*Article*

# Hedging Around a CEO Change: Further Evidence from the Oil and Gas Industry

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## ABSTRACT

This study examines hedging activities around hiring of chief executive officer (CEO). Data on the use of derivatives by a sample of oil and gas firms were hand collected from the 10-k filings and compared for several years before and after a CEO change. A regression method was employed to examine if hedging is associated with the CEO change after controlling for the effects of hedging variables. The findings show that net hedging decreased from three years prior to CEO hiring and increased for several years thereafter. The regression results show that hiring of a new CEO explains change in hedging one year after the CEO is hired when interactions among the explanatory variables are considered. This is one of the few studies that examine the relationship between hedging behavior and CEO change.

## KEYWORDS

Hedging, CEO Hiring, Risk Management, Oil and Gas

## INTRODUCTION

Although price risk is common in the oil and gas industry (Scholtens and Wang 2008; Mohanty and Nanda 2011; and Gogineni 2010); and there is evidence that oil and gas firms hedge price risk (Haushalter 2000; Jin and Jorion 2006; and Hong et al. 2019), hedging occurs in other industries. For example, there is evidence of hedging in gold mining (Tufano 1996), in the airline industry (Carter et al. 2006), in the pharmaceutical industry (Choi et al. 2013), and in the insurance industry (Cummins et al. 1997). A survey by El-Masry (2006) shows that 67 percent of the U.K. firms use derivatives to hedge risk. A survey by Bodnar et al. (1998) reports that firms use derivatives to manage foreign exchange, interest rate, commodity, and equity risks.

Kumar and Rabinovitch (2013) observe that hedging is low in the year a CEO is hired supporting the entrenchment argument that a new CEO has less incentive to access free-cash flow to fulfill his or her empire-building initiative. The incentive to access free-cash flow, and hence the level of hedging can increase overtime as the CEO's tenure with the firm increases. Prior empirical studies including that by Kumar and Rabinovitch (2013) do not provide direct evidence of hedging behavior of a firm in the years surrounding a CEO hiring. This study examines hedging activities around a CEO change in the oil and gas industry[1].

To measure the impact of a CEO change on hedging, net hedging is used which adjusts for the effects of factors specific to the oil and gas industry, e.g., changes in oil price. Net hedging is computed

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[1] As pointed out by Kumar and Rabinovitch (2013), because of price volatility, oil and gas industry is an excellent example for studying hedging behavior.

as hedging activities by a firm that changed its CEO in a particular year minus hedging activities of a firm that did not change its CEO in the same year.

The empirical findings of this study show that net hedging is significantly less in the year a CEO is hired when compared to net hedging three years before. Furthermore, net hedging is significantly higher in the years after a new CEO is hired suggesting that he or she increased the level of hedging possibly for entrenchment and free-cash flow reasons. These results validate a positive relationship between hedging and CEO tenure. The regression results provide evidence that change in hedging a year after a CEO hiring can be attributed to the new CEO even after controlling for firm size, debt, liquidity, return on assets, oil price volatility, and interaction effects. The remainder of the paper is organized as follows. The next section provides background of the paper, followed by descriptions of the data and sample. The following section presents the empirical results. Concluding remarks are given in the final section.

## BACKGROUND

### *HEDGING BENEFITS*

Prior studies identify several benefits of hedging. Mayers and Smith (1982) and Smith and Stulz (1985) indicate that hedging lowers variability of cash flows and expected costs of financial distress. Smith and Stulz (1985) argue that volatility of a firm's earnings is costly when the tax function is convex. Hedging can reduce earnings variability, thereby reducing tax payments for the firm. Froot et al. (1993) argue that, when external funds are costlier than internal funds, hedging provides earnings stability and helps avoid underinvestment by the managers. It ensures enough internal funds, which can be invested in profitable investment projects.

Managers may also engage in hedging to maximize their own utility functions (Stulz 1984; and Smith and Stulz 1985). Stulz (1984) shows that risk-averse managers pursue optimal hedging policies under the assumption of maximizing utility functions. Smith and Stulz (1985) show that hedging can be associated with managerial risk aversion. They argue that risk-averse managers may hedge less if their compensation is tied to the volatility of the firm's stock. On the other hand, risk-averse managers will hedge more if they own more of the firm's stock as their future payoff is linearly related to firm value. For example, Tufano (1996) finds that companies with high managerial stock ownership hedge more, and companies with managers holding higher percentage of stock options hedge less. Rogers (2002) provides evidence that firms whose managers are compensated with greater risk-taking incentives hedge less.

