Convexity of CFO compensation, risk-taking, and corporate hedging

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Abstract

We study how risk-taking incentives of CFOs, incrementally to those of CEOs, affect a firm's hedging policy. We employ hand-collected firm-level data on hedging with derivatives and manager-level data on compensation for a sample of US oil and gas firms between 2009 and 2019. Our results show that the relative convexity of the CFO's equity compensation negatively affects the hedging likelihood and the extent of hedging, i.e. expected production and current reserves hedged. When the CFO and the CEO have different hedging incentives, the relative convexity of the CFO's equity payoff prevails over that of the CEO. This evidence suggests a stronger role of the CFO relative to the CEO in shaping a firm's hedging strategy.

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Keywords: CFO; Compensation; Hedging; Derivatives.

1. Introduction

The identity and attributes of the firm's top management are critical determinants of a firm's strategy and organizational outcome (Hambrick and Mason, 1984; Hambrick, 2007; Quigley and Hambrick, 2015). The Chief Executive Officer (CEO) plays a prominent role among all senior corporate executives, and extensive literature has examined their role as the key decision-maker on corporate strategy and performance (e.g., Bertrand and Schoar, 2003; Malmendier and Tate, 2005; Pérez-González, 2006; Bennedsen et al., 2007; Bloom et al., 2013; Custódio and Metzger, 2014; Bernile et al., 2017; Bennedsen et al., 2020; among others). While the CEO is the firm's highest-ranking executive, the second most important senior manager is likely to be the Chief Financial Officer (CFO) (Zorn, 2004; Uhde et al., 2017). Responsibilities of the CFO have risen over the last decades, and they now extend beyond their original role of supervising financial reporting and planning (Hoitash et al., 2016). Not only the CFO advises the CEO and oversees external financial communication, but they also play a crucial role in capital budgeting, cash management, capital structure, and financial risk management (Schopohl et al., 2021). Therefore, the CFO has progressed as the "second-in-command" and is nowadays directly involved in shaping and executing a firm's corporate strategy (Zorn, 2004; Indjejikian and Matejka, 2009; Huang and Kisgen, 2013; Datta and Datta, 2014; Uhde et al., 2017).

Despite their relevance in modern corporations, the literature has paid far less attention to the contribution of the CFO relative to the CEO and has largely "ignored [their] central role as a key decision maker" (Uhde et al., 2017; Gupta et al., 2020). This is somewhat surprising, as it is established that CFOs and CEOs have different managerial personalities. Kaplan and Sorensen (2012) study the behavioral features of CEOs and CFOs, based on a sample of candidates for these positions. Their results show that CFOs and CEOs are "diametrically opposite." CFOs show a lower general ability score and are more interpersonal, detail-focused, and analytical. In contrast, CEOs score higher in general ability, are more aimed at execution, have a greater strategic focus, and are more charismatic (Kaplan and Sorensen, 2012). Graham et al. (2013) administer a

psychometric test to senior executives and show that CFOs have a less optimistic view and are more risk-averse than CEOs.

Due to their specialized expertise and technical competency, one of the CFO's most sophisticated areas of responsibility is risk management (Copeland, 2001; Hoitash et al., 2016). According to the IBM Institute for Business Values 2010 global survey of more than 1,900 CFOs from around the world, almost 80% of respondents classify managing and mitigating enterprise risk as "very" or "critically important" (IBM Institute for Business Values, 2010), up from 40% of them in the previous 2006 survey. According to the 2016 McKinsey Global Survey on the role of the CFO,[1] garnering responses from more than 500 CFOs worldwide, risk management is the first among the nonfinancial accounting-related activities that report directly to them.

Hedging marketable risks is widespread among nonfinancial firms. Recent academic surveys of CFOs (Giambona et al., 2018; Bodnar et al., 2019) show that nonfinancial firms extensively manage corporate exposures, and this evidence holds worldwide (see Bodnar et al., 1998, for the US; Bodnar and Gebhardt, 1999, for Germany; Mallin et al., 2001, for the UK; Bodnar et al., 2013, for Italy; among others). Almost 90% of the surveyed CFOs in Giambona et al. (2018) indicate that hedging increases a firm's cash flows, and nearly 80% conclude that it is ultimately value-increasing. The evidence that hedgers present higher performance and are worth more is also well-established in the corporate finance literature (Carter et al., 2006; Allayannis et al., 2012; Pérez-González and Yun, 2013; Gilje and Taillard, 2017).

With few exceptions, most of the literature investigating the relationship between managerial attributes and preferences and hedging decisions looks at the incentives of the CEO, viewed as the ultimate decision-maker (e.g., Kumar and Rabinovitch, 2013; Croci et al., 2017). However, a firm's risk management policy is primarily the result of the CFO's strategic choices. Motivated by the survey evidence above, we argue that financial risk management is a suitable laboratory to study the predominant role of the CFO over that of the CEO. This should be especially true in industries where marketable risks are deemed to affect a firm's future cash flows very materially. Therefore, this paper studies

[1] Survey results are available at: https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/are-todays-cfos-ready-for-tomorrows-demands-on-finance.

how CFO's managerial preferences affect a firm's hedging policy. To our knowledge, this is the first study which provides evidence on the central role of the CFO in deciding whether and how to hedge marketable risks.

We exploit the well-established causal relationship between the convexity of a manager's compensation policy and risk aversion (Bakke et al., 2016) to investigate how CFO's risk management incentives significantly affect a firm's hedging decisions, beyond and above the incentives of the CEO. To this purpose, we focus on US oil and gas producers between 2009 and 2019, and we show that the CFO's fraction of equity underlying stock options over total equity owned is negatively associated with the hedging likelihood. Moreover, a higher CFO's relative payoff convexity is negatively related to the fraction of expected annual production hedged and the fraction of a firm's oil and gas reserves hedged. This evidence holds when the CFO is analyzed in isolation from the CEO, when the CFO is combined with the CEO, and when the different incentives of the CFO and the CEO are separately considered. Interestingly, when the CFO has a higher relative payoff convexity and, at the same time, the CEO's payoff is less convex, the firm is less likely to hedge and hedges quantitatively less. Consistent with the above-mentioned survey evidence, we interpret this as evidence of a stronger impact of the CFO relative to the CEO on a firm's hedging policy.

This study contributes to two strands of literature. The first set of studies analyzes how managerial risk aversion impacts a firm's hedging policy. The second is the narrow literature studying the incremental effect of CFO preferences, beyond those of the CEO, on a firm's policies.

Managerial preferences significantly affect a firm's hedging choice. Risk-averse managers have the incentive to hedge in full when their utility is concave in the firm's value, and such incentives reverse when their utility function gets convex (Stulz, 1984; Smith and Stulz, 1985). Since Executive Stock Options (ESOs) are convexity-increasing instruments, the theory predicts a negative relation between ESOs and hedging (Smith and Stulz, 1985). Early empirical studies confirm the negative and significant correlation between ESOs and hedging. Tufano (1996) studies hedging practices in the North American gold mining industry and finds that managers holding more (less) options manage less (more) gold price risk. Haushalter (2000) focuses on the oil and gas industry

and confirms a negative relation between options holdings and the decision and the extent of hedging. Géczy et al. (1997) analyze currency derivatives usage by Fortune 500 firms and do not find a statistically significant relationship between managerial option ownership and derivative usage likelihood. Rogers (2002) finds a negative link between CEO risk-taking incentives (measured as the relative vega of the CEO's compensation) and the amount of derivative holdings. Croci et al. (2017) also study whether managerial characteristics and preferences impact corporate hedging in the oil and gas industry. Their focus, however, is on how firms hedge, choosing a more or less convex hedging instrument. For this choice, the convexity of managerial compensation is insignificant.

The relationship between managerial incentives and the extent of hedging is complex, as empirical measures of managerial risk aversion and option pay are endogenously determined. A neat causal relationship between the convexity of compensation and hedging is established by Bakke et al. (2016). They exploit a quasi-natural experiment, i.e., a new accounting regulation mandating firms to expense ESOs at the fair value (Financial Accounting Standard 123R). Since the new regulation significantly reduces management's option pay but is exogenous to hedging, the resulting significant increase in hedging relative to similar untreated firms points toward a causal relationship. The same evidence, but directly from the field, is provided by Bodnar et al. (2019). They perform a psychometric test on 681 CFOs of nonfinancial firms globally distributed and directly estimate their degree of risk aversion. The results confirm that firms with more risk-averse managers hedge more, and the link between risk aversion and hedging propensity is stronger when executives are compensated with stock and options. Summing up, while it is accepted that ESOs have an impact on increasing managerial risk tolerance, the relative importance of CFO's incentives over those of the CEO is still an uninvestigated area.

We also contribute to the stream of literature studying the relative importance of CFO preferences and characteristics, beyond those of the CEO, on corporate policies. Only a few studies consider the incremental role of the CFO, and this dearth of evidence is "particularly troubling when it comes to corporate financial decisions, which is an area where the CFO wields substantial influence" (Gupta et al., 2020). In their seminal paper, Bertrand and Schoar (2003) study how individual managers affect a firm's decision-

making and outcomes. Interestingly, CFO fixed effects matter more for financial decisions, particularly when explaining leverage, cash holdings, and interest coverage ratios. Similarly, Frank and Goyal (2007) find that CFO dominates CEO effect in explaining a firm's leverage. Chava and Purnanandam (2010) note that both CEO and CFO's risk-taking incentives affect corporate decisions, but at different stages of the decision-making process. CFOs are relevant, but only for more technical financial choices, such as those related to capital structure, where their expertise matters more. Dittmar and Duchin (2016) examine how prior employment of CEOs and CFOs affects a firm's investment and financing decisions. Firms operated by a CEO who experienced financial distress in the past are more conservative. For financing decisions (but not for investing decisions), the joint impact of CEO and CFO experience is strongly significant, suggesting an incremental role of the CFO on a firm's capital structure. Florackis and Sainani (2018) investigate the effect of CFOs on cash decisions. They characterize "strong" and "weak" CFOs based on an index of managerial ability to influence financial policies. Firms with "strong" CFOs hold less cash than firms with "weak" CFOs, and the effect goes beyond that of the CEO. Similarly, Mobbs (2018) shows that firms where the CFO is also a member of the board have fewer financial constraints and hold less cash. Recently, Ferris and Sainani (2021) focus on M&As and find that CFO's influence is significant throughout the whole process. Their impact is higher when the CFO is paired with a less influential CEO or a CEO with few characteristics in common. In sum, as firm's hedging is likely the result of the CFO's decisions, risk management is a suitable area of investigation to isolate the relative impact of the CFO over the CEO on corporate strategy.

Overall, our paper is related to a few studies which look at the impact of CFO's attributes and compensation policy on firms' derivative usage. Géczy et al. (2007) characterize corporate speculators by administering a survey to 1,928 publicly traded nonfinancial firms (the response rate is 19%). Their results show that CFOs of firms speculating with interest rate and FX derivatives have a higher (and significant) wealth delta and a higher (but not significant) wealth vega, suggesting a link between CFO's compensation and their firm's trading with derivatives. Géczy et al. (2007) also conclude that CFOs (and not CEOs) are ultimately responsible for forming a view reflecting a

firm's derivatives position. Chernenko and Faulkender (2011) study firms' usage of interest rate swaps and find that firms with more performance-sensitive compensation schemes metrics (especially for the CFO) use more interest rate swaps, but the same metrics are generally insignificant in explaining the direction of swap activity. This evidence suggests a speculative component of a firm's derivative usage. Our paper is tangential to these studies as it focuses on hedging. We examine the risk management decisions of firms in the context of the oil and gas sector (SIC code 1311). This sector has been largely employed in hedging studies. It allows to isolate a homogeneous common risk (commodity price risk), and oil and gas firms provide high-quality and granular information on hedging with derivatives. Within this context, and as a novelty in the literature, we aim to explicitly disentangle hedging incentives of the CFO from those of the CEO and show how the former are stronger determinants of the firm's hedging policy.

The remainder of the paper is organized as follows. The following section presents our data, describes the variables, and discusses the characteristics of the sample. Section 3 presents the univariate evidence, the multivariate setting, and discusses potential causal challenges. Finally, section 4 concludes.

2. Data, variables, and sample description

2.1 Data

Our initial sample consists of US-listed firms belonging to SIC code 1311 (Crude Petroleum and Natural Gas) from 2009 to 2019. Limiting the analysis to only one industry is customary when studying hedging. For example, papers studying risk management from a user perspective generally look at airline firms (e.g., Carter et al., 2006; Treanor et al., 2014; Rampini et al., 2014), while studies on commodity producers examine either gold miners (e.g., Tufano, 1996; Tufano, 1998; Adam and Fernando, 2006; Adam, 2009; Adam et al., 2017), or the oil and gas industry (e.g., Haushalter, 2000; Jin and Jorion, 2006; Bakke et al., 2016; Croci et al., 2017; Gilje and Taillard, 2017) (see Carter et al., 2017, for a review). Industry-specific analyses allow to focus on risk-homogeneous firms

and attenuate endogeneity concerns from omitted firm-specific characteristics. Our study chooses the oil and gas industry for three reasons.

