives, dampening the overly aggressive motivation of managers to heavily invest in new projects. However, this approach risks deterring managers from engaging in new ventures that could be profitable in the long term for the firm. Therefore, it is critical to balance the preservation of managerial initiative with adherence to efficient investment levels. In this regard, setting a high requirement for favorable reporting can be instrumental. Such stringent requirements, reflective of the genuine

success for new investment, enable the board to effectively oversee and assess the utility of managerial decisions for the firm. This concept of stringent requirements is consistent with the definition of accounting conservatism as presented in the model by Laux and Ray.

This perspective aligns with the conceptualization of accounting conservatism as a monitoring mechanism, as posited by Ball and Shivakumar (2005), who suggests the role of accounting conservatism in the oversight of managerial investment decisions. A conservative accounting approach incentivizes managers to act promptly to mitigate losses from underperforming investments. However, this prudent stance might also inhibit aggressive investment behaviors, potentially leading to reduced innovation quality, as Chang et al. (2015) observed. While conservative investment strategies may result in fewer patents, innovation efficiency considers the quality of outcomes, not just the quantity. High-quality innovation, as defined in this study, is characterized by exploratory advancements stemming from efficient investments.

To achieve innovation efficiency, which is defined as the achievement of high-quality innovation without excessive investment, two conditions must be satisfied. First, investment decisions must adhere closely to an efficient threshold, thus preventing substantial deviations. Second, these decisions should give rise to exploratory innovation that demonstrates tangible success from new ventures. Within this framework, managerial incentives and accounting conservatism are posited to function collaboratively. By increasing the criteria for favorable reporting, accounting conservatism ensures that only truly successful investments are recognized, thus embodying the real success of an endeavor. Concurrently, an effective managerial incentive structure rewards efforts that lead to such successes, fostering an environment conducive to efficient innovation. In accordance with this rationale, I have organized three propositions based on the model of Laux and Ray (2020).

Proposition 1: While a high bonus can motivate the manager to expend effort in developing innovative ideas, it may also lead to inefficient investment decisions as the manager might lower the investment threshold.

Proposition 2: An increase in both bonus and accounting conservatism allows the board to enhance the manager's incentive for innovation without increasing the propensity for overinvestment.

Proposition 3: An increase in bonus and accounting conservatism results in high-quality innovation.

III. HYPOTHESIS DEVELOPMENT

My principal hypotheses are based on the principals of the model of Laux and Ray (2020) described in section 2. Based on their model, my research proposal is designed to explore the role of accounting conservatism in balancing innovation efficiency with managerial risk-taking incentives.

Equity-based compensation is known to potentially align managers' incentives with those of shareholders. Smith and Stulz (1985) propose that shareholders can mitigate managers' risk aversion by increasing the convexity of the relationship between managers' wealth and firm performance, such as through the use of stock options. As a result, the sensitivity of manager wealth to the firm's stock return volatility (vega) is thought to encourage managers to make riskier investment decisions. However, the heightened sensitivity of managerial wealth to stock price volatility may also lead managers to undertake risky investments without sufficient consideration.

Coles et al. (2006) observe that managers with high vega are more likely to invest heavily in R&D. This inclination is linked to the nature of high vega, which is designed to stimulate a manager's drive towards innovative endeavors, potentially leading to excessive

investments. Shen and Zhang (2013) also find that compensation structures with high vega can prompt managers to excessively invest in R&D projects, adversely affecting the firm's overall performance. They specifically noted that firms with high-vega compensation schemes experienced reductions in both abnormal stock returns and operating performance[1] after increasing their R&D investments. These findings indicate that high-vega compensation may lead to overinvestment in R&D, thereby diminishing investment efficiency. This underscores the need for stringent criteria in investment decision-making.

To validate the necessity of stringent requirements in investment decisions, my proposal is designed to examine the association between high-vega compensation and R&D investment efficiency. Moreover, this study will investigate the impact of high-vega compensation on the pursuit of explorative innovation. While high-vega compensation might motivate managers to overinvest in R&D, it could also stimulate explorative innovation. Mao and Zhang (2018) find that a reduction in managers' risk-taking incentives tends to suppress riskier and explorative innovations, which implies the positive relationship between vega and explorative innovation. If empirical findings indicate that high vega leads to both explorative innovation and overinvestment, it becomes imperative to identify processes that preserve the beneficial aspects of risk-taking incentives while fostering investment efficiency. This leads to the following hypotheses:

H1a: Managerial risk-taking incentives (vega) negatively affect the efficiency of R&D investments.