### *NEW CEO, TENURE, AND RISK-TAKING*

Prior empirical studies that examine CEO tenure and risk taking provide mixed results. One group of studies claims a negative association between CEO tenure and risk taking. Chakraborty et al. (2007) argue that a longer tenured CEO has greater human capital invested in the firm, and hence will incur higher costs if terminated when compared to a new CEO. Thus, a longer tenured CEO is less likely to take risk. Chakraborty et al. (2007) find a negative relationship between termination risk, which depends on CEO tenure, and risk taking. Similarly, Coles et al. (2006) observe a negative association between CEO tenure and firm's research and development (R&D) and leverage ratios. Berger et al. (1997) argue that CEOs with longer tenure and higher cash compensation are more likely to be entrenched and will avoid risk. They find that CEO tenure is significantly negatively related to firm risk. A more recent study by Kumar and Rabinovitch (2013) shows that hedging intensity is high when a CEO has a very long tenure. A CEO with a very long tenure and more authority is more entrenched and is less inclined to take risk.

Another group of studies show that risk taking by a firm and CEO tenure have a positive association. Bloom and Milkovich (1998) find a positive association between the tenure of a CEO and several measures of a firm's risk. Serfling (2014) shows a positive relationship between CEO tenure and stock return volatility. He argues that new managers have harsher penalties for making mistakes in terms of future career opportunities and are less likely to take risk.

This study contributes to prior literature by examining changes in a firm's hedging activities before and after a CEO is hired. If hedging propensity is low in the year of a new CEO hiring as observed by Kumar and Rabinovitch (2013), declining hedging activities prior to the hiring can be expected. The following hypothesis is proposed:

**H1.** Hedging activities will decline from prior years to the year of CEO hiring.

Following Kumar and Rabinovitch's (2013) entrenchment argument that risk taking has a negative relationship with CEO tenure, hedging activities are expected to rise after a new CEO is hired. Thus, the following hypothesis is proposed:

**H2.** Hedging activities will increase from the year of CEO hiring to subsequent years.

A regression analysis is conducted to examine if the relationship between hiring a new CEO and changes in hedging activities holds after controlling for other factors that can impact the use of derivatives. The following hypotheses are specified for the regression analysis:

**H3.** There is a significant and negative association between changes in hedging activities in prior years and CEO change after controlling for the effects of other hedging variables.

**H4.** There is a significant and positive association between the CEO change variable and changes in hedging activities in subsequent years after controlling for the effects of other hedging variables.

The control variables are selected because of their relationships with hedging observed in prior empirical studies. Because of the small sample size, the number of the explanatory variables in the regressions is limited to six.

Prior empirical studies by Nance et al. (1993) and Berkman and Bradbury (1996) find a positive relationship between firm size and the use of derivatives. Because derivatives involve costs, larger firms have a better ability to employ derivatives than smaller firms. A positive relationship between hedging and firm size (SIZE) is expected.

Mayers and Smith (1982) and Smith and Stulz (1985) argue that firms hedge to reduce the costs of financial distress. Nance et al. (1993) claim that financial leverage and the probability of financial distress are directly related. Hence, hedging is needed when a firm has a higher level of debt. Empirical studies by Dolde (1995) and Haushalter (2000) find that debt is positively related to hedging activities. Following these studies, hedging percentage and debt ratio (DEBT) are expected to have a positive relationship.

Froot et al. (1993) contend that a liquid firm has less need for costly external financing when cash flows are variable. Hence, hedging is less valuable for a liquid firm. Geczy et al. (1993) reports that users of currency derivatives have lower liquidity ratio than nonusers. Following this argument, a negative relationship between hedging and liquidity measured by current ratio (CR) is expected.

In addition, an earnings variable (ROA) is included in the regression analysis. Since hedging is employed to manage price risk, low earnings are expected to trigger an increase in hedging activities. The relationship between hedging and the firm's ROA is expected to be negative.

Finally, we control for the impact of oil price volatility on hedging activities by including an oil price volatility (VOL) variable in the regression. High volatility in oil prices may necessitate hedging activities. A positive association is expected between hedging activities and oil price volatility.

## DATA AND SAMPLE

An initial sample of 106 oil and gas firms with an SIC code of 1311 that trade on the NYSE, ASE, and NMS is identified from the *Standard & Poor's Mergent Online* database. Of the 106 firms, 48 are eliminated because their 10-k filings are not available on the *SEC Edgar* every year during the sample period from 2007 to 2016. Hedging data for every year without any break is required for this study. The sample period for this study covers two major downturns in the oil and gas industry, in 2009 and in 2014. The 10-k filings are utilized to collect data on derivatives defined as swaps, collars, and instruments such as futures, and fixed price contracts used for non-trading purposes. Of the 58 firms with complete hedging data for every year, 22 did not replace their CEOs. Of the remaining 36 firms, 26 replaced CEOs once, 8 replaced CEOs two times, and 2 replaced CEO three times during the sample period. Thus, the sample has a total of 48 CEO replacements.

To control for the effects of factors specific to oil industry on hedging, a net measure is computed as hedging by a firm with change in CEO minus hedging by a matched firm from the oil and gas industry with no change in CEO during the sample period.[2] Specifically, for each CEO change firm, a matched firm is selected from the sample of "no CEO change" using the hedging percentage two years before the year of the CEO change. Hedging percentage is computed as the volume of derivatives used (in barrels) to hedge crude oil divided by crude oil production volume (in barrels) in the same year. Since there are only 22 firms with no changes in CEO and 48 firms with changes in CEO, a "no-CEO change" firm was matched with a "CEO change" firm multiple times.