First, not only do all firms face the same commodity price risk, but this risk is material. Oil and gas prices are volatile, as both the supply and the demand are inelastic, and the price determinants are outside the firm's control. As an example, the period covered by this study encompasses the 2014-2016 collapse in oil prices, one of the largest since World War II (World Bank Group, 2018). Between mid-2014 and early 2016, the WTI delivered in Cushing, Oklahoma, went down from about $106 (June 30, 2014) to $26 (February 11, 2016), i.e., a 75% drop (data from St. Louis Fed). Second, the high volatility of oil and gas prices translates into a significant variation in revenues and high cash flow volatility of affected firms (Bakke et al., 2016). According to S&P, the energy sector showed the highest concentration of global bankruptcies in 2015 and 2016, accounting for more than 50% of defaults in both years (i.e., 142 energy firms) (S&P Global, 2016, 2017). In other words, oil price risk is economically important. The third reason for choosing this industry is data availability. Most firms disclose detailed information on hedging activity, including quantity (i.e., the fraction of production hedged) and instruments employed.

We manually collect most of the data from EDGAR, the Electronic Data Gathering, Analysis and Retrieval system provided by the SEC. Therefore, we first require 10-Ks to be available on EDGAR for inclusion in the sample. The initial search leads to a sample of 316 firms and 2,103 firm-year observations. As in Jin and Jorion (2006), we exclude firm-year observations for which no oil or natural gas production was reported (425 observations). Moreover, we exclude firm-year observations for firms that choose not to disclose hedging data in tabular form (22 observations), as they do not allow us to quantify their hedged exposure (Croci et al., 2017). Finally, we follow Jin and Jorion (2006) and Bakke et al. (2016), and we only consider directional contracts (such as swaps and options), discarding basis spreads and other non-directional contracts, as they do not hedge against price risk. The final sample is comprised of 247 unique firms and 1,524 firm-year observations.

We merge this dataset with manually-gathered biographical information and compensation data of CFOs and CEOs obtained from the firm's annual proxy statements

(DEF-14A). Therefore, we require DEF-14As to be available in EDGAR and the biographies of both CEOs and CFOs to provide enough information to construct all our variables. This step reduces our sample to 1,152 firm-year observations (182 unique firms). We identify the CFO and the CEO in charge during each fiscal year. In case of a change in the midst of a fiscal year, we retain the manager in charge for most of the year. The short bio allows us to extract information on age and tenure. Then, we collect information on the total number of shares beneficially owned by each executive from the "Beneficial (or Security) Ownership" table, the number of shares underlying ESOs (both exercisable and not) from the "Outstanding Equity Awards at Fiscal Year-End" table, and cash compensation (cash salary and bonuses) from the "Summary Compensation" table. We finally collect firm-specific financial controls from Compustat. The final sample usable for our empirical investigation is an unbalanced panel of 154 firms and 867 firm-year observations.

Single-industry empirical works on hedging are generally characterized by limited sample size, regardless of the industry.[2] This is true also for our article, as the full sample consists of 867 firm-year observations. Sample size has an impact on the explanatory power of our models, especially in subsample analyses. Moreover, limited sample size is particularly constraining in empirical studies linking managerial-level characteristics to hedging, as the reliance on commercial databases for executive attributes and compensation (i.e., Execucomp and BoardEx) further decreases the number of usable observations. Our hand-collected dataset overcome data constraints on executive compensation and renders our sample considerably larger than that of paper studying the same industry, such as Jin and Jorion (2006) (330 firm-year observations for the 1998-2001 period) and Croci et al. (2017) (about 500 observations for the 2000-2013 period).

2.2 Variables

2.2.1 Dependent variables

Our dependent variables measure a firm's hedging. The first variable (*Hedger*) is meant to capture a firm's hedging likelihood, and it is a dummy equal to 1 if the firm

[2] For example, Adam and Fernando (2006) and Adam et al. (2017) (gold miners) have about 200 observations in most of their models.

hedges a portion of next year's production with financial derivatives and 0 otherwise. As we will show later in the paper (Table 1), *Hedger* takes the value of zero in 209 firm-year observations out of 867 (i.e., 24% of the sample). We set *Hedger* to zero either when the 10-K explicitly states that the firm does not hedge commodity price risk with financial derivatives (172 firm-year observations, i.e. about 80% of the subsample for which *Hedger* = 0), or when the 10-K does not explicitly mention any hedging activity in place (37 firm-year observations, i.e. about 20% of the subsample for which *Hedger* = 0). In the latter case, hedging may be non-existent or immaterial relative to the firm's size.

Tabular information on derivative instruments also enables us to measure the extent of hedging, i.e., the fraction of production hedged (*FPH*). *FPH* will be our second hedging variable. Unlike *Hedger*, which is a dummy variable, the fraction of production hedged allows for cross-sectional variation in the portion of the naked position a firm decides to hedge. Following Bajo et al. (2021), we focus on derivative contracts for oil, natural gas (NG), and natural gas liquids (NGLs) with a maturity of one year or less. We convert NG into barrels of oil equivalents and assimilate NGLs to oil (as in Jin and Jorion, 2006). All derivative positions open at the end of each fiscal year are tallied up and scaled by next year's total production (Jin and Jorion, 2006). Assuming that the estimated future production is a proxy for actual production (Bajo et al., 2021), this variable represents the portion of the expected output that the firm decides to hedge each year.

We acknowledge that using actual future production rather than expected future production (not reported in 10-Ks) might lead to significant measurement error in case of a substantial distance between actual production and expected production when the hedge was placed (Bakke et al., 2016). Therefore, following Jin and Jorion (2006) and Bakke et al. (2016), we also use the fraction of actual reserves hedged (*FRH*) as a proxy of the hedging extent. *FRH* will be our third hedging variable. In the Appendix A, we provide an example of how *FPH* and *FRH* are computed.

2.2.2 Independent variables

Theoretical models (Stulz, 1984; Smith and Stulz, 1985) suggest that the convexity of a manager's compensation increases their sensitivity to stock returns volatility. In other words, a more convex compensation makes the decision-maker less

risk-averse (Guay, 1999; Chava and Purnanandam, 2010). As stock options increase convexity, they reduce managerial hedging propensity (Bakke et al., 2016). We capture compensation-linked risk aversion similarly to Tufano (1996) and Haushalter (2000). For each CFO (and CEO), we compute the ratio between the number of shares underlying options (both exercisable and not) and the total number of shares beneficially owned by the manager, also including shares underlying options (*Options/total shares*).[3] This variable provides a measure of relative convexity (and therefore hedging incentive) of the manager's total wealth invested in the firm. The higher the number of shares underlying stock options held by the manager, the more sensitive their equity compensation to the firm's stock volatility, and the less they are expected to hedge.

While this variable has a straightforward interpretation, it does not consider the option's moneyness. The convexity of an option payoff decreases as the option goes more in-the-money, and its delta approaches one. For this reason, later in the paper, we alternatively measure compensation-linked risk aversion through the vega of the manager's equity compensation (Guay, 1999; Bakke et al., 2016). *Vega* is defined as the sensitivity of a manager's wealth invested in the firm to the volatility of stock returns. To capture hedging incentives, we standardize the dollar vega by the market value of the total equity invested in the firm (i.e., shares and options). In so doing, we obtain a measure of the relative incremental change in the manager's wealth invested in the firm in response to a 1% variation in stock volatility.[4] For evaluating stock options and computing their vega, we use Black and Scholes' (1973) model corrected for dividends (Merton, 1973), following Core and Guay (2002) and Bakke et al. (2016).

Rogers (2002) employs a slightly different measure of relative risk-taking incentives, i.e. the ratio between the manager's dollar vega and their dollar delta, where

[3] We collate the number of shares underlying options (both exercisable and not) from the "Outstanding Equity Awards at Fiscal Year-End" table, and the number of shares beneficially owned by each executive from the "Beneficial (or Securities) Ownership" table. Both tables are part of the firm's proxy statement.

[4] We assume that the vega of stock holdings is zero, as in Rogers (2002) and Bakke et al. (2016). In theory, since the value of the equity is a call option written on the firm's assets, its sensitivity to stock volatility is non-zero. However, as Guay (1999) points out, stock holdings provides a negligible risk-taking incentive.

the latter is the sensitivity of the equity compensation to the stock price.[5] We also use this proxy later in the paper. The *Vega-to-delta* ratio measures risk-taking incentives per dollar of value-increasing incentives from stock and options. The higher the numerator (dollar vega) and the lower the denominator (dollar delta), the higher the vega-to-delta ratio, and the lower the hedging incentive. In other words, by dividing the dollar vega by the dollar delta, we standardize vega, and we obtain a relative risk-taking measure conditional to a given managerial value-increasing incentive. More detail on how vega and delta are computed is reported in the Appendix B.

Besides relative risk-incentive variables, annual cash and stock compensation are relevant controls affecting managerial risk aversion. The annual cash compensation (*Cash + bonus*) is a measure of diversification, as cash potentially allows managers to invest in assets other than their firm (Bakke et al., 2016). All else equal, a higher cash compensation makes hedging less significant to managers, leading them to hedge less. Similarly, we also control for the dollar value of annual stock awards granted (*Stock awards*), as managers with greater stock ownership would prefer to hedge more (Smith and Stulz, 1985; Tufano, 1996)

We construct four dummy variables that capture incentive alignment and misalignment to explore the interaction between CFO and CEO's compensation-induced risk-taking, similarly to Ferris and Sainani (2021). *CFO High_CEO High* (*CFO Low_CEO Low*) is a dummy variable equal to 1 if both the CFO and CEO have a high (low) convexity of their equity compensation, where high and low are measured relative to the median value of the considered convexity measure in our sample. For example, the fraction of options over total shares (*Options/total shares*) above (below) the sample median for both the CFO and the CEO leads to *CFO High_CEO High* = 1 (*CFO Low_CEO Low* = 1). These two variables result in the same risk-taking incentives for both managers.

On the contrary, *CFO High_CEO Low* (*CFO Low_CEO High*) is a dummy variable equal to 1 if the CFO has a fraction of *Options/total shares* above (below) the sample median and the CEO has a fraction of *Options/total shares* below (above) the

[5] The dollar delta is the sum of the dollar delta of options and stocks, where we assume a unit stock delta as in Rogers (2002).

sample median. For example, the fraction of *Options/total shares* above (below) the sample median for the CFO and below (above) the sample median for the CEO leads to *CFO High_CEO Low* = 1 (*CFO Low_CEO High* = 1). These two variables will be of particular interest for our analysis, as they imply different risk-taking incentives. Hence, they will measure the incremental effect of one manager over the other.

As mentioned, in the main analyses, we use *Options/total shares* to define compensation-induced risk-taking incentives. However, later in the paper, we will follow the same logic and employ *Vega* and *Vega-to-delta* in place of *Options/total shares*.

At the CFO/CEO-level, we also use *Age* and *Tenure* as risk aversion-related controls. We include *CEO duality*, a dummy variable equal to one if the firm's CEO is also the chair of the board of directors. *CEO duality* proxies managerial entrenchment and should be negatively correlated to risk aversion and hedging propensity (Croci et al., 2017). Finally, to control for CFO managerial power, we use *CFO director*. This dummy variable detects firms where the CFO sits on the board of directors, as in Ferris and Sainani (2021).

At the firm level, we control for characteristics related to hedging (Smith and Stulz, 1985; Froot et al., 1993). *Total assets* and *Tobin's Q* control for size and growth opportunities, *Negative EBIT* detects negative operating income firm-year observations, *Leverage* (long-term debt plus short-term debt over total assets), and *Quick Ratio* (cash and cash equivalents plus receivables over current liabilities) proxy financial constraints and liquidity, *Investment* controls for the firm's investment intensity (ratio of capital expenditures to total assets), and finally, a dummy variable detects firms that pay dividends (*Dividend*). The definition of all variables is provided in the Appendix C.

2.3 Sample description

Table 1 presents the yearly distribution of hedgers. The left-hand side of the table shows the number of firms and the percentage of hedgers by year. Except for 2014, where hedgers represent 68% of the sample, the fraction of hedgers floats between 70 and 90%, and the average over the 11-year period we consider is 76%. Conditional to hedging, firms choose to hedge about 55% of their annual production and 5% of their reserves (Table 1, last two columns). This evidence confirms that price risk is relevant among

firms operating in the oil and gas industry, and hedging is a strategic decision. The figures in Table 1 are in line with those presented in other studies on the same sector (e.g., Jin and Jorion, 2006; Bakke et al., 2016).

Please insert Table 1 here

Table 2 presents the descriptive statistics of all variables in the following order. The first section of Table 2 includes CFO remuneration, age, tenure, and board membership. The second section shows the same variables for the CEO (*CEO duality* replaces *CFO director* to proxy managerial power). The third section presents control variables at the firm level. We winsorize continuous variables (*FPH, FRH, Options/total shares*, *Vega, Vega-to-Delta, Cash + bonus, stock awards, Total assets, Tobin's Q, Leverage, Quick Ratio, Investment*) at the 1% and 99% probability level.

Please insert Table 2 here

Interestingly, the option-based compensation of the average CFO in our sample is very relevant, as more than 30% of their total equity invested in the firm is represented by stocks underlying stock options. There is also significant variability in our data, as the median is about 20%, and the third quartile is 60%. This initial evidence suggests that the relative convexity of the CFO's compensation is an arguably relevant factor affecting their risk aversion and, ultimately, the firm's hedging policy. Also, the average market value of the CFO's annual stock awards is about $1.1 million, relative to the average annual cash compensation of only $0.5 million. These figures confirm that stock and option-based compensations are preponderant also for CFOs (Indjejikian and Matějka, 2009; Chava and Purnanandam, 2010) and strongly impact their incentives and corporate decisions (Ge et al., 2011; Feng et al., 2011; Kim et al., 2011; Hoitash et al., 2012), not only in the US (Caglio et al., 2018). As expected, the CEO's compensation is higher than that of the CFO. The average CEO in our sample has a dollar value of annual stock awards

of $2.9 million, and annual cash compensation (*Cash + bonus*) of about $0.9 million. Interestingly, about 20% of the shares held by the CEO are underlying options, which is less than the corresponding figure for CFOs. The annual value of stock awards and cash compensation are right-skewed and will be log-transformed in regression analysis.

