

Review

The Effect of Option Grants on Managerial Risk Taking: A Review

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Abstract: This article presents a systematic review of the theoretical and empirical literature on option grants and managerial risk taking. One of the objectives is the motivation of further research on the topic. Risk-averse managers hold less diversified portfolios and, thus, tend to take less risk than optimal for shareholders. More option grants may encourage risk taking and result in higher firm value or alternatively increase the sensitivity of wealth to stock-price fluctuations mitigating overall risk-taking incentives. The net effect of options on risk-taking behavior is, therefore, ambiguous and calls for more empirical investigation. This is crucial for fiscal policymaking and regulation reforms. Yet, establishing a causal link between option granting and managerial risk taking has been challenging due to reverse causality, omitted correlated variables and measurement errors. In this review, we revisit the VegaDelta question by synthesizing the relevant research in economics, finance and accounting. We find that the empirical literature has successfully utilized natural experiments (e.g., regulation changes) to better establish causality, even though some mixed results are also documented. Finally, we also emphasize potential future research avenues especially relating to accounting disclosure, earnings management and tax policy.



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1. Introduction

In the economics, finance, accounting and management literature, many studies investigated the effect of compensation contracts on managerial behavior (e.g., [Holmstrom 1979](#); [Shavell 1979](#); [Lothe et al. 1999](#); [Lazear 2018](#)). Within this area, equity compensations, especially option grants, have grown increasingly popular as a key component in driving executive decisions ([Murphy 1999](#); [Perry and Zenner 2000](#); [Lazonick 2014](#)). Unlike shareholders, who can diversify their portfolios, a large part of a manager's wealth is tied to the company's financial performance. Therefore, managers sometimes tend to take less risk than the optimal level for the shareholders by forgoing positive Net Present Value (NPV) projects. To rectify this conflict of interest between managers and shareholders, companies often award option grants to managers as option holding can potentially make their wealth a convex function of the value of the equity. However, option holding can lead to ambivalent (or indeterminate) results. On the one hand, option holding may increase the sensitivity of the manager's expected wealth to the volatility of the firm's value (i.e., Vega effect), which can serve as a mechanism to induce managers to increase risk taking and make more optimal decisions for shareholders. On the other hand, option holding may also increase the sensitivity of the manager's wealth to the change in firm value (i.e., Delta effect), which can encourage a generally risk-averse manager to be less willing to take risks

and harm shareholders' interest. Together, these alternative scenarios raise the empirical question of whether granting more options increase or decrease managers' risk taking to maximize shareholders benefits.

The question can also be expressed mathematically by considering the manager's utility as a function of the equity value of the firm:

$$utility = u(wealth) = u(f(equity\ value)),$$

where $u(.)$ is a concave utility function, and function $f(.)$ summarizes the compensation package. The compensation function $f(.)$ is characterized by the first derivative of the function $f'(.)$, which is also known as Delta, and the second derivative $f''(.)$, which is also known as VegaVegaDelta. Delta measures how sensitive wealth is to changes in equity value. It may provide incentives for the managers to take on more risks and increase the firm's value. However, it is worth mentioning that the utility function is concave for risk-averse managers and, as a result, increasing Delta may also potentially increase a manager's risk exposure. Vega measures the convexity of the compensation function, which could counteract the concavity of the utility function and induces/motivates managerial risk taking.

Finally, in practice, option holding could increase Delta and Vega simultaneously. Noteworthy to also state, early research on this topic generally documents a positive correlation between the amounts of options held by the managers and firm risk (c.f., [Agrawal and Mandelker 1987](#); [DeFusco et al. 1990](#); [Tufano 1996](#); [Schrand and Unal 1998](#)), and although such a positive association between options and firm risk has been documented, it is still necessary to further specify a causal relationship between the two.

To establish the causal relationship, one challenge, besides option grants to managers, is that a firm's risk is also affected by other firm characteristics such as business complexity, corporate governance and market competition. These additional factors are difficult to control for thoroughly in academic studies, especially with the current econometric tools. It is also challenging to explicitly spell out the rationale of option grant in a simple manner. For example, [Murphy \(2013\)](#) and [Ittner et al. \(2003\)](#) suggest that firms with more growth potentials tend to grant more options to incentivize managers to seek out more profitable opportunities. Nonetheless, because growth opportunities are also positively correlated with firm risk (e.g., [Kogan and Papanikolaou 2014](#)), two companies might also use option grants to restrict managers' aggressive risk-seeking activities so that by combining managers' individual benefit with their firms' performance, the overall corporate risk-premia can be controlled ([Armstrong and Vashishtha 2012](#)). In sum, this review of recent studies synthesizes the findings of prior research and contributes to the literature by showing a more complete picture of the relationship between option granting and managerial risk taking.

