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Does having previous working experiences in finance affect corporate hedging decisions made by the CEO?

A study on U.S. oil and gas producers

by

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May 2018

Master's Programme in Accounting and Finance

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ACKNOWLEDGEMENTS

The authors would like to thank their supervisor Håkan Jankensgård for the data, his professional support and helpful comments throughout the process of writing this thesis.

ABSTRACT

The purpose of this thesis is to investigate if a CEO with finance and accounting working experiences would affect corporate hedging decisions, in terms of the decision to hedge, the extent of hedging, and the type of hedging tools used.

This thesis uses panel data regressions where the hedge ratio, binary hedging decisions and hedging types are dependent variables, controlled by independent variables such as a dummy variable for CEOs with finance working experience, various CEO characteristics, and firm-level variables. The sample used in this study consists of 187 publicly traded oil and gas producers in the US (SIC code 1311) between Q4 2012 and Q3 2016.

CEO financial working experience does seem to play an important part in the hedging decisions of oil and gas firms. The results on the decision to hedge is negatively correlated to CEOs with financial training and experience, but the results on the extent of production hedged are weaker and insignificant, although it also seems to show a negative correlation with having financial training and experience. Further testing results for hedging instruments of choice point out that 3-way collar strategy is more preferred by finance trained CEOs, while a linear strategy is less preferred. Hence, the results would support the hypothesis that finance trained CEOs are less likely to hedge, and if they do hedge, they prefer hedging tools that can preserve upside potential. Possible reasons are that they are more financially sophisticated and make their hedging decisions based on experience, thus, they value hedging less and prefer hedging instruments with less hedging intensity.

Key words: Hedging, Hedge ratio, Chief executive officers, CEO characteristics, CEO risk preferences, Finance career

LIST OF ABBREVIATIONS

$	United States Dollar
Bbl	Barrel
CEO	Chief Executive Officer
CFO	Chief Financial Officer
IT	Information Technology
Mcf	Thousand cubic feet
OLS	Ordinary Least Squares
Q	Quarter
SIC	Standard Industrial Classification
U.S.	United States of America
WTI	West Texas Intermediate

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1. Introduction

1.1 Background

In this day and age, the use of hedging as a risk management tool has become increasingly more important. More firms have been using financial derivatives to hedge their exposures (Bodnar, Hayt, & Marston, 1998). Although risk management is irrelevant to firm's value under the classic Miller and Modigliani (1958) perfect capital markets, it can theoretically increase firm's value through its impact on imperfections arising in capital markets, more specifically from taxes, costs of financial distress, and agency costs (Nance, Smith, & Smithson, 1993). Empirical research has been conducted to support this theory and have identified multiple firm's characteristics as determinants for corporate hedging, such as size (Block & Gallagher, 1986; Booth, Smith & Stolz, 1984; Nance, Smith & Smithson, 1993) leverage level (Dolde, 1995; Haushalter, 2000), and investment opportunities (Carter, Rogers & Simkins, 2006).

Opposing the theory of hedging being used as a value maximization tool, another theory that has been presented is that hedging has no relations to firm's value, and the motive behind hedging decisions come from managerial preferences, modified through managerial compensation tools. This theory presents the use of corporate hedging to purposely to accommodate manager's wealth, which is tied with the firm's assets. This theory is supported by number studies such as Stulz (1984), Smith and Stulz (1985), Tufano (1996), and Jin and Jorion (2006).

Among these two branches of theory, numerous corporate hedging determinants have been observed in literatures involving two branches of research, focusing on firm's characteristics and managerial preferences. However, most of the research is concentrated on firm's characteristics to explain the use of corporate hedging, while lesser research can be found on managerial preferences, such as compensation contracts and the impact of management age and hedging, which are also relevant and important as a hedging determinant. Manager's work experience is one of the managerial characteristics that is largely neglected from the literature.

Working is an integral part of human life. More than half of the world population would spend at least one-third of our adult lives working, actively contributing to society and the development of well-being for themselves and their families (World Health Organization, 1994). Given the high proportion of time an individual spends at work, it is likely that over time, work would come to

shape our individual characteristics, beliefs and his/her propensity for risk taking. This would potentially be shaped through the function of which a person previously worked as, such as in finance, where the focus would be on budgeting, cost management, managing cash flow, and monitoring of the firm's performance. In this paper, we investigate CEOs in the oil and gas sector, and whether having previous financial working experience would modify their risk appetite and how they view hedging, and whether that might translate to impact on a firm's hedging behavior. The relationship between having a financial working experience and corporate hedging decisions can explained by two opposing theories, the first theory relates to the risk aversion characteristic of people in the finance-related field that drives the use of hedging to avoid financial distress, and the competing theory describes their usage of hedging tools based on their sophisticated knowledge of such instruments and their decision making based on past experiences.

Our sample of oil and gas firms follows previous hedging studies (Jin & Jorion, 2006; Croci, Giudice & Jankensgård, 2017; Andrén & Jankensgård, 2018). The benefits of using oil and gas firms as our sample is that they provide sufficient hedging information and hedging is economically important for them due to high volatility in oil prices. Studying managerial preferences through CEOs is also widely accepted in previous research papers (Coles, Daniel & Naveen, 2006); Croci, Giudice & Jankensgård, 2017; Doukas & Mandal, 2018) as CEOs are deemed the highest managerial position and ultimately make the final corporate decisions in a firm.

1.2 Research purpose

Our main purpose in this study lies in investigating the relationship between corporate hedging, in terms of the decision to hedge, the extent of hedge and hedging strategy of choice, and CEO characteristics, specifically past experiences in financial-related position.

Different CEOs can have different working experiences, such as finance, sales and marketing, legal, operating and engineering as examples. A study from Heidrick & Struggles (2017) indicates that finance is the most dominant background the CEOs have. This highlights the importance of having financial training when it comes to firm management. CEO's previous financial working experience as one of the CEO characteristics was introduced in two recent risk management studies. Croci, Giudice and Jankensgård (2017) included CEO's past experience in a finance field (a variable called financial expertise) as a control variable to explain how U.S. oil and gas firms

hedge from the perspective of CEO age and risk incentives provided by compensation schemes. The result is that the finance expertise does not significantly determine a decision to hedge. A more recent study from Doukas and Mandal (2018) used a sample of firms in Fortune 500 to investigate the extent of corporate hedging from characteristics of the CEO having a finance background being one of the independent variables. Their results align with Croci, Giudice and Jankensgård (2017) where no significant relationship has been found between finance-trained CEO's and hedging decisions. Despite the two previous researches finding no relationship between finance working experience and corporate hedging, it has never been on the focal point and this is the area where current literature is still lacking. This hence paper focuses specifically on the finance experience variable itself on a more detailed level and suggests the mechanism behind the relationship between past finance experiences and corporate hedging.

This thesis contributes to the literature on how firms hedge. Experience in finance positions exposes CEOs to certain aspects of hedging that could eventually influence them on the decision to hedge and the extent of hedging, captured by hedge ratio. While hedging has been widely studied in the risk management literature (Tufano, 1996; Rampini, Sufi & Viswanathan, 2014; Jankensgård & Andersson, 2017), it rarely appears in the managerial preferences studies outside managerial compensation point of view. In our study, we introduce the hedge ratio as an independent variable which is different to the hedger dummy variable of Croci, Giudice and Jankensgård (2017) and the notional value of firm's derivatives scaled by firm's assets value of Doukas and Mandal (2018), along with a binary variable derived from the hedge ratio, seen as the decision to hedge. There is not much existing research on CEO's finance working experience and hedging in the studies where the background of CEOs was specifically mentioned, hence this thesis aims to shed light upon on CEO's finance working experience as a main explanatory variable for corporate hedging decisions.

Furthermore, we investigate further into the hedging instrument of choice. A clear agency problem within managerial preferences and the hedging strategy is highlighted in Croci, Giudice and Jankensgård (2017). Jin and Jorion (2006) argue that investors may invest in a security to gain exposure to an underlying risk factor (e.g., a commodity price). Investors, however, may appear to prefer hedging strategies that preserve the upside potential and risk-averse managers may have incentives that are against the upside preservation, exposing the investors to potential agency

problems (Croci, Giudice & Jankensgård, 2017). Hence in this study, we investigate the choice of firm's hedging strategy to see whether having a financially-trained CEO could affect the decision to preserve upside potential.

1.3 Research question

In this study, we study relationships between finance trained CEOs with firm's hedging decisions in term of decision to hedge, extent of hedging, and the type of hedging tools used.

1.4 Target group and limitations

The results on this thesis between financial working experience and firm risk taking would be of interest in recruitment firms and firms that are searching for CEOs that would fit their overall envisioned shareholder strategy. Through screening of the backgrounds of such CEOs, firms would be able to identify a proper fit of the type of CEO they want in managing the company's risk strategy.

We are aware that the allocation of CEOs to firms is not random and it is possible that CEOs are purposefully chosen by firms because of their risk-taking or risk-aversion attributes that suit the firms, or more specifically, the second interpretation on how individual managers affect firm's policies according to Bertrand and Schoar (2003). Our study cannot estimate causation effect of CEOs on firm's hedging policies. Our objective is to assess any relationship between firm's hedge ratio and the identity of CEOs in these firms, whether the hedge ratios are the result of CEO's idiosyncratic style, or the CEOs got appointed because their style suit such hedging policies of the firms.

Our research relies on the CEO being the person who have the final decision on firm's hedging strategies. Our sample being oil and gas firms helps strengthen this assumption. Cash flows of oil and gas firms are substantially affected by the energy price movements (Jin & Jorion, 2006), and therefore, such important decision to protect the firm against price volatility should be involved by the CEO. The paper by Doukas and Mandal (2018) have the same claim that it is the CEO who is ultimately responsible for the signing off and enacting the hedging policies.

1.5 Outline of the thesis

Section 2 covers the theoretical framework and background necessary for supporting the general overview to support our hypothesis. Section 3 includes the methodology of the following research, with subsections describing sample selection, defining variables, regression techniques used, model specification and how endogeneity is handled. Section 4 explains how hypotheses are formulated. Section 5 presents and analyses our descriptive and regression results. Section 6 presents theoretical and managerial implications of the results. Section 7 concludes the thesis and further research is mentioned in section 8. Following section 8 is the reference list and appendix.

2. Theoretical background and literature review

2.1 Managerial preferences and corporate decision making

In making decisions that would ultimately shape the company's future and have significant impact, it cannot be denied that the risk propensity of CEOs would play an important role in managing firms and creating firm value. There is much debate as to what the role of the CEO plays in a firm, but one thing that is agreed upon is that the CEO ultimately helps mold the overall direction of the firm and have to make business decisions that would impact the firm's strategy and overall well-being (Harvard Business Review, 2009).

Making decisions however, are not easy as it always comes with risks. A research from Russell Reynolds (2012) found the different distinct attributes and traits of what a successful CEO has. The most prominent attribute is the willingness to take calculated risks, of which CEOs scored 27% higher than all the other C-executives. Kaplan and Sorensen (2017) also found that CEOs are perceived to be more risk-taking than other executives. Graham, Harvey and Puri (2013) found the same that CEOs are more risk-tolerant than other executives.

Managerial preferences can negatively affect a firm's decision making, due to potential conflicts of interest between managers and shareholders under the agent-principal relationship, and opportunities for managers to act on their own discretions. Under a classic view of the corporate finance, a CEO being one of owners' agent, he/she shall act and make decisions that are best for owners without personal preferences. In this view, the CEO should decide to invest in every project with a positive net present value to maximize shareholder's value regardless of his/her risk appetites. However, in practice, an agency problem arises from this conflict of interest where the agent is able to exert his/her risk preferences on the corporate decision making. As a result, a risk-averse CEO might decide to not take up a risky project, even though it is of net present value, due to his own risk preference and bias. This effect of CEO's risk propensity to the firm can be explained by the upper echelons theory (Hambrick & Mason, 1984). The theory suggests that outcomes of firms are partially predicted by managerial background characteristics of the top-level management team. The strategic vision and the organizational direction of a firm pursued by the CEO is guided or influenced by his/her understanding of the world.

Supporting the upper echelons theory, it has been found empirically that managers do matter in the determination of firm policies. Bertrand and Schoar (2003) documented that a significant portion of heterogeneity in firms' financial, investment, and organizational practices is explainable by the presence of manager fixed effects. According to their studies, there are two interpretations as to how managerial differences translate to corporate choices. In the first interpretation, a manager can impose his or her own idiosyncratic style on a company if corporate control is poor or limited. In the second interpretation, managers do not impose their idiosyncratic style on the firm, but rather are chosen by firms because of their specific attributes. The two interpretations differ in their cause and effect perspective. However, it is clear that the risk appetite of the CEO can potentially relate to risk propensity of the firm.

2.2 Hedging as a tool to create firm value

Firms hedging through the use financial derivatives such as forwards, futures, and options can alter firm's risk profile and decrease the variability of corporate cash flows. Although risk management is irrelevant to firm's value under the classic Miller and Modigliani (1958) perfect capital markets, it can theoretically increase firm's value through its impact the imperfections arising in capital markets, more specifically in term of existence of taxes, costs of financial distress, and agency costs (Nance, Smith, & Smithson, 1993).

2.2.1 Hedging to deal with capital market imperfections

The existence of a progressive tax schedule enables hedging to create firm value. The progressive tax schedule is common among many countries and it makes post-tax value of a firm a concave function of its pre-tax value. Thus, hedging plays a part in increasing firm's post-tax value by reducing the variability of its pre-tax value and expected tax liability (Smith & Stulz, 1985). In term of costs of financial distress and firm's value, Smith and Stulz (1985) argue that hedging reduces the probability that the firm would encounter financial distress by reducing the variance of firm value, and thereby reducing the expected costs arising from financial distress. Furthermore, hedging can prevent Myer's (1977) underinvestment problem by restricting the states in which the firm would default on debt payments that would discourage the firm from pursuing value-creating investments (Smith & Stulz, 1985). Underinvestment problem can also be viewed from another angle. Froot, Scharfstein and Stein (1993) argue that if external financing is more expensive than

internally generated funds, hedging can add value by ensuring firms with sufficient internal funds to take advantage of attractive investment opportunities. Without hedging, firms may be forced to underinvest and not be able to take up attractive investments because it is too costly or impossible to raise external finance.

From theory behind hedging and firm's value, one would be able to predict the use of corporate hedging from firm's characteristics. Smith and Stulz (1985) suggest that larger firms tend to hedge more because financial distress costs such as reorganization and liquidation costs are higher large firms. In addition, they argue that firms with more investment opportunities and firms with high leverage are more likely to hedge because they are more likely to face the underinvestment problem. However, there is a paradox to the theory where financially constrained firms hedge more. Collateral constraints-theory of Rampini, Sufi and Viswanathan (2014) show that as hedging requires collateral, financially constrained firms tend to use collateral for borrowing for real investments, and thereby crowding out hedging. An empirical study of Jankensgård and Andersson (2017) supports collateral constraints-theory. They investigated the theory using the difference-in-difference approach by explaining the response of oil and gas firms to the dramatic fall of oil price in 2014 as an exogenous shock. The main findings from the study were that the hedge ratios of the oil and gas firms significantly fell following the exogenous shock and such drops are more noticeable in distressed firms with high levels of leverage and low levels of cash.

With regards to whether hedging contributes to firm's value, there exists studies that have found a positive relationship between them. Allayannis and Weston (2001) examined the relationship between U.S. multinational firms' foreign currency hedging and Tobin's Q and concluded that hedging is associated with higher firm value. An empirical study from Carter, Rogers and Simkins (2006) showed that jet fuel hedging is positively related to airline firm value, and the results suggest as well that hedging provides additional sources of cash for making acquisitions during distressed periods for the airline industry where fuel prices were usually high. This implies that airlines hedge to protect the ability to invest in bad times, or to counteract the underinvestment problem. Furthermore, Dolde (1995) and Haushalter (2000) reported a positive and significant relation between hedging and leverage, consistent with the theory that hedging helps reduce financial distress.

2.2.2 Substitutes to hedging

Hedging as a form of risk management can also be substituted by other financial tools. As the main benefits of hedging are to reduce expected taxes, transaction costs of financial distress, and agency costs, there are other financial policies that can substitute hedging such as maintaining low debt and investing in liquid assets (Nance, Smith & Smithson, 1993). Alviniussen and Jankensgård (2009) present the concept of risk capacity of a firm where it represents the firm's ability to carry on its operations under difficult circumstances without making costly adjustments to its business activities. Risk capacity can be enhanced by having high amounts of liquid assets, spare debt capacity, and hedging positions. These elements constitute the amount of liquidity the firm is able efficiently operate to support its cash commitments including debt obligations and investment plans in the event that the firm's internally generated cash flow is insufficient to cover these commitments.

2.3 Hedging and managerial preferences

Apart from the studies discussed above that support theory of firms hedge to gain value through capital market imperfections, there exists studies that argue for an insignificant relationship between hedging and firm's value. Instead, in these studies the motivation for corporate hedging lies within managerial preferences rather than value maximization. Tufano (1996) found no support for the value maximization theory and the only important systematic determinant of corporate hedging decisions was the managerial ownership of shares and the nature of the managerial compensation contracts. Jin and Jorion (2006) also found no relation between hedging and firm value, measured by the Q ratio, which similar to Tobin's Q, for oil and gas producers. They suggested that if hedging is not relevant to firm's market value, then the motivation for the use of corporate hedging can potentially be explained via the theory of maximization of management's personal utility.