## EMPIRICAL RESULTS

### *DESCRIPTIVE STATISTICS*

Table 1 provides descriptive statistics on oil price and hedging for the sample period, 2007-2016. Panel A presents oil price in real terms, measured by the value of West Texas Intermediate (WTI) at the end of the year deflated by the producer price index for that year.[3] The data show that the mean value of real oil price decreased from $0.42 per barrel in the year 2007 to $0.23 per barrel in the year 2016. There were two major oil price shocks in this period; the first occurred in the early part of 2009 and the second in the later part of 2014. Figure 1 presents the real WTI price movements from the month of January 2007 through the month of December 2016. The graph clearly shows two major oil price downturns, around the years 2009 and 2014. Also, not reported in Table 1, the volatility of the real WTI price measured by standard deviation is higher in the second half of the sample period (2012-2016) than in the first half (2007-2011).

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[2] Examples of oil industry factors are changes in oil price, OPEC production, and U.S. energy policies. Changes in these industry factors are likely to impact hedging decisions in a "CEO change" firm and a "no CEO change" firm in a similar way. The difference in amount of hedging between these two types of firms is expected to capture the effect of a CEO change.

[3] The value of the WTI is scaled by the reported value of the producer price index (PPI) to arrive at the real WTI. For example, the January 2008 WTI of $92.97 was divided by the PPI value of 181 to arrive at $0.51 real value of WTI.

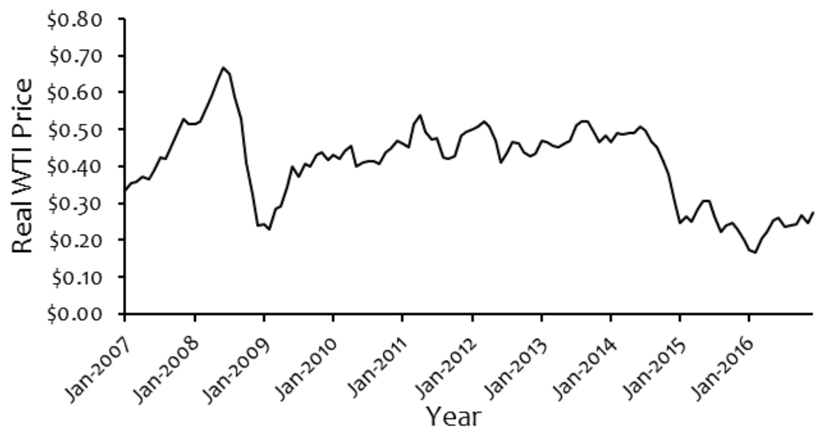


**Figure 1.** Oil Price Measured by Real WTI for the Period, 2007-2016.

Panel B of Table 1 provides descriptive information on hedging. The data shows that 30 firms used a derivative instrument in the year 2007, while 39 firms used a derivative instrument in the year 2016. During the sample period, the mean value of derivatives increased slightly from 27.6 percent to 28.2 percent, while the median value increased by a bigger margin from 1.7 percent to 21.9 percent. Overall, the use of derivatives as a percentage of production increased during the sample period. The highest use of derivatives (mean = 45.3 percent and median = 48.9 percent) occurred in the year 2014, and the highest number of firms (43 firms) used a derivative instrument in the year 2013. It appears that the oil and gas firms hedged their productions more actively around the major downturn year of 2014.

Panel B reports that the mean use of swaps decreased slightly between the years 2007 (18.9 percent) and 2016 (15.2 percent), and the highest use occurred around the years 2013 and 2014. The mean use of collars, on the other hand, increased during the sample period, with the highest amount occurring in the year 2011.

Panel C of Table 1 provides additional information on hedging. Of the 58 oil and gas firms in the sample, 52 firms or about 89.7 percent used a derivative instrument to hedge price risk during the sample period. Also, 16 firms or 27.6 percent used a derivative instrument every single year during the sample period. Since a large drop in oil price may trigger an increase in hedging, the number of firms that introduced hedging around major drops in oil price in the years 2009 and 2014 was examined. Fourteen firms, or about 24.2 percent of the 58 sample firms introduced hedging around the periods of major drops in oil price during 2008-2010 and 2013-2015.

Finally, Panel D of Table 1 shows that the majority of the 48 CEO changes occurred during the period of high volatility in oil price between the years 2012 and 2016. Only 13 CEO changes occurred during 2007-2011, while 35 changes occurred during 2012-2016. Thus, the CEO changes in the sample appear to be associated with volatile oil prices in recent years than in the early years.