2. Literature Review

We begin with gathering papers published in leading accounting and finance journals with direct links to option holding and corporate risk taking. We summarize the results in Table 1. In total, there are 15 papers published in the top five accounting journals and 31 papers in the top four finance journals. Among accounting journals, the *Journal of Accounting and Economics* is the most highly published with 11 articles, while no articles have been published in *Contemporary Accounting Research*. For the Finance journals, there have been 22 papers published in the *Journal of Financial Economics* while only 1 has been published in the *Review of Financial Studies*. We observe high dispersion in the journals published.

Table 1. Publications in Leading Finance and Accounting Journals and Journals Information.

Journal Name	Publications Number
Top 5 Accounting Journals	
<i>Journal of Accounting and Research</i>	1
<i>Journal of Accounting and Economics</i>	11
<i>The Accounting Review</i>	1
<i>The Review of Accounting Studies</i>	2
<i>Contemporary Accounting Research</i>	0
Top 4 Finance Journals	
<i>Journal of Finance</i>	5
<i>Journal of Financial Economics</i>	22
<i>Review of Financial Studies</i>	1
<i>Journal of Financial and Quantitative Analysis</i>	3

2.1. Theoretical Research

Information asymmetry and principal–agent theory research in economics have shown to be critical frames in several bodies of work. Evidenced in the application of agency models in finance and accounting areas, the theories have reshaped modern economic research and played a pivotal role in producing several important works (c.f., [Jensen and Meckling 1976](#); [Antle and Smith 1986](#); [Jensen and Murphy 1990](#); [Bushman and Indjejikian 1993](#)).

In terms of compensation, to some extent determining a managers' compensation plan based on their firms' stock market performance might solve the agency problem for the following reason: by including stocks, warrants and options in a manager's compensation structure, managerial incentives may be better aligned with shareholder/stock value. In this regard, and as [Bushman and Indjejikian \(1993\)](#) suggest in their renowned agency model, on top of accounting earnings, including the stock price-based measure in the compensation can effectively unleash managers' passion and efforts. And adding to this rationale, [Acharya et al. \(2000\)](#) explored the incentive effects of option repricing and provided evidence that option granting to managers may potentially increase the entire firm's value.

In addition to the impacts on the agency problem, other extant research suggests that option granting affects a manager's risk-taking preference. In that regard, presumably, options can either increase or decrease managers' risk-seeking tendency. [Ross' \(2004\)](#) model provides one such example in that including a put option may encourage managers to take on more risk. Conversely, however, [Carpenter \(2000\)](#) tests a scenario in which a money manager's risk incentive is under a call option type of compensation contract and finds that including an option in the compensation contract may not necessarily induce more risk-taking behavior, and in some cases, a manager's optimal volatility is lower with the option than if the manager was trading their account. As such, granting more options in managerial compensation contracts may encourage the executive to reduce volatility or, similarly, the riskiness of the companies. Continuing to dig deeper into the literature, we also note that [Haugen and Senbet \(1981\)](#) explore how options can be used to mitigate the agency problems of external financing. Interestingly, they find that the agency problems related to manager incentives can be alleviated with a solution that combines a set of put and call options possessed by the owner–manager as well as external financiers. And along the same trajectory, [Green \(1984\)](#) shows that warrants can be used to mitigate the agency problem arising from debt financing; [Ju et al. \(2014\)](#) explores the research question of how the conflict of investment risk relates to option compensation and found that the inclusion of the lookback call option has desirable countervailing effects on managerial decisions on corporate risk taking. Moreover, being focused on non-standards options,

as uncovered by [Johnson and Tian \(2000a, 2000b\)](#), reveal the incentive consequences of granting non-standard options to managers. Similarly, [Brenner et al. \(2005\)](#) found that rescindable options may induce better incentives than regular options. Finally and most recently, [Choi et al. \(2021\)](#) hypothesized that a nonlinear relation exists between option compensation and managers financing decisions. The authors investigate this question based on the ambivalent effect of option grants on managers risky behaviors. The main finding is that, in low range of option Vega, a firm's debt ratio rises while the opposite happens for higher Vega level.

Clearly, since option granting helps to align managers with the firms' overall value, this does prompt the question as to whether granting options or stocks is the most efficient way to incentivize managers. [Feltham and Wu \(2001\)](#) offered one possible answer as they analyze the incentive efficiency and costs of including stocks and options in managerial compensation structure. More specifically, they suggest that if the manager's effort substantially affects corporate operating risk, using options as compensation to incentivize managers is more efficient than stocks.