2.3.1 Hedging and managerial risk aversion

Risk-averse managers who have their wealth and human capital concentrated within the firm they manage find that hedging at the firm level is cheaper than diversifying their wealth away from the

firm (Stulz, 1984; Smith & Stulz 1985). This leads to potential agency problems arising from risk-averse managers displaying undesirable excessive hedging behavior.

Based on the theory that if corporate hedging decisions are known to be affected by risk propensity of managers, shareholders would then need tools to align managerial interests with the firm's desired risk level. The alignment of such managerial interest can be done using management compensation. According to Smith and Stulz (1985), the managerial compensation contract must be designed to incentivize managers to maximize firm's value. When designing managerial compensation, a more convex function of firm value should be desired, as it encourages risk-averse managers to take more risks that are necessary to increase firm's value. A study from Coles, Daniel and Naveen (2006) further supports this theory. They found that by granting option-based compensations, which have a higher sensitivity to stock price volatility and provides convex pay-off, managers had more incentive to invest in riskier assets and implement more aggressive debt policy.

2.3.2 Hedging and age

Another possible managerial preference as one of the determinant for corporate hedging decision is age. Studies have found a that negative relationship exists between age and risk taking (Valsecchi, Billino & Gegenfurtner, 2018; Bogdan et al, 2017). From a finance setting, Bogdan et al, 2017 found that younger accountants below age 45 tend to be more optimistic than their counterparts, resulting in resulting a higher risk appetite then their older counterparts. (Bogdan et al, 2017), which in the context of CEOs are closely tied to one's performance aspirations (Hambrick, Finkelstein & Mooney, 2005).

While generally described and looked upon as highly motivated leaders with burning desire for firm success (Donaldson & Lorsch, 1983), CEOs can actually vary significantly in both drive and aspirations. Those who are strongly motivated to take their firms to new heights may demand more of themselves, and those who are driven to achieve high levels of performance may experience intense pressure, both from external factors and self (Hambrick, Finkelstein & Mooney, 2005), whereas referring to the "quiet life" hypothesis, some CEOs would rather not experience such pressure, such as older CEOs. Older CEOs are generally more risk averse to financial distress risk due such intense pressure described that would arise from such a situation (Bertrand &

Mullainathan, 2003). Croci, Giudice and Jankensgård (2017) found that firms with older CEOs are more likely hedge more. When looking at the perspective of younger CEOs, Yim (2013), found that younger CEOs are much more likely to make acquisitions for the firm and Serfing (2014) found that firms with younger CEOs tend to invest more in research and development, make less diversifying acquisitions and have higher operating leverage. Hence, these studies seem to confirm the higher risk taking younger CEOs have on the firm. One potential reason why is that compared with older and veteran CEOs, younger executives may feel a stronger need to prove themselves and to establish a reputation and foothold within the industry (Hambrick & Fukutomi, 1991).

Contrasting with the quiet-life hypothesis, career-risk hypothesis explains motives to why younger CEOs can hedge less. Croci, Giudice and Jankensgård (2017) argue that younger CEOs have strong incentives to hedge because they face greater reputational risk over longer career horizon than older CEOs. Financial distress greatly signals poor managerial ability and thus incentivizes younger CEOs to hedge to avoid such negative reputation impact. There are empirics that support this argument such as Chevalier and Ellison (1999), Hong, Kubik and Solomon (2000), and Eckbo, Thorburn and Wang (2014).

2.4 CEO's financial background and corporate hedging

Much research has been attempted to try and identify general attributes and characteristics of CEOs that might characterize risk takers or risk averters. One popular attribute researched is age, yet the results remain inconclusive. Hirshleifer and Thakor (1992), Holmstrom (1999), Zwiebel (1995) among others find that younger CEOs are risk averse while Hambrick and Mason (1984), MacCrimmon and Wehrung (1990), Serfling (2014) among others, show that younger CEOs take more risk. MacCrimmon and Wehrung (1990) also found that executives with high degree of education tend to be more risk-averse. Although not much research focus is directed on hedging decisions but rather their individual risk aptitude, this personal characteristic is proven to be reflected in the firm's hedging strategy as well. Croci, Giudice and Jankensgård (2017) found that older CEOs hedge more and prefer more linear hedging strategy.

Among other characteristics, personal experiences can also affect one's personal and corporate decision making. Hertwig et al. (2004) show that decision making that is based on past experience rather than information provided (or '*decisions from description'*) tends to underweight the

probability of rare events from the objective probability of occurrence warranted. On the other hand, when people make decisions from description where the outcomes of options and their probabilities are provided, they tend to overweight the probability of rare events. Another study from Dittmar & Duchin (2015) found that CEOs who had previously experienced distress tend to deploy more conservative financial policies with lesser debt, higher cash reserves, and low levels of investments, with this effect being magnified in firms with weaker governance. Hence based on these studies, previous work experiences do influence the decision-making process of individuals, and at the CEO level, such influences can be shown though firm level decision making.

A CEO with working experience in a finance related field can potentially influence how a firm shifts its risk, due to the CEO's exposure to such tools in the past. Adjusting capital structures, excess cash holdings, and derivative financial instruments are prime examples of such tools and a person specialized in finance field are likely to have managed such tools in their everyday lives. Such examples of finance trained personnel include chief financial officers, vice-presidents of finance, controllers, accountants, auditors or investment bankers, whom all have had involve with such financial management tools and are likely to be more proficient in dealing with such tools. Hence, when such a finance-trained person becomes a CEO, they likely to be are comfortable and capable of using such tools they have had experienced in the past according to the upper echelons theory. A research from Graham, Harvey and Puri (2013) has proven that past experiences of CEOs that worked in finance/accounting can affect corporate decisions. Empirical results from the research found that those firms led by such CEOs tend to have a higher debt ratio.

However, research the on general traits of finance professionals have been very limited. From the limited research we found, Nicholson et al. (2005) developed a scale for accessing risk propensity in several domains (i.e. career, financial, safety, and social) and applied the scale to study characteristics of a person such as sex, age, and job functions with the risk propensity. They found that people working in finance function have lower overall risk propensity than people working in other professions such as engineering, sales, and IT (see figure 1). Such results hold true in almost every domain, especially for career risk domain (i.e. they rarely quit jobs without securing the new ones first). However, one risk domain where people from finance sector score the highest mean is the financial risk (i.e. gambling or take risky investments), suggesting that the risk propensity might have some degree of business sector conditioning. These two contrasting results between

the different risk domains of financially-trained people would then establish predictions of firm's hedging decisions differently. This will be further discussed in subsection 2.4.1 and 2.4.2.

		Risk propensity domain				
Job Function	**N**	**Career**	**Financial**	**Safety**	**Social**	**Overall**
HR/PR/communications	52	8	8	8	3	8
Finance	805	7	2	7	8	7
Operations/engineering	153	6	6	1	7	6
General management	315	5	7	1	5	5
IT/professions	70	3	4	4	6	4
Other professional	177	2	3	6	4	3
Sales and marketing	226	4	5	3	2	2
Consulting	190	1	1	5	1	1

Note: 1 denotes highest ranked in risk propensity (with highest mean of risk propensity score), 8 denoting lowest ranked in each job function group

Figure 1: Risk propensity of persons from different job functions (source: Nicholson et al. 2005)

2.4.1 Why do finance trained CEOs hedge more?

It is among common belief that people from finance professions are usually more conservative. They are less optimistic and more risk averse than people from other professions. It is usually non-finance professionals, such as sales people and engineers, who make decisions toward risky investments or operation decisions. Finance professionals such as accountants or CFOs would be there to execute it and taking care of consequences such as making payment approvals and ensuring positive cash flows so that those decisions will not affect the firms' abilities to continue as a going concern, or even getting penalized for missing consensus analyst forecasts (Mergenthaler, Rajgopal & Srinivasan, 2012). Apart from acting as a back office and keeping record of what other functions do, financial management can actively contribute to firms mainly by cost savings rather than revenue generation, and cost savings usually represent ways to for the firm raise performance without incurring additional risk (Bromiley & Washburn, 2011). Hence the role they take, and the way they see whole picture of the firms could be one of the reasons for this common belief.

According to research from Nicholson et al. (2005) mentioned in previous section, people from finance sector have low overall risk propensity and they are the most risk-averse professionals regarding the propensity toward career risk. This empirical evidence can relate to career-life hypothesis where younger CEOs hedge more because they face greater negative consequences from financial distress over a longer career horizon. Therefore, if people from finance functions

are more risk-averse toward career-risk (Nicholson et al. 2005), CEOs who has past experiences in the finance function would likely to hedge more with the identical reason to avoid financial distress that might eventually impair their career reputation.

Furthermore, the trend toward finance professionals are more risk averse are proven in research focusing on CFOs, one of the highest position for finance professionals. Kaplan and Sorensen (2017), and Graham, Harvey and Puri (2013) found that CFOs are the least risk-taking among the executive positions. These researches suggest that people who have experience in finance function is generally more risk averse than those who do not. This attitude toward risk can be either from an already risk-averse person opting into the finance professions, or that their careers has molded this risk-averse personality and have changed how they perceive risks. Hence, based on these arguments, it is likely that if a CEO is finance trained, he would likely hedge more, given that they are more likely to be risk adverse comparatively to a CEO who is non-finance trained.

2.4.2 Why do finance trained CEOs hedge less?

On the other hand, one can argue that finance trained CEOs hedge less with the main driving force being their sophisticated knowledge of hedging. Aside from benefits of hedging, people who are experienced in finance area would be more exposed to a negative side of hedging and understand it's risks involved as well. There are cases that the misuse of hedging can be destructive for firms such as the case of Metallgesellschaft Corporation where it lost $1.3 billion in 1993 from the flawed long hedge strategy in near term futures contracts that was meant to protect against forward sales commitments (Mellow and Parsons, 1995). Warren Buffett, a CEO of Berkshire Hathaway, once stated in 2002's annual report that "In our view, however, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal". He points out the major flaw of derivatives being counterparty risks and the potential mischief in mark-to-market valuation of the derivative contracts. Hence, people with previous finance working experience would be more exposed to such events and stories compared to their non-finance counterparts because of such information exposure arising during work, and the decision to hedge can be influenced due to such previous exposure.

Empirical evidence from Nicholson et al. (2005) show that people from finance functions tend to have high risk propensity specifically in the financial risk domain compared to the overall low risk

propensity earlier discussed in section 2.4.1. This can relate to the decisions-from-experience theory mentioned in Hertwig et al. (2004). Although finance people are more risk-averse in overall risk propensity, when it comes to financial decisions where they are familiar with, they potentially make decisions based on their past experiences. This makes them underweight probability of rare events and take more risks in the financial domain, i.e. more risky investments. Therefore, if CEOs with past experiences in the finance function perceive lower chances of extreme events when making decisions relating to the financial domain, hedging as a tool to reduce the variability of firm's performance and to reduce financial distress risk would likely to fall out of favour.

2.5 Hedging strategies and risk profile

Hedging generally reduces firm's risk by decreasing the variability of corporate cash flows and there is more depth to the hedging decisions than the extent of hedging. Firms can deploy several hedging strategies that differ in risk profile and how they are financed. We follow Croci, Giudice and Jankensgård (2017) for the identification of hedging strategies.

2.5.1 Hedging strategies

Linear and bought puts are classical risk management strategies where they provide firms a protection against falling output prices and we consider only linear and bought put contracts, regardless of how they are financed, in our hedge ratio calculation to measure extent of hedging. Linear contracts consist of forwards, futures, and price swaps, that is, derivative instruments in which the payoff is a linear function of the underlying commodity and involve no cash financing.

A put option can be viewed as an insurance contract as firms can buy enough puts to cover their holdings of the underlying commodity so that if a drastic downward movement of the underlying price occurs, they have the option to sell the holdings at the strike price. Purchases of put options can be financed entirely by cash or selling call options, or partially of both. It is also possible to finance the puts by selling puts with a lower strike price. Selling puts however expose firms to commodity price risk in exchange for cash inflow at inception.

Selling puts or calls can also be done in excess of puts bought, e.g. more calls sold than puts bought, but expose firms to more price risk. Therefore, the options sold in excess of puts bought is often considered as speculative or a way to generate immediate cash flow from the options sold. Hedging

strategies commonly found are the combination of linear and put options, and how they are financed. Based on the paper of Croci, Giudice and Jankensgård (2017), we categorize hedging strategies as below;

Linear is the strategy where firms are using purely forwards, futures, or swaps.

Pure insurance is the strategy where firms buy put options with cash financing.

Insurance is the strategy where firms buy put options and finance the put by both cash and selling calls.

Collar is the strategy where firms buy put options and finance the puts by selling calls.

3-way collar is the strategy where firms buy put options and finance the puts by selling calls and puts (with lower strike price than puts bought).

Pure sold call is the strategy where firms buy put options and sell calls in excess of the puts they bought.

2.5.2 Hedging dimensions – risk and reward tradeoff

Different hedging strategies provide different risk and reward tradeoff. As illustrate in Figure 2, linear strategy locks in a forward price which completely protect firms against falling prices, but it comes at a cost of limiting all upside potential. Without limiting upside, pure insurance strategy gives firms downside protection in exchange with upfront cash payment. Collar strategy provides the same protection against falling prices, but firms concede upside potential in exchange with downside risk protection instead of paying cash. 3-way collar strategy has the same elements of the collar strategy as in puts bought and calls sold, but in addition, put options are sold at the strike price below puts bought. The net effect is it preserves more upside than the collar (Andrén & Jankensgård, 2018). In short, these strategies have tradeoff in three dimensions, namely downside risk, upside potential, and cash.

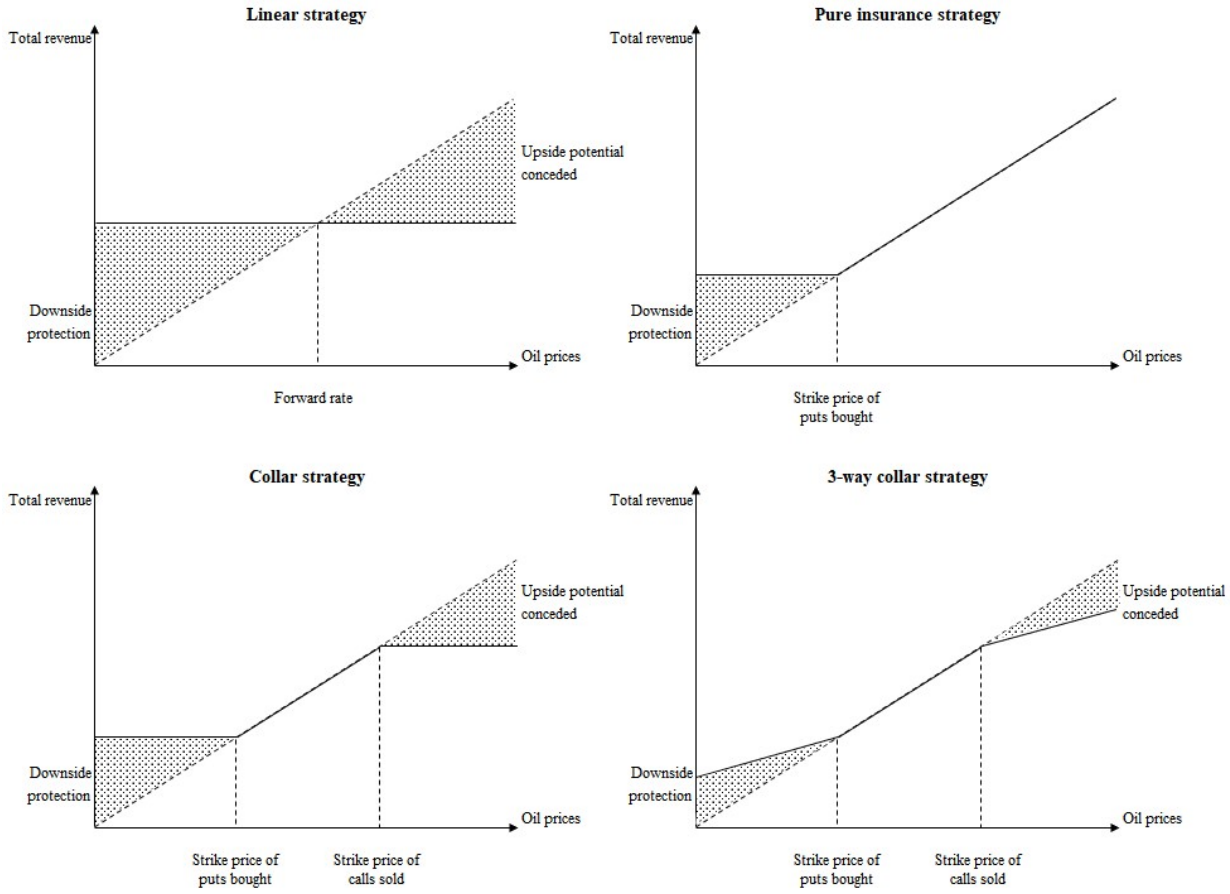


Figure 2: Payoff of pure insurance and collar strategy

Protection from downside risk is the benefit of hedging and it is how hedging reduces costs of financial distress and underinvestment problem. To illustrate, a firm can buy put options to insure its output price at the threshold that would provide the firm with sufficient cash flow to fulfill debt obligation and pursue investment opportunities, without having to raise costly external financing or make asset sales in a depressed market. If the market price falls below such threshold, the firm would be unable to generate sufficient internal funds without hedging.

