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Financial Distress around Introduction of Hedging in the Oil and Gas Industry

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ABSTRACT

This study examines financial distress indicators around the time oil and gas firms first introduce derivative instruments for hedging. We compare financial leverage and short-term liquidity data between the hedge and nonhedge firms. Our results show that the hedge firms have higher debt than the nonhedge firms in the years prior to the introduction of derivatives and that the level of debt decreases in subsequent years. In the area of short-term liquidity, we find that the number of firms paying dividends and the dividend payouts are higher after the introduction of derivatives. Overall, these results can be interpreted as evidence that firms introduce hedging to lower expected costs of financial distress.

JEL Classifications: *G32, G39*

Keywords: *hedging; derivatives; financial distress; oil and gas*

I. INTRODUCTION

The shareholder wealth maximization hypothesis of hedging suggests that hedging can increase firm value by reducing expected taxes (Mayers and Smith, 1982; Smith and Stulz, 1985), by reducing underinvestment problem in the presence of costly external financing (Froot et al., 1993), and by reducing expected cost of financial distress (Mayers and Smith, 1982; Smith and Stulz, 1985).[1] To empirically test these arguments, prior studies examine several determinants of hedging with mixed results. For example, Gezcy et al. (1997) show that firms that have high financial leverage are more likely to use derivatives to avoid costs of financial distress. Tufano (1996) and Mian (1996), on the other hand, find little support for the financial distress argument. One issue not examined in prior studies is the behavior of these determinants around the time derivative instruments are first introduced. It is quite possible that the firm implemented hedging in response to high leverage and that leverage subsequently decreased as part of the firm's overall hedging policy. Hence, the difference in leverage may not be as pronounced between the hedge and nonhedge firms after hedging is adopted.

This study fills the gap in the risk management literature by examining the hedging indicators around the time financial derivatives are first introduced by a firm.[2] Specifically, we examine the determinants of financial distress around the introduction of derivative instruments in the oil and gas industry. According to Mayers and Smith (1982) and Smith and Stulz (1985), hedging reduces the probability that a firm encounters financial distress. Prior empirical studies identify several indicators that can reduce these expected costs, and hence have an impact on hedging decision. Some of the key financial distress indicators are the firm's financial leverage (Nance et al., 1993; Gezcy et al., 1997; Haushalter, 2000) and short-term liquidity (Gezcy et al., 1997; Haushalter, 2000).

Our study focuses on the oil and gas industry which is subject to significant price risk as observed in prior studies (Scholtens and Wang, 2008; Mohanty and Nanda, 2011; Gogineni, 2010). This industry has been experiencing extreme price volatility ever since the oil embargo in 1973. Although Haushalter (2000) examines hedging data for the oil and gas firms, it is not known whether the hedge firms are financially distressed around the introduction of derivative instruments.

Our results suggest that the hedge firms have higher debt than the nonhedge firms in the years immediately before derivative instruments are first used. There is no evidence of high leverage in the three years following the introduction of hedging. We also find evidence that the dividend payouts and the number of firms paying dividends are higher in the year and immediately after hedging is first introduced.

The rest of the paper is organized as follows. The next section provides background information, followed by descriptions of the sample in section III and the empirical results in section IV. Concluding remarks are given in section V.

II. BACKGROUND

A. Oil Price Risk

Prior studies show that volatility in oil and gas prices impacts earnings and stock returns in the oil and gas sector. Gogineni (2010) shows that the oil and gas industry is

sensitive to unexpected movements in oil prices and Scholtens and Wang (2008) find that oil stock returns are positively correlated with crude oil prices. According to Mohanty and Nandha (2011), oil price risk exposures of the U.S. oil and gas companies are generally positive and significant.

To hedge price risk, many oil and gas companies implement risk management strategies as evidenced in prior empirical studies (Haushalter, 2000; Jin and Jorion, 2006). In his sample of 100 firms, Haushalter (2000) finds that 43 firms hedged in 1992, 49 hedged in 1993, and 57 hedged in 1994. Also, these firms hedged 32.2 percent of production in 1992, 29.6 percent in 1993, and 28.4 percent in 1994. In Jin and Jorion's (2006) study, hedging of oil and gas price risk occurred during 106 out of 330 firm-years.