We find the same qualitative evidence when we look at the alternative proxies of manager's compensation convexity, i.e. relative *Vega* and the ratio between Vega and Delta (*Vega-to-delta*). In response to a 1% positive change in stock return volatility, the average CFO's wealth invested in the firm increases by 0.33%, against 0.19% for the average CEO. If we standardize vega by delta, and we condition to a 1% positive change in the underlying stock price, a 1% increase in stock return volatility represents about 40% of the CFO's increased wealth invested in the firm, against 24% for the CEO.

On average, CFOs are younger than CEOs (the mean is about 51 years for the CFO and 57 for the CEO) and less tenured (6 years for the CFO, vs. 9 years for the CFO). CEO figures are consistent with recent studies on the same industry (the average CEO age and tenure are 55.0 and 8.1 in Bakke et al., 2016, and 55.4 and 7.2 in Croci et al., 2017, respectively). As far as *CEO duality* is concerned, almost half of the CEOs in our sample also hold the office of the board chair. About 8 CFOs out of 100 are also members of the board, and these CFOs are expected to have more influence on firm decisions.

Finally, over the whole time period, the average (median) firm has $6 billion ($1.8 billion) total assets, a *Tobins's Q* of 1.5 (1.3) times, and 45% of the firm-year observations display a negative operating income. This substantial negative profitability is in line with the descriptive statistics reported in Bajo et al. (2021) and is concentrated in 2009 (where two-thirds of the firms in our sample are unprofitable) and 2015-16 (following the oil price drop, virtually all US oil and gas firms show negative operating performance in 2015 and 2016). The average (median) quick ratio is about 119% (72%), the leverage ratio is 35% (31% in median), and firms in the sector have a notably high investment intensity, as the average CAPEX over total assets (*Investment*) is 22% (20% in median). Finally, almost half of the firms are dividend-paying.

3. Results

We now study the relationship between the convexity of CFO's compensation and the firm's hedging propensity. We proceed as follows. First, we compare hedgers to non-hedgers to provide preliminary univariate evidence on the significant difference in the relative convexity of CFO's (and CEO's) compensation between the two subsamples. Second, we look at the relative impact of the CFO's incentives over those of the CEO by comparing the firm's hedging strategy when the relative payoff of the CFO and the CEO has a different degree of convexity. We then study the hedging likelihood and the extent of hedging in a multivariate setting.

3.1 Univariate results

We split our sample between hedgers and non-hedgers according to the *Hedger* dummy. As previously shown (Table 1), hedgers are 76% of our sample (658 firm-year observations out of 867). Table 3 compares hedgers to non-hedgers relative to CFO and CEO compensation and attributes, and firm controls.

Please insert Table 3 here

The relative convexity of CFO pay is a strongly significant variable in discriminating hedgers from non-hedgers. The average *CFO options/total shares* is 27% for hedgers and 46% for non-hedgers, and the 19% negative difference is statistically significant at the 1% level. This means that CFOs of hedging firms have less convex equity compensation. Equivalently, CFOs with a more convex compensation (because of the higher percentage of stock options held) are less likely to hedge. This is an expected but interesting first piece of evidence. When looking at the same variable for the CEO, we note that the difference between hedgers and non-hedgers is smaller. Hedging firms have an average *CEO options/total shares* of 22%, against 25% for non-hedgers. The difference is negative, as expected, but modest (only 3%) and statistically insignificant. Combined with the previous evidence, this figure supports the conjecture that CFOs' incentives have a stronger impact than CEOs' on hedging.

Similar evidence holds when we use a different measure of relative convexity, such as the relative vega or the ratio between vega and delta. CFOs of non-hedgers firms are more sensitive to the volatility of stock returns. Relative vega (*Vega*) is 0.61% for non-hedgers and 0.25% for hedgers, and the 0.36% difference is significant. This means that a 1% stock volatility change of the average hedging (non-hedging) firm converts into a 0.25% (0.61%) change in the total wealth the CFO has invested in the firm. The same figures for the CEO are 0.18% and 0.24%, respectively, and the 0.06% difference is only slightly significant. The evidence is analogous when turning to the ratio between the dollar vega and the dollar delta (*Vega-to-delta*). Conditional to a 1% change in the price of the underlying stock (delta), CFO dollar vega represents 56% (34%) of this change in the subsample of non-hedgers (hedgers) (the 22% difference is strongly significant). When inspecting *Vega-to-delta* for the CEO, we find 27% (for non-hedgers) and 23% (for hedgers). The difference is small and insignificant. Overall, this evidence points towards a more decisive role of compensation-induced risk aversion of the CFO, rather than that of the CEO, on the hedging likelihood.

Not only do CFOs of hedging firms have a less convex compensation, but they also have higher stock awards. The CFO's average annual stock award (*CFO stock awards*) is \$1.3 million for hedgers and \$0.4 million for non-hedgers (the \$0.9 million difference is statistically significant). This is also expected, as the annual equity compensation is a proxy for a manager's under-diversification. The less diversified the manager's wealth, the more utility they obtain from hedging. The same significant effect holds for the CEO (\$3.5 million vs. \$0.9 million).

Finally, a different degree of cash compensation characterizes CFOs (and CEOs) of hedgers and non-hedgers. CFOs (CEOs) of hedging firms have a higher annual cash compensation, and the \$0.2 million (\$0.4 million) difference is statistically significant. According to the theory, we would expect the opposite sign, as a higher cash compensation suggests that the manager is less invested in the firm and hence more diversified. However, from Table 2, we note that the average value of annual stock awards is more than twice the average annual cash compensation for CFOs (more than three times when considering CEOs), making cash compensation less important than stock compensation from an economic viewpoint.

Differences in tenure are only slightly significant for CFOs (5 years for hedgers vs. 6.5 years for non-hedgers) and insignificant for CEOs. Both CFOs and CEOs of hedging firms are younger compared to non-hedging firms, but the differences are economically small (2.4 years for CFOs, 2 years for CEOs). Also, previous literature has shown that *Age* has a more complex effect on hedging, also impacting the hedging instrument (Croci et al., 2017). Finally, hedgers are more likely to have a CEO serving as board chair and less likely to have a CFO sitting on the board.

To corroborate the first evidence provided in Table 3, we now carry out a more in-depth investigation. As in Ferris and Sainani (2021), we split our sample based on the relative compensation convexity of the CFO and the CEO. The first comparison is between the subsample of observations where both the CFO and the CEO jointly have a more convex equity compensation (and therefore a lower hedging incentive) and the subsample of observations where both the CFO and the CEO jointly have a less convex equity compensation (i.e., a higher hedging incentive). The higher or lower relative convexity of the compensation is defined in terms of *Options/total shares* and the respective sample median. In line with the previous univariate analysis, we expect that when both the CFO and the CEO (jointly considered) have a more convex equity compensation, firms are less likely to hedge and hedge a smaller fraction of their future production or actual reserves. The first panel of Table 4 shows the results.

Please insert Table 4 here

The two subsamples are composed of 346 and 347 firm-year observations each, respectively, meaning that for about 80% of the sample (i.e., 693 over 867 firm-year observations), the hedging incentives of the CFO and the CEO coincide. This is not surprising, as a more or less option-based compensation scheme generally applies to both the CFO and the CEO of the same firm. Firms are about 7% less likely to be hedgers when the CFO and CEO have a higher relative pay convexity. This difference is significant at the 5% level (Table 4, panel A). Also, on average, 42% of the expected production is hedged when both the CFO and the CEO have highly convex compensation,

against 46% when the compensation is less convex (the 4% difference is insignificant). The same evidence applies to *FRH*. Firms with joint higher (lower) relative pay convexity of their managers hedge about 3.7% (4.3%) of the reserves (the 0.6% difference is significant at the 5% level).

More interesting to our research is investigating the firm hedging policy when the CFO and the CEO have contrasting risk-taking incentives. To do so, in panel B of Table 4, we compare two subsamples. In the first subsample, the relative convexity of the CFO's equity compensation is higher than the median, and the relative convexity of the CEO's equity compensation is lower than the median (*CFO High & CEO Low*). In the second subsample, the relative convexity of the CFO's equity compensation is lower than the median, and the relative convexity of the CEO's equity compensation is higher than the median (*CFO Low & CEO High*). Contrasting the two subsamples allows to disentangle the relative importance of the CFO's risk-taking incentive (over that of the CEO) in affecting the firm's hedging choices. Panel B of Table 4 shows the results of this analysis, based on two subsamples composed of 87 firm-year observations each (174 firm-year observations), i.e. about one-fifth of the firm-year observations in our sample.

The evidence is notable. When the CFO has a highly convex payoff and the CEO has a less convex payoff, firms are about 30% less likely to hedge relative to the subsample in which the CEO has a highly convex payoff and the CFO has lower convexity. Since about 76% of the firms in our sample are hedgers, not only this 30%-difference is statistically significant, but it is also economically important. This evidence corroborates the univariate results shown in Table 3, where the ratio *Options/total shares* is markedly lower for hedgers than for non-hedgers when the CFO (rather than the CEO) is concerned. The relative incentives of the CFO seem to prevail over those of the CEO also when we consider the average production (the average of *FPH* in panel B of Table 4 is 30% vs. 38%). However, as in the previous panel, the difference is not significant. Finally, the same evidence is found, and the statistical significance is recovered, when we consider the fraction of reserves hedged (2.5% vs. 3.7%).

In Table 4, we split our sample depending on the median of *Options/total shares*. We now repeat the same univariate comparison but use *Vega* and *Vega-to-delta* as alternative measures of relative convexity of manager's compensation and, therefore,

hedging incentives. Table 5 shows the results of this analysis (to save space, we collapse all variables but the three of our interest, i.e. *Hedger*, *FPH*, and *FRH*). Panel A uses *Vega* to discriminate between high and low risk-taking incentives, while Panel B employs *Vega-to-delta*. As in the previous Table 3, it is confirmed that when the CFO and the CEO have different risk-taking incentives, the higher relative convexity of the CFO equity compensation prevails over that of the CEO.

Please insert Table 5 here

The same directional relationship is confirmed when we look at the sample pairwise correlations of our variables (Table 6). *CFO options/total shares* and *CEO options/total shares* are negatively correlated with *Hedger*, but the -25% correlation coefficient of *CFO options/total shares* (significant at the 1% level) is, in absolute value, much larger than the -5% correlation coefficient of *CEO options/total shares* (insignificant). A negative correlation is also registered between *CFO options/total shares* and the extent of hedging, i.e., *FPH* and *FRH* (and, again, more sizeable than the negative correlation between *CEO options/total shares* and the extent of hedging). Analogously, the same qualitative evidence holds for the other two alternative measures of relative convexity of equity compensation (i.e., *Vega* and *Vega-to-delta*).

Please insert Table 6 here

Taken together, these findings are suggestive of a stronger effect of CFO's incentives in shaping a firm's hedging policy. To confirm this evidence in a multivariate setting, in the next subsection, we regress the firm's hedging decision and the hedging extent on CFO and CEO's compensation and attributes, and firm controls.

3.2 Multivariate results

3.2.1 Hedging likelihood

We first investigate the effect of CFOs' and CEOs' characteristics on the hedging likelihood (Table 7). To this aim, we run a linear probability model where the dependent variable is the dummy *Hedger*.[6] Standard errors are clustered at the firm level, and all models include year fixed effects.

Please insert Table 7 here

In the first model of Table 7, we only look at the CFO. We regress *Hedger* on the relative convexity of the CFO's equity payoff (*CFO options/total shar*es), CFO annual compensation variables (*CFO Cash+bonus*, *CFO Stock awards*), CFO attributes (*Age* and *Tenure*), and firm controls. Then, we augment model 1 with the same variables for the CEO (model 2), hence investigating the joint effect of CFOs' and CEOs' traits on the firm's hedging decision. In line with the previous evidence, the relative convexity of a CFO's equity payoff negatively affects the hedging likelihood in both models. A 1%-increase in the proportion of shares underlying options relative to the total shares held by the CFO yields a 22 (23) basis points decrease in the hedging likelihood in model 1 (model 2). Notably, the same variable for the CEO (*CEO options/total shares*) is not significant in model 2, when the convexities of the CFO and CEO's payoff are jointly considered. Other compensation variables at the CFO and CEO level are insignificant (*Cash + bonus* and *Stock awards*). Finally, the sign of the control variables at the firm level is in line with the predictions of the hedging literature. The hedging likelihood is positively related to size and profitability (as there are economies of scale in hedging), leverage (proxying financial distress risk), and investment intensity (proxying intangible capital and operational risk). Also, hedging is negatively associated with Tobin's Q and liquidity (as more liquid and highly valued firms draw less utility from hedging). Dividend-paying firms hedge no different than their non-dividend-paying counterparties.

[6] We use a linear probability model as it allows to immediately interpret the economic relevance of our coefficients. However, we also repeat the analysis using logit models. The evidence is robust and qualitatively unchanged. For brevity, we do not report it in the paper.