2.2. Empirical Research

Options increase managerial payoffs' convexity by increasing executive wealth's sensitivity to firm risk (i.e., Vega effect), but this also increases the sensitivity of managerial wealth to stock price changes (i.e., Delta effect). Even if the Delta effect increases managerial risk taking, the Vega effect can offset Delta's impact and make the overall result unpredictable. Some studies try to downplay the impact of the Vega effect from that of Delta effect. For instance, [Coles et al. \(2006\)](#) suggest estimating a set of simultaneous equations related to Vega and Delta effects. One of the equation models posits how Vega affects risk taking, as measured by more (less) investment in R&D (PPE), less industry diversification, and higher leverage. Another equation presents how the policy riskiness affects Vega. Delta is considered a control variable in both of the equations. The results support a notion that the coefficients of both Vega and risk-taking measures in the simultaneous equations are positive, which is interpreted as evidence that causality runs from both directions.

For empirical studies related to option granting and manager risk taking, an issue is how to mitigate the endogeneity problems caused by reverse causality on top of the omitted correlated variable in an econometrics model. It may be challenging to find a convincing theory suggesting that it is optimal for shareholders to provide managers with more incentives to take risks if they are exogenously forced to take more risks. In this case, it might be optimal to only grant less risk-taking incentives. Specifically, [Low \(2009\)](#) examines the causal effect of Vega on risk taking through the lens of reverse causality. The author finds that if a manager is exogenously set to take less risk, the Vega should be adjusted up if the Vega induces more risk taking.

In the mid-1990s, several court rulings in Delaware suddenly increased the takeover protection of Delaware-based companies, which led managers to be less concerned about value maximization for shareholders. [Low \(2009\)](#) takes this regime shift as a natural experiment and postulates that the risk is reduced by 6% on average after the regime shift. Additionally, the most significant decrease in risk occurs in firms with a low Vega. Based on this result, if increasing the Vega causes managers to take more risk, then it may be optimal for the company to offer managers compensations with a greater Vega, which can potentially compensate for the negative effect of the increased takeover protection on risk taking. [Low \(2009\)](#) confirms this prediction by showing that after the regime shifts, firms contemporaneously provide managers with a greater Vega in their option portfolios. Because the causality finding in [Low \(2009\)](#) is not established directly by examining the decrease in risk-taking on the increase in Vega, the tension underlying this inquiry may be something researchers can explore in the future.

Later, [Armstrong and Vashishtha \(2012\)](#) found that the Vega effect provides risk-averse CEOs with incentives to increase firms' risk more by increasing systematic rather than idiosyncratic risk. It is reasonable to expect that the Vega effect manifests as the increase

in companies' systematic risk, which can be hedged by a CEO who can trade the market portfolio, which has been supported with evidence in the paper. Furthermore, [Lee \(2022\)](#) investigated the differential effect of managers' stock options on firm vs. market specific risk. The author reports that managers' option compensation is positively linked total risk but lowers the ratio of idiosyncratic to total risk.

However, among all the managerial option granting and risk-taking literature, there are still some controversies. Some studies suggest that option holding does not have a causal effect on risk taking. For example, [Hayes et al. \(2012\)](#) exploited the change of accounting treatment for option compensation as a quasi-natural experiment. Before FAS 123R, firms had the choice to expense option grants by the intrinsic value, which is usually much lower than the Black–Scholes fair value. However, FAS 123R mandates the use of fair value. After revising the accounting treatment, there is a significant decrease in the use of option grants as a part of the overall compensation package. Accompanying the reduction in the option grants is the decrease in the Vega of the managers' portfolios. However, [Hayes et al. \(2012\)](#) did not find that any expected decrease in option grants (Vega) led to a less risky financial policy. As a result, [Hayes et al. \(2012\)](#) suggested that firms offer option grants not due to the risk-taking incentive effect of option holding. Instead, it may be due to the favorable accounting treatment before FAS 123R.

There has been a criticism against the banking industry because the excess risk-taking induced by option grants to bank managers partially led to the 2008 financial crisis. [Fahlenbrach and Stulz \(2011\)](#) argued that if option holding induces more risk taking, banks with managers holding more options (Vega) should have performed worse than banks with managers holding fewer options (Vega). Surprisingly, contrary to this prediction, [Fahlenbrach and Stulz \(2011\)](#) did not find any statistical evidence supporting the notion that a higher Vega led to worse performance during the crisis. However, the paper does show that larger Delta can lead to a worse financial performance. Based on this evidence, the authors argue that banks with managers whose interests are better aligned with the shareholders performed worse during the crisis. Here, some potential caveats are in order. First, linear regression may not address the causality problem perfectly well. Second, a larger Delta does not necessarily mean less misalignments of interests between managers and shareholders. Entrenched managers can award themselves more equity incentives than the optimal level, which may result in overpay. If managerial entrenchment is positively correlated with worse performance, a worse performance can be positively correlated with higher pay-for-performance sensitivity (PPS). Moreover, entrenched risk-averse managers would avoid holding option portfolios. Hence, the lack of positive correlation between Vega and worse performance during the crisis could also be due to managerial entrenchment.