Upside potential and cash are the costs of hedging. Firms either finance for their hedging by cash (e.g. pure insurance) or by sacrificing upside potential (e.g. linear, collar), or both (e.g. insurance). Cash is can be considered as a type of risk management tool. It provides firms with buffer against the cost of externally financing their investments (Dittmar & Mahrt-Smith, 2007; Alviniussen & Jankensgård, 2009). Upside potential is an opportunity cost that firms sacrifice in exchange with downside protection. Dimensions of hedging as in protection against downside risk, upside

potential preservation, and cash retention interact with each other and with risk preferences of the firm. Firms with high cash reserve can afford cash financing strategies such as pure insurance and hence, they can fully maintain upside potential. However, for constrained firms, Denis & Sibilkov (2009) found that high cash holdings is important for them to undertake value-increasing projects that might otherwise be bypassed. Therefore, distressed firms which lack liquidity might prefer cashless strategies such as 3-way collar or pure sold call.

The dimensions of hedging can cause a managerial agency problem as shareholders may invest in a firm to gain exposure to an underlying risk factor (e.g., a commodity price). If a CEO, that acts as an agent of shareholders, prefers hedging strategies that fully limit upside potential (e.g., linear contracts) that the shareholders aim for, this situation exposes the shareholders to potential agency problems (Croci, Giudice & Jankensgård, 2017).

Croci, Giudice and Jankensgård (2017) report linear as the most dominant strategy found in the sample of oil and gas firms within their studies. This might be due to the low complexity of this strategy that makes it easier to execute, or that firms are willing to sacrifice more upside potential than cash. However, sacrificing too much upside potential can hinder firm's ability to invest in the circumstance where output prices are rising, especially for the firms with investment opportunities highly correlated with their cash flows. For these firms where rising in prices and revenue are also accompanied by inflated marginal costs of additional investments, sacrificing too much upside potential may result in insufficient internally generated cash flows to pursue new investments. Moreover, giving up upside potential by setting ceiling prices in certain derivative contracts can force firms to post collateral to trading counterparts (margin call) if the prices go beyond the ceiling. This margin call then pulls valuable cash out of the firms where they initially intend to preserve cash by using cashless derivative strategies. There are examples of firms losing vast amounts of collateral because market prices turned against them. In 2008, Delta Airlines had contracts to lock fuel purchase prices between $90 to $100 per barrel, and when the prices fell at $33.87 below the floor the firm had set, the airline had to hand in large sum of collateral money to trading counterparts (Cui, 2009).

Each strategy tackles different risk, but this does not simply mean one strategy is risker than the other. The choice for hedging strategies revolves around balancing between the benefits of hedging firms want to pursue and the resources firms have available and willing to pay. However, linear

hedging instruments are arguably the strategy with the highest hedging intensity (Croci, Giudice & Jankensgård (2017). While option-based strategies generally leave room for price movements in between the strike prices, the linear strategy secure firms with forward rate and are the more effective at reducing variability. With regards to corporate hedging strategies, previous research has found determinants for the hedging instrument choice. Adam (2002) reports that financially constrained firms tend to sell call options to finance real assets and unconstrained firms prefer buying put options to insure against future market prices. Croci, Giudice and Jankensgård (2017) study hedging strategies from managerial preferences perspective and find that firms with CEOs approaching retirement tend to use linear strategies because they provide more certainty than other strategies. This is proven to align with quiet-life hypothesis where older CEOs prefer corporate policies that help them avoid difficult situations such as financial distress.

3. Hypothesis formulation

By referring to the previously presented empirical evidences and theoretical framework discussed in section two, the following research hypotheses have been developed.

3.1 Hypothesis 1

Theories about finance trained CEOs hedge more revolve around finance-trained personnel being well-equipped to manage various financial tools and hence are more conservative and less of a risk-taker. Based on theory discussed, their expertise in such tools and their risk-averse characteristic should then affect firm's hedging decisions. As hedging activities involve limiting variability of firm's expected cash flow and reduce risk of financial distress, the decision to hedge should theoretically be preferred by risk-averse CEOs.

Hypothesis 1A: A positive relationship exists between firms with financially-trained CEOs and firm's decision to hedge and extent of hedging (hedge ratio).

Furthermore, when choosing a type of hedging strategy, they are more likely to choose strategies that focus on limiting downside risk, such as linear strategy that has high hedging intensity, as that reduces strategy the risk related to financial distress.

Hypothesis 1B: A positive relationship observed in choices of hedging strategies that are focused in limiting downside risk, at times at the expense of upside potential, (e.g. linear strategy) and firms with financially-trained CEOs.

3.2 Hypothesis 2

Another competing branch of theory suggests that finance-trained CEOs avoid hedging because they have more sophisticated knowledge about hedging and are more exposed to negative side of hedging compared to non-finance trained CEOs. Furthermore, because of their tendency to underweight probability of rare circumstances happening in the finance domain, they find that it is less necessary to hedge.

Hypothesis 2A: A negative relationship exists between firms with financially-trained CEOs and firm's decision to hedge and extent of hedging (hedge ratio).

Even though they have a tendency to avoid hedging, if they choose to hedge, they are more likely to choose strategies that limit upside potential less, as they understand the risk arising from limiting profit, with Delta airlines being the prime example. Also, because they give rare events less weight than the objective probability (i.e. events that lead to financial distress), they perceive that they can afford to sacrifice some downside protection and choose strategies that preserve more upside potential.

Hypothesis 2B: A positive relationship observed in choices of hedging strategies that are focused in preserving upside potential (e.g. 3-way collar strategy) and firms with financially-trained CEOs.

Given that the two hypothesis reaches different conclusions, we explore which hypothesis can be explained by our empirical results.

4. Methodology

4.1 Methodological approach

The study in this research on the relationship between CEOs with financial experience and hedging will be based on methologies used in Doukas and Mandal (2018) and Croci, Giudice and Jankensgård (2017). The hedging ratio portion will be investigated similar to the method used in Doukas and Mandal (2018). Another binary based dependent variables, the decision to hedge would be investigated similar to the method used in Croci, Giudice and Jankensgård (2017). This, together with existing similar research and previously presented theories, will become the foundation for the following analysis. The data period of the study is four years, between 2012 to 2016, consisting of a total of 16 quarters.

4.2 Data gathering and validity

The sample used in this study consists of publicly traded oil and gas producers in the US (SIC code 1311) between Q4 2012 and Q2 2016. Oil and gas producing firms have been widely used as samples for corporate hedging researches. The reasons for using this industry are that it has relatively large number of firms and they mostly disclose sufficient information about derivative positions. (Croci, Giudice & Jankensgård, 2017; Andrén & Jankensgård, 2018) Furthermore, cash flow volatility in this industry is high enough to make risk management economically important and emphasizing in one industry gives a homogenous sample with less unobservable differences in firm characteristics (Bakke et al. 2016).

The data gathering can be separated into three parts, which are firms' hedging data, financial data, and CEO data.

Hedge data

Hedge ratio is our measure of the extent of hedging. While the recent study from Doukas and Mandal (2018) measures the extent of hedging using notional amount of derivatives scaled by firm's total assets, such scaling might not properly capture the risk exposure that firms are facing. Tufano (1996) argues that "it is necessary to scale the firm's financial risk management portfolio against its natural exposure to understand its economic importance". The hedge ratio can better match to the CEO's risk-taking ability with firm's exposure as in production volume, especially

for oil and gas firms where production output price is a major exposure that these firms must consider.

Types of hedging strategy are identified as described in section 2.5.1, which are linear, pure insurance, insurance, collar, 3-way collar, and pure sold call.

The hedging data was provided by Hakan Jankensgård from School of Economics and Management, Lund university.

Financial data

Financial data is used as control variables. We gathered the data from the S&P Capital IQ Platform. The data from Capital IQ is derived from the annual reports of each company, which means that the data has been audited and approved. Therefore, the data collected is of high reliability.

CEO data

CEO data as in age, founder status, board duality, education level, and finance or non-finance trained was hand collected from Bloomberg as a main source, and then cross checked for data's accuracy with other sources when applicable such as Linkedin, company's websites, and Thomson Reuters.

Sample and selection procedure

Out of the original sample involving a total of 222 firms, selection procedure to remove potential outliers arising from either data that was inconclusive or missing was applied. The selection procedure consists of the following two steps.

1. Firms of which had no financial data available was excluded

2. Firms of which CEO data was unavailable, or inconclusive, was excluded.

After applying the filter, 35 firms that did not meet the mark were excluded. The final data panel set consists of 187 firms for the period spanning from Q4, 2012 to Q3, 2016.

4.3 Variables

In this section we discuss about the various dependent and explanatory variables used in the study. A summarized table of how these variables are calculated can be found in Appendix B.

4.3.1 Dependent variables

Hedge ratio was calculated as in Jankensgård and Andersson (2017). Hedge Ratio is computed as the sum of linear hedging contracts and put option contracts bought with a maturity of less than 12 months, scaled by expected production within the next 12 months (barrels of oil equivalents). Linear contracts consist of forwards, futures, and price swaps, that is, derivative instruments in which the payoff is a linear function of the underlying commodity. Natural gas is converted into barrels of oil equivalents using the standard assumption that 6 Mcf of gas has the same energy content as 1 bbl of oil. Expected production is assumed to be equal to actual production.

The decision to hedge variable is a binary variable spanning of values of 0 and 1 of which the value of 1 is assigned if a firm has a hedge ratio that is greater than 0. A value of 0 is assigned if the firm's hedge ratio is 0.

In investigating the different types of strategies, being the linear strategy, 3-way collar strategy, collar strategy, pure insurance strategy, insurance strategy and pure sold call strategy, a binary variable spanning values of 0 and 1 is used. In each instance, if the said strategy is used by the firm, the firm is given a value of 1. If the firm employs any other strategy than the said strategy in investigation, the firm is given a value of 0. For example, when the model is specified to be investigating specifically the firm's use of a linear strategy, if there are three firms, A, B and C using a linear strategy, collar strategy and an insurance strategy, firm A would be assigned a value of 1, while firm B and C would be assigned values of 0.

Finally, in investigating whether between if the firm's strategy falls under the definition of a cash vs cashless strategy, if the firm employs the pure insurance or insurance strategy, the firm would be given a value of 1. For all other strategies, they fall under the definition of a cashless strategy, and hence if the firm employs those strategies, being linear strategy, 3-way collar strategy, collar strategy and pure sold call strategy, the firm would be given a value of 0.

4.3.2 Explanatory variables

4.3.2.1 Financial working experience variable

Finance trained CEOs are defined as CEOs with previous training in finance related roles within the firm. Examples of such roles include previous experiences as chief financial officers, audit or

accounting experience, asset management and investment banking. Finance trained CEOs would be assigned a value of 1. Non – finance trained CEOs would then comprise of all other previous working experiences that are not finance in nature, such as previous jobs in sales, marketing, operations and law. Non-finance trained CEOs would be assigned a value of 0.

4.3.2.2 Control variables

A set of control variables is included to rule out alternative explanations. Studies regarding managerial preferences and risk taking of Tang, Li and Liu (2015) and Croci, Giudice and Jankensgård (2017), and Doukas and Mandal (2018) largely influence our choice of control variables.

CEO age is one factor in determining the extent to which psychological characteristics might influence a CEO's decision making. There are two contrasting theories around age and risk-taking. Referring to the 'quiet life'-hypothesis, older CEOs are generally more risk averse to financial distress risk due such intense pressure described that would arise from such a situation (Bertrand and Mullainathan, 2003). In contrast, younger CEOs can have strong incentives to hedge because they face greater reputational risk over longer career horizon than older CEOs (Croci, Giudice & Jankensgård, 2017).

Duality is when the CEO also taking position as chairman of the board. Board of directors is a mechanism deployed by shareholders to monitor management. When the board is doing a more vigilant job monitoring its CEO, the CEO would face greater job pressure. Nevertheless, the board's monitoring function is largely weakened if it is chaired by the CEO (Mizruchi, 1983). Decisions made by CEOs who are more powerful (such as those who are also board chairs) will reflect their overconfidence in their decision making that leads to more risk taking (Tang, Li & Yang, 2015). Furthermore, a CEO that is also the chairman of the board signals entrenchment, which suggests less need for hedging as the manager is at less risk of being replaced in the event of financial distress (Croci, Giudice & Jankensgård, 2017). Duality is set as a binary variable of 0 or 1 and is set such that if the CEO also concurrently the chairman at the specified period in the dataset, the variable would be assigned a value of one. Else, the value is set at 0.

Founder CEOs play considerably different roles in firm strategy and performance than agent CEOs, because the two types of CEOs possess substantially different knowledge, values, and

attitudes in managing the firms and they receive vastly different economic pay-offs for their efforts (Amihud & Lev, 1981; Eisenmann, 2002; He, 2008; Souder, Simsek & Johnson, 2012). Such differences can lead to more risk-taking behavior from founder CEOs. Eisenmann (2002) found a positive relationship between founder CEOs and firm's risk taking and believes that the relationship may stem from the founders receive substantially higher personal pay-off from sponsoring risky investments of the firms. An empirical study from Tang, Li and Yang (2015) supports this theory and shows that founder CEOs are more likely to be overconfident and thus take more risks. The Founder variable is set as a binary variable of 0 or 1 and is set such that if the CEO also the founder or a founding member of the firm, the variable would be assigned a value of one. Else, the value is set at 0.

The *CEO's education level* was included because research has shown that managers' personal demographics can and do influence their risk-taking behavior (MacCrimmon & Wehrung, 1990). CEO education spans between 0 to 3, where 0 represents the CEO not having any university education, 1 representing the CEO having a bachelor's degree, 2 being the CEO having a master's degree, junior doctorate or an MBA and 3 representing the CEO having a P.H.D.

Empirical studies have shown that men exhibit more risk-taking than women (Kantrowitz & Kalb, 1998; Dwyer, Gilkeson & Faccio, 2002; Marchica & Mura, 2016). While this study might benefit from the inclusion of the CEO's gender as a control variable, we excluded gender from our study as there are no female CEOs present in our data set. This exclusion of gender is comparable with previous CEO's characteristics and hedging studies done by Croci, Giudice and Jankensgård (2017) and Doukas and Mandal (2018).

Option-based compensation is calculated as the fair value of option compensation the CEO receives being a function of the total compensation the CEO receives during the period. For example, if the CEO has a total expected compensation, including options, of $100,000, and during the year the firm issues option compensation of $20,000 to the CEO, then value of the option-based compensation variable used in the model would be 0.2. Smith and Stulz (1985) show that greater convexity with respect to firm value induces managerial risk-seeking behavior that counteracts managers' natural risk aversion. According to the managerial risk incentives theory of hedging strategy, a convex compensation schedule that finance trained CEOs received likely to

weaken their risk aversion. Hence, the more option-based compensation they receive, the less they are willing to hedge because it can reduce their upside potential.

Firm size is the logarithm of the firm's total assets. Previous research has shown that large firms tend to use derivatives more often (e.g., Haushalter, 2000).

We control for *firm performance*, measured as the return on assets over the prior period, because prior performance may influence the CEO's perception of the gain/loss situation and hence firm risk taking (Wiseman & Gomez-Mejia, 1998).

Firms with high investment rate and investment opportunities are normally assumed to have a stronger incentive to hedge because shortfalls of internal funds are relatively costlier (Froot, Scharfstein & Stein, 1993). *Investment rate* is the ratio between investment in fixed assets and net property, plant, and equipment. *Investment opportunities* are represented by Tobin Q and is defined as the sum of the market value of equity and the book value of debt, divided by the book value of assets.

Leverage is total debt scaled by total assets. Highly leveraged firms are usually considered to have higher expected costs of financial distress, which provides an incentive to use hedging (Smith & Stulz, 1985; Kumar & Rabinovitch, 2013).

Cash Reserves is defined as cash and cash equivalents scaled by total assets. Having high cash reserves represents more risk capacity (Alviniussen & Jankensgård, 2015), thus lowers the need for corporate hedging.

Oil Price Volatility is the annualized standard deviation of daily returns for WTI Crude oil in a given year. The volatility of the hedgeable product price is one of the determinants of firms' overall risk and may therefore affect the hedging decision (Croci, Giudice & Jankensgård, 2017).

4.4 Regression approach

Based on the methodology employed by Doukas and Mandal (2018) where the authors investigated the firm's derivatives usage against CEO risk preference measures, the authors used the OLS approach to determine the relationship, where the dependent variable was the log of derivatives/assets ratio and the main independent variables being CEO compensation and characteristics variables.