***HEDGING AROUND A CHANGE IN CEO***

Table 2 presents unadjusted hedging as well as net hedging data, for eight years from y=−3 to y=+4 around a CEO change (with y=0 being the year of the change). Unlike unadjusted hedging, net hedging adjusts for oil and gas industry effects. Net hedging is calculated as the hedging percentage for a "CEO change" firm minus the hedging percentage for its matched "no CEO change" firm in the same calendar year. The sample sizes (N) in Table 2 vary from year to year because hedging data for a few firms fall outside the 2007-2016 sample period. For example, the hedging percentage for y=+4 is available for only 21 of the 48 "CEO change" firms. For the remaining 27 firms, the hedging percentage for y=+4 is outside the sample period.

**Table 1.** Descriptive Statistics on Oil Price in Real WTI Scaled by PPI Index Value, Hedging as a % of Production, and Additional Data on Hedging and CEO Changes.

**Panel A: Oil Price (Real WTI in U.S. $)**

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 0.42 | 0.52 | 0.36 | 0.43 | 0.47 | 0.47 | 0.48 | 0.45 | 0.26 | 0.23 |
| **Median** | 0.40 | 0.54 | 0.39 | 0.43 | 0.47 | 0.46 | 0.47 | 0.48 | 0.25 | 0.24 |

**Panel B: Hedging (as % of crude oil production) (N = 58)**

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total Hedging** | | | | | | | | | | |
| **Mean** | 27.6 | 26.8 | 27.9 | 32.4 | 33.8 | 35.1 | 42.4 | 45.3 | 36.1 | 28.2 |
| **Median** | 1.7 | 12.8 | 9.6 | 26.3 | 31.8 | 34.1 | 32.5 | 48.9 | 22.2 | 21.9 |
| **# firms hedged** | 30 | 36 | 34 | 37 | 41 | 40 | 43 | 40 | 34 | 39 |
| **Swaps** | | | | | | | | | | |
| **Mean** | 18.9 | 12.0 | 15.7 | 18.6 | 16.9 | 18.6 | 26.6 | 28.7 | 20.7 | 15.2 |
| **Median** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 12.3 | 20.9 | 3.0 | 0.0 |
| **Collars** | | | | | | | | | | |
| **Mean** | 8.7 | 14.4 | 11.6 | 13.7 | 16.3 | 15.9 | 13.8 | 13.3 | 11.9 | 11.0 |
| **Median** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Other** | | | | | | | | | | |
| **Mean** | 0.0 | 0.3 | 0.6 | 0.0 | 0.7 | 0.6 | 1.9 | 3.2 | 3.5 | 2.0 |
| **Median** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Panel C: Additional Statistics on Hedging (N=58)**

| | # | % |
|---|---|---|
| **Firms Hedged at Least Once During 2007-2016** | 52 | 89.7 |
| **Firms Hedged Every Single Year During 2007-2016** | 16 | 27.6 |
| **Introduced Hedging Around a Large Drop in Oil Price:** | | |
| **2008-2010** | 11 | 19.0 |
| **2013-2015** | 3 | 5.2 |

**Panel D: CEO Changes (N=48 changes by 36 firms)**

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **# CEO Changes** | 0 | 2 | 6 | 1 | 4 | 8 | 6 | 8 | 6 | 7 |
| **% of Total** | 0.0 | 4.2 | 12.5 | 2.1 | 8.3 | 16.8 | 12.5 | 16.8 | 12.5 | 14.6 |

Panel A of Table 2 shows that both the mean and median values of the "CEO change" firms increased from y=−3 to y=0, and subsequently in y=+4. The t-statistic and Wilcoxon Z-value indicate that the unadjusted values increased significantly only from y=−2 to y=0; and the Wilcoxon Z-value indicates that the unadjusted values increased significantly only from y=0 to y=+1. Thus, there is weak evidence that unadjusted hedging changes occurred around the hiring of a new CEO.

Panel B presents the net hedging results which show that the mean value decreased significantly from 10.53 percent in y=–3 to –5.25 percent in y=0. Both the t-statistic and Wilcoxon Z-value are significant at the conventional levels supporting hypothesis (H1) that hedging activities decline from prior years to the year of CEO hiring. Following the CEO change, the mean net hedging increased significantly from –5.25 percent in y=0 to 4.78 percent in y=+2, 8.81 percent in y=+3, and 15.24 percent in y=+4. The t-statistics and the Wilcoxon Z-values are significant for these changes in net hedging. These results for the post CEO change support the second hypothesis (H2) that hedging activities will increase from the year of CEO hiring to subsequent years.

Additional results in Panel B show that the % of firms with a positive net hedging was 45.00 percent in y=–3 and declined to 35.43 percent in y=0. The % of firms with a positive net hedging increased substantially after the CEO change. For example, the % Positive increased to 57.14 percent in y=+4 from 35.43 percent in y=0. These results are consistent with both hypotheses H1 and H2.