H1b: High vega is positively associated with explorative innovation.

To test these hypotheses, my study will decompose vega into two components: 'normal vega', the predictable part based on established determinants of vega, and 'abnormal vega', the

[1] Shen and Zhang (2013) used the adjusted operating performance that is defined as the operating performance measure plus the after-tax R&D expense.

deviation from these predicted levels. By differentiating between high and low vega using abnormal vega, I aim to validate the hypotheses and partially address the issue of endogeneity. In assessing R&D investment efficiency, I will incorporate the concept of the investment threshold as described in the model in Section 2. For analyzing innovation outcomes, I will employ various measures to assess innovation, considering both its quantity and quality. The detailed research design is elaborated in Section 4.

Gox and Wagenhofer (2009) underscore the role of accounting conservatism in enhancing investment efficiency, particularly under debt contracting. They argue that conservatism can increase the likelihood of securing financing and reduce associated debt costs. In line with this perspective, Lara et al. (2016) find that in situations prone to underinvestment, more conservative firms tend to invest more and issue additional debt, indicating that accounting conservatism enhances investment efficiency in the context of debt contracting. Furthermore, in overinvestment-prone environments, conservatism was observed to result in reduced investment levels.

This finding implies that a more conservative accounting system prompts firms to expedite the write-off of assets in response to unfavorable news, thereby mitigating overinvestment and improving overall investment efficiency. This aligns with the role of accounting conservatism as a stringent requirement for investment decision-making, as proposed in Laux and Ray's (2020) model. In investment decisions, accounting conservatism functions as a threshold that indicates the genuine success of a new investment, thereby enhancing overall investment efficiency.

In the context of this study, if accounting conservatism can mitigate the negative impact of high vega on both the efficiency of R&D investments and the explorative innovation, it suggests that conservatism plays a crucial role in improving both investment efficiency and innovation quality. This leads to the following hypothesis:

H2a: Accounting conservatism reduces the negative effects of managerial risk-taking incentives (vega) on R&D investment efficiency.

H2b: The combined influence of accounting conservatism and risk-taking incentives (vega) results in explorative innovations.

IV. RESEARCH DESIGN

4.1. Test for H1

To test H1, which aims to examine the influence of high-vega compensation on R&D investment efficiency and its association with resultant innovation, my study will differentiate between high and low vega using the concept of abnormal vega. Following Core and Guay (2002), I plan to estimate the vega of CEO's compensation portfolio. This will involve evaluating the worth of CEO's stock option holdings, reported in the Compustat Execucomp Database, and then applying a modified Black-Sholes option pricing model to measure the value of these options. Vega will be represented as the dollar change in the CEO's compensation portfolio value for a 1% increase in stock return volatility. The abnormal vega will be estimated using the methodology of Shen and Zhang (2013):

$$VEGA_{it} = \beta_0 + \beta_1 CashCompensation_{it} + \beta_2 Log(CEO\ Tenure)_{it} + \beta_3 CEOAge_{it} + \beta_4 Log(SALE)_{it} + \beta_5 MTB_{it} + \beta_6 Idiosyncratic\ Risk_{it} + \beta_7 Lagged\ Free\ Cash\ Flow_{it} + \beta_8 Leverage_{it} + Industry\ Effect + Year\ Effect + \varepsilon it \quad (1)$$

, where *VEGA* is the change in the value of a CEO's stock option portfolio resulting from a 1% change in annualized stock volatility, *Cash Compensation* is the total of the salary and bonus received by a CEO, *MTB*(Market-to-Book ratio) is calculated as the ratio of the book value of assets minus the book value of equity plus the market value of equity to the book value of assts,

Idiosyncratic Risk is measured as the standard deviation of daily return residuals, which are extracted from the market model over the four-year period preceding the current year. The residuals from this regression model will be used to define abnormal vega(*AB_VEGA*). Using this abnormal vega, I plan to categorize the samples into high-vega and low-vega firms. Subsequently, the relationship between vega and R&D investment efficiency will be examined.