In one of the testing sections in Croci, Giudice and Jankensgård (2017), the authors tested the determinants of the decision to hedge, as well as the various hedging strategies such as the linear hedging strategy, selling of put options and selling of call options through a probit model estimation.

For the testing of the hedge ratio, modifying the method employed by Doukas and Mandal (2018), we employed the OLS model approach, with various specifications to triangulate more accurate and meaningful results. All models specified using white period to ensure robust standard errors clustered around the mean.

For the testing of the decision to hedge, as well as the various hedging strategies employed, we employed a logit model estimation instead of a Probit model used in Croci, Giudice and Jankensgård (2017), although, both models would be applicable have no difference to the results and conclusion.

A time lag was introduced to tackle the issue of changes in CEOs during the investigated period, which will be further discussed in the section 4.4.1 discussing regression model specification.

Notably this correction would result in a reduction of observations as the lag between the individual and firm specific variables increases. Hence, Time = 4 is set as the maximum number of lag periods and all regression results would be evaluation and shown from Time = 0 to Time = 4, as we noted in the dataset collected that almost all current committed hedging positions would have been resolved after 4 periods. As such, the equation for the model is at T = 0

$$Hedge_{it} = \beta_1 Finance_{it} + \beta_2 FirmControls_{it} + \beta_3 IndividualControls_{it} + \varepsilon$$

$Hedge_{it}$ are the various dependent variables that are observed, such as the hedge ratio, the decision to hedge and the various hedging strategies.

$Finance_{it}$ is the finance training variable being investigated, where if the CEO was finance trained, the $Finance_{it}$ variable would be set to 1, else the $Finance_t$ variable would be set to 0.

$FirmControls_{it}$ are firm specific controls such as the firm size, investment rate, return on assets, Tobin's Q, cash reserve and oil volatility.

$IndividualControls_{it}$ are CEO specific characteristics such as age, duality, founder status level of option compensation and education.

In the scenario when lagging the finance and individual controls, the equation for the model is then modified to this. At T = 1, we lag the individual specific variables that are specific to the characteristics of the CEOs, hence the model would be specified as:

$$Hedge_{i,t+1} = \beta_1 Finance_{it} + \beta_2 FirmControls_{i,t+1} + \beta_3 IndividualControls_{it} + \varepsilon$$

4.4.1 Regression model specification

A potential problem might arise from firms who had changes in CEOs during the period. As per the main hypothesis, CEOs will influence the hedging decisions of the firm. However, during the transition phase of the new CEO, the existing hedging policies previously put in place by the previous CEO would remain in motion, while the new CEO takes time to familiarize himself with the firm. Furthermore, the firm would have likely to have existing hedging positions already signed and in effect, plus additional committed future hedging positions in the short term. These hedging positions would reflect the decisions made by the previous CEO, and not the current CEO, and hence could result in potential misinterpretation when running the regression. Furthermore, as mentioned while tackling endogeneity, almost half of the firms that had a change in CEO also had a change in the financial training and background between the outgoing and incoming CEO (e.g. previous CEO was finance trained, current CEO is not finance trained).

Firm specific variables include all dependent variables, such as the binary decision to hedge, the hedged production ration and the different hedging strategies, as well as firm control variables, such as firm size, firm performance, investment rate, investment opportunities, leverage, cash reserves and volatility.

Individual specific variables consist of the main binary variable finance as well as other individual control variables such as CEO age, duality, founder status, CEO education and CEO option compensation.

In the regression when time = 0, that would mean the same period of both firm and individual variables. However, when time = 1, that would mean that the individual specific variables would lag the firm specific variables by one period. For example, when time = 1, at the Q4, 2012 datapoint, individual specific variables would be values at Q4, 2012, while firm specific variables

would be values at Q1, 2013. Likewise, when time = 4, individual specific variables would be values at Q4, 2012, while firm specific variables would be values at Q4, 2013.

The rationale of this implementation is that such a delay in individual specific variables would help reduce the potential problem of the previous CEO's hedging strategies being attributed to the current CEO in charge. For example, if the change in CEO occurred between Q1 and Q2 of 2013, the hedging strategy of Q2, 2013 would likely be attributable to the previous CEO and not the current CEO. However, with a time lag of T = 4, it is likely that all previous hedging positions and strategies from the previous CEO have expired, and the hedging strategy of Q2, 2014 would be due to the decision making of current CEO.'

The introducing of time lag into the equation would also help in tackling endogeneity problems, which will be further addressed in section 4.4.2.1.

4.4.2 Regression assumptions

The regression models used in this study must meet the following assumptions to be considered reliable, in order to fulfill its desirable properties. (Brooks, 2008).

The main assumptions of OLS are:

There is no correlation between the error term and any independent variable. This is required to obtain unbiased estimates of regression coefficients. The assumption regarding the exogenous variable is further explained in subsection 4.4.2.1.

Homoscedasticity defined as the constant variance of the error term associated with cross-sectional data; will be controlled by using White heteroscedasticity (white period), which result in corrected standard errors for all regressions. If this assumption is not met, the standard error could be wrong and may cause is misrepresentation in the statistical conclusion (Brooks, 2008).

There is no exact co-linearity between the independent variables. This will be tackled by looking at the correlation matrix to ensure that none of the independent variables are significantly correlated. Correlation values greater than 0.8 might indicate the presence of co-linearity and if there is such a case the use of those independent variables should be reconsidered (Gujarati & Porter, 2010). (Appendix C)

4.4.2.1 Endogeneity problems

In considering the issues arising from endogeneity, it is not possible to rule out a time-variant omitted variable or a possible reverse causality issue arising from our main finance training variables and hedging.

While we recognise that it is virtually impossible to eliminate all omitted variable bias, we deal with it by examining and using results with and without fixed effects specification. Furthermore, we included multiple relevant control variables as we recognise that fixed effects cannot control for variables that vary over time, to further deal with the omitted variable bias.

It is possible as well that there might be a reverse causality issue arising from our regression. In accordance to our main hypothesis, it assumes that finance and non-finance CEOs behave differently and have different risk appetites, which influence hedging behaviour and hence to a certain extent, the risk-taking behavior of a firm.

Assuming that the hedge ratio and hedging decisions are a proxy of the firm's risk-taking appetite, there might arise a potential reverse causality issue where in fact, a risky firm, with a low hedge ratio, would employ a CEO that takes more risks; or vice versa where a conservative firm, with a high hedge ratio, would employ a conservative CEO, as shareholders would want to align their risk preference for firm risk taking with the management of the firm, and in this case, the CEO. For example, a high-risk firm that has a constant low hedge ratio strategy would only employ high risk CEOs. Hence, the CEO employed would have the same risk preferences with the firm, and the hedge ratio would not change. Hence, it would seem as if the hedge ratio effectively influences the CEO, rather than the other way around.

To investigate, we looked at the firms within the data set that changed CEO during the period of 2012 to 2016. From there we identified 50 firms of which had a change in CEO, i.e the previous CEO resigned, and a new CEO took place. Hence, in the perspective of shareholders who hire a CEO according to their risk appetite that can cause reverse-causality, the board would likely to appoint a new CEO with the same financial background as the previous one to match with shareholders' risk preferences, unless such preferences are changing over time. (Croci, Giudice & Jankensgård, 2017)

As such, we designed the following test within the 50 firms that had a change in CEO. Two variables were created, expected training and actual training, denoted as X and Y respectively. For the firm that had a change in CEO, if the previous CEO was financially trained, we expect the incoming/current CEO to be financially trained as well, hence X is assigned a value of 1. Likewise, if the previous CEO was not financially trained, X is assigned a value of 0.

To determine the Y variable, we looked at the new incoming CEO's characteristic, if they are financially or non-financially trained. If they are financially trained then Y is given a value of 1, else if they are not financially trained, Y is given a value of 0. If the expected and actual variables are either positively (riskier firms employ riskier CEOs) or negatively (riskier firms employ more conservative CEOs) significantly correlated, endogeneity arising from reverse causality might be present. Otherwise, if the result is insignificant, that would potentially signal that there is no endogeneity arising from this issue.

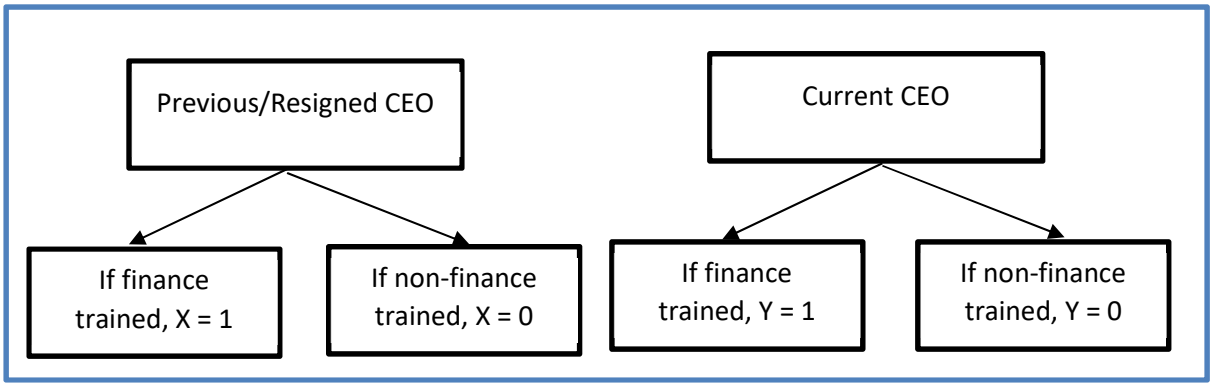


Figure 3: Explanation of how variable numbers are assigned

From the results, we noted that almost half of the firms had a change in CEO financial background during the period, i.e. from finance trained to non-finance trained and vice versa. Running a simple OLS regression and plotting a line graph between the expected and actual variables, we found that the result was insignificant.

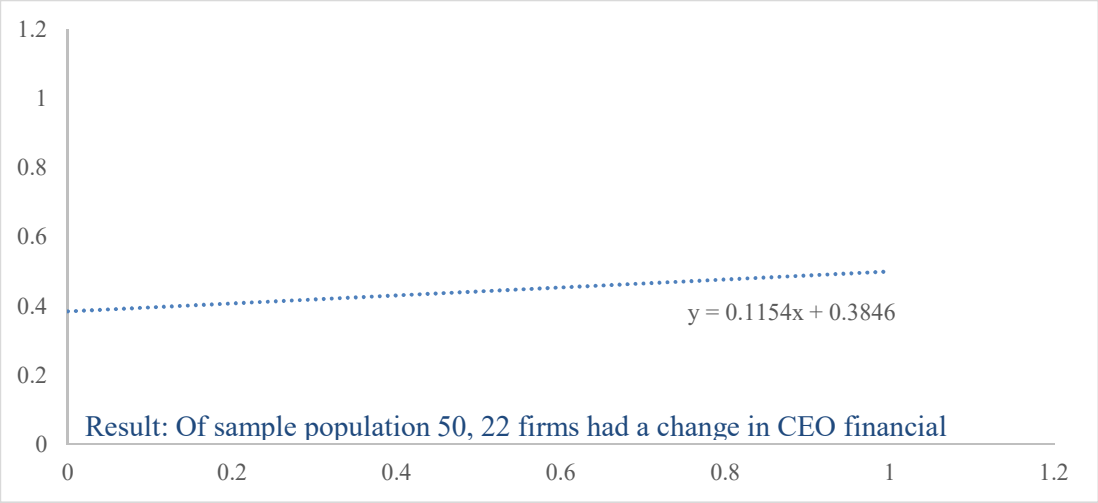


Figure 4: Graphical representation of endogeneity test

Hence, based on the results, it is unlikely that there is any endogeneity arising from a reverse causality issue. Notably given that the sample size is small, we cannot conclude definitively that there is no endogeneity. Furthermore, this endogeneity test assumes that shareholders' risk appetite does not change over time.

Earlier as mentioned in section 4.4.1 on dealing with changes in CEOs, we introduced a time difference into the equation. A time difference would also help tackle the issue with endogeneity arising from reverse causation, as it is unlikely that future values of hedging would influence current characteristics of a CEO in terms of working experience.

Lastly, while we have tried to tackle and reduce endogeneity in our model, it is important to recognise that endogeneity would not affect our main conclusion, as our main assumption is that CEOs do influence hedging decisions within the firm, and shareholders would have taken that into account upon employment of such CEOs. Furthermore, if shareholders' risk appetite did change over time, the goal of employing a new CEO would be to align the firm's current risk taking towards the new level of risk wanted by shareholders, which then would influence the hedge ratio correspondingly. Hence, the dependent variables, in this case hedging decisions, would still be due to the actions of the new CEO, which would not change our main hypothesis.

5. Results

5.1 Explanatory variables discussion

Table 1 - detailed breakdown by period for finance-trained variable

Panel breakdown - finance trained vs non-finance trained

Year	Quarter	Finance	Non-finance	Mean	Median	No of Obs
2012	Q4	27	26	0.51	1	53
2013	Q1	58	90	0.39	0	148
2013	Q2	62	91	0.41	0	153
2013	Q3	64	94	0.41	0	158
2013	Q4	66	92	0.42	0	158
2014	Q1	67	92	0.42	0	159
2014	Q2	71	93	0.43	0	164
2014	Q3	66	91	0.42	0	157
2014	Q4	62	89	0.41	0	151
2015	Q1	59	88	0.40	0	147
2015	Q2	57	88	0.39	0	145
2015	Q3	51	81	0.39	0	132
2015	Q4	44	74	0.37	0	118
2016	Q1	41	69	0.37	0	110
2016	Q2	39	71	0.35	0	110
2016	Q3	2	0	1.00	1	2

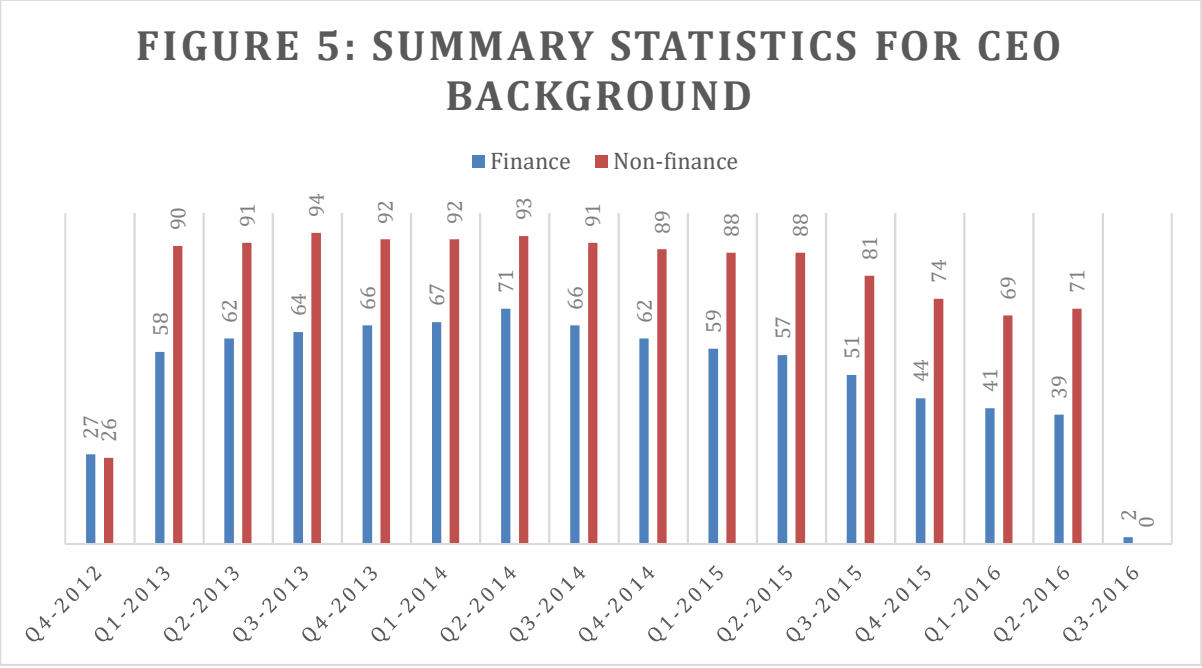


Table 1 and figure 2 presents summary statistics for CEOs that are financially trained and CEOs that are not for each quarter, spanning between 2012 to 2016. As seen from figure 2, there is a larger proportion of CEOs that do not have financial training in general. Furthermore, the ratio between CEOS that are financially trained hold steady at approximately 40% of the population.

This result is slightly higher than reported statistics by Heidrick and struggles (2017), where they found the percentage to be at 31%. This ratio holds steady even after the oil prices dropped significantly in December 2014, resulting in an increase in financial distress in many firms. This might suggest that the finance training variable is independent of exogeneous shock within the oil industry.