**Table 2.** Hedging Around the Year of CEO Change (y=0). Unadjusted Hedging Data and Adjusted Hedging Data Net of Oil and Gas Industry Effects are Reported.

| y | −3 | −2 | −1 | 0 | +1 | +2 | +3 | +4 |
|---|---|---|---|---|---|---|---|---|
| N | *40* | *46* | *48* | *48* | *41* | *35* | *27* | *21* |
| **Panel A: Unadjusted Hedging** | | | | | | | | |
| **Mean** | *31.72* | *28.97* | *36.56* | *38.93* | *37.10* | *42.59* | *41.21* | *47.57* |
| **Median** | *21.31* | *26.34* | *31.47* | *34.98* | *35.07* | *37.41* | *34.46* | *54.50* |
| **t–statistic** | *1.04* | *2.29*[b] | *0.53* | *n/a* | *1.77* | *0.63* | *−0.36* | *−0.77* |
| **Wilcoxon Z** | *−1.12* | *−2.18*[b] | *−0.54* | *n/a* | *−1.97*[b] | *−0.55* | *−0.16* | *−0.89* |
| **Panel B: Adjusted or Net Hedging** | | | | | | | | |
| **Mean** | *10.53* | *1.14* | *−4.72* | *−5.25* | *−2.47* | *4.78* | *8.81* | *15.24* |
| **Median** | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *0.00* | *7.38* | *15.53* |
| **t–statistic** | *−1.97*[a] | *−1.04* | *−0.09* | *n/a* | *−0.91* | *−2.17*[b] | *−2.14*[b] | *−1.76*[a] |
| **Wilcoxon Z** | *−1.68*[a] | *−1.12* | *−0.14* | *n/a* | *−1.33* | *−1.86*[a] | *−1.94*[a] | *−1.69*[a] |
| **% Positive** | *45.00* | *43.48* | *33.33* | *35.43* | *39.02* | *45.71* | *55.56* | *57.14* |
| **% Negative** | *25.00* | *19.57* | *47.92* | *47.92* | *48.78* | *45.71* | *40.74* | *33.33* |

**Notes:**
[a] Significant at the 10 percent level, when compared to y=0.
[b] Significant at the 5 percent level, when compared to y=0.
[c] Significant at the 1 percent level, when compared to y=0.

Figure 2 provides a graphical representation of the movements in net hedging from y=–3 to y=+4. The graph shows that unadjusted data for the "CEO change" firms have an upward trend in hedging from y=0 (the year of the CEO change) to y=+4. The net hedging data, which controls for the industry effects, clearly shows that net hedging fell from y=–3 to y=0 and increased for several years after a new CEO is hired which supports both H1 and H2.

Overall, the results for net hedging are consistent with the findings in Kumar and Rabinovitch (2013) that the use of derivatives is low in the year a new CEO is hired. Furthermore, this study shows that net hedging activities decline prior to a CEO hiring and increase over several years after a new CEO is hired.

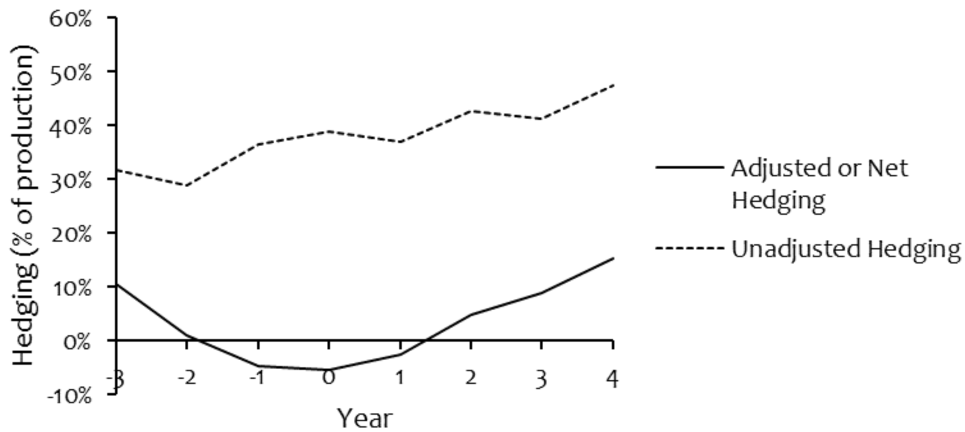


**Figure 2.** Unadjusted and Adjusted Hedging for the "CEO Change" Firms. Year=0 is the Year of the CEO Change.

***REGRESSION RESULTS***

We obtain the regression results utilizing the following equation:

$$\Delta H_i = \beta_{0,i} + \beta_{1,i}CEO + \beta_{2,i}SIZE + \beta_{3,i}DEBT + \beta_{4,i}CR + \beta_{5,i}ROA + \beta_{6,i}VOL + \varepsilon_i \quad (1)$$

where,

$\Delta H_i$ = Yearly change in hedging. For example, $\Delta H_{+1}$ is defined as hedging in y=+1 minus hedging in y=0, with year=0 being the year of the CEO change. Hence, $\Delta H_{+1}$ reflects change in hedging activities from y=0 to y=+1, one year after the CEO change.