B. Financial Distress and Hedging

Prior studies identify specific benefits that induce firms to hedge. One of the benefits is reduction of expected costs of financial distress. Mayers and Smith (1982) and Smith and Stulz (1985) indicate that a reduction in the variability of cash flows and firm value reduces the expected costs of financial distress. Some of the expected costs arise from deterioration of long-term relationships with suppliers and customers during periods of financial distress. As a consequence, firms with high leverage and low liquidity should have greater incentives to hedge their risks.

C. Financial Leverage

Nance et al. (1993) state that the magnitude of the reduction of expected costs is a positive function of the probability that financial distress will occur which is directly related to the amount of financial leverage. Hedging and financial leverage are related because both affect the probability of financial distress. Hence, the higher the level of debt, the greater the need to hedge firm's risk. Empirical study by Dolde (1995) reports a positive and significant relationship between the use of hedging instruments and financial leverage. Haushalter (2000) examines hedging activities of the oil and gas producers and finds that debt ratio is positively related to the percentage of production hedged. Using a sample of New Zealand firms, Berkman and Bradbury (1996) observe that hedging activities increase with debt ratio. These results are interpreted as evidence that high expected costs of financial distress cause firms to use more derivatives. Mian (1996) and Tufano (1996), on the other hand, find no evidence of any relationship between hedging and expected costs of financial distress. Mian's (1996) findings show no difference in book-value of debt to market-value of firm between the hedgers and the nonhedgers. Using book-value of debt to market-value of firm as a proxy for financial distress, Tufano (1996) also finds a weak support for the financial distress argument.

D. Short-Term Liquidity

Nance et al. (1993) argue that firms can reduce the expected costs of financial distress by maintaining a high level of short-term liquidity. More liquid assets or low dividend-payout ratios help assure bondholders that funds will be available to pay fixed claims.

Froot et al.(1993) contend that short-term liquidity ensure that the firm has more internal funds that reduces the need for costly investment and financing alternatives in the face of variable cash flows. Hence, hedging is less valuable when the firm has more short-term liquid assets. Gezcy et al. (1997) find that the users of currency derivatives have lower quick ratio values than that of the nonusers. Their logistic regression results indicate a significantly low probability of using currency derivatives for firms with high quick ratio. Haushalter's (2000) study shows that the hedgers in the oil and gas industry have higher dividends when compared to the nonhedgers.

E. Empirical Predictions

Based on the above discussions, we propose the following empirical predictions in our study. Hedge firms are likely to have higher leverage than nonhedge firms when they first introduce derivatives. Also, since low short-term liquidity increases the expected costs of financial distress, hedge firms are likely to have lower short-term liquidity than nonhedge firms around the time derivatives are first introduced.

III. SAMPLE

This study examines financial distress around the introduction of derivative instruments in the oil and gas industry. To accomplish our research goal, an initial sample of 482 firms is obtained from the Compustat Research Insight database of which 310 firms are in the crude petroleum and natural gas production and exploration business (SIC 1311). The remaining firms belong to drilling, oil field services, refining, and other oil and gas related businesses. From the initial sample, we identify hedge firms by searching sections 1A and 7A of the SEC Edgar 10-K and DEF-14 filings for information related to hedging during 1994–2010.[3] Hedging is defined as the use of futures, options, swaps, and fixed price contracts for non-trading purposes. Here are some excerpts on hedging provided in the 10-K reports: "Anadarko uses derivative commodity instruments to hedge the Company's exposure to changes in the market price of natural gas and crude oil and to provide methods to fix the price for natural gas independently of the physical purchase or sale". "Berry Petroleum has periodically entered into bracketed zero cost collar hedge contracts on a portion of its crude oil production with California refiners to protect the Company's revenues from potential price declines".

Of the 482 firms, 107 reported use of derivative instruments for commodity hedging purposes in their SEC filings. We use two methods to identify the year when derivative is first used for hedging. The first method requires that hedging be reported at least one year after the first SEC filing.[4] For example, if the first filing for a firm was 1996, and use of derivatives was first reported in 1998, we classify 1998 as the introduction year for the firm. We identified introduction years for 18 firms using this method. For the remaining 89 firms, we search the financial statements on the Compustat Research Insight database to determine financial data on hedging prior to the first SEC filing. Examples of hedging or derivative data are, "hedging", "gains/losses on commodity derivatives", "derivative instruments", "derivative assets", "derivative liabilities", "fair value of derivatives", etc. We identified data on hedging for 31 firms using this second method. Thus, our final samples consist of 49 hedgers with an introduction year.