In models 3 and 4, we run the same regressions as before, but we aim to disentangle the CFO's incremental effect (over that of the CEO). In other words, we wish to test whether CFO's incentives remain significant at different levels of CEO's incentives. Model 3 (model 4) only considers the subsample of firm-year observations where the relative convexity of the CEO's equity compensation is high (low), i.e. above (below) the sample median. Therefore, only half of the observations (433 and 434 out of 867) are employed in these two regressions. The relevance of the CFO's incentives is confirmed in both models. In particular, very interesting to our purpose is model 4. Here we investigate the effects of the CFO's relative equity payoff convexity when the CEO has a less convex equity compensation. A 1%-increase of *CFO options/total shares* in this subsample decreases the firm's hedging probability by 29 basis points. Therefore, when the intensities of CFOs' and CEOs' risk-taking incentives are different, the impact of the CFO is substantial.

Motivated by this evidence, in model 5 of Table 7, we explore the effect of the interaction between CFOs' and CEOs' risk-taking incentives on the hedging likelihood with four dummies. Two dummies (*CFO High_CEO Low* and *CFO Low_CEO High*) detect incentive misalignment, and two dummies (*CFO High_CEO High* and *CFO Low_CEO Low*) detect incentive alignment. The latter variable is omitted in model 5, as it is subsumed in the constant. As before, this analysis points toward the relevance of CFOs on hedging, especially when their incentives are not aligned with those of the CEO. *CFO High_CEO Low* is significant, while *CFO Low_CEO High* is not. This means that a higher convexity of the CFO's payoff (relative to that of the CEO) significantly reduces the hedging likelihood by 15 basis points. On the contrary, a higher convexity of the CEO's payoff (relative to that of the CFO) is instead insignificant.

3.2.2 Hedging expected production

We now turn our attention to the effect of CFOs' and CEOs' characteristics on the extent of hedging. In Table 8, we run Tobit regressions where the dependent variable is the fraction of the next year's (expected) production hedged (i.e., *FPH*). We choose a Tobit model as the dependent variable is left-censored at zero for about 24% of the sample

(i.e., for non-hedgers). We include year fixed effects, and we cluster standard errors at the firm level.

The structure of Table 8 replicates that of Table 7. The first two models investigate whether the negative effect of CFO's relative equity payoff convexity also persists on the extent of hedging. Then, models 3 and 4 explore the relative strength of CFO's incentives, over those of the CEO, through a subsample analysis, i.e., when the convexity of the CEO's payoff is higher or lower than the median in our sample. Finally, the last model replicates the interaction analysis already presented.

Please insert Table 8 here

In model 1 of Table 8, *CFO options/total shares* is negative and significant. In model 2, although negative, *CFO options/total shares* does not reach the usual significance thresholds. Looking at the two complementary subsamples in models 3 and 4, i.e., firm-year observations for which the CEO has a higher or lower convexity of their payoff, respectively, we find that the CFO incrementally matters in deciding the extent of hedging. In both subsamples, an increase in *CFO options/total shares* reduces the quantity of expected production hedged, and the sensitivity is stronger when the incentives of the CFO and the CEO differ. When the CEO equity compensation is less convex, a 1%-increase in *CFO options/total shares* generates a significant 0.31%-decrease in quantity hedged. Finally, in model 5 of Table 8, we replicate our investigation on the effect of aligned and misaligned hedging incentives on the fraction of expected production hedged. As in Table 7, *CFO High_CEO Low* is significant. It also generates a material decrease in the annual production hedged (16%). If we consider the sample average (from Table 1) of *FPH* (about 55% for hedgers), this effect represents an economically relevant 30% change. This confirms that CFO's incentives are also important for the quantity of expected production hedged.

3.2.3 Hedging reserves

The fraction of expected annual production hedged is subject to a potential discrepancy between the actual next year's production and the firm's expectation when it places the hedge, which is unobservable. In other words, the "perfect foresight" assumption might be systematically biased. To circumvent this issue, as in Bakke et al. (2016), we also use the fraction of a firm's total reserves hedged. Total reserves are contemporaneous to the moment when the firm places the hedge, and they are also far less volatile over time.

In Table 9, we replicate the same multivariate analysis (Tobit regressions) as in Table 8, using *FRH* rather than *FPH* as our dependent variable.

Please insert Table 9 here

The evidence is qualitatively very similar to what is already shown in Table 8. The coefficient of *CFO options/total shares* is negative and significant in model 1 (CFO alone), model 2 (CFO and CEO), models 3 (subsample with higher CEO's payoff convexity), model 4 (notably in the subsample with lower CEO's payoff convexity), and model 5 (with dummies indicating the aligned and misaligned incentives of the CFO and the CEO). The coefficients of the relevant variables are smaller in absolute value than those in Table 8. This depends on the fact that the average total reserves being hedged in our sample is 5% (from Table 1), while the average is 55% for the expected production hedged.

3.2.4. Alternative proxies of relative payoff convexity

In this section, we use two different proxies of a manager's hedging incentive. The first proxy is the equity compensation's relative vega (*Vega*). The logic is that our main variable, *Options/total shares*, does not consider the option moneyness. However, the option moneyness has itself an effect on the convexity of the relative equity compensation. For example, if a manager holds options far from the moneyness (regardless of the direction), keeping the other variables unchanged, their hedging incentives are weaker. The relative sensitivity of a manager's total wealth invested in the

firm to the volatility of stock returns captures such moneyness-corrected hedging incentives. Another way of standardizing dollar vega is dividing it by the manager's dollar delta. This is our second alternative relative convexity variable. The logic is that the incentive to raise stock prices is also relevant when setting the hedging strategy (Rogers, 2002). In Table 10 and Table 11, we repeat the previous multivariate investigations using these two interchangeable proxies. We suppress control variables for brevity.

Please insert Table 10 here

Please insert Table 11 here

CFO Vega, in Table 10, is stronger than *CEO Vega* in explaining a firm's hedging likelihood (panel A) and extent of hedging (panel B and panel C). Using model 2 as an example for all three panels, one standard deviation change in CFO vega (0.58, from Table 1) decreases the hedging likelihood by almost 8 percentage points (against a sample average of 76%), the fraction of production hedged by about 9% (the sample average for hedgers is 55%), and the fraction of reserves hedged by 1% (the sample average for hedgers is 5%). This is a tangible effect. These conclusions are robust to replacing *Vega* with *Vega-to-delta* (Table 11).

3.2.4 Transitioning subsample

Our previous analyses cannot rule out concerns about the potentially endogenous relationship between CFO remuneration and a firm's hedging policy. One could argue that unobservable firm-level characteristics have explanatory power on both compensation and hedging policy. To tackle this potential issue, we follow Boubaker et al. (2020) and Michaely et al. (2016) and focus on firms that jointly experienced (a) a change in the CFO and (b) a change in the CFO's payoff convexity within our sample period. Retaining only firms which underwent a transition (i.e., a new CFO takes office, and the convexity of their payoff is markedly different from that of the old CFO) allows us to avoid the overlap between firm attributes and compensation characteristics.

Therefore, we can control for the effect of unobserved firm characteristics on hedging choices.

We first restrict our sample to firms that experienced at least one CFO change. This filter reduces the number of usable firms to 71 and the number of firm-year observations to 517. Then, we only consider firms for which we observe a significant change in the compensation policy between the departing and the incumbent CFO. To define this "significant change," we look at transitions from a high (low) to a low (high) level of *CFO options/total shares*. More precisely, we only retain in our sample firms for which the new CFO has a fraction of *CFO options/total shares* above (below) the sample median and for which *CFO options/total shares* of the old CFO is below (above) the sample median. We use the restricted sample of firms undergoing a CFO transition (71 firms, 517 observations) for computing medians. This approach is consistent with the incentive variables we have used in our previous multivariate analysis (Ferris and Sainani, 2021) and follows Bajo et al. (2021). The final sample for this analysis comprises 24 firms and 168 firm-year observations.

Table 12 shows the results of a linear probability model for the hedging likelihood (panel A), a Tobit regression for *FPH* (panel B), and a Tobit regression for *FRH* (panel C). We do not report control variables for brevity. As before, standard errors are clustered at the firm level, and all models include year fixed effects.

Please insert Table 12 here

Panel A of Table 12 shows that the incentives of the CFO retain their negative and significant effect on the hedging probability. This conclusion holds when considering only the CFO (model 1), both the CFO and the CEO (model 2), two subsamples according to the lower or higher CEO payoff convexity (model 3 and model 4, respectively), and

when using dummies to detect the different incentives of the CFO and the CEO (model 5).[7]

Panel B of Table 12 reports the coefficients of a Tobit regression for the expected production hedged. The general evidence is in line with the results in Table 7, as CFO's convexity negatively affects the extent of hedging (models 1 and 2), even if only at the 5% and 10% confidence level, respectively. The variable *CFO options/total shares* loses significance in subsequent models when the two subsamples are considered. This is somewhat expected since we only have about 80 observations in each subsample.

Panel C replicates the results of Table 12 for the reserves hedged. The results are qualitatively similar to those reported in Table 9. As for Panel B, the small number of observations affects the explanatory power of the models. However, in model 5, we recover the statistical significance (at the 5% level) of the dummy *CFO High_CEO Low*, which remarkably confirms the relevant role of the CFO (relative to the CEO) and their incentives on the fraction of reserves hedged.

Finally, we repeat the same analysis replacing *CFO options/total shares* with *Vega* and *Vega-to-delta* to validate our results. With the caveat represented by the limited sample size, the results confirm the relevance of the CFO risk-taking incentives, after factoring in the incentives of the CEO, on the hedging likelihood and the hedging extent.[8]

4. Conclusion

Due to the specialized expertise and technical competency it requires, risk management is one of the CFO's most sophisticated areas of responsibility. Surveys of professionals clearly indicate that risk management is the first among the several nonfinancial accounting-related activities that report directly to the CFO. Despite this evidence, most of the literature investigating the relationship between managerial preferences and a firm's hedging policy looks at the risk-taking incentives of the CEO, usually viewed as the ultimate decision-maker in this area.

[7] In model 5 (for all three panels of Table 9) we compute *CFO High_CEO Low, CFO High_CEO Low* and *CFO High_CEO Low* according to the median of the subsample we use in this analysis (168 observations).

[8] For brevity, we do not report these tables in the paper. They are available upon request.

In this paper, we exploit the well-established causal relationship between the relative convexity of a manager's equity compensation and risk aversion to investigate how CFOs' risk-taking incentives significantly affect a firm's hedging policy and whether the impact of the CFO goes beyond and above that of the CEO. We use a sample of US oil and gas producers between 2009 and 2019, and we show that the CFO's compensation-induced risk-taking is negatively associated with the hedging likelihood, the amount of expected annual production hedged, and the fraction of a firm's current reserves hedged. This evidence holds when the CFO is analyzed in isolation from the CEO, when both the CFO and the CEO are considered jointly, and when their different incentives are studied separately. When the CFO has a higher relative payoff convexity and, at the same time, the CEO has a lower convexity, the firm is less likely to hedge and hedges quantitatively less. These results survive after replacing our main relative convexity measure (i.e., the number of options over the number of shares held by the manager) with two alternatives (i.e., the relative vega and the ratio between dollar vega and dollar delta), and when we restrict the sample to firms undergoing a transition in both the CFO and their compensation structure.

Our study confirms that the CFO and their incentives, rather than the CEO, ultimately matter in shaping a firm's hedging strategy. This evidence has important managerial implications, as CFOs' option-based compensation increases the relative convexity of their payoff and might have unintended consequences on a firm's risk management. We contend that option-based compensation packages should be carefully designed to account for the joint risk-taking incentives of both the CFO and the CEO. The acknowledged increasing importance of the CFO on a wide array of strategic decisions makes their risk preferences ultimately very relevant. When hedging is considered, CFO's preferences are incremental to those of the CEO and have additional explicative power. Overall, our study contributes to the literature on managerial risk aversion and hedging, particularly to the underinvestigated area on the role played by the CFO on making such decisions.

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Appendix A. Computation of *FPH* and *FRH*.

This Appendix provides an example of how we construct *FPH* and *FRH*. The firm we consider for this example is Continental resources Inc., fiscal year 2009. Tables reported in the 10-K are replicated below.

Production hedged. Derivatives contracts outstanding on December 31, 2009, are reported in the following tables:

Crude Oil

			Floors		Ceilings	
Period and Type of Contract	**Volume in MBbls**	**Swaps Weighted Average**	**Range**	**Weighted Average**	**Range**	**Weighted Average**
January 2010 – June 2010						
Swaps	905	$80.50				
Collars	453	—	$ 70.00	$ 70.00	$ 95.00	$ 95.00
July 2010 – December 2010						
Collars	644	—	$ 75.00	$ 75.00	$ 96.75	$ 96.75
January 2011 – December 2011						
Collars	1,278	—	$ 75.00	$ 75.00	$ 89.00	$ 89.00

Natural gas

Period and Type of Contract	**Volume in MMMBtus**	**Swaps Weighted Average**
January 2010 – March 2010		
Swaps	2,700	$ 6.18
April 2010 – June 2010		
Swaps	2,710	$ 6.18
July 2010 – September 2010		
Swaps	2,720	$ 6.18

October 2010 – December 2010 Swaps	2,720	$	6,.8
Natural Gas Basis Centerpoint East			
Period and Type of Contract	**Volume in MMMBtus**	**Swaps Weighted Average**	
January 2010 – December 2010 Swaps	7,200	$	(0.62)

First, derivatives positions for the next fiscal year (2010) are considered. All hedged volumes are summed up and converted in thousands of barrels of oil equivalent (MBOE). This firm has hedged 905 MBbls of future oil production with swaps, and 1097 (= 453 + 644) MBbls with collars. The total volume for natural gas is 18,050 (= 2,700 + 2,710 + 2,720 + 2,720) MMMBtus. MMBtus (Million British Thermal Units) are converted into Mcf (thousand cubic feet), by dividing the number by 1.037[1] (resulting in 17,405,978.8 Mcf). Then, the result is converted in MMcf (millions cubic feet) and divided by 6[2] to obtain the volume in MBOE (17,405.98/6 = 2900,99 MBOE). The total volume hedged of oil and natural gas is: (905 + 1097 + 2900,99) = 4902.996 MBOE.