CEO = Coded 1 if a "CEO change" firm, 0 if a "no CEO change" matched firm,
SIZE = Firm size, measured as log of total assets one year before the year of a CEO change,
DEBT = Total debt divided by total assets one year before the year of a CEO change,
CR = Current ratio one year before the year of a CEO change,
ROA = Return on assets one year before the year of a CEO change, and
VOL = Standard deviation of the monthly real WTI prices one year before and in the year of the CEO change.

The results for regression (1) are presented in Table 3. The regression results for prior period show that the CEO variable is related to $\Delta H_{-3}$ only. The CEO coefficient is negative and significant for the $\Delta H_{-3}$ regression suggesting that a CEO change occurs for firms that experience a decline in hedging in y=–3.

The CEO coefficients for the $\Delta H_{+1}$, $\Delta H_{+2}$, $\Delta H_{+3}$, and $\Delta H_{+4}$ regressions are statistically insignificant indicating that there is no relationship between a CEO change and annual changes in hedging activities in y=+1, y=+2, y=+3, and y=+4. These regression results in Table 3 fail to support hypothesis H4 that there is a significant and positive association between a CEO hiring and changes in hedging activities in subsequent years.

With regard to the control variables, firm size measured by the SIZE variable exhibits a negative association with ΔH+1. This finding is not consistent with the argument that larger firms have better ability to hedge than smaller firms. Our findings show that the smaller firms increased hedging activities more than the larger firms one year after a CEO change. The coefficients for DEBT are negative for ΔH-3 and ΔH+1 regressions suggesting that annual changes in hedging are higher for firms that carry less debt. This relationship does not bode well with the argument presented in prior studies that firms with more debt reduce financial distress through hedging. The coefficient for the CR variable is negative and significant in the ΔH+1 regression suggesting an annual increase in hedging for firms that are less liquid. This finding is consistent with the argument that hedging is more valuable for less liquid firms that need access to costly external financing. The coefficient for the ROA variable is positive in the ΔH-2 regression and negative in the ΔH+1 regression. The positive sign of the ROA coefficient for y=–2 does not support the argument that low earning firms hedge more to stabilize earnings.[4] The negative sign of the ROA coefficient in y=+1 indicates that low earning hedging activities in one-year after the CEO hire. The positive coefficient value for the VOL variable in the ΔH+4 regression indicates that changes in a firm's hedging activities is related to oil price volatility four years after the CEO hire.

**Table 3.** Regression Results. Annual Change in Hedging is Regressed on CEO Change and Determinants of Hedging.

| | Regressions | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | $\Delta H_{-3}$ | $\Delta H_{-2}$ | $\Delta H_{-1}$ | $\Delta H_{+1}$ | $\Delta H_{+2}$ | $\Delta H_{+3}$ | $\Delta H_{+4}$ |
| **Constant** | 0.05 | 0.54 | −0.41 | 0.85[b] | 0.01 | −0.00 | −1.01 |
| **CEO** | −0.11[b] | −0.06 | −0.03 | 0.08 | 0.07 | 0.07 | −0.01 |
| **SIZE** | −0.00 | −0.01 | 0.02 | −0.03[a] | −0.01 | −0.00 | 0.04 |
| **DEBT** | −0.08[a] | −0.09 | −0.02 | −0.32[b] | 0.11 | −0.06 | 0.14 |
| **CR** | −0.00 | −0.03 | 0.03 | −0.05[b] | 0.01 | −0.00 | 0.05 |
| **ROA** | −0.17 | 0.30[a] | −0.01 | −0.44[b] | 0.12 | −0.29 | 0.24 |
| **VOL** | 1.61 | −0.82 | 1.79 | −1.09 | 0.72 | −0.23 | 2.60[a] |
| **N** | 79 | 91 | 95 | 81 | 69 | 53 | 41 |
| **F-value** | 1.66 | 2.25[b] | 0.73 | 2.47[b] | 0.40 | 0.66 | 1.21 |
| **Adj. $R^2$** | 0.05 | 0.08 | −0.02 | 0.10 | −0.06 | −0.04 | 0.03 |
| **White Test $\chi^2$(26)** | 15.43 | 21.55 | 15.61 | 23.82 | 36.93[a] | 38.17[a] | 27.88 |

**Notes:**
[a] Significant at the 10 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 1 percent level.

***REGRESSION RESULTS WITH INTERACTIONS***

Overall, the results of regression equation (1) show that there is no significant change in hedging activity around a new CEO hire. To examine if interaction among the explanatory variables can add to the explanatory power of the CEO hire, we utilize the following regression:

$$\Delta H_i = \beta_{0,i} + \beta_{1,i}CEO + \beta_{2,i}SIZE + \beta_{3,i}DEBTt + \beta_{4,i}CR + \beta_{5,i}ROA + \beta_{6,i}VOL + \beta_{7,i}CEO * VOL + \beta_{8,i}SIZE * VOL + \beta_{9,i}DEBT * VOL + \beta_{10,i}CR * VOL + \beta_{11,i}ROA * VOL + \varepsilon_i \quad (2)$$

Equation (2) adds interactions of the CEO variable and the firm's control variables with the oil price

[4] While there is no strong theoretical justification for a positive relationship between hedging activities and firm earnings, it can be assumed that higher earnings for oil & gas firms are associated with higher production which may necessitate an increase in hedging.

volatility variable. It is quite possible that a new CEO hire can explain the firm's hedging activity only when its interaction with oil price volatility is considered.