5.2 Independent variables discussion

Table 2 - Descriptive statistics for dependent variables

Variable	Mean	Median	No of Obs
Hedging Decision	0.5492	1.0000	2065
Hedge Ratio	0.2722	0.1142	2065
Linear	0.1492	0.0000	1134
3-Way Collar	0.1579	0.0000	1134
Collar	0.1530	0.0000	1134
Insurance	0.0324	0.0000	1134
Pure Insurance	0.0247	0.0000	1134
Sold Call Strategy	0.0291	0.0000	1134
Cash/Cashless	0.1406	0.0000	1134

Table 3 - Detailed breakdown by period on ratio of hedged production

		All firms		*Firms that hedge*		
Year	**Quarter**	**Production Hedged**	**No of Obs**	**Production Hedged**	**No of Obs**	**Ratio of firms that hedge**
2012	Q4	0%	53	0%	0	0%
2013	Q1	29%	148	54%	78	53%
2013	Q2	27%	153	50%	83	54%
2013	Q3	28%	158	48%	90	57%
2013	Q4	29%	158	51%	91	58%
2014	Q1	29%	159	51%	90	57%
2014	Q2	28%	164	50%	93	57%
2014	Q3	27%	157	47%	90	57%
2014	Q4	28%	151	53%	80	53%
2015	Q1	28%	147	53%	79	54%
2015	Q2	28%	145	49%	84	58%
2015	Q3	27%	132	45%	79	60%
2015	Q4	28%	118	49%	67	57%
2016	Q1	27%	110	45%	65	59%
2016	Q2	27%	110	45%	65	59%
2016	Q3	0%	2	0%	0	0%

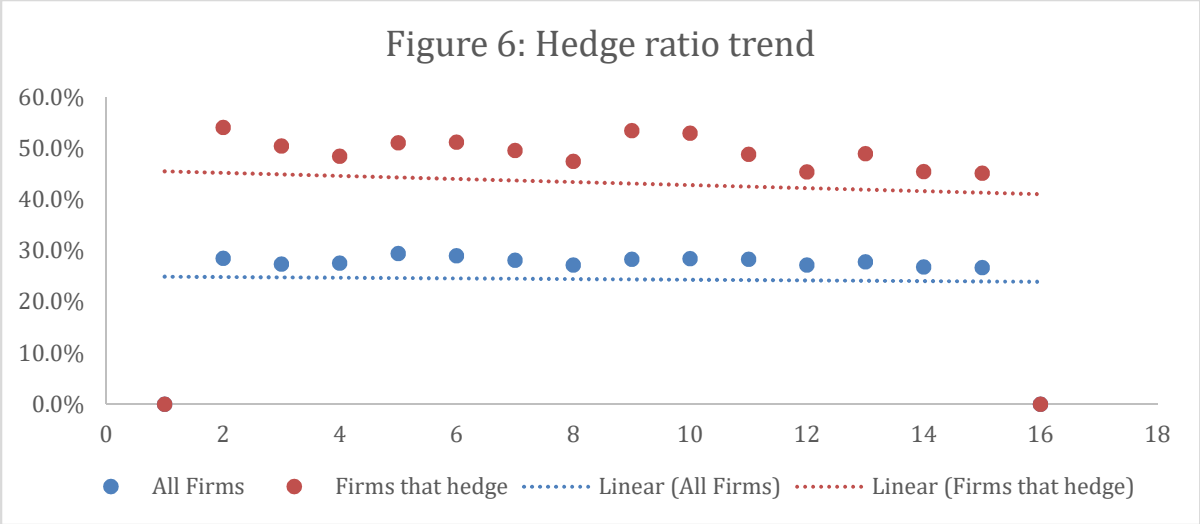
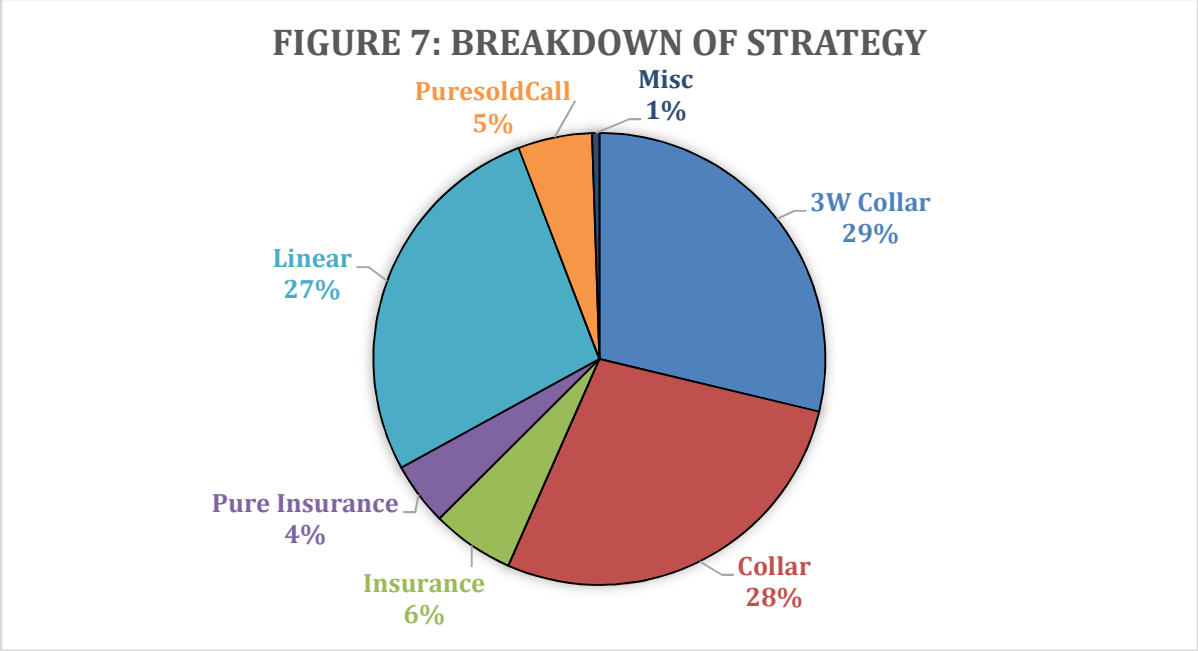


Table 2 reports summary statistics for hedging variables, while table 3 and figure 3 reports the period changes in the level of production hedged (hedge ratio). Table 2 and 3 shows that oil and gas firms are more likely to hedge their production, varying between 53% to 60% of the population. The level of production hedged from the dataset remained relatively constant through the period, hovering around the 50% mark for firms that engaged in hedging, with a slight dip in hedge volumes after the oil price shock that happened in December 2014.

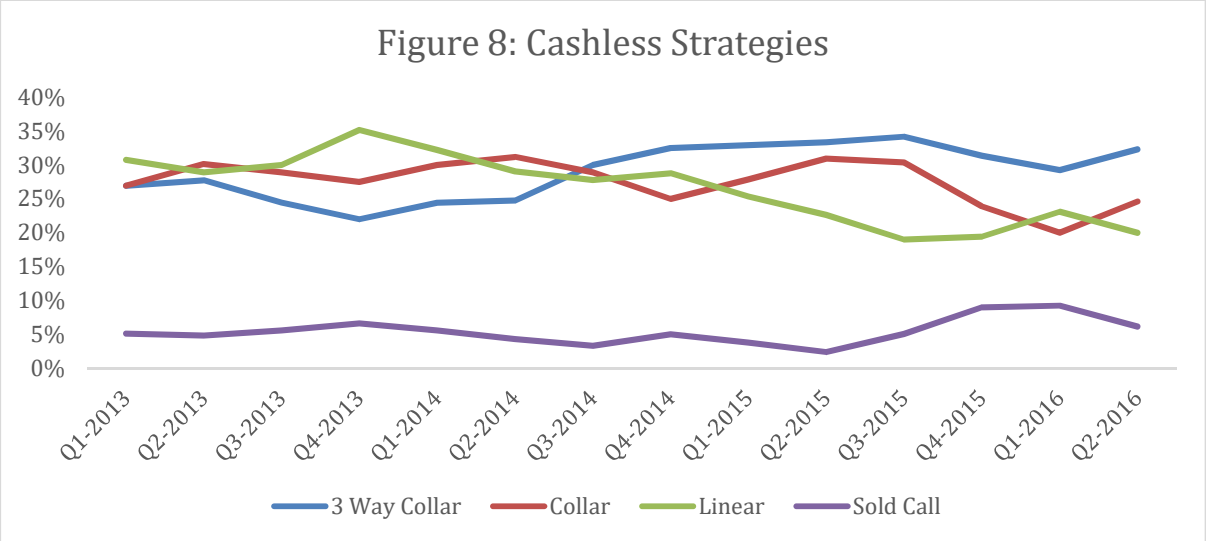


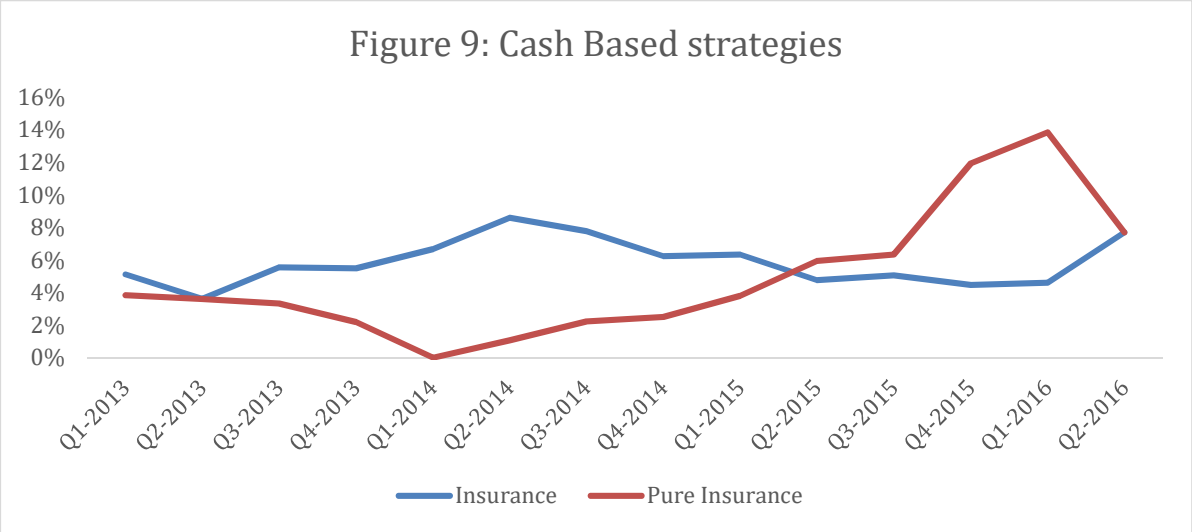
Notably from figure 4, most oil firms that hedge their production opt to use three main hedging strategies, being linear (27%), 3-way collar (29%) and collar (28%) for the entire sample period.

One interesting fact to note is that these three strategies are cashless, and hence no upfront cash investment is actually required for the firm to implement these strategies, unlike the pure insurance and insurance strategy. From the paper by Alviniussen and Jankensgård (2009), they propose holding cash is also considered a form of risk management. Based on the current results, this might signal that the majority of oil and gas firms that hedge would rather forgo potential future profits arising from the volatility of oil prices than spend current cash holdings for the purchase of put options to retain unlimited upside but limit downside.

Table 4 - Detailed breakdown by period on hedging strategy type

		Cashless Strategies				*Cash-based Strategies*	
Year	**Quarter**	**3 Way Collar**	**Collar**	**Linear**	**Sold Call**	**Insurance**	**Pure Insurance**
2012	Q4	0%	0%	0%	0%	0%	0%
2013	Q1	27%	27%	31%	5%	5%	4%
2013	Q2	28%	30%	29%	5%	4%	4%
2013	Q3	24%	29%	30%	6%	6%	3%
2013	Q4	22%	27%	35%	7%	5%	2%
2014	Q1	24%	30%	32%	6%	7%	0%
2014	Q2	25%	31%	29%	4%	9%	1%
2014	Q3	30%	29%	28%	3%	8%	2%
2014	Q4	33%	25%	29%	5%	6%	3%
2015	Q1	33%	28%	25%	4%	6%	4%
2015	Q2	33%	31%	23%	2%	5%	6%
2015	Q3	34%	30%	19%	5%	5%	6%
2015	Q4	31%	24%	19%	9%	4%	12%
2016	Q1	29%	20%	23%	9%	5%	14%
2016	Q2	32%	25%	20%	6%	8%	8%
2016	Q3	0%	0%	0%	0%	0%	0%





Breaking down these strategies into individual periods, from table 4 and figure 6 we notice a significant increase in use of the pure insurance strategy in 2015 after the oil price shock in December 2014. On the other hand, there was a significant decrease in linear strategies, as shown in figure 5, in 2015. These changes in strategy types might indicate the potential optimism arising from oil firms where there is an expectation that oil might rise again after the drop, that the drop is merely temporary.

5.3 Control variables discussion

Table 5 - Descriptive statistics for control variables

Control Variables

Variable	Mean	Median	STD	Min	Max
Individual specific control variables					
Age	56.53	57.00	8.58	34.00	80.00
Duality	0.50	1.00	0.50	0.00	1.00
Founder Status	0.27	0.00	0.44	0.00	1.00
Options compensation	0.08	0.00	0.18	0.00	0.89
Education	1.27	1.00	0.72	0.00	3.00
Firm specific control variables					
Log(Total Assets)	2.63	2.86	1.18	0.14	4.80
Total Assets	5,081.18	716.66	13,597.41	0.02	121,648.00
ROA	-0.06	-0.01	0.26	-1.82	0.23
Tobin's Q	1.81	1.03	3.45	0.19	28.61
Investment Rate	0.07	0.05	0.08	0.00	0.51
Log(Cash/Total assets)	-3.88	-3.59	2.16	-10.35	-0.07
Cash/Total assets	0.09	0.02	0.17	0.00	0.94
Total Debt/Total Assets	0.47	0.32	0.80	0.00	9.58
Oil Volatility	3.83	3.30	2.28	2.07	11.46

As can be seen from Table 3, from individual specific control variables, CEO age remained largely constant throughout the sample period. The mean of 56 years and median 57 years values are very close to those reported in Yim (2013), Jenter and Lewellen (2015) and Croci, Giudice and Jankensgård (2017). The percentage of CEO duality (50%) and founder status (27%) are notably higher than the descriptive results found in Tang, Li and Liu (2016), where in their sample size, they found duality and founder status to be 37% and 19% respectively. This is likely due to the different sectors investigated, where Tang, Li and Liu (2016)'s focus on the manufacturing sector where as in our current data set is focused on the oil and gas sector.

At firm specific control variables, cash reserves, represented by cash/total assets had a higher mean (9%) compared to the descriptive results in Croci, Giudice and Jankensgård (2017) of 4%. However, the median of 2% is still very close what is reported in Croci, Giudice and Jankensgård (2017). While both datasets mainly focused on oil and gas firms, the period of which the study conducted is different, where Croci, Giudice and Jankensgård (2017) had a dataset spanning 2000 to 2013, while our current dataset is concentrated between 2012 to 2016. This might suggest a shift in the later years for firms to hold more excess cash, possibly as a form of risk management. Comparing the leverage level, where Croci, Giudice and Jankensgård (2017) used the same

variable of total debt divided by total assets, we noted an increase in leverage in our current dataset of mean 47% and median 32%, where Croci, Giudice and Jankensgård (2017) reported a mean and median leverage level of 25% and 24% respectively. This change is likely due to the oil price change in December 2014, resulting in firms requiring incurring additional debt in the latter years in order to maintain operations.

5.4 Regression results

5.4.1 Decision to hedge

In this section we analyse the determinants on the decision to hedge, which help in determining if hypothesis 1A, that finance trained CEOs hedge more, or hypothesis 2A, that finance trained CEOs hedge less, is stronger.

Table 6 reports the results from estimating a logit model where the dependent variable is the binary hedging decision. The table also shows the various results from the time lag between firm specific and individual specific variables. From the results, the finance training variable is negatively correlated to the decision to hedge (at the 1% significance level). This seems to support hypothesis 2A, where finance trained CEOs hedge less.

Other results in the model are comparable to a large literature studying the determinants of corporate hedging. Cash reserves are negatively correlated with the decision to hedge, supporting the idea that holding cash might be an alternative way of managing risk, which reduces the need for financial derivatives. We found that highly leverage firms are more likely to use derivatives. This finding supports the theory that financially constrained firms hedge more but it contrasts with the collateral constraints-theory of Rampini, Sufi and Viswanathan (2014). One sign contrary to our expectations based on previous research however is age, where a positive sign is expected according to previous research done by Croci, Giudice and Jankensgard (2017). This, however, supports the career concern-hypothesis where younger CEOs hedge more to protect their longer career horizon.