Total production. The following table reports production figures for the company at fiscal year-end.

	Year Ended December 31,		
	2010	**2009**	**2008**
Net production volumes:			
Crude oil (MBbls)			
North Dakota Bakken	4,45	2,257	1,145
Arkoma Woodford	9	13	8
Total Company	11,820	10,022	9,147
Natural gas (MMcf)			

[1] The conversion factor between MMBtus and Mcfs is provided by the United States Energy Information Administration: https://www.eia.gov/tools/faqs/faq.php?id=45&t=8.

[2] For this industry, the standard assumption is that 6 Mcf of NG produce the same amount of energy of one barrel of oil (Bajo et al., 2021).

North Dakota Bakken	3,994	1,729	720
Arkoma Woodford	8,726	9,152	5,407
Total Company	23,943	21,606	17,151
Crude oil equivalents (MBoe)			
Total Company	**15,811**	13,623	12,006

The total production in 2010 is 15,811 MBOE. Hence, the fraction of 2010 production that was hedged in 2009 (*FPH*) is: (4902.996 MBOE / 15,811 MBOE) * 100 = 31.01%.

Reserves. FRH is computed similarly to *FPH*, but with the value of proved reserves at the fiscal year end. Reserves are reported in the following table.

	December 31, 2009			
	Crude oil (MBbls)	**Natural Gas (MMcf)**	**Total (MBoe)**	**P-V 10 (in thousands)**
Proved developed producing	83,745	169,556	112,004	$ 1,797,923
Proved developed non-producing	1,525	226	1,563	$ 10,689
Proved undeveloped	88,01	334,298	143,726	$ 437,328
Total proved reserves	173,280	504,080	257,293	$ 2,245,940
Standardized measure				$ 1,841,540

The sum of total reserves at the end of 2009 is 257,293 MBOE. Therefore, the fraction of reserves hedged (*FRH*) is (4902.996 MBOE / 257,293 MBOE) * 100 = 1,9%.

APPENDIX B. Vega and Delta.

Vega is the change in the dollar value of the manager's equity-based compensation when the firm's annualized standard deviation of stock returns changes by 0.01 (Bakke et al., 2016). To obtain a relative measure of manager's payoff convexity, we standardize vega by the sum of the market value of shares beneficially owned plus the market value of ESOs:

$$\text{Vega} = \frac{Vega\ (option\ holdings)}{MV(stock\ holdings) + Value\ (option\ holdings)}$$

Following Guay (1999), Core and Guay (2002), and Bakke et al. (2016), vega of ESOs is computed according to Black and Scholes (1973) formula, modified to account for dividends payouts by (Merton, 1973):

$$\text{Vega (option holdings)} = e^{-dT} N'(Z) S T^{1/2} \times 0.01 \times number\ of\ options$$

Where:

- $\text{Z} = \frac{ln\left(\frac{S}{X}\right) + T\left(r - d + \frac{\sigma^2}{2}\right)}{\sigma T^{1/2}}$
- S = underlying stock price
- X = exercise price of the option
- T = time to maturity of the option (in years)
- $\text{r} = \ln(1 + risk - free\ rate)$
- $\text{d} = \ln(1 + dividend\ yield)$
- σ = annualized stock return volatility
- N' = Normal density function

We use end-of-the-year stock prices from Compustat (item *prcc_f*) for the underlying stock price (S). For the risk-free rate (r), we use Treasury rates provided by the Federal Reserve[1] with the maturity closest to the option.[2] Dividend yield (*d*) is computed as dividends per share (Compustat item *dvpsx_f*)

[1] https://www.federalreserve.gov/datadownload/Choose.aspx?rel=H15.

[2] For maturities in-between those provided by the Federal reserve, we interpolate rates as in Coles et al. (2006).

over the end-of-the-year stock price. Annualized volatility (σ) is computed starting from daily stock returns from Compustat Security daily. As in Bakke et al. (2016), we compute the vega of total compensation by summing up vegas of all tranches of the executive's option holdings. We consider the vega of stock holdings equal to zero (Coles et al., 2006; Bakke et al., 2016)

We compute the value of option holdings using the modified Black and Scholes (1973) formula to value a European call option:

$$\text{Value}(option\ holdings) = \text{S}e^{-dT}\text{N}(Z) - \text{X}e^{-rT}\text{N}\left(Z - \sigma T^{1/2}\right) \times number\ of\ options$$

Where *N* is the cumulative probability function of the normal distribution. The total aggregate value of options holdings is the sum of the values of all options tranches held at the end of each fiscal year by each executive.

Following Rogers (2002), we compute the ratio of the vega of each executive's stock and option holding to the delta of their compensation package.

$$\text{Vega} - to - \text{delta} = \frac{Vega(option\ holdings)}{\text{Delta}(option\ holdings) + Delta(stock\ holdings)}$$

As before, vega of stock holdings is set to zero. *Delta* is the change in the dollar value of each executive's compensation package when the firm's stock price changes by 1%. We compute the aggregate delta of each executive's option-based compensation as the sum of the deltas of all tranches of option holdings. Then, we sum the aggregate delta of option holdings and the delta of the stock holdings. To compute deltas, we again follow Guay (1999), Core and Guay (2002), and Bakke et al. (2016), and employ the Black and Scholes (1973) formula, modified to account for dividends Merton (1973):

$$\text{Delta (stock holdings)} = \text{S} \times 0.01 \times number\ of\ shares$$

$$\text{Delta (option holdings)} = e^{-dT}\text{N}(Z)\text{S} \times 0.01 \times number\ of options$$

Where N is the cumulative density function of the normal distribution.

APPENDIX C. Definition of variables.

Variable Name	Definition
Hedger	Dummy variable equal to one if the firms hedges with financial derivatives, and zero otherwise.
% Production	Volume of oil and gas production hedged with financial derivatives, over the next year's total production (MBOE).
% Reserves	Volume of oil and gas production hedged with financial derivatives, over actual reserves (MBOE).
CFO options/total shares	Number of shares underlying options (exercisable and non exercisable) / (total number of shares beneficially owned by the CFO + number of shares underlying options (exercisable and non exercisable)).
CFO Vega	Vega of ESOs (exercisable and non exercisable) / (market value of shares beneficially owned by the CFO + dollar value of ESOs (exercisable and non exercisable)).
CFO Vega-to-delta	Vega of ESOs (exercisable and non exercisable) / (Delta of ESOs (exercisable and non exercisable) + Delta of Stocks).
CFO Cash+bonus	Log of salary plus bonus (in $ million) of the CFO.
CFO Stock awards	Log of stock awards (in $ million) of the CFO.
CFO age	Log of age of the CFO.
CFO tenure	Log of total amount of years in the position of CFO.
CFO director	Dummy variable equal to one if the CFO is a member of the board of directors, and zero otherwise.
CEO options/total shares	Number of shares underlying options (exercisable and non exercisable) / (total number of shares beneficially owned by the CEO + number of shares underlying options (exercisable and non exercisable)).
CEO Vega	Vega of ESOs (exercisable and non exercisable) / (market value of shares beneficially owned by the CEO + dollar value of ESOs (exercisable and non exercisable)).
CEO Vega-to-delta	Vega of ESOs (exercisable and non exercisable) / (Delta of ESOs (exercisable and non exercisable) + Delta of Stocks).
CEO Cash+bonus	(Log of) salary plus bonus (in $ million) of the CEO.
CEO Stock awards	(Log of) stock awards (in $ million) of the CEO.
CEO age	(Log of) age of the CEO.
CEO tenure	(Log of) total amount of years in the position of CEO.
CEO duality	Dummy variable equal to one if the CEO is also the chairman of the board of directors, and zero otherwise.

CFO High_CEO Low	Dummy equal to one if the CFO has a fraction of option/total shares which is above the median and the CEO has a fraction of option/total shares which is below the median of the overall sample, and zero otherwise.
CFO Low_CEO High	Dummy equal to one if the CFO has a fraction of option/total shares which is below the median and the CEO has a fraction of option/total shares which is above the median of the overall sample, and zero otherwise.
CFO High_CEO High	Dummy equal to one if both the CFO ad the CEO are awarded a fraction of option/total shares which is above the median, and zero otherwise.
CFO High_CEO Low (vega)	Dummy equal to one if the Vega of CFO's ESOs is above the median and the the Vega of CEO's ESOs is below the median of the overall sample, and zero otherwise.
CFO Low_CEO High (vega)	Dummy equal to one if the Vega of CFO's ESOs is below the median and the the Vega of CEO's ESOs is above the median of the overall sample, and zero otherwise.
CFO High_CEO High (vega)	Dummy equal to one if both the Vega of CFO's and CEO's ESOs is above the median, and zero otherwise.
CFO High_CEO Low (vega-to-delta)	Dummy equal to one if the Vega-to-delta of CFO's compensation is above the median and the the Vega-to-delta of CEO's compensation is below the median of the overall sample, and zero otherwise.
CFO Low_CEO High (vega-to-delta)	Dummy equal to one if the Vega-to-delta of CFO's compensation is below the median and the the Vega-to-delta of CEO's compensation is above the median of the overall sample, and zero otherwise.
CFO High_CEO High (vega-to-delta)	Dummy equal to one if both the Vega-to-delta of CFO's and CEO's compensation is above the median, and zero otherwise.
Total Assets	(Log of) total assets.
Tobin's Q	Market value of equity plus total assets minus book value of equity, divided by total assets
Negative EBIT	Dummy equal to one if the firms has reported negative Earnings Before Interests and Taxes (EBIT) in the current fiscal year, and zero otherwise
Leverage	Short term debt plus long term debt over total assets.
Quick Ratio	Cash and cash equivalents over current liabilities.
Investment	Capital expenditures over total assets.
Dividend	Dummy variable equal to one if the firm is a dividend payer, and zero otherwise.

Year	Full sample				Hedgers only	
	Hedger = 0	Hedger = 1	Total	% Hedgers	% Production Hedged	% Reserves Hedged
2009	25	66	91	72.5%	64.3%	5.5%
2010	25	67	92	72.8%	54.7%	4.8%
2011	23	66	89	74.2%	47.4%	3.9%
2012	24	68	92	73.9%	50.0%	4.5%
2013	19	69	88	78.4%	57.0%	5.1%
2014	27	57	84	67.9%	53.3%	4.2%
2015	19	57	76	75.0%	47.2%	4.5%
2016	17	60	77	77.9%	55.5%	5.9%
2017	9	58	67	86.6%	57.7%	5.7%
2018	11	49	60	81.7%	62.0%	6.1%
2019	10	41	51	80.4%	56.1%	5.3%
Total	**209**	**658**	**867**	**75.9%**	**54.9%**	**5.0%**

Table 1 – *Yearly distribution of hedgers and non-hedgers*. The table reports the yearly distribution of hedgers and non-hedgers for the sample of 867 firm-year observations (154 unique firms). The first three columns report the distribution of firms by year, differentiating between hedgers and non-hedgers. The last three columns report the descriptive statistics on the percentage of hedgers each year, and the yearly average of the fraction of production and reserves hedged. All variables are defined in the Appendix.

	N	Mean	SD	Min	Q1	Median	Q3	Max
Chief Financial Officer								
CFO options/total shares, %	867	31.20	32.79	0.00	0.00	21.70	57.47	100.00
CFO Vega, %	867	0.33	0.58	0.00	0.00	0.08	0.44	3.57
CFO Vega-to-delta, %	867	39.84	60.38	0.00	0.00	10.27	62.02	330.94
CFO Cash+bonus, $ mln	867	0.50	0.29	0.00	0.31	0.44	0.60	1.64
CFO stock awards, $ mln	867	1.08	1.18	0.00	0.09	0.76	1.66	5.49
CFO age, years	867	50.75	8.18	30.00	45.00	51.00	57.00	73.00
CFO tenure, years	867	5.37	5.31	0.00	2.00	4.00	7.00	34.00
CFO director, %	867	7.50	26.35	0.00	0.00	0.00	0.00	100.00
Chief Executive Officer								
CEO options/total shares, %	867	22.71	27.17	0.00	0.00	11.17	37.86	100.00
CEO Vega, %	867	0.19	0.34	0.00	0.00	0.03	0.23	1.65
CEO Vega-to-delta, %	867	23.66	40.01	0.00	0.00	3.55	31.04	196.32
CEO Cash+bonus, $ mln	867	0.94	0.72	0.00	0.48	0.80	1.10	3.85
CEO stock awards, $ mln	867	2.86	3.31	0.00	0.12	1.73	4.27	15.20
CEO age, years	867	57.22	8.35	33.00	53.00	57.00	62.00	90.00
CEO tenure, years	867	8.22	9.15	0.00	2.00	5.00	11.00	52.00
CEO duality, %	867	53.63	49.90	0.00	0.00	1.00	1.00	100.00
Firm								
Total Assets, $ bln	867	5.99	10.38	0.01	0.37	1.78	6.25	52.05
Tobin's Q	867	1.48	0.84	0.54	0.97	1.25	1.67	5.65
Negative EBIT, %	867	44.75	49.75	0.00	0.00	0.00	100.00	100.00
Leverage, %	867	34.75	27.42	0.00	18.13	31.13	44.99	154.55
Quick Ratio, %	867	118.85	140.82	4.51	48.96	71.97	126.65	853.72
Investment, %	867	22.23	13.46	0.32	12.33	20.00	30.44	63.06
Dividend, %	867	46.02	49.87	0.00	0.00	0.00	100.00	100.00

Table 2 – *Descriptive statistics.* The table reports the descriptive statistics of the variables. The first group refers to compensation and other attributes of CFOs. The second group refers to compensation and other attributes of the CEO. The third group contains summary statistics of firm-specific financial variables. All variables are defined in the Appendix. All continuous variables have been winsorized at the 1% and 99% level.