3. Discussion

Overall, prior literature has shown mixed evidence of the causal effect of option holding on managerial risk-taking behavior. Again, option holding emerged as an effort to address the principal–agent problem for managers' compensation, and although this was expected to better align executives' incentives with shareholders' values, empirical studies have shown mixed results. The reasons are many-folds. First, the question of how to solve the endogeneity of the casual effect of option grant on corporate risk taking may be challenging. This may partially explain why the empirical results are mixed. Second, the executive may use other ways to hedge the risk they bear from more option grants. Third, companies may offer option grant to reduce the cash payments to executive or to reduce taxes and not to encourage executives' risk taking (e.g., [Hayes et al. 2012](#)).

4. Conclusions

To conclude, we do find that the current literature is mixed and controversial on the effect of option grants on executives' risk taking. Indeed, options do raise executives' wealth sensitivity to firm risk (i.e., the Vega effect), but they also increase managerial

wealth to stock price changes (i.e., the Delta effect). Understanding the net effect of the two countervailing effects has been at the center of the prior research and our review.

This is made more challenging because of econometric challenges of reverse causality and omitted variables. These make the proper assessment of the causality between option granting and risk behaviors of managers more difficult. Our review shows evidence that increasing the Vega may cause managers to take on more risk. This suggests that it may be more beneficial for companies to offer compensation packages with a higher Vega. Despite similar positions in several other extant pieces, a substantial body of research also shows that there is still more controversy around the causal impact of option granting as risk-taking incentives. This not only stems from the aforementioned econometrics issues but also from the debated relevance of the cited quasi-experiment studies to other firms in different contexts. In sum, we conjecture that the question is underexplored.

5. Implications

Even though the findings from the current literature are mixed, we try to offer some practical and theoretical implications. First, companies should be careful when trying to offer the executive option grants to motivate them to take on more risks. The empirical findings are mixed so far; thus, if the option grant cannot motivate the executives to take on more risks, it may generate some side effects. Second, more theoretical exploration is needed. Offering conclusive and clear implications from the theoretical lens to guide the empirical investigation is sounder and more reasonable. Third, the government agencies (e.g., SEC, IRS, and PCAOB) may consider more regulation. One of the reasons companies want to offer option grants is to reduce cash payment and tax considerations. This has nothing to do with motivating executive to take more risks. This may explain partially why the current empirical findings are mixed. The government agencies (e.g., SEC, IRS, and PCAOB) may consider enacting some laws to discourage this behavior.

6. Limitations and the Future Research Directions

Admittedly, our review is by no means exhaustive and conclusive. Some limitations exist in our review. First, both theoretically and empirically, the literature is still controversial. The second limitation of our review is the systematic framework. This is partially due to the controversy in the current literature. As such, in hopes of moving the needle, future researchers may be interested in the following related research topics.

Firstly, in addition to the effects on risk taking, exploring the impact of option holdings on accounting disclosure, earnings management, and tax policy may be a fruitful area for future research. In accounting research, one of the incentives to conduct earnings management is to smooth earnings (smoothing-induced incentive); therefore, exploring how option holdings affect earnings management could be an interesting research question. Moreover, because the convexity value in options may induce the managers to perform less smoothing-induced earnings management, addressing how this will affect shareholder values and social efficiency might be a topic that deserves researchers' efforts as well. Additionally, granting options may also induce managers to be more aggressive in disclosure, affecting management disclosure behaviors. Thus, exploring how option granting is associated with financial information disclosure is also an avenue for future research.

Secondly, the accounting issue of internal controls may draw more attention. Internal control is a key issue in auditing research and has been explored extensively (e.g., [Chen et al. 2020](#); [Feng et al. 2009, 2015](#)). Combined with the issue of option granting, future researchers may examine the relationship among internal control quality, option granting, and managerial risk-taking preference.

Thirdly, identifying how corporate governance affects managers' risk preference in the context of option granting is also noteworthy. Although the theoretical model of agency theory assumes that executive compensation is typically optimally determined, this may not hold in all situations. There have already been some criticisms that entrenched executives are holding too many equity portfolios through common stocks or options. To some extent,

entrenched risk-averse managers have incentives to substitute common stock holding for option holding, making it likely that managerial risk-taking behavior is correlated with managerial entrenchment and corporate governance. However, it is still unclear whether this correlation is positive or negative.

Finally, a research topic regarding the effect of debt holders on option holding can be of interest to future researchers. For example, when the debt holders have enough bargaining power to influence the compensation contracts, to protect their benefit as external stakeholders, they may prefer to reduce the Vega effect and prevent managers from taking excessive risks. Clarifying the interaction with shareholders' incentives to induce managers' risk-taking behavior could also be a fruitful avenue.

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