Table 6 - Hedging decision

This table reports the estimates of the logit models where the dependent variable is the binary hedging decision of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Hedging Decision				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	-1.1725**	-0.7275	-0.3919	-0.1199	0.1560
	[2.1504]	[1.3142]	[0.6809]	[0.1988]	[0.2454]
Finance	-0.422***	-0.5152***	-0.6038***	-0.6558***	-0.6701***
	[3.2127]	[3.848]	[4.3303]	[4.5048]	[4.376]
Age	-0.0199***	-0.0253***	-0.0292***	-0.0334***	-0.0387***
	[2.659]	[3.2895]	[3.6278]	[3.9485]	[4.3188]
Duality	0.1965	0.1904	0.1767	0.1665	0.1562
	[1.58]	[1.4999]	[1.3348]	[1.204]	[1.0747]
Founder Status	0.2481*	0.2684**	0.2895**	0.3175**	0.2868*
	[1.8674]	[1.98]	[2.051]	[2.15]	[1.846]
Options compensation	-2.5589***	-2.4519***	-2.1853***	-2.2097***	-2.2849***
	[6.1589]	[6.0776]	[5.4405]	[5.3965]	[5.3594]
Education	-0.3313***	-0.3415***	-0.3036***	-0.2786***	-0.2469***
	[4.0563]	[4.1098]	[3.5328]	[3.1256]	[2.6581]
Log(Total Assets)	1.0301***	1.0037***	0.9499***	0.9182***	0.8914***
	[16.2304]	[15.5505]	[14.3612]	[13.4258]	[12.5312]
ROA	1.6636***	1.6895***	1.7185***	1.3791***	1.2532***
	[4.0449]	[3.9833]	[3.9965]	[3.1679]	[2.8764]
Tobin's Q	-0.4652***	-0.4781***	-0.5072***	-0.509***	-0.509***
	[5.628]	[5.6343]	[5.6122]	[5.2872]	[4.8862]
Investment Rate	4.1884***	4.8304***	4.815***	4.9868***	5.0949***
	[5.6407]	[5.9144]	[5.5738]	[5.2678]	[5.0027]
Log(Cash/Total assets)	-0.2005***	-0.2106***	-0.2266***	-0.2381***	-0.2429***
	[6.5822]	[6.7561]	[6.84]	[6.8602]	[6.6287]
Oil Volatility	-0.0574**	-0.0645**	-0.0694***	-0.0713***	-0.0638**
	[2.2476]	[2.4779]	[2.6059]	[2.6053]	[2.265]
Total Debt/Total Assets	0.5848***	0.5542***	0.5647***	0.5282***	0.5245***
	[4.3462]	[4.0644]	[4.0139]	[3.6639]	[3.4933]
Pseudo R2	0.3389	0.3367	0.3304	0.3229	0.3152
No. of obs.	2065	1977	1800	1625	1448

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

5.4.2 Extent of hedge

In this section we analyse the determinants on the decision to hedge, which help in determining if hypothesis 1A, that finance trained CEOs hedge more, or hypothesis 2A, that finance trained CEOs hedge less, is stronger. Furthermore, we analyse whether the production amount hedged can be explained by whether the CEO is financially trained.

A total of three models were specified, with a base case using OLS regression, a model with firm fixed effects and a model with firm fixed effects and limiting the sample population to only firms that hedged. All three models would be used in determining the relationship between the finance variable and the extent of hedge. Table 7 shows the summary of results. Full results can be found in tables 7.1 to 7.3, found in appendix A.

Fixed effect specification was included in order to address the issue of endogeneity, although we recognize that fixed effects do reduce efficiency within the adjusted model. Limiting the samples to only firms that hedge production was also considered in order to mitigate any potential issues that do not allow firms to hedge (e.g. financial constraints).

Table 7 - Summary of results from hedge ratio tests

This table is the summary of the estimates from the results of the OLS models with different specifications where the dependent variable is the hedge ratio of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Extent of hedging (hedge ratio) - Finance variable				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
OLS	-0.0491	-0.0568	-0.0613*	-0.0668*	-0.0721**
	[1.4107]	[1.6055]	[1.7137]	[1.8412]	[1.9617]
Firm fixed Effects	-0.0320	-0.0474	-0.0821*	-0.1078**	-0.1328**
	[0.7637]	[1.0775]	[1.6577]	[2.1928]	[2.3822]
Firm fixed Effects	-0.0681	-0.1003	-0.1361**	-0.2122***	-0.2421***
(Sample limited)	[1.1467]	[1.599]	[2.3819]	[4.5956]	[4.9108]

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Based on the results from the regression, the finance variable is insignificant for periods time = 0 and time = 1. However, these could be due to potential misspecification arising especially from the dataset of firms that had a change in CEOs during the period. These results when Time = 0 are

similar to the paper by Doukas and Mandal (2018), where the authors concluded that CEO financial experience was not significant in any of their regression models.

From time = 2 onwards for all models, we notice that the finance dependent variable becomes significant at 10% and 5% significance levels. This might suggest a possible relationship between finance training and the extent of hedged production, although the results shown are relatively weak.

The relationship between the finance training variable and the extent hedging is noted to be negative for all models, which seems to support hypothesis 2A, of a negative relationship between finance trained CEOs and the hedge ratio.

5.4.2.1 Model specification testing – extension of hedge ratio test

As an extension to the previous test on the finance variable and hedge ratios, to test if the lag between firm variables and individual variables is reasonable for correction to the extent of hedging done by firms, two other regression models were specified to investigate with the data population limited to only firms that had no changes in CEOs. If the result in T=0 is significant, it would signal that the changes in CEO did result in misspecification for the previous model with full population, as discussed in the regression model specification in section 4.4.1.

One model was specified as an ordinary least squares model while the other was specified as a random effects model, as the Hausman correlated random effects test was ran and found to be significant, hence indicating that the random effects model might be a better fit for the dataset compared to OLS. Fixed effects could not be used in these tests due to the population being limited to firms with only one CEO, changing the nature of the panel data. Both models did not include any lag between the firm variables and individual specific variables.

Looking at table 8 for the results, the finance coefficient is significant when excluding firm-specific control variables. This result shows an insignificant relationship between the finance training variable and the extent of hedging. Excluding firm specific control variables and individual specific variables result in a high level of significance between the finance training variable and extent of hedge. Notably, all models had robust standard errors around the mean. Hence, based on these results, we can only conclude that the relationship between the finance training variable and the extent of hedging based on the results is likely to be negative which seems

to support hypothesis 2A, although the result of the regression is relatively weak and possibly insignificant and hence inconclusive.

Table 8 - Extent of production hedged (Limited Sample test)

This table reports the estimates of the OLS model and OLS model with specification where the dependent variable is the hedged amount of total production for oil and gas firms. Population is reduced to include only firms that have no changes in CEOs between 2012 - 2016. Non-binary variables are winsorized at 1% on both tails. All regressions include firm fixed effects and period fixed effects. Figures in parentheses denote heteroskedasticity-robust t-statistics clustered by firm (White Period). Variable definitions are provided in Appendix B.

	OLS			OLS with random effect specification		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Constant	-0.0301	0.5172***	0.3041***	0.3909**	1.0096***	0.2967***
	[0.1596]	[2.8252]	[8.8333]	[2.0475]	[4.2211]	[8.8244]
Finance	-0.0103	-0.1238**	-0.0922*	-0.0612	-0.2007***	-0.1042**
	[0.2291]	[2.3715]	[1.7701]	[1.2847]	[3.6364]	[2.094]
Age	-0.0013	-0.0041		-0.0065**	-0.0112***	
	[0.5091]	[1.435]		[2.384]	[3.0245]	
Duality	-0.0305	-0.0054		-0.0349	-0.0765	
	[0.6845]	[0.108]		[1.007]	[1.3566]	
Founder Status	0.0904*	0.1345**		0.0630	0.0994*	
	[1.7532]	[2.4457]		[1.248]	[1.7166]	
Options compensation	-0.0721	-0.1374		0.0402	0.0532	
	[0.8631]	[1.5872]		[0.6019]	[0.8434]	
Education	-0.0145	0.0049		-0.0347	-0.0253	
	[0.4595]	[0.1364]		[1.095]	[0.6573]	
Log(Total Assets)	0.11***			0.1267***		
	[4.7684]			[5.9573]		
ROA	0.0661			0.0050		
	[1.5136]			[0.3342]		
Tobin's Q	-0.0031			0.0006		
	[0.7783]			[0.3253]		
Investment Rate	0.2341*			-0.0022		
	[1.7888]			[0.0329]		
Oil Volatility	-0.0031			-0.0019		
	[1.4355]			[1.2983]		
Log(Cash/Total assets)	-0.0254***			-0.008*		
	[3.0478]			[1.8834]		
Total Debt/Total Assets	0.0276			-0.063**		
	[1.2883]			[2.2299]		
Pseudo R2	0.2841	0.0759	0.0187	0.1252	0.0287	0.0022
No. of obs.	1416	1416	1416	1416	1416	1416

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

5.4.3 Hedging strategy of choice

In this section, we analyse whether the hedging tool used along with their hedging preference can be explained by whether the CEO is financially trained. The results would support either hypothesis 1B, where finance trained CEOs are more likely to choose hedging strategies that limit downside more, or hypothesis 2B, where finance trained CEOs are more likely to choose hedging strategies that preserve more upside potential.

Table 9 reports the summarized results from estimating a logit model where the dependent variables are the various possible strategies that the CEO can employ. More detailed results can be found in tables 9.1 to 9.6, attached in appendix A. Table 9 also shows the various results from the time lag between firm specific and individual specific variables.

Table 9 - Summary of results from hedging strategies

This table is the summary of the estimates from the results of the logit models where the dependent variables are the different binary hedging strategies of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Hedging strategies (Finance Variable results)				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
3 Way Collar	0.377**	0.3994**	0.3917**	0.449**	0.5492**
	[2.0749]	[2.1258]	[1.994]	[2.1688]	[2.5142]
Collar	-0.0948	-0.0399	0.0282	0.0937	0.1185
	[0.54]	[0.2163]	[0.1453]	[0.4556]	[0.5383]
Insurance	-0.2228	-0.2848	-0.4767	-0.8344**	-0.8987**
	[0.7208]	[0.8747]	[1.3764]	[2.1332]	[2.1057]
Linear	-0.5546***	-0.5857***	-0.6696***	-0.7593***	-0.9872***
	[3.0906]	[3.0971]	[3.2934]	[3.452]	[3.9814]
Pure Insurance	0.9426**	0.7955**	0.4823	0.4926	0.5896
	[2.4469]	[1.9713]	[1.1353]	[1.0928]	[1.2386]
Pure Sold Call	0.2016	0.2570	0.1850	0.0663	-0.2266
	[0.5215]	[0.6288]	[0.4206]	[0.1358]	[0.4064]

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

From the results, the finance training variable is negatively correlated to the decision to use a linear based strategy (at 1% significance level) but positively correlated to using a 3-way collar strategy (at 5% significance level). Two other weaker results also show possible correlations between the finance variable, a negative relationship with the insurance strategy and a positive relationship

with the pure insurance strategy respectively. There is an insignificant relationship between the finance variable and the collar and pure sold call strategies respectively.

Our findings suggest that finance-trained CEOs prefer to use a 3-way collar strategy more compared to non-finance trained CEOs. One potential reason why is that 3-way collars are relatively more complex, hence finance-trained CEOs are more likely to employing such hedging strategies compared to non-finance trained CEOs in, as they have more experience in this strategy and are able to better understand and weigh the pros and cons, i.e. more sophisticated knowledge in this field. This explanation is consistent with our analysis when deriving hypothesis 2. Another reason would be that finance-trained CEOs place greater emphasis compared to non-finance CEOs on not limiting too much upside benefits arising from price volatility. Hence, the results specific to the 3-way collar strategy seem to favor hypothesis 2B, where finance trained CEOs would want to preserve upside potential.

Our findings suggest that non-finance trained CEOs prefer the linear strategy more compared to finance trained CEOs. A linear strategy is much simpler to execute compared to the other hedging strategies available, hence, it is might be preferred more by non-finance trained CEOs, given the simplicity of execution. For a finance trained CEO however, while this strategy is also available and is simple to execute, they would have a wide pool of strategies they understand and can executive, such as the 3-way collar, albeit being more complex. Hence, the results from the linear strategy test rejects hypothesis 1B, which states a positive relationship between hedging intensive tools and finance trained CEO. A linear hedging strategy also limits upside potential and given that finance trained CEOs would not prefer such a strategy, this result seems to favor hypothesis 2B.

Looking at the weaker and potentially insignificant results arising from the insurance and pure insurance strategies, our findings suggest that finance trained CEOs would likely prefer to use pure insurance strategies compared to non-finance trained CEOs. However, non-finance trained CEOs would more likely use the insurance strategy compared to finance trained CEOs. While the two regressions are not directly comparable, these results seem to favor hypothesis 2B, given that the pure insurance strategy involves only the limiting of downside risk, whereas in the insurance strategy, the upside risk is somewhat reduced, given the presence of the sell call option portion of the strategy.

6. Theoretical and managerial implications

Understanding tendency of hedging decisions that come from executives with different background can be beneficial for firms, especially when it comes to decisions of choosing a CEO based on a level of risk that the firm might want to move towards. Working experience vary across CEOs and it is a crucial factor in determining corporate hiring decisions for executive positions. To illustrate, a firm that has little to no exposure to price risk, interest rate risk, and foreign exchange rate risk might find that benefits from hedging can hardly exceed its costs. Hence, it is better for them to appoint an executive that have tendency not to hedge, of which based on the current results of this paper, appear to be finance trained CEOs. On the other hand, a highly levered firm which is greatly exposed to price risk can make a great use of hedging to reduce financial distress costs, and an executive with a tendency to hedge is a good appointment for them.

Although there are tools to align managerial interests with the firm such as well-designed managerial compensation contracts and corporate governance to monitor hedging policies and activities, it cannot be denied that the phrase 'put the right man on the right job' has been around for ages and it is still relevant in the current world.

Our paper contributes to the literature on whether individual top executive matters for corporate decisions in term of hedging policies. It also contributes to the risk management literature, specifically on the related question on how firms hedge by focusing on hedging behavior of firms with CEOs with finance and non-finance background. Hence future research on hedging decisions can potentially include the finance variable as a control variable when investigating other explanatory variables.

7. Conclusion

In this paper, we investigated whether previous working experience would affect a CEO's decision making in hedging decisions, such as the decision to hedge, the extent of hedge as well as the type of hedging instruments preferred. Previous empirical research on the hedging instrument choice has tested different theories related to firm financial status, CEO age, CEO compensation and other dimensions related to managerial preferences.

To tackle endogeneity, we included firm fixed effects, as well as many control variables as recognised in the literature in order to reduce the omitted bias problem. We recognize there might be a reverse causality issue where a riskier firm that has a lower hedge ratio might employ a risker CEO but concluded based on a simple test on the firms that had changes in CEOs that there was no endogeneity. In addition, we added a time difference between firm variables and CEO variables to help deal with endogeneity, if any. We recognise that even in the event there was still endogeneity that cannot be fully eliminated, endogeneity would not affect our conclusion of results.

From the perspective of the decision to hedge, the extent of hedging and the type of hedging instruments available, hypothesis 1A, 1B, 2A and 2B were constructed based on previous literature on CEOs, with the basis that hedging decision making can be affected by past working experiences.

In hypothesis 1A, finance trained CEOs are more likely to hedge and hedge more. Finance trained CEOs are generally more exposed cost saving functions in the past, resulting in an unconscious bias towards cost savings, which in theory translates to a higher level of risk aversion. Hypothesis 1B expands this theory in the hedging strategy type, explaining because of the preference of placing greater emphasis on financial distress, finance trained CEOs are likely to choose hedging strategies that are more effective in limiting downside risk.

In the 2A hypothesis, a counter argument to hypothesis 1A is presented, that finance trained CEOs are less likely to hedge and hedge less. This is due to CEOs being more financially sophisticated and hence more exposed to the negative effects that arise from hedging, such as in the case of Metallgesellschaft. Furthermore, when conducting financial decision making, finance-trained CEOs are more likely to underweight the probability of rare events, such as drastic drops in oil price, making hedging less desirable. Hence supplementing this hypothesis is hypothesis 2B,

where instead of the focus on rare events that lead to financial distress, CEOs are more likely to choose strategies that preserve upside potential, while sacrificing some downside protection.

Based on the results, CEO financial working experience do seem to play an important part in the hedging decisions of oil and gas firms. The results on the decision to hedge is negatively correlated to CEOs with financial training and experience, but the results on the extent of production hedged are weaker and somewhat insignificant, although it also seems to show a negative correlation with having financial training and experience. Hence these results seem to favor hypothesis 2A, where in the case of finance trained CEOs hedging less, due to them being more financially sophisticated.

From the results on the types of hedging instruments used, we found a negative relationship between finance CEOs and the use of a linear strategy and a positive relationship between finance CEOs and the 3-way collar strategy. We also found weaker results on a negative relationship between finance CEOs and the insurance strategy and a positive relationship between finance CEOs and the pure insurance strategy. We had insignificant results for the collar strategy and the pure sold call strategy. These results seem to support hypothesis 2B, where finance trained CEOs seem to prefer strategies that preserve upside potential.