	Hedger = 1	Mean	Hedger = 0	Mean	Difference	t-statistic	
CFO options/total shares, %	658	26.51	209	45.99	-19.48	-6.68	***
CFO Vega, %	658	0.25	209	0.61	-0.36	-5.67	***
CFO Vega-to-delta, %	658	34.46	209	56.77	-22.31	-3.91	***
CFO Cash+bonus, $ mln	658	0.54	209	0.35	0.19	8.58	***
CFO stock awards, $ mln	658	1.30	209	0.40	0.90	11.63	***
CFO age, years	658	50.18	209	52.57	-2.40	-3.62	***
CFO tenure, years	658	5.02	209	6.48	-1.46	-2.78	***
CFO director, %	658	6.23	209	11.48	-5.25	-2.19	**
CEO options/total shares, %	658	21.91	209	25.24	-3.33	-1.45	
CEO Vega, %	658	0.18	209	0.24	-0.06	-1.83	*
CEO Vega-to-delta, %	658	22.61	209	26.98	-4.37	-1.27	
CEO Cash+bonus, $ mln	658	1.05	209	0.58	0.46	8.97	***
CEO stock awards, $ mln	658	3.47	209	0.94	2.53	12.97	***
CEO age, years	658	56.73	209	58.77	-2.04	-2.81	***
CEO tenure, years	658	7.98	209	8.98	-1.00	-1.22	
CEO duality, %	658	55.78	209	46.89	8.89	2.24	**
Total Assets, $ bln	658	6.98	209	2.86	4.12	5.84	***
Tobin's Q	658	1.37	209	1.82	-0.45	-4.88	***
Negative EBIT, %	658	38.45	209	64.59	-26.14	-6.84	***
Leverage, %	658	38.34	209	23.43	14.91	6.09	***
Quick Ratio, %	658	89.98	209	209.71	-119.73	-7.45	***
Investment, %	658	23.65	209	17.74	5.91	5.11	***
Dividend, %	658	50.30	209	32.54	17.77	4.69	***

Table 3 – *Univariate analysis, hedgers vs. non-hedgers*. The table reports the descriptive statistics considering two subsamples of hedgers (658 firm-year observations) and non-hedgers (209 firm-year observations). The last column reports the t-statistic of the mean difference and its significance at 1%, 5% and 10% level (denoted as ***, **, *, respectively). All variables are defined in the Appendix.

Panel A, Aligned Incentives

	CFO High & CEO High	Mean	CFO Low & CEO Low	Mean	Difference	t-statistic	
Hedger, %	346	74.57	347	81.56	-6.99	-2.23	**
FPH, %	346	41.68	347	45.59	-3.91	-1.35	
FRH, %	346	3.69	347	4.31	-0.62	-2.02	**
CFO Cash+bonus, $ mln	346	0.50	347	0.51	-0.01	-0.36	
CFO stock awards, $ mln	346	0.97	347	1.30	-0.33	-3.60	***
CFO age, years	346	51.31	347	50.18	1.13	1.80	*
CFO tenure, years	346	4.63	347	5.63	-1.01	-2.79	***
CFO director, %	346	5.78	347	9.80	-4.02	-1.98	**
CEO Cash+bonus, $ mln	346	0.93	347	0.98	-0.05	-0.86	
CEO stock awards, $ mln	346	2.72	347	3.22	-0.51	-1.97	**
CEO age, years	346	56.96	347	56.58	0.38	0.63	
CEO tenure, years	346	6.62	347	9.19	-2.58	-3.81	***
CEO duality, %	346	49.13	347	57.64	-8.50	-2.25	**
Total Assets, $ bln	346	8.09	347	3.97	4.12	5.36	***
Tobin's Q	346	1.45	347	1.48	-0.04	-0.59	
Negative EBIT, %	346	44.80	347	41.21	3.59	0.95	
Leverage, %	346	31.65	347	37.22	-5.57	-2.87	***
Quick Ratio, %	346	113.36	347	119.87	-6.51	-0.63	
Investment, %	346	21.97	347	22.28	-0.31	-0.31	
Dividend, %	346	48.27	347	47.84	0.43	0.11	

Panel B, Misaligned Incentives

	CFO High & CEO Low	Mean	CFO Low & CEO High	Mean	Difference	t-statistic	
Hedger, %	87	52.87	87	81.61	-28.74	-4.22	***
FPH, %	87	29.86	87	37.60	-7.75	-1.43	
FRH, %	87	2.47	87	3.65	-1.19	-2.52	**
CFO Cash+bonus, $ mln	87	0.44	87	0.51	-0.07	-1.68	*
CFO stock awards, $ mln	87	0.52	87	1.26	-0.74	-4.94	***
CFO age, years	87	49.98	87	51.63	-1.66	-1.39	
CFO tenure, years	87	7.70	87	4.95	2.75	2.64	***
CFO director, %	87	3.45	87	9.20	-5.75	-1.56	

CEO Cash+bonus, $ mln	87	0.78	87	0.93	-0.15	-1.59	
CEO stock awards, $ mln	87	1.66	87	3.19	-1.53	-3.55	***
CEO age, years	87	61.00	87	57.02	3.98	2.88	***
CEO tenure, years	87	13.33	87	5.57	7.76	5.79	***
CEO duality, %	87	60.92	87	48.28	12.64	1.68	*
Total Assets, $ bln	87	4.96	87	6.68	-1.72	-1.06	
Tobin's Q	87	1.60	87	1.49	0.11	0.75	
Negative EBIT, %	87	51.72	87	51.72	0.00	0.00	
Leverage, %	87	35.00	87	36.96	-1.96	-0.38	
Quick Ratio, %	87	150.75	87	104.69	46.06	1.94	*
Investment, %	87	20.79	87	24.49	-3.70	-1.79	*
Dividend, %	87	43.68	87	32.18	11.49	1.56	

Table 4 – *Univariate analysis, CFO and CEO risk-taking incentives*. The table reports the descriptive statistics of the variables considering two subsamples according to (mis)alignment of risk-taking incentives of CFOs and CEOs. In panel A, risk-taking incentives of CFOs and CEOs are aligned, i.e. the variable *options/total shares* is jointly above or below the median for both the CFO and the CEO (CFO High & CEO High or CFO Low & CEO Low). In panel B, risk-taking incentives of CFOs and CEOs are misaligned, i.e. the variable *options/total shares* is either above the median for the CFO and below the median for the CEO (CFO High & CEO Low) or below the median for the CFO and above the median for the CEO (CFO Low & CEO High). In both panels, the last column reports the t-statistic of the mean difference and its significance at 1%, 5% and 10% level (denoted as ***, **, *, respectively). All variables are defined in the Appendix.

Panel A, Vega

Aligned incentives	CFO High & CEO High	Mean	CFO Low & CEO Low	Mean	Difference	t-statistic	
Hedger, %	355	75.77	356	79.78	-4.00	-1.28	
FPH, %	355	42.08	356	42.49	-0.41	-0.15	
FRH, %	355	3.80	356	4.03	-0.24	-0.79	
Misaligned incentives	**CFO High & CEO Low**	**Mean**	**CFO Low & CEO High**	**Mean**	**Difference**	**t-statistic**	
Hedger, %	78	53.85	78	80.77	-26.92	-3.72	***
FPH, %	78	33.72	78	43.77	-10.06	-1.61	
FRH, %	78	2.64	78	4.04	-1.40	-2.54	**

Panel B, Vega-to-delta

Aligned incentives	CFO High & CEO High	Mean	CFO Low & CEO Low	Mean	Difference	t-statistic	
Hedger, %	354	75.71	355	78.87	-3.17	-1.01	
FPH, %	354	41.96	355	42.11	-0.15	-0.05	
FRH, %	354	3.75	355	4.05	-0.29	-0.98	
Misaligned incentives	**CFO High & CEO Low**	**Mean**	**CFO Low & CEO High**	**Mean**	**Difference**	**t-statistic**	
Hedger, %	79	55.70	79	83.54	-27.85	-3.97	***
FPH, %	79	34.94	79	44.91	-9.97	-1.63	
FRH, %	79	2.69	79	4.17	-1.48	-2.79	***

Table 5 – *Univariate analysis, CFO and CEO risk-taking incentives, alternative convexity variables*. The table reports the descriptive statistics of the three main variables (*Hedger*, *FPH*, *FRH*) considering two subsamples according to alignment and misalignment of risk-taking incentives of CFOs and CEOs, as in the previous table, but with two different variables to detect manager's compensation convexity. In panel A, risk-taking incentives are defined in terms of the manager's Vega. In panel B, risk-taking incentives are defined in terms of the Veg-to-delta ratio. In both panels, the last column reports the t-statistic of the mean difference and its significance at 1%, 5% and 10% level (denoted as ***, **, *, respectively). All variables are defined in the Appendix.

		#1	#2	#3	#4	#5	#6	#7	#8
#1	*Hedger, %*	1							
#2	*FPH, %*	**0.621*****	1						
#3	*FRH, %*	**0.551*****	**0.848*****	**1**					
#4	*CFO options/total shares, %*	**-0.254*****	**-0.170*****	**-0.175*****	1				
#5	*CFO Vega, %*	**-0.265*****	**-0.184*****	**-0.175*****	**0.745*****	1			
#6	*CFO Vega-to-delta, %*	**-0.158*****	**-0.081****	**-0.099*****	**0.668*****	**0.782*****	1		
#7	*CFO Cash+bonus, $ mln*	**0.271*****	**0.149*****	**0.122*****	**-0.060***	**-0.071****	-0.048	1	
#8	*CFO stock awards, $ mln*	**0.324*****	**0.197*****	**0.191*****	**-0.209*****	**-0.147*****	**-0.107*****	**0.506*****	1
#9	*CFO age, years*	**-0.126*****	**-0.184*****	**-0.157*****	**0.055***	**0.065***	0.016	0.036	**-0.074****
#10	*CFO tenure, years*	**-0.118*****	**-0.169*****	**-0.141*****	-0.036	**-0.060***	**-0.087****	**0.125*****	**0.087****
#11	*CFO director, %*	**-0.085****	**-0.141*****	**-0.108*****	**-0.059***	**-0.028**	**-0.057***	0.03	0.002
#12	*CEO options/total shares, %*	**-0.052**	**-0.084****	**-0.085****	**0.638*****	**0.414*****	**0.439*****	**0.041**	-0.032
#13	*CEO Vega, %*	**-0.073****	**-0.072****	**-0.058***	**0.531*****	**0.496*****	**0.528*****	**0.083****	0.017
#14	*CEO Vega-to-delta, %*	-0.047	-0.051	-0.043	**0.497*****	**0.459*****	**0.577*****	**0.083****	0.054
#15	*CEO Cash+bonus, $ mln*	**0.274*****	**0.132*****	**0.107*****	**-0.056***	**-0.076****	**-0.062***	**0.779*****	**0.363*****
#16	*CEO stock awards, $ mln*	**0.327*****	**0.187*****	**0.185*****	**-0.140*****	**-0.128*****	**-0.092*****	**0.470*****	**0.780*****
#17	*CEO age, years*	**-0.105*****	**-0.181*****	**-0.130*****	**0.063***	0.036	0.026	**0.065***	-0.031
#18	*CEO tenure, years*	-0.047	**-0.161*****	**-0.176*****	-0.02	-0.026	**-0.064***	**0.142*****	-0.029
#19	*CEO duality, %*	**0.076****	0.025	0.027	**-0.079****	**-0.088*****	**-0.118*****	**0.143*****	**0.084****
#20	*Total Assets, $ bln*	**0.170*****	-0.002	-0.003	**0.144*****	**0.093*****	**0.116*****	**0.421*****	**0.473*****
#21	*Tobin's Q*	**-0.229*****	**-0.210*****	**-0.131*****	0.042	-0.05	**-0.097*****	**-0.153*****	**-0.109*****
#22	*Negative EBIT, %*	**-0.225*****	**-0.080****	-0.05	**0.067****	**0.095*****	**0.118*****	**-0.135*****	**-0.131*****
#23	*Leverage, %*	**0.233*****	**0.233*****	**0.184*****	**-0.112*****	0.016	**0.081****	**0.078****	0.028
#24	*Quick Ratio, %*	**-0.364*****	**-0.260*****	**-0.177*****	**0.113*****	0.003	**-0.079****	**-0.129*****	**-0.148*****
#25	*Investment, %*	**0.188*****	**0.109*****	**0.129*****	**-0.064***	-0.04	**-0.063***	0.036	0
#26	*Dividend, %*	**0.152*****	**0.102*****	**0.101*****	-0.027	-0.018	0.051	**0.170*****	**0.247*****