**Table 4.** Regression Results. Annual Change in Hedging is Regressed on CEO Change, Determinants of Hedging, and Interaction Variables.

| | Regressions | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | $\Delta H_{-3}$ | $\Delta H_{-2}$ | $\Delta H_{-1}$ | $\Delta H_{+1}$ | $\Delta H_{+2}$ | $\Delta H_{+3}$ | $\Delta H_{+4}$ |
| **Constant** | −0.79 | 3.64 | −1.25 | 0.73 | 0.10 | 1.26 | −1.51 |
| **CEO** | −0.25 | 0.22 | −0.04 | 0.24[b] | 0.01 | 0.21 | 0.10 |
| **SIZE** | 0.01 | −0.14[c] | 0.07[a] | −0.03 | −0.02 | −0.05 | 0.04 |
| **DEBT** | 0.77 | −0.32 | −0.49[a] | −0.26 | 0.22 | −0.27 | 0.60 |
| **CR** | 0.25 | −0.23[c] | 0.06 | −0.08 | 0.08 | −0.16[b] | 0.07 |
| **ROA** | 1.19 | 0.68 | −0.94[b] | −1.35[c] | 1.04[b] | −0.47 | 0.37 |
| **VOL** | 26.24 | −81.65[b] | 21.47 | −3.44 | 3.04 | −23.80 | 5.81 |
| **CEO*VOL** | 3.21 | −6.37[a] | 0.02 | −3.78 | 1.20 | −2.33 | −2.21 |
| **SIZE*VOL** | −0.10 | 3.39[b] | −1.20 | 0.18 | 0.02 | 0.93 | 0.13 |
| **DEBT*VOL** | −25.44 | 6.51 | 12.42[a] | −1.41 | −1.59 | 1.79 | −9.10 |
| **CR*VOL** | −7.60 | 4.98[c] | −0.83 | 0.78 | −1.66 | 3.31[b] | −0.30 |
| **ROA*VOL** | −41.84[a] | −8.13 | 21.96[b] | 16.93[b] | −16.03[a] | 1.44 | −3.19 |
| **N** | 79 | 91 | 95 | 81 | 69 | 53 | 41 |
| **F-value** | 1.50 | 2.67[c] | 0.94 | 2.35[b] | 1.07 | 1.04 | 0.81 |
| **Adj. $R^2$** | 0.07 | 0.17 | −0.01 | 0.16 | 0.01 | 0.01 | −0.06 |
| **White Test $\chi^2$(59)** | 38.23 | 63.89 | 54.55 | 72.86 | 66.29 | 54.03 | 41.26 |

**Notes:**
[a] Significant at the 10 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 1 percent level.

The results of regression equation (2) reported in Table 4 show that, for ΔH+1 (i.e., regression for one year after hiring a CEO), the coefficient value for the CEO variable is 0.24 and significant at the 5 percent level. This result indicates that hedging activities increase one year after the CEO hire once interaction with oil price volatility is considered. The results for the control variables show that only ROA explains hedging with a coefficient value of –1.35. As expected, lower earnings increase the need for hedging. Also, the coefficient for ROA*VOL interaction variable is 16.93 and significant, indicating that hedging increases for firms with high earnings during periods of high volatility.

### *REGRESSION RESULTS WITH INTERACTIONS (DEBT RATIO DROPPED)*

The results of regression equation (2) show that a CEO change explains hedging by an oil and gas firm when interaction with oil price volatility is considered. One of the econometrics problems that can undermine the results is multicollinearity or collinearity among the explanatory variables. To address this possible problem, bivariate Pearson correlations for the control variables are computed. The results indicate a statistically significant high correlation of –0.61 between the debt ratio and ROA. Since the next highest correlation also involves the debt ratio (correlation coefficient between the debt ratio and current the ratio is –0.31), we dropped it from the regression as follows:

$$\Delta H_i = \beta_{0,i} + \beta_{1,i}CEO + \beta_{2,i}SIZE + \beta_{3,i}CR + \beta_{4,i}ROA + \beta_{5,i}VOL + \beta_{6,i}CEO * VOL + \beta_{7,i}SIZE * VOL + \beta_{8,i}CR * VOL + \beta_{9,i}ROA * VOL + \varepsilon_i \quad (3)$$

**Table 5.** Regression Results. Annual Change in Hedging is Regressed on CEO Change, Determinants of Hedging, and Interaction Variables. Debt Ratio is Removed from the Regressions because of its High Collinearity with ROA.