For comparison purposes, we pair each hedge firm with a firm from the nonhedge sample by the 4-digit SIC code and by total assets in the introduction year. A breakdown of the samples by 4-digit SIC code and total assets in Table 1 shows that, of the 49 hedge firms, 40 belong to the crude petroleum and natural industry (SIC 1311). The mean asset size of the hedge sample is $2.87 billion while that of the non-hedge sample is $3.43 billion. The mean asset size of the crude petroleum and natural gas firms (SIC 1311) for both the hedge and nonhedge samples is around half a billion dollars.

Table 1
This table provides a breakdown of the samples

Sample	N
Initial Sample	158
Deletions:	
Not on SEC Edgars (1994-2010)	14
Introduction of hedging could not be determined	58
Final Sample	49

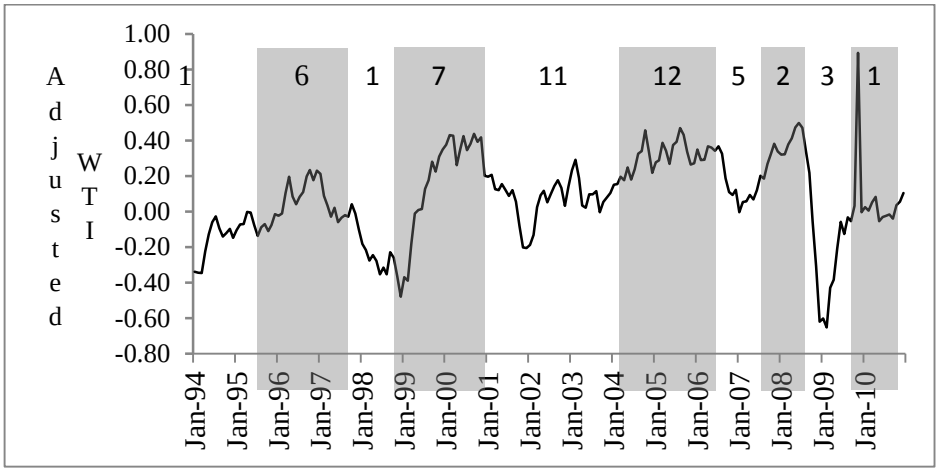
Final Sample – by 4-digit Industry and Asset Size	Hedge Firms		Nonhedge Firms	
	Assets (in millions of dollars)			
	N	Mean	N	Mean
Crude Petroleum and Natural Gas (SIC 1311)	40	490.42	40	501.04
Drilling Oil and Gas Wells (SIC 1381)	1	698.64	1	837.24
Oil and Gas Field Services (SIC 1389)	3	5,492.92	3	9,002.80
Petroleum Refining (SIC 2911)	2	47,000.00	2	58,000.00
Special Industry Machinery (SIC 3559)	1	133.92	1	136.10
Petroleum Bulk Stations (SIC 5171)	1	2,210.01	1	1,859.47
Engineering Services (SIC 8711)	1	671.98	1	360.49
Total	49	2,872.60	49	3,426.23

IV. EMPIRICAL FINDINGS

To gain an understanding of when the oil and gas firms first introduced hedging, we provide a breakdown of the hedge sample in relation to the movements of the price of crude oil. We collect monthly West Texas Intermediate (WTI) prices from January 1994 to December 2010 from the Haver Analytics database. For oil price, we utilize adjusted real oil price that is similar to the measure used by Davis and Haltiwanger (2001). The real oil price is computed as the nominal WTI price divided by producer price index for all commodities. Davis and Haltiwanger (2001) argue that a change in real oil price can be a reversal of a previous change which may not represent unexpected shocks in the oil market. To address this, they propose adjusting the real oil price, computed as the log of real WTI price divided by weighted average of real WTI prices in prior sixty months (five years), with weights summing to one and declining linearly to zero. This adjusted measure produces significant change in oil price relative to the average price over the past five years.