		#9	#10	#11	#12	#13	#14	#15	#16
#9	*CFO age, years*	1							
#10	*CFO tenure, years*	**0.310*** **	1						
#11	*CFO director, %*	**0.061***	**0.214*** **	1					
#12	*CEO options/total shares, %*	0.029	**-0.123*** **	-0.018	1				
#13	*CEO Vega, %*	-0.003	**-0.131*** **	0.012	**0.829*** **	1			
#14	*CEO Vega/Delta, %*	0.001	**-0.123*** **	-0.029	**0.756*** **	**0.898*** **	1		
#15	*CEO Cash+bonus, $ mln*	0.004	**0.056***	-0.038	0.037	**0.064***	0.052	1	
#16	*CEO stock awards, $ mln*	**-0.068****	0.046	-0.053	0.02	0.03	**0.056***	**0.449*** **	1
#17	*CEO age, years*	**0.164*** **	**0.330*** **	-0.011	**-0.067****	**-0.086****	**-0.083****	0.047	-0.019
#18	*CEO tenure, years*	0.029	**0.440*** **	0.026	**-0.225*** **	**-0.222*** **	**-0.229*** **	**0.172*** **	0.017
#19	*CEO duality, %*	0.014	**0.175*** **	**0.063***	**-0.159*** **	**-0.145*** **	**-0.151*** **	**0.174*** **	**0.119*** **
#20	*Total Assets, $ bln*	-0.007	0.012	0.045	**0.271*** **	**0.294*** **	**0.274*** **	**0.459*** **	**0.600*** **
#21	*Tobin's Q*	0.049	-0.024	-0.011	-0.039	**-0.144*** **	**-0.130*** **	**-0.115*** **	**-0.106*** **
#22	*Negative EBIT, %*	0.02	0.002	**0.096*** **	-0.001	0.027	**0.060***	**-0.155*** **	**-0.149*** **
#23	*Leverage, %*	0.023	-0.035	-0.024	**-0.122*** **	**-0.094*** **	**-0.059***	**0.079****	0.027
#24	*Quick Ratio, %*	-0.024	-0.004	-0.009	0.001	-0.048	-0.051	**-0.133*** **	**-0.127*** **
#25	*Investment, %*	**-0.089*** **	**-0.132*** **	-0.005	-0.042	**-0.091*** **	**-0.094*** **	0.053	-0.037
#26	*Dividend, %*	**-0.072****	**-0.074****	-0.017	**0.068****	**0.109*** **	**0.114*** **	**0.210*** **	**0.315*** **

		#17	#18	#19	#20	#21	#22	#23	#24	#25	#26
#17	*CEO age, years*	1									
#18	*CEO tenure, years*	**0.454*** **	1								
#19	*CEO duality, %*	**0.276*** **	**0.342*** **	1							
#20	*Total Assets, $ bln*	**0.073** **	0.003	**0.064***	1						
#21	*Tobin's Q*	-0.023	0.053	**0.086** **	**-0.168*** **	1					
#22	*Negative EBIT, %*	-0.01	-0.05	-0.042	**-0.162*** **	0.042	1				
#23	*Leverage, %*	**-0.068** **	**0.102*** **	0.01	**-0.104*** **	**0.073** **	**0.156*** **	1			
#24	*Quick Ratio, %*	0.027	-0.036	-0.053	**-0.111*** **	**0.300*** **	0.047	**-0.324*** **	1		
#25	*Investment, %*	**-0.088*** **	-0.021	-0.002	**-0.173*** **	**0.126*** **	**-0.076** **	**0.080** **	**-0.109*** **	1	
#26	*Dividend, %*	-0.007	**-0.103*** **	**0.056***	**0.371*** **	-0.024	-0.049	0.03	-0.035	**-0.140*** **	1

Table 6 – *Correlation table.* The table shows the pairwise correlations between variables. Statistical significance at the 10%, 5% and 1% is denoted as *, **. ***, respectively (and statistically significant correlation coefficient are in bold). All variables are defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)
	CFO	CFO/CEO	CEO options upper median	CEO options lower median	Interaction up-down median
CFO options/total shares	-0.221***	-0.233***	-0.189**	-0.286**	
	(0.0578)	(0.0863)	(0.0733)	(0.117)	
CEO options/total shares		0.0313			
		(0.103)			
CFO High_CEO Low					-0.154**
					(0.0730)
CFO Low_CEO High					-0.0208
					(0.0377)
CFO High_CEO High					-0.0793**
					(0.0379)
CFO Cash+bonus	-0.0966	-0.0260	0.0382	0.0111	-0.0293
	(0.0952)	(0.120)	(0.186)	(0.161)	(0.124)
CFO Stock awards	0.0128	0.0135	-0.00985	0.0337	0.0208
	(0.0464)	(0.0495)	(0.0720)	(0.0684)	(0.0492)
CFO age	-0.138	-0.122	-0.286**	-0.0575	-0.142
	(0.102)	(0.0990)	(0.122)	(0.122)	(0.0993)
CFO tenure	-0.0127	-0.00815	0.0546*	-0.0360	-0.00590
	(0.0216)	(0.0230)	(0.0308)	(0.0292)	(0.0228)
CFO director	-0.0200	-0.0284	0.0344	-0.0743	-0.0286
	(0.0545)	(0.0536)	(0.0634)	(0.0629)	(0.0512)
CEO Cash+bonus		-0.0565	-0.0860	0.00758	-0.0596
		(0.0728)	(0.126)	(0.0945)	(0.0773)
CEO Stock awards		-0.0124	0.0236	-0.0338	-0.00584
		(0.0319)	(0.0398)	(0.0471)	(0.0324)
CEO age		-0.164	-0.198	-0.116	-0.164
		(0.112)	(0.182)	(0.122)	(0.115)
CEO tenure		0.00181	0.0534*	-0.0300	0.00226
		(0.0208)	(0.0315)	(0.0218)	(0.0221)
CEO duality		0.0310	0.0255	0.0230	0.0377
		(0.0360)	(0.0480)	(0.0467)	(0.0371)
Total assets	0.0931***	0.0966***	0.0861***	0.0942***	0.0934***
	(0.0132)	(0.0157)	(0.0209)	(0.0228)	(0.0162)
Tobin's Q	-0.0559***	-0.0573***	-0.0940***	-0.0385	-0.0599***
	(0.0197)	(0.0198)	(0.0296)	(0.0294)	(0.0197)
Negative EBIT	-0.111***	-0.111***	-0.0960*	-0.110**	-0.118***
	(0.0384)	(0.0378)	(0.0558)	(0.0459)	(0.0383)
Leverage	0.252***	0.251***	0.380***	0.169*	0.259***
	(0.0665)	(0.0687)	(0.0773)	(0.0931)	(0.0696)

Quick ratio	-0.0405***	-0.0395***	-0.0415***	-0.0384**	-0.0430***
	(0.0104)	(0.0106)	(0.0148)	(0.0176)	(0.0103)
Investment	0.615***	0.617***	0.601***	0.545***	0.639***
	(0.116)	(0.116)	(0.151)	(0.145)	(0.117)
Dividend	0.0106	0.0147	-0.00602	0.00164	0.0193
	(0.0355)	(0.0357)	(0.0492)	(0.0465)	(0.0378)
Constant	1.471***	2.053***	2.660***	1.669**	2.099***
	(0.392)	(0.581)	(0.772)	(0.687)	(0.604)
Observations	867	867	433	434	867
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.469	0.469	0.489	0.485	0.456

Table 7 – *Hedging likelihood.* The table shows the results of a pooled OLS model, where the dependent variable is *Hedger*, i.e. a dummy equal to 1 if the firm hedges with financial derivatives and zero otherwise. Model 1 considers only CFO-level variables. Model 2 adds CEO-level variables. Models 3 and 4 split the sample according to the value of CEO *Options/total shares* above (model 3) and below (model 4) the median. Model 5 includes three dummy variables indicating the alignment or misalignment of risk-taking incentives between CFOs and CEOs (*CFO Low_CEO Low* is subsumed in the constant). Heteroskedasticity-robust standard errors are clustered at the firm level and are reported in parentheses. All models include year fixed effects. ***, ** and * denote statistical significance at the 1, 5, and 10% level, respectively. All variables are defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)
	CFO	CFO/CEO	CEO options upper median	CEO options lower median	Interaction up-down median
CFO options/total shares	-0.222***	-0.156	-0.179*	-0.305**	
	(0.0747)	(0.105)	(0.101)	(0.145)	
CEO options/total shares		-0.107			
		(0.125)			
CFO High_CEO Low					-0.159*
					(0.0915)
CFO Low_CEO High					-0.0925*
					(0.0517)
CFO High_CEO High					-0.0704
					(0.0524)
CFO Cash+bonus	-0.0997	0.148	0.222	0.234	0.138
	(0.130)	(0.170)	(0.273)	(0.235)	(0.180)
CFO Stock awards	0.0733	0.0187	-0.0704	0.0563	0.0315
	(0.0562)	(0.0716)	(0.102)	(0.0817)	(0.0737)
CFO age	-0.324**	-0.309**	-0.484**	-0.160	-0.321**
	(0.152)	(0.143)	(0.214)	(0.166)	(0.142)
CFO tenure	-0.0350	-0.000982	0.0863**	-0.0541*	0.000633
	(0.0283)	(0.0274)	(0.0403)	(0.0319)	(0.0271)
CFO director	-0.199**	-0.213***	-0.204	-0.197**	-0.227***
	(0.0814)	(0.0771)	(0.128)	(0.0784)	(0.0787)
CEO Cash+bonus		-0.166	-0.171	-0.169	-0.165
		(0.113)	(0.168)	(0.157)	(0.122)
CEO Stock awards		0.0134	0.0946*	-0.0397	0.0232
		(0.0406)	(0.0543)	(0.0524)	(0.0427)
CEO age		-0.344**	-0.492*	-0.235*	-0.339**
		(0.141)	(0.272)	(0.131)	(0.143)
CEO tenure		-0.0594**	-0.00672	-0.0923***	-0.0541**
		(0.0267)	(0.0366)	(0.0291)	(0.0265)
CEO duality		0.0716	0.0633	0.0888	0.0825*
		(0.0473)	(0.0753)	(0.0541)	(0.0485)
Total assets	0.0663***	0.0758***	0.0370	0.110***	0.0671***
	(0.0182)	(0.0201)	(0.0276)	(0.0240)	(0.0203)
Tobin's Q	-0.152***	-0.150***	-0.267***	-0.0868**	-0.154***
	(0.0318)	(0.0323)	(0.0611)	(0.0343)	(0.0320)
Negative EBIT	-0.0504	-0.0610	-0.0277	-0.0647	-0.0619

	(0.0455)	(0.0448)	(0.0657)	(0.0576)	(0.0449)
Leverage	0.426***	0.436***	0.562***	0.392***	0.453***
	(0.0865)	(0.0855)	(0.129)	(0.103)	(0.0868)
Quick ratio	-0.0591***	-0.0572***	-0.0687**	-0.0415	-0.0596***
	(0.0199)	(0.0200)	(0.0306)	(0.0258)	(0.0199)
Investment	0.663***	0.662***	0.824***	0.486**	0.690***
	(0.178)	(0.176)	(0.258)	(0.199)	(0.174)
Dividend	0.0191	0.0233	0.0400	0.00899	0.0188
	(0.0435)	(0.0442)	(0.0675)	(0.0532)	(0.0469)
Constant	1.957***	3.319***	4.459***	2.341***	3.295***
	(0.567)	(0.741)	(1.394)	(0.819)	(0.750)
Observations	867	867	433	434	867
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.384	0.407	0.385	0.513	0.399

Table 8 – *Fraction of expected production hedged.* The table shows the results of a pooled Tobit model, where the dependent variable is *FPH*, i.e. the fraction of the expected output hedged. Model 1 considers only CFO-level variables. Model 2 adds CEO-level variables. Models 3 and 4 split the sample according to the value of CEO *Options/total shares* above (model 3) and below (model 4) the median. Model 5 includes three dummy variables indicating the alignment or misalignment of risk-taking incentives between CFOs and CEOs (*CFO Low_CEO Low* is subsumed in the constant). Heteroskedasticity-robust standard errors are clustered at the firm level and are reported in parentheses. All models include year fixed effects. ***, ** and * denote statistical significance at the 1, 5, and 10% level, respectively. All variables are defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)
	CFO	CFO/CEO	CEO options upper median	CEO options lower median	Interaction up-down median
CFO options/total shares	-0.0239***	-0.0194*	-0.0188*	-0.0358**	
	(0.00817)	(0.0111)	(0.00968)	(0.0148)	
CEO options/total shares		-0.00768			
		(0.0129)			
CFO High_CEO Low					-0.0192**
					(0.00881)
CFO Low_CEO High					-0.00716
					(0.00533)
CFO High_CEO High					-0.00879
					(0.00598)
CFO Cash+bonus	-0.0117	0.00873	0.0248	0.00390	0.00856
	(0.0135)	(0.0168)	(0.0293)	(0.0259)	(0.0176)
CFO Stock awards	0.00752	0.00385	-0.0118	0.0121	0.00478
	(0.00625)	(0.00751)	(0.00878)	(0.00948)	(0.00766)
CFO age	-0.0269*	-0.0266*	-0.0409*	-0.0172	-0.0283*
	(0.0157)	(0.0150)	(0.0221)	(0.0178)	(0.0149)
CFO tenure	-0.00349	-0.000351	0.00823**	-0.00406	-0.000109
	(0.00311)	(0.00318)	(0.00413)	(0.00380)	(0.00312)
CFO director	-0.0142*	-0.0157**	-0.00774	-0.0170**	-0.0172**
	(0.00833)	(0.00785)	(0.0130)	(0.00780)	(0.00760)
CEO Cash+bonus		-0.0135	-0.0162	-0.0105	-0.0138
		(0.0109)	(0.0169)	(0.0150)	(0.0116)
CEO Stock awards		0.000375	0.00896*	-0.00475	0.00129
		(0.00400)	(0.00487)	(0.00570)	(0.00415)
CEO age		-0.0232	-0.0420	-0.00581	-0.0226
		(0.0170)	(0.0283)	(0.0191)	(0.0174)
CEO tenure		-0.00640**	-0.000843	-0.0112***	-0.00594**
		(0.00250)	(0.00334)	(0.00317)	(0.00251)
CEO duality		0.00721	0.00431	0.0111*	0.00820
		(0.00520)	(0.00760)	(0.00612)	(0.00536)
Total assets	0.00666***	0.00745***	0.00398	0.0113***	0.00670***
	(0.00196)	(0.00229)	(0.00285)	(0.00306)	(0.00231)
Tobin's Q	-0.0109***	-0.0108***	-0.0259***	-0.00322	-0.0112***
	(0.00400)	(0.00390)	(0.00664)	(0.00447)	(0.00388)
Negative EBIT	-0.00511	-0.00615	-0.00457	-0.00494	-0.00636
	(0.00484)	(0.00475)	(0.00687)	(0.00594)	(0.00472)