| | Regressions | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | $\Delta H_{-3}$ | $\Delta H_{-2}$ | $\Delta H_{-1}$ | $\Delta H_{+1}$ | $\Delta H_{+2}$ | $\Delta H_{+3}$ | $\Delta H_{+4}$ |
| **Constant** | 0.19 | 3.32[c] | −0.89 | −0.03 | 0.54 | 0.68 | −1.05 |
| **CEO** | −0.07 | 0.26 | −0.02 | 0.22[a] | 0.03 | 0.17 | 0.10 |
| **SIZE** | −0.01 | −0.14[c] | 0.04 | −0.00 | −0.03 | −0.03 | 0.04 |
| **CR** | 0.05 | −0.21[c] | 0.05 | −0.03 | 0.05 | −0.16[b] | 0.02 |
| **ROA** | 0.63 | 1.01[c] | −0.48 | −1.25[c] | 0.91[b] | −0.33 | −0.22 |
| **VOL** | −5.11 | −74.88[c] | 10.75 | 6.24 | −1.26 | −18.61 | 6.08 |
| **CEO*VOL** | −1.20 | −6.90[a] | −0.40 | −3.23 | 0.83 | −1.80 | −2.35 |
| **SIZE*VOL** | 0.40 | 3.26[b] | −0.39 | −0.29 | 0.17 | 0.75 | −0.14 |
| **CR*VOL** | −1.37 | 4.80[c] | −0.55 | 0.17 | −1.29 | 2.80[b] | 0.20 |
| **ROA*VOL** | −20.01 | −13.91[a] | 10.80 | 19.39[c] | −15.31[b] | 0.84 | 6.00 |
| **N** | 79 | 91 | 95 | 81 | 69 | 53 | 41 |
| **F-value** | 0.95 | 3.03[c] | 0.76 | 2.12[b] | 1.22 | 1.11 | 0.79 |
| **Adj. R2** | −0.01 | 0.17 | −0.02 | 0.11 | 0.03 | 0.02 | 0.05 |
| **White Test $\chi^2$ (41)** | 24.46 | 45.30 | 34.65 | 48.27 | 52.58 | 40.60 | 42.03 |

**Notes:**
[a] Significant at the 10 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 1 percent level.

The results of regression (3) presented in Table 5 are similar to those reported in Table 4. The CEO variable of 0.22 for ΔH+1 is positive and significant indicating that hedging activities increase one year after a CEO is hired. With regards to the control variables, only ROA is significant with a coefficient value of −1.25 suggesting that low ROA firms increase the use of hedging. The ROA*VOL interaction coefficient is also significant with a value of 19.39 indicating high volatility of oil price is an important factor for hedging decisions.

### *HETEROSCEDASTICITY*

To test whether the variance of the errors from the regression models is dependent on the values of the explanatory variables, we utilized REGWHITETEST procedure on RATS (Regression Analysis of Time Series). The estimated value of White heteroscedasticity χ2 shows if the variance of errors is constant across the observations. If the variance of errors is not constant, the regression results may not be reliable. Of all the White χ2 values reported for the regression models, only the ΔH+2 and ΔH+3 error variances exhibit heteroscedasticity. Hence, we can reasonably assume that the key results for all the regression models reported in Tables 4 and 5 are reliable and drawn from a population of constant error variance.

## CONCLUSION

Prior studies provide evidence that CEO successions impact firm policies. A new CEO can impact key corporate policies including those related to risk management and the use of derivatives for hedging. The preliminary findings show that net hedging activities decline over several years until the year of the CEO change and rise in subsequent years. The regression results, after allowing for interaction among the explanatory variables, show that an increase in hedging one year after a CEO hire can be attributed to the new CEO.

Overall, the results of this study should be interpreted with caution because CEO hiring is associated with hedging only when the firm variables are interacted with oil price volatility. Despite the weak findings, several implications can be drawn from this study. First, although prior empirical studies identified several determinants of hedging, it appears that a change in top management also contributes to risk taking by the firm. The evidence, although weak, provides support for the managerial entrenchment argument that a CEO increases hedging activities to entrench herself in office after being hired. Second, an important finding of this study is that the new CEO takes about a year to increase hedging activities. This result can indicate that a year is enough time for the new CEO to review the firm's resources and overall risk management strategies before making changes to the hedging policy. Finally, the findings of this study suggest that CEO successions play an important role in the hedging and risk management policies of a firm. For the board of directors, CEO successions can be a part of the firm's overall risk management strategy.

This study has several limitations that should be considered when interpreting the current findings and addressed in future research. First, the study uses a small sample which can affect the reliability of the results. Second, as with any other hand-collected data, we may have used missing or inaccurate hedging data in some cases. Third, the year of a CEO change is used as a benchmark for the regression data instead of annual changes. Fourth, the firm variables are interacted with only the oil price volatility variable instead of every other firm variable in the regression. Finally, dropping the debt variable to address the multicollinearity problem resulted in removing the impact of financial risk on hedging from the regressions.

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