8. Further research

The different risk management tools of liquid assets, spare debt capacity, and hedging positions, under the concept of risk capacity as mentioned in Alviniussen and Jankensgård (2009), have not been fully instigated and ranked in accordance to which is prioritized over the other. From the risk management literature, collateral constraints-hypothesis of Rampini, Sufi and Viswanathan (2014) suggests that for financially constrained firms, hedging is less prioritized because collateral is optimally used for borrowing to finance real assets. This can be inferred to cash and liquid assets, as a form of collateral might be prioritized over hedging in financially constrained firms. However, the dynamic of risk capacity and characteristics of CEOs has never been observed. While we found relationships between financial background of CEOs and firm's hedging decision, further research can help enhance the understanding of the dynamic and preference of which risk management tool is more preferred than the other. From there, if the results are significant, further research can be conducted on all three risk management tools to give a more accurate assessment on the actual risk profile and characteristics of CEOs.

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Appendix A – Detailed testing information

Table 7.1 - Extent of production hedged (OLS, No firm fixed effects)

This table reports the estimates of the ordinary least squares model where the dependent variable is the hedged amount of total production for oil and gas firms. Population includes firms that did not hedge. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Non-binary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust t-statistics clustered by firm (White Period). Variable definitions are provided in Appendix B.

	Hedge Ratio (No firm fixed effects)				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	0.1218	0.1548	0.1779	0.1960	0.2264
	[0.8802]	[1.0918]	[1.2148]	[1.2936]	[1.4464]
Finance	-0.0491	-0.0568	-0.0613*	-0.0668*	-0.0721**
	[1.4107]	[1.6055]	[1.7137]	[1.8412]	[1.9617]
Age	-0.0027	-0.0031	-0.0034	-0.0037*	-0.0042*
	[1.3641]	[1.5169]	[1.619]	[1.7008]	[1.9082]
Duality	-0.0176	-0.0214	-0.0244	-0.0256	-0.0240
	[0.4755]	[0.5748]	[0.6522]	[0.6768]	[0.6267]
Founder Status	0.0579	0.0624	0.0634	0.0684	0.0712*
	[1.4135]	[1.5309]	[1.5377]	[1.6263]	[1.6571]
Options compensation	-0.1485**	-0.1284*	-0.1241*	-0.1338**	-0.1329**
	[2.3067]	[1.9354]	[1.9294]	[2.0701]	[1.9903]
Education	-0.0436*	-0.0458*	-0.042*	-0.0361	-0.0300
	[1.779]	[1.8316]	[1.6478]	[1.3852]	[1.1368]
Log(Total Assets)	0.1062***	0.1046***	0.1002***	0.097***	0.093***
	[5.8649]	[5.7396]	[5.4156]	[5.1601]	[4.8713]
ROA	0.0563	0.0537	0.0612	0.0427	0.0464
	[1.5557]	[1.3539]	[1.504]	[1.0219]	[1.1075]
Tobin's Q	-0.0028	-0.0039	-0.0040	-0.0047	-0.0045
	[0.8991]	[1.0299]	[0.9379]	[0.9999]	[0.9048]
Investment Rate	0.1687*	0.1773	0.1568	0.1575	0.1544
	[1.6925]	[1.6004]	[1.391]	[1.2573]	[1.1784]
Oil Volatility	-0.0026	-0.0031*	-0.0026*	-0.0031**	-0.0032**
	[1.5147]	[1.8615]	[1.6692]	[2.1541]	[2.2235]
Log(Cash/Total assets)	-0.0236***	-0.0243***	-0.0251***	-0.0256***	-0.026***
	[3.5559]	[3.6688]	[3.7508]	[3.7638]	[3.7583]
Total Debt/Total Assets	0.0462**	0.046**	0.0439**	0.0394*	0.037*
	[2.2229]	[2.1682]	[2.0649]	[1.8097]	[1.6588]
Pseudo R2	0.2836	0.2808	0.2765	0.2693	0.2632
No. of obs.	2065	1977	1800	1625	1448

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 7.2 - Extent of production hedged (With firm fixed effects)

This table reports the estimates of the ordinary least squares model where the dependent variable is the hedged amount of total production for oil and gas firms. Population includes firms that did not hedge. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Non-binary variables are winsorized at 1% on both tails. All regressions include firm fixed effects and period fixed effects. Figures in parentheses denote heteroskedasticity-robust t-statistics clustered by firm(White Period). Variable definitions are provided in Appendix B.

	Hedge Ratio (With firm fixed effects)				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	0.0286	0.0859	0.1114	0.1322	0.2503
	[0.2169]	[0.5663]	[0.7704]	[0.9213]	[1.5985]
Finance	-0.0320	-0.0474	-0.0821*	-0.1078**	-0.1328**
	[0.7637]	[1.0775]	[1.6577]	[2.1928]	[2.3822]
Age	0.0011	0.0003	-0.0004	-0.0014	-0.0032*
	[0.6855]	[0.1575]	[0.2496]	[0.8401]	[1.7626]
Duality	0.0239	0.0271	0.0225	0.0189	0.0184
	[0.7384]	[0.8228]	[0.6669]	[0.6388]	[0.6786]
Founder Status	-0.0293	-0.0270	0.0017	0.0277	0.0290
	[0.8778]	[0.7954]	[0.0453]	[0.7646]	[0.7107]
Options compensation	0.0406	0.0734	0.0904**	0.0641*	0.0580
	[0.858]	[1.4426]	[2.1247]	[1.8569]	[1.5764]
Education	-0.0227	-0.0262	-0.0205	-0.0132	0.0054
	[1.2069]	[1.1637]	[0.9021]	[0.5783]	[0.2654]
Log(Total Assets)	0.0868***	0.0889**	0.0931***	0.1015***	0.0937**
	[2.6594]	[2.5494]	[2.6723]	[2.7472]	[2.3406]
ROA	0.0160	0.0254*	0.0278**	0.0131	0.0123
	[1.2164]	[1.7446]	[2.0933]	[0.9955]	[0.8631]
Tobin's Q	0.0015	0.0004	-0.0001	-0.0001	-0.0003
	[0.8132]	[0.1651]	[0.0226]	[0.0196]	[0.0833]
Investment Rate	0.0267	0.0412	0.0349	0.0143	0.0221
	[0.5156]	[0.763]	[0.6263]	[0.2215]	[0.3604]
Oil Volatility	-0.002*	-0.0026**	-0.002*	-0.0013	-0.0022**
	[1.6506]	[2.367]	[1.8262]	[1.194]	[2.0154]
Log(Cash/Total assets)	-0.007*	-0.0058	-0.0054	-0.0054	-0.0051
	[1.845]	[1.5326]	[1.4108]	[1.3653]	[1.2089]
Total Debt/Total Assets	-0.0812***	-0.0776***	-0.0761***	-0.071***	-0.0785***
	[2.8386]	[2.805]	[2.887]	[2.6]	[2.6944]
Pseudo R2	0.8498	0.8502	0.8573	0.8589	0.8594
No. of obs.	2065	1977	1800	1625	1448

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 7.3 - Extent of production hedged (only firms with hedged production)

This table reports the estimates of the ordinary least squares model where the dependent variable is the hedged amount of total production for oil and gas firms. Population is reduced to include only firms that hedged. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Non-binary variables are winsorized at 1% on both tails. All regressions include firm fixed effects and period fixed effects. Figures in parentheses denote heteroskedasticity-robust t-statistics clustered by firm (White Period). Variable definitions are provided in Appendix B.

Hedge Ratio (Companies with hedged production)					
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	-0.2401	-0.0881	0.0360	0.2113	0.3343
	[0.6603]	[0.2539]	[0.1054]	[0.6592]	[1.254]
Finance	-0.0681	-0.1003	-0.1361**	-0.2122***	-0.2421***
	[1.1467]	[1.599]	[2.3819]	[4.5956]	[4.9108]
Age	0.0039	0.0031	0.0002	-0.0030	-0.0062**
	[1.0122]	[0.7247]	[0.0481]	[0.7724]	[2.0465]
Duality	0.0205	0.0159	0.0019	0.0084	0.0126
	[0.4514]	[0.3324]	[0.0417]	[0.2009]	[0.3738]
Founder Status	-0.0087	-0.0189	0.0240	0.0575	0.0226
	[0.1426]	[0.3211]	[0.4157]	[1.1157]	[0.5468]
Options compensation	0.0931	0.1400	0.1119	0.1030	0.1392
	[0.8275]	[1.3616]	[1.2918]	[1.2625]	[1.4918]
Education	-0.0127	-0.0122	-0.0106	-0.0002	0.0293
	[0.4028]	[0.3361]	[0.2975]	[0.006]	[1.114]
Log(Total Assets)	0.194**	0.1686**	0.1745**	0.1605**	0.1675**
	[2.2677]	[2.3325]	[2.3763]	[2.2383]	[2.5483]
ROA	0.1076***	0.0815***	0.0353	0.0441	0.0501*
	[3.3048]	[2.6947]	[1.2782]	[1.5787]	[1.7139]
Tobin's Q	-0.0387	-0.0304	-0.0194	-0.0028	0.0075
	[1.304]	[0.968]	[0.6067]	[0.0886]	[0.2591]
Investment Rate	-0.0584	-0.0530	-0.0459	-0.0636	-0.1974
	[0.6725]	[0.5301]	[0.3964]	[0.5218]	[1.4987]
Oil Volatility	-0.0047**	-0.0052***	-0.0033*	-0.0018	-0.0029
	[2.1045]	[2.6396]	[1.6866]	[0.9051]	[1.4336]
Log(Cash/Total assets)	0.0013	0.0021	0.0023	-0.0009	-0.0023
	[0.2605]	[0.4165]	[0.4466]	[0.1723]	[0.4499]
Total Debt/Total Assets	-0.0302	-0.0851	-0.0973**	-0.1051***	-0.1095***
	[0.4301]	[1.6334]	[2.1369]	[2.6534]	[3.0058]
Pseudo R2	0.7064	0.7068	0.7226	0.7383	0.7605
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 9.1 - 3-way collar strategy

This table reports the estimates of the logit models where the dependent variable is the 3 way collar strategy of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	3 Way Collar				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	-3.8343***	-3.4933***	-3.4607***	-3.7949***	-3.9329***
	[4.7996]	[4.2988]	[4.1187]	[4.2429]	[4.1285]
Finance	0.377**	0.3994**	0.3917**	0.449**	0.5492**
	[2.0749]	[2.1258]	[1.994]	[2.1688]	[2.5142]
Age	-0.0238**	-0.0221**	-0.0211*	-0.0147	-0.0108
	[2.1915]	[1.9622]	[1.7924]	[1.181]	[0.8118]
Duality	0.6573***	0.5878***	0.5385***	0.4285**	0.3721**
	[4.2163]	[3.6359]	[3.1814]	[2.4052]	[1.9602]
Founder Status	0.5056***	0.5431***	0.5827***	0.6258***	0.6196***
	[3.1448]	[3.2734]	[3.37]	[3.4399]	[3.1941]
Options compensation	-0.0414	0.1436	-0.0316	0.1527	-0.1756
	[0.0685]	[0.2364]	[0.0491]	[0.2292]	[0.2467]
Education	-0.2653**	-0.2519**	-0.2635**	-0.2577**	-0.2484*
	[2.485]	[2.2766]	[2.2698]	[2.1145]	[1.9089]
Log(Total Assets)	1.254***	1.1908***	1.1777***	1.1882***	1.211***
	[9.8389]	[9.1471]	[8.6151]	[8.1416]	[7.6329]
Tobin's Q	-0.6421***	-0.6707***	-0.7273***	-0.8325***	-0.9342***
	[4.3049]	[4.3368]	[4.3641]	[4.5373]	[4.53]
Investment Rate	2.2296**	2.1352*	2.2038*	2.9144**	2.7561
	[2.0351]	[1.8464]	[1.7369]	[1.9902]	[1.6302]
Log(Cash/Total assets)	0.0335	0.0317	0.0238	0.0158	0.0070
	[0.914]	[0.8355]	[0.5975]	[0.3763]	[0.1559]
Oil Volatility	0.0072	-0.0155	-0.0105	-0.0174	-0.0158
	[0.2322]	[0.4911]	[0.3283]	[0.5174]	[0.4563]
Total Debt/Total Assets	0.8572***	0.5522**	0.4798**	0.4635*	0.2905
	[3.2297]	[2.2756]	[2.0172]	[1.8735]	[1.2318]
ROA	-0.5734	-0.4379	-0.5372	-0.4915	0.0249
	[1.038]	[0.8081]	[1.006]	[0.8807]	[0.0428]
Pseudo R2	0.1421	0.1345	0.1343	0.1384	0.1415
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 9.2 - Collar strategy

This table reports the estimates of the logit models where the dependent variable is the collar strategy of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Collar				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	-0.6538	-0.9258	-1.0967	-1.0150	-0.9577
	[0.8996]	[1.2092]	[1.3553]	[1.1896]	[1.0552]
Finance	-0.0948	-0.0399	0.0282	0.0937	0.1185
	[0.54]	[0.2163]	[0.1453]	[0.4556]	[0.5383]
Age	0.0119	0.0143	0.0141	0.0114	0.0119
	[1.1588]	[1.3105]	[1.2289]	[0.9366]	[0.9156]
Duality	-0.2449	-0.2819*	-0.3087*	-0.296*	-0.1913
	[1.6177]	[1.7623]	[1.8221]	[1.6482]	[0.9907]
Founder Status	-0.0824	-0.0741	-0.0732	-0.1206	-0.1836
	[0.5104]	[0.437]	[0.4094]	[0.6365]	[0.9039]
Options compensation	1.5818***	1.9339***	2.1934***	2.2846***	2.7003***
	[2.9515]	[3.54]	[3.9055]	[3.9226]	[4.3237]
Education	-0.2089*	-0.2498**	-0.2107*	-0.2154*	-0.1678
	[1.9596]	[2.2275]	[1.783]	[1.7212]	[1.262]
Log(Total Assets)	-0.3955***	-0.359***	-0.3178***	-0.3163***	-0.3285***
	[4.3109]	[3.7658]	[3.1879]	[3.0155]	[2.9492]
ROA	0.3285	0.5123	0.9753	1.0782	1.0449
	[0.552]	[0.8638]	[1.4049]	[1.404]	[1.344]
Tobin's Q	0.6772***	0.612***	0.5943***	0.5818***	0.5638***
	[5.5476]	[4.6944]	[4.2006]	[3.7741]	[3.3229]
Investment Rate	-1.3843	-0.8159	-1.4150	-0.3231	-0.0150
	[1.2381]	[0.7026]	[1.0871]	[0.2218]	[0.0095]
Log(Cash/Total assets)	-0.1232***	-0.1429***	-0.145***	-0.1495***	-0.1505***
	[3.4946]	[3.8752]	[3.7178]	[3.6237]	[3.3712]
Oil Volatility	0.0042	-0.0145	-0.0233	-0.0336	-0.0684*
	[0.132]	[0.4446]	[0.6848]	[0.9279]	[1.7915]
Total Debt/Total Assets	-1.471***	-1.3856***	-1.3191***	-1.296***	-1.3274***
	[4.9873]	[4.7366]	[4.528]	[4.4964]	[4.434]
Pseudo R2	0.0820	0.0847	0.0848	0.0864	0.0911
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 9.3 - Insurance strategy

This table reports the estimates of the logit models where the dependent variable is the insurance strategy of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Insurance				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	-2.2307*	-1.7912	-1.4565	-1.1291	-1.0856
	[1.6643]	[1.2893]	[1.0224]	[0.7449]	[0.6706]
Finance	-0.2228	-0.2848	-0.4767	-0.8344**	-0.8987**
	[0.7208]	[0.8747]	[1.3764]	[2.1332]	[2.1057]
Age	-0.0026	-0.0116	-0.0108	-0.0177	-0.0137
	[0.14]	[0.5925]	[0.5326]	[0.8103]	[0.5779]
Duality	-0.7211***	-0.8213***	-0.859***	-1.0252***	-1.1305***
	[2.5997]	[2.778]	[2.8243]	[3.1468]	[3.2206]
Founder Status	0.0812	0.0726	0.1996	0.4053	0.3689
	[0.2663]	[0.2282]	[0.6295]	[1.2587]	[1.0848]
Options compensation	-3.3209*	-5.8004**	-5.5846**	-5.4663**	-5.0562*
	[1.744]	[2.2064]	[2.1609]	[2.0894]	[1.9373]
Education	0.347*	0.3639*	0.3296	0.3770	0.2725
	[1.7332]	[1.6785]	[1.4804]	[1.578]	[1.068]
Log(Total Assets)	-0.1178	-0.0703	-0.0911	-0.1220	-0.1241
	[0.6512]	[0.3602]	[0.4607]	[0.5848]	[0.5625]
ROA	0.4358	0.6173	0.5225	0.4900	0.6500
	[0.4072]	[0.5501]	[0.465]	[0.4102]	[0.5122]
Tobin's Q	-0.0556	0.0306	0.0001	0.0633	0.1268
	[0.2321]	[0.1227]	[0.0003]	[0.232]	[0.4349]
Investment Rate	-4.2011	-3.8855	-3.0672	-2.3175	-1.6196
	[1.538]	[1.4096]	[1.1022]	[0.7955]	[0.5327]
Log(Cash/Total assets)	-0.0852	-0.0732	-0.0527	-0.0643	-0.0306
	[1.3826]	[1.1283]	[0.7808]	[0.918]	[0.4025]
Oil Volatility	0.0128	0.0041	-0.0046	-0.0026	0.0019
	[0.2265]	[0.0715]	[0.0787]	[0.0426]	[0.0294]
Total Debt/Total Assets	-0.2372	-0.3780	-0.5362	-0.5268	-0.5898
	[0.5065]	[0.849]	[1.1922]	[1.2165]	[1.3301]
Pseudo R2	0.0407	0.0524	0.0548	0.0730	0.0769
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 9.4 - Linear strategy