Leverage	0.0342***	0.0362***	0.0539***	0.0304***	0.0378***
	(0.00841)	(0.00818)	(0.0133)	(0.00892)	(0.00841)
Quick ratio	-0.00403**	-0.00382*	-0.00505	-0.00245	-0.00409**
	(0.00205)	(0.00205)	(0.00319)	(0.00266)	(0.00205)
Investment	0.0814***	0.0816***	0.105***	0.0614**	0.0843***
	(0.0203)	(0.0201)	(0.0268)	(0.0247)	(0.0199)
Dividend	0.00441	0.00454	0.00268	0.00682	0.00442
	(0.00463)	(0.00443)	(0.00636)	(0.00597)	(0.00462)
Constant	0.156***	0.253***	0.377***	0.145	0.252***
	(0.0589)	(0.0796)	(0.143)	(0.0930)	(0.0808)
Observations	867	867	433	434	867
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.318	0.335	0.341	0.440	0.327

Table 9 – *Fraction of reserves hedged.* The table shows the results of a pooled Tobit model, where the dependent variable is *FRH*, i.e. the fraction of reserves hedged. Model 1 considers only CFO-level variables. Model 2 adds CEO-level variables. Models 3 and 4 split the sample according to the value of CEO *Options/total shares* above (model 3) and below (model 4) the median. Model 5 includes three dummy variables indicating the alignment or misalignment of risk-taking incentives between CFOs and CEOs (*CFO Low_CEO Low* is subsumed in the constant). Heteroskedasticity-robust standard errors are clustered at the firm level and are reported in parentheses. All models include year fixed effects. ***, ** and * denote statistical significance at the 1, 5, and 10% level, respectively. All variables are defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)
			CEO vega	CEO vega	Interaction
	CFO	CFO/CEO	upper median	lower median	up-down median
CFO Vega	-0.146***	-0.132***	-0.124***	-0.136***	
	(0.0261)	(0.0289)	(0.0325)	(0.0431)	
CEO Vega		-0.0426			
		(0.0628)			
CFO High_CEO Low (vega)					-0.174***
					(0.0653)
CFO Low_CEO High (vega)					-0.0240
					(0.0429)
CFO High_CEO High (vega)					-0.0661*
					(0.0372)
Constant	1.382***	2.026***	2.322***	1.792**	2.099***
	(0.374)	(0.581)	(0.830)	(0.688)	(0.601)
Observations	867	867	433	434	867
R-squared	0.494	0.499	0.530	0.531	0.475
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.481	0.482	0.497	0.498	0.456

Panel A. Dependent variable: *Hedger*

Panel B. Dependent variable: *FPH*

	(1)	(2)	(3)	(4)	(5)
			CEO vega	CEO vega	Interaction
	CFO	CFO/CEO	upper median	lower median	up-down median
CFO Vega	-0.187***	-0.157***	-0.193***	-0.170***	
	(0.0392)	(0.0398)	(0.0522)	(0.0507)	
CEO Vega		-0.0774			
		(0.0822)			
CFO High_CEO Low (vega)					-0.100
					(0.0901)
CFO Low_CEO High (vega)					-0.0169
					(0.0567)
CFO High_CEO High (vega)					-0.0443
					(0.0532)
Constant	1.910***	3.298***	3.348**	3.065***	3.358***

	(0.560)	(0.735)	(1.343)	(0.852)	(0.772)
Observations	867	867	433	434	867
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.399	0.423	0.394	0.527	0.393
Panel C. Dependent variable: *FRH*					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	CFO	**CFO/CEO**	**CEO vega upper median**	**CEO vega lower median**	**Interaction up-down median**
CFO Vega	-0.0185***	-0.0174***	-0.0179***	-0.0202***	
	(0.00417)	(0.00403)	(0.00495)	(0.00544)	
CEO Vega		-0.00342			
		(0.00877)			
CFO High_CEO Low (vega)					-0.0153*
					(0.00862)
CFO Low_CEO High (vega)					-0.00213
					(0.00634)
CFO High_CEO High (vega)					-0.00495
					(0.00594)
Constant	0.151***	0.249***	0.313**	0.197**	0.258***
	(0.0582)	(0.0794)	(0.135)	(0.0946)	(0.0818)
Observations	867	867	433	434	867
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.329	0.346	0.344	0.450	0.323

Table 10 – *Hedging and vega*. Panel A of this table shows the results of a pooled OLS model, where the dependent variable is *Hedger*, i.e. a dummy equal to 1 if the firm hedges with financial derivatives and zero otherwise. Panel B shows the results of a pooled Tobit model, where the dependent variable is *FPH*, i.e. the fraction of expected production hedged. Panel C shows the results of a pooled Tobit model, where the dependent variable is *FRH*, i.e. the fraction of reserves hedged. Hedging incentives are captured in this Table by *Vega*. Heteroskedasticity-robust standard errors are clustered at the firm level and are reported in parentheses. All models include CFO controls, firm controls, and year fixed effects. CEO controls are included in all models but the first. ***, ** and * denote statistical significance at the 1, 5, and 10% level, respectively. All variables are defined in the Appendix.

Panel A. Dependent variable: *Hedger*

	(1)	(2)	(3)	(4)	(5)
	CFO	**CFO/CEO**	**CEO vega-to-delta upper median**	**CEO vega-to-delta lower median**	**Interaction updown median**
CFO Vega-to-delta	-0.103***	-0.0852**	-0.0819***	-0.0942*	
	(0.0258)	(0.0358)	(0.0308)	(0.0501)	
CEO Vega-to-delta		-0.0396			
		(0.0558)			
CFO High_CEO Low (Vega-to-delta)					-0.162**
					(0.0676)
CFO Low_CEO High (Vega-to-delta)					-0.00523
					(0.0434)
CFO High_CEO High (Vega-to-delta)					-0.0666*
					(0.0378)
Constant	1.460***	2.108***	2.410***	1.841***	2.099***
	(0.389)	(0.598)	(0.836)	(0.703)	(0.599)
Observations	867	867	433	434	867
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.463	0.463	0.490	0.479	0.456

Panel B. Dependent variable: *FPH*

	(1)	(2)	(3)	(4)	(5)
	CFO	**CFO/CEO**	**CEO vega-to-delta upper median**	**CEO vega-to-delta lower median**	**Interaction up-down median**
CFO Vega-to-delta	-0.103***	-0.0601	-0.116**	-0.0487	
	(0.0390)	(0.0474)	(0.0449)	(0.0673)	
CEO Vega-to-delta		-0.104			
		(0.0747)			
CFO High_CEO Low (Vega-to-delta)					-0.0775
					(0.0908)
CFO Low_CEO High (Vega-to-delta)					-0.0114
					(0.0574)
CFO High_CEO High (Vega-to-delta)					-0.0477
					(0.0538)
Constant	1.936***	3.380***	3.514***	2.999***	3.358***
	(0.572)	(0.758)	(1.357)	(0.891)	(0.775)

Observations	867	867	433	434	867
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.380	0.406	0.392	0.502	0.393

Panel C. Dependent variable: FRH

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	CFO	**CFO/CEO**	**CEO vega-to-delta upper median**	**CEO vega-to-delta lower median**	**Interaction up-down median**
CFO Vega-to-delta	-0.0110***	-0.00860**	-0.00997**	-0.00925	
	(0.00391)	(0.00434)	(0.00436)	(0.00601)	
CEO Vega-to-delta		-0.00631			
		(0.00788)			
CFO High_CEO Low (Vega-to-delta)					-0.0143*
					(0.00863)
CFO Low_CEO High (Vega-to-delta)					-0.000908
					(0.00654)
CFO High_CEO High (Vega-to-delta)					-0.00630
					(0.00592)
Constant	0.154***	0.257***	0.327**	0.201**	0.257***
	(0.0591)	(0.0805)	(0.134)	(0.0975)	(0.0815)
Observations	867	867	433	434	867
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.313	0.332	0.339	0.434	0.323

Table 11 – *Hedging and vega-to-delta*. Panel A of this table shows the results of a pooled OLS model, where the dependent variable is *Hedger*, i.e. a dummy equal to 1 if the firm hedges with financial derivatives and zero otherwise. Panel B shows the results of a pooled Tobit model, where the dependent variable is *FPH*, i.e. the fraction of expected production hedged. Panel C shows the results of a pooled Tobit model, where the dependent variable is *FRH*, i.e. the fraction of reserves hedged. Hedging incentives are captured in this Table by *Vega-to-delta*. Heteroskedasticity-robust standard errors are clustered at the firm level and are reported in parentheses. All models include CFO controls, firm controls, and year fixed effects. CEO controls are included in all models but the first. ***, ** and * denote statistical significance at the 1, 5, and 10% level, respectively. All variables are defined in the Appendix.

	Panel A. Dependent variable: *Hedger*				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	CFO	**CFO/CEO**	**CEO options upper median**	**CEO options lower median**	**Interaction up-down median**
CFO options/total shares	-0.255***	-0.184**	-0.285**	-0.102	
	(0.0572)	(0.0707)	(0.126)	(0.147)	
CEO options/total shares		-0.215			
		(0.172)			
CFO High_CEO Low					-0.0932**
					(0.0394)
CFO Low_CEO High					-0.131
					(0.0796)
CFO High_CEO High					-0.195***
					(0.0580)
Constant	2.776***	4.526***	-1.774	5.900***	4.498***
	(0.907)	(1.377)	(2.778)	(1.749)	(1.410)
Observations	168	168	84	84	168
R-squared	0.580	0.603	0.681	0.631	0.592
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.496	0.501	0.545	0.397	0.486

	Panel B. Dependent variable: *FPH*				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	CFO	**CFO/CEO**	**CEO options upper median**	**CEO options lower median**	**Interaction up-down median**
CFO options/total shares	-0.348**	-0.219*	-0.223	-0.111	
	(0.150)	(0.130)	(0.170)	(0.134)	
CEO options/total shares		-0.386**			
		(0.192)			
CFO High_CEO Low					-0.114
					(0.0825)
CFO Low_CEO High					-0.0436
					(0.0715)
CFO High_CEO High					-0.259***
					(0.0982)
Constant	2.850***	1.785	-10.49***	4.174**	1.819
	(1.074)	(1.896)	(1.896)	(1.615)	(1.948)

Observations	168	168	84	84	168
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.563	0.590	0.752	0.665	0.578

Panel C. Dependent variable: *FRH*

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	CFO	**CFO/CEO**	**CEO options upper median**	**CEO options lower median**	**Interaction up-down median**
CFO options/total shares	-0.0281*	-0.0136	-0.00193	-0.0167	
	(0.0154)	(0.0129)	(0.0132)	(0.0173)	
CEO options/total shares		-0.0393*			
		(0.0219)			
CFO High_CEO Low					-0.0168**
					(0.00735)
CFO Low_CEO High					-0.0139*
					(0.00733)
CFO High_CEO High					-0.0231*
					(0.0128)
Constant	0.336***	0.237	-1.048***	0.485***	0.246
	(0.121)	(0.177)	(0.136)	(0.171)	(0.184)
Observations	168	168	84	84	168
CFO controls	Yes	Yes	Yes	Yes	Yes
CEO controls	No	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.533	0.561	0.783	0.655	0.553

Table 12 – *Hedging likelihood and hedging extent, transitioning subsamples.* This table only considers a subsample of firms which experienced both a change in CFO and a significant change in their relative convexity of equity compensation. First, only firms that experienced a at least one CFO change (71 firms) during the sample period are retained. Second, the sample is further restricted to firms for which *CFO options/total shares* for the new CFO is above (below) the median of this variable (in the subsample of firms which changed CFO) and *CFO options/total shares* for the old CFO is below (above) the same median (24 firms). Panel A shows the results of a pooled OLS model, where the dependent variable is *Hedger*. Panel B shows the results of a pooled Tobit model, where the dependent variable is *FPH*. Panel C shows the results of a pooled Tobit model, where the dependent variable is *FRH*. Heteroskedasticity-robust standard errors are clustered at firm level and are reported in parentheses. All models include CFO controls, firm controls, and year fixed effects. CEO controls are included in all models but the first. ∗∗∗, ∗∗ and ∗ denote statistical significance at the 1, 5, and 10% level, respectively. All variables are defined in the Appendix.