To conduct this analysis, an appropriate proxy for R&D investment efficiency is required. Following Biddle et al. (2009), I define R&D investment efficiency as the abnormal R&D investment that is not justified by firm's investment opportunities. Abnormal R&D investment (XRND) of firm i in year t is calculated as the residual from the following expected investment model:

$$RND\_A_{it} = \beta_0 + \beta_1 GROWTH_{it-1} + \varepsilon it \quad (2)$$

, where *RND_A* represents total R&D expenditures divided by lagged total assets, and *GROWTH* for year *t-1* is sales growth from year *t-2* to year *t-1*. A firm is considered to be investing inefficiently if its actual investment level significantly deviates from the expected level, which is derived based on the assumption that the average firm makes efficient R&D investment decisions. This approach is in line with the definition of investment efficiency outlined in Section 2, where an efficient investment level does not deviate excessively from a certain threshold.

For testing H1a and H1b, firms will be sorted based on the rank of abnormal vega, and the association between vega and R&D investment efficiency will be investigated using the following regression model:

$$XRND_{it} = \beta_0 + \beta_1 AB\_VEGA_{it} + \beta_2 SIZE_{it} + \beta_3 LEVERAGE_{it} + \beta_4 LOSS_{it} + \beta_5 CASH_{it} + \beta_6 MTB_{it} + \beta_7 PPE_{it} + \beta_8 LAG\_XRNE_{it} + \varepsilon_{it} \quad (3)$$

, where *XRND* is the residuals from Equation (2), *LOSS* is an indicator variable for net losses, *CASH* is cash and cash equivalents scaled by total assets, *PPE* is tangibility defined as PP&E scaled by total assets. The primary interest lies in the sign and significance of β_1. If the high-vega compensation leads firms to make less efficient R&D investment decisions, the value of β_1 will be positive.

Subsequently, the impact of vega on resultant innovation will be assessed. To measure innovation, three proxies will be used: the number of patents, citation of patents, and technological proximity, with the latter being the primary measure based on Jaffe (1989)[2]:

$$P_{it} = \sum_{k=1}^{K} f_{i,k,t} f_{i,k,t-1} / \left(\sum_{k=1}^{K} f_{i,k,t}^2 \sum_{k=1}^{K} f_{i,k,t-1}^2 \right)^{1/2} \quad (4)$$

, where $f_{i,k,t}$ is the fraction of the firm i's patents that belong to patent class k at time t. A greater value of technological proximity (P_{it}) indicates a narrower innovation within known areas. This technological proximity will be used as a proxy for explorative innovation:

$$P_{it} = \beta_0 + \beta_1 AB\_VEGA_{it-1} + \sum \beta Control + \varepsilon_{it.} \quad (5)$$

A negative coefficient for β_1 in this equation would imply a positive relationship between high vega and explorative innovation.

[2] I plan to utilize data from the USPTO (Patents View; Patents Assignment Database), and a detailed methodology for processing this data will need to be further developed; https://www.uspto.gov/learning-and-resources/open-data-and-mobility

4.2. Test for H2

To test H2a, I will use the following regression model:

$$XRND_{it} = \beta_0 + \beta_1 VEGA_{it} + \beta_2 VEGA_{it} \times CONS_{it} + \sum \beta Control + \varepsilon_{it.} \quad (6)$$

, where *CONS* represents the proxy for conservatism, which is based on *C-Score* suggested by Khan and Watts (2009), and the control variables are the same as those in equation (1). The primary focus will be on the sign and significance of β_2.

To test H2b, I will regress the following model:

$$INNOVATION_{it} = \beta_0 + \beta_1 VEGA_{it-1} + \beta_2 VEGA_{it-1} \times CONS_{it-1} + \sum \beta Control + \varepsilon_{it} \quad (7)$$

The proxy for innovation would be the number of patents, citation of patents, and technological proximity. A positive relationship between the interaction term of vega and conservatism with technological proximity would suggest that managerial risk-taking incentives and conservatism collectively enhance explorative innovation.

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