This table reports the estimates of the logit models where the dependent variable is the linear strategy of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Linear				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	0.1251	0.5350	1.0614	1.3483	1.8865**
	[0.1722]	[0.7151]	[1.3565]	[1.6282]	[2.0918]
Finance	-0.5546***	-0.5857***	-0.6696***	-0.7593***	-0.9872***
	[3.0906]	[3.0971]	[3.2934]	[3.452]	[3.9814]
Age	-0.0043	-0.0093	-0.0193*	-0.0276**	-0.0376***
	[0.4248]	[0.8714]	[1.7256]	[2.3007]	[2.8583]
Duality	-0.1472	-0.0195	0.0575	0.1544	0.1856
	[0.9851]	[0.1243]	[0.3476]	[0.8778]	[0.9651]
Founder Status	-0.4291**	-0.3996**	-0.4475**	-0.4531**	-0.475**
	[2.557]	[2.2976]	[2.4455]	[2.3517]	[2.2824]
Options compensation	-0.3314	-1.182*	-1.5202**	-1.8509**	-2.4548***
	[0.5525]	[1.7589]	[2.0792]	[2.3063]	[2.6817]
Education	0.7238***	0.699***	0.6502***	0.5856***	0.5601***
	[6.8399]	[6.3322]	[5.5944]	[4.7911]	[4.2349]
Log(Total Assets)	-0.4743***	-0.4438***	-0.4497***	-0.4096***	-0.4063***
	[4.9617]	[4.4744]	[4.2803]	[3.6978]	[3.3415]
ROA	0.5044	0.7164	0.7385	0.4191	0.2449
	[0.8895]	[1.3325]	[1.2818]	[0.7092]	[0.4254]
Tobin's Q	0.0978	0.0426	0.0773	0.0994	0.0285
	[0.7846]	[0.3269]	[0.5519]	[0.661]	[0.1692]
Investment Rate	0.2458	0.9893	1.8629	1.9398	2.5908*
	[0.2353]	[0.9098]	[1.5876]	[1.4573]	[1.707]
Log(Cash/Total assets)	0.0762**	0.0854**	0.0739*	0.0558	0.0646
	[2.0825]	[2.22]	[1.8283]	[1.3207]	[1.3895]
Oil Volatility	0.0077	-0.0032	0.0048	0.0127	0.0295
	[0.243]	[0.1004]	[0.148]	[0.3767]	[0.8555]
Total Debt/Total Assets	0.4638**	0.0520	-0.1482	-0.2581	-0.1588
	[2.0389]	[0.2572]	[0.7635]	[1.3253]	[0.7649]
Pseudo R2	0.0677	0.0669	0.0693	0.0671	0.0777
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 9.5 - Pure insurance strategy

This table reports the estimates of the logit models where the dependent variable is the pure insurance strategy of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Pure Insurance				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	1.9547	2.8973*	3.9966**	4.3974***	4.366**
	[1.3734]	[1.9357]	[2.5227]	[2.6711]	[2.5662]
Finance	0.9426**	0.7955**	0.4823	0.4926	0.5896
	[2.4469]	[1.9713]	[1.1353]	[1.0928]	[1.2386]
Age	-0.0381*	-0.0515**	-0.0669***	-0.0669***	-0.0681***
	[1.9033]	[2.3993]	[2.8822]	[2.7562]	[2.7116]
Duality	0.4911	0.3089	0.1478	0.2009	0.3994
	[1.5164]	[0.9054]	[0.4127]	[0.531]	[0.9911]
Founder Status	-0.9067*	-0.803*	-0.7461	-0.6768	-0.6485
	[1.9216]	[1.6875]	[1.5465]	[1.3789]	[1.28]
Options compensation	-0.0007	-0.1460	-0.6055	-0.7051	-0.3538
	[0.0005]	[0.1075]	[0.4704]	[0.5542]	[0.2772]
Education	0.3432	0.3166	0.2283	0.2055	0.1725
	[1.4777]	[1.2566]	[0.8534]	[0.7386]	[0.6029]
Log(Total Assets)	-0.8535***	-0.7831***	-0.7112***	-0.7753***	-0.8366***
	[3.827]	[3.3383]	[2.908]	[3.0132]	[3.1191]
ROA	-0.3978	-0.2724	-0.3898	-0.4397	-0.4151
	[0.5036]	[0.3613]	[0.5189]	[0.5388]	[0.5038]
Tobin's Q	-1.8518***	-1.957***	-1.9005***	-1.9881***	-1.787***
	[3.5469]	[3.4781]	[3.1572]	[3.0266]	[2.6452]
Investment Rate	-7.7907**	-10.5351**	-10.4188**	-9.1261**	-7.84*
	[2.1895]	[2.4882]	[2.3464]	[2.0645]	[1.7762]
Log(Cash/Total assets)	-0.0291	-0.0371	0.0136	0.0600	0.0440
	[0.3329]	[0.4097]	[0.1419]	[0.5804]	[0.3991]
Oil Volatility	-0.0723	-0.0697	-0.0578	-0.0546	-0.0648
	[0.9347]	[0.8885]	[0.7248]	[0.6628]	[0.7788]
Total Debt/Total Assets	2.0002***	1.7581***	1.6045**	1.4964**	1.3012*
	[3.366]	[2.8889]	[2.5404]	[2.2173]	[1.8633]
Pseudo R2	0.2060	0.2103	0.2072	0.2103	0.2145
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Table 9.6 - Pure sold call strategy

This table reports the estimates of the logit models where the dependent variable is the pure sold call strategy of the oil and gas firms. Time indicates the amount of lag between firm based variables and individual based variables where a difference of 1 denotes 1 period lag. Nonbinary variables are winsorized at 1% on both tails. All regressions include period fixed effects. Figures in parentheses denote heteroskedasticity-robust Z-statistics clustered by firm. Variable definitions are provided in Appendix B.

	Pure Sold Call				
	Time = 0	**Time = 1**	**Time = 2**	**Time = 3**	**Time = 4**
Constant	-6.7709***	-6.9817***	-7.3465***	-7.5425***	-7.9847***
	[3.7811]	[3.6737]	[3.6388]	[3.31]	[3.0652]
Finance	0.2016	0.2570	0.1850	0.0663	-0.2266
	[0.5215]	[0.6288]	[0.4206]	[0.1358]	[0.4064]
Age	0.0956***	0.0954***	0.0967***	0.0989***	0.0895**
	[3.5372]	[3.2817]	[3.1136]	[2.8552]	[2.333]
Duality	-1.2489***	-1.337***	-1.4264***	-1.7019***	-1.7403***
	[3.5218]	[3.5763]	[3.6234]	[3.8892]	[3.5972]
Founder Status	0.2842	0.3546	0.5642	0.6865*	0.7963*
	[0.7854]	[0.9678]	[1.5255]	[1.7696]	[1.9276]
Options compensation	-4.0019**	-2.8219*	-1.9048	-0.5951	-0.3760
	[2.3862]	[1.8198]	[1.2858]	[0.4217]	[0.2528]
Education	-1.9003***	-1.9397***	-1.9364***	-1.9474***	-1.8427***
	[6.4275]	[6.3313]	[6.0527]	[5.5088]	[4.8615]
Log(Total Assets)	0.5324**	0.4608**	0.4115*	0.4204	0.4805
	[2.3516]	[1.9626]	[1.6532]	[1.5906]	[1.5371]
ROA	-0.5776	-0.8999	-0.8837	-1.1046	-1.3979*
	[0.6215]	[1.2825]	[1.334]	[1.5799]	[1.9368]
Tobin's Q	-0.8637**	-0.6135*	-0.4693	-0.2848	-0.1566
	[2.5169]	[1.8317]	[1.3528]	[0.7779]	[0.4021]
Investment Rate	3.1175	1.6469	1.1158	-2.6462	-0.9583
	[1.5893]	[0.7363]	[0.4501]	[0.6199]	[0.2203]
Log(Cash/Total assets)	0.0765	0.0352	0.0047	-0.0035	-0.0844
	[0.9704]	[0.4321]	[0.0551]	[0.0381]	[0.8768]
Oil Volatility	-0.0667	-0.0700	-0.0507	-0.0074	0.0078
	[0.9245]	[0.9518]	[0.7038]	[0.1014]	[0.1024]
Total Debt/Total Assets	0.5292	0.7561*	0.8561**	0.5058	0.4295
	[1.0163]	[1.6913]	[2.0182]	[1.1044]	[0.8541]
Pseudo R2	0.2231	0.2302	0.2449	0.2540	0.2605
No. of obs.	1134	1050	962	872	770

***Significant at the 0.01 level
**Significant at the 0.05 level
*Significant at the 0.10 level

Appendix B – Definition of variables

Hedging variables	
Hedging Decision	Binary variable that takes the value of 1 if the firm has a hedge ratio above 0
Hedge Ratio	% of total production volume hedged
Linear	Binary variable that takes the value of 1 if the firm uses a linear hedging strategy
3-Way Collar	Binary variable that takes the value of 1 if the firm uses a collar hedging strategy
Collar	Binary variable that takes the value of 1 if the firm uses a 3-way collar hedging strategy
Insurance	Binary variable that takes the value of 1 if the firm uses an insurance hedging strategy
Pure Insurance	Binary variable that takes the value of 1 if the firm uses a pure insurance hedging strategy
Pure Sold Call Strategy	Binary variable that takes the value of 1 if the firm uses a pure sold call hedging strategy
Cash/Cashless	Binary variable that takes the value of 1 if the firm uses a Cash hedging type strategy
CEO variables	
Finance	Binary variable that takes the value of 1 if the CEO has finance working experience
Age	CEO age adjusted for year effects, extracted from bloomberg E.g. if John is 67 in 2017, john will be 66 in 2016
Duality	Binary variable that takes the value of 1 if the CEO is concurrently the chairman of the board in the same period
Founder Status	Binary variable that takes the value of 1 if the CEO is also a founding member of the firm
Options compensation	Computed as fair value of options issued by the firm to the CEO as a function of total compensation received by CEO
Education	Based on the highest level of the CEO's education, values assigned from 0 to 3. 0 represents education lower than university level, 1 represents a bachleor's degree, 2 represents masters/MBA/junior doctorate level and 3 represents CEO holding a PHD
Firm specific control variables	
Log(Total Assets)	Natural lograthim of total assets of the firm
ROA	Calculated as sales over total assets
Tobin's Q	(Market Capitalization + Total Debt)/Total assets
Investment Rate	Capital expenditure over net PPE
Log(Cash/Total assets)	Log (cash and cash equivalents, scaled by total assets)
Total Debt/Total Assets	Total debt scaled by total assets
Oil Volatility	Standard deviation of daily returns for the WTI Crude oil in a given period

Appendix C – Correlation matrix

This is the correlation matrix of the variables used, excluding the hedge binary variables as they are derived from the production hedge (hedge ratio) variable.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Production hedged	1.0000													
2.Finance	-0.1841	1.0000												
3.Age	-0.0954	-0.2968	1.0000											
4.Duality	0.0159	-0.1769	0.2992	1.0000										
5.Founder	0.1088	0.0645	-0.0755	0.0936	1.0000									
6.Options Compensation	-0.1502	0.0781	0.0539	-0.0517	-0.0294	1.0000								
7.Education	-0.0062	-0.0237	-0.0705	-0.1051	-0.0261	-0.0333	1.0000							
8.Log(Total assets)	0.4695	-0.2956	-0.0574	0.0461	0.0731	-0.0639	0.2070	1.0000						
9.ROA	0.2200	-0.1635	0.0110	0.0921	0.0144	-0.1338	0.0469	0.3914	1.0000					
10.Tobin's Q	-0.1735	0.0776	-0.0081	-0.0708	0.0125	0.1006	-0.0560	-0.3529	-0.5347	1.0000				
11.Investment Rage	0.0190	0.0788	-0.1288	-0.1049	0.0466	0.0641	-0.0241	-0.0212	-0.0551	0.0363	1.0000			
12.Log(cash/total assets)	-0.2810	0.1259	0.0026	-0.0768	0.0088	0.1431	0.0023	-0.2436	-0.1138	0.0361	0.1396	1.0000		
13.Debt/Total assets	0.0253	0.0801	-0.0385	-0.0001	-0.0115	-0.0331	-0.0279	-0.0994	-0.3717	0.3587	0.0062	-0.0530	1.0000	
14.Oil Volatility	0.0134	-0.0035	-0.0128	0.0055	0.0102	-0.0158	0.0029	0.0530	0.0033	-0.0473	0.0195	-0.0295	0.0247	1.0000

Appendix D – Example of CEO data coding

This appendix illustrates data coding of the CEO binary variables of finance, education, duality and founder status. Below is the biography of R.A Walker, a CEO of Anadarko Petroleum Corporation. The data is available online and extracted on 2nd April 2018 from the website https://www.bloomberg.com/research/stocks/people/person.asp?personId=358845&privcapId=251349

R. A. Walker

Chairman, President & CEO, Anadarko Petroleum Corporation

Age	Total Calculated Compensation
60	$16,959,900

This person is connected to **43** board members in **4** different organizations across **13** different industries.

See Board Relationships

Background*

Mr. R. A. Walker, also known as Al, has been the Chairman of Anadarko Petroleum Corporation since May 14, 2013, has been Chief Executive Officer since May 15, 2012 and has been its President since February 2010. Mr. Walker served as the Chief Operating Officer of Anadarko Petroleum Corp. from March 1, 2009 to May 15, 2012. He served as the Managing Director for the Global Energy Group of UBS Investment Bank from 2003 to 2005, where he was responsible for UBS's upstream energy practice. He joined Anadarko Petroleum Corp. on September 6, 2005 as Senior Vice President of Finance and Chief Financial Officer and served until March 2009. He served as Director of Seagull Energy Corp. and Enex Resources Corp. He served as the President and Chief Financial Officer of 3TEC Energy Corporation until its merger with Plains Exploration and Production Company in 2003. From 1987 to 2000, he worked for Prudential Financial in a variety of merchant banking positions as Senior Managing Director and Co-head of Prudential Capital Group. Mr. Walker has experience in both the banking and energy sectors. He served as the Chairman of Western Gas Holdings, LLC from August 2007 to October 2009Mr. Walker serves as a Director of Ocean Energy Inc. and the Houston Producers Forum. He has been a Director of Anadarko Petroleum Corporation since May 2012. He has been Director of BOK Financial Corporation since 2013. He serves on the Board of Trustees for the United Way of Greater Houston and the Houston Museum of Natural Science. He had been a Director at Maxus Energy Corporation since 1994. He served as a Director of Centerpoint Energy Resources Corp. since April 2010. He served as a Director of CenterPoint Energy, Inc. since April 22, 2010 until April 23, 2015. He served as a Director of Western Gas Equity Holdings, LLC from September 2012 to March 2013. Mr. Walker served as a Director of Temple-Inland Inc. since November 2008 February 2012. He served as a Director of Western Gas Holdings, LLC from August 2008 to March 12, 2013. He served as Director of TIN Inc., and Global Natural Resources. He served as a Director of Texas Eastern Products Pipeline Company LLC since July 2002. He served as a Director of 3TEC Energy Corporation since 2000. Mr. Walker Holds a Bachelor of Science in 1979 and a Masters of Business Administration in 1984 from the University of Tulsa.

We looked at the history of the CEO prior to joining the firm and focused on key words that would indicate financial training, such as chief financial officer, vice president of finance, accountant, finance executive, controller, and auditor, to determine if he had previous financial training.

In this example, R. A. Walker is the CEO of Anadarko Petroleum Corporation for the sample period between Q4 2012 – Q3 2016. Given that R. A. Walker was previously the senior vice

president of finance and CFO for Anadarko corporation and was the chief financial officer of 3TEC Energy Corporation, we deemed him to have finance training and experience and hence is assigned a value of 1.

Education wise, Mr. R. A. Walker has a highest level of education capped at an MBA. Hence, we value of 2 is assigned for education.

For the duality variable, although Mr. R. A. Walker holds both the chairman and CEO position in the firm as 14 May 2013, we follow the dates of which he actually held office. Hence, for the period of Q4 2012 to Q2, 2013, we set the duality variable to 0, as while he was a CEO then, he did not hold the chairman status as at that period. From Q3 2013 onwards, the duality variable is set as 1. Discretion is used when assigning the value, as although he gained duality status on 14 May 2013, we still assigned a value of 0 for Q2 2013, as he was not the chairman for the majority of the period.

Looking at founder status, the Bloomberg biography does not state that he is a founder of the firm. We cross referenced this to other supporting websites, such as the firm home page and as he was not listed as one of the founding members, we assigned him a value of 0.