Figure 1 shows that 35 of the 49 hedging introductions in the oil and gas industry (roughly 71 percent) occurred during a 9-year period from 2000 to 2008. There are about 4 introductions per year. The remaining 14 introductions occurred during 8 years

Figure1
This figure shows yearly breakdown of the oil and hedge sample in relation to adjusted real WTI price



in 1994–1999 and 2009–2010. In relation to the direction of oil price changes, 28 introductions occurred during the years when real WTI price declined, and the remaining 21 introduction occurred during the years when real WTI price rose. These data suggest that more firms introduced hedging during falling oil prices. One possible reason is that, since most of our sample firms belong to the oil and gas extraction industry (SIC 1311), hedging is more valuable for these firms during periods of falling oil prices when revenue declines than during periods of rising oil prices when revenue remains steady.

Table 2 presents data on financial leverage for the hedge and nonhedge firms. Three measures of leverage are used. We use coverage ratio following Nance et al. (1993) and Gezcy et al. (1997), long-term debt ratio following Gezcy et al. (1997) and Haushalter (2000), and total debt ratio following Nance et al. (1993). Mian (1996), and Tufano (1996). Coverage ratio is computed as earnings before interest and taxes to interest expenses. Long-term debt ratio is computed as the book-value of long-term debt to firm size (defined as market value of equity plus book-value of total debt and book-value of preferred stock). Total debt ratio is book-value of all debt to firm size. Based on the empirical predictions on leverage discussed earlier, we predict lower coverage ratio, higher long-term debt ratio, and higher total debt ratio for the hedge firms than for the nonhedge firms.

Table 2
This table reports the leverage ratios for the hedge and nonhedge oil and gas firms. Year 0 is the year of introduction of hedging

	Nonhedge Firms			Hedge Firms		
Year	N	Mean	Median	N	Mean	Median
			Panel A: Interest Coverage			
-3	27	4.03	1.47	21	14.63	4.63
-2	35	16.76	3.26	25	18.09	3.25
-1	37	30.88	2.89	29	2.77	4.85
0	39	11.95	2.89	39	1.05[a]	2.15
1	41	5.01	2.27	43	13.35	2.60
2	41	1.85	2.01	44	2.66	1.43
3	41	4.71	2.70	46	8.72	3.62
			Panel B: Long-Term Debt to MV of Assets (%)			
-3	31	22.25	10.05	13	51.51[c]	59.58[c]
-2	36	24.69	15.56	16	43.53[b]	25.64[a]
-1	35	23.33	10.72	22	41.54[b]	27.18[a]
0	38	27.69	20.88	28	32.80	19.14
1	43	27.25	22.07	33	35.14	24.39
2	44	29.05	24.55	38	30.73	22.53
3	44	29.68	24.53	39	33.06	24.46
			Panel C: Total Debt to MV of Assets (%)			
-3	31	32.77	22.55	18	57.02[b]	64.60[b]
-2	36	33.86	24.45	30	56.65[b]	64.40[b]
-1	38	39.11	19.80	36	54.06	61.30[a]
0	39	33.41	21.80	44	40.48	24.70
1	43	32.77	23.85	44	35.64	24.00
2	44	34.57	25.45	47	33.17	23.80
3	44	33.83	25.45	48	35.19	26.45

[a]Significantly different from the mean or median of the nonhedge firms at the 0.10 level.
[b]Significantly different from the mean or median of the nonhedge firms at the 0.05 level.
[c]Significantly different from the mean or median of the nonhedge firms at the 0.01 level.

Panel A of Table 2 presents mean and median values of coverage ratio from year -3 to year 3, with year 0 being the year of introduction. The results in Panel A show that there is no difference in coverage ratio between the hedgers and the nonhedgers in any of the years from year -3 to year 3, except for the mean value in year 0. The overall findings on coverage ratio are, therefore, not adequate to conclude that the hedgers have higher leverage any time before or after the derivative instruments are introduced.

Panel B of Table 2 presents the results on long-term debt ratio. The results show that the hedge firms have higher long-term debt than the nonhedge firms primarily in the three years prior to the introduction year. The mean or median values of long-term debt for the hedgers are significantly higher than that of the nonhedgers in years -3, -2, and -1. For example, the hedger's mean value is roughly 41.54 percent while the nonhedger's mean value is roughly 23.33 percent in year -1. The results clearly show that the hedgers are highly leveraged prior to the introduction year. In contrast, the data show that the mean or median values of the long-term debt ratio of the hedgers in the introduction year and three subsequent years are no different from that of the nonhedgers. Overall, our findings of higher long-term debt prior to introduction support the argument that hedging occurs due to financial distress in prior period. Following the introduction, it appears that the long-term debt decreases to a normal level and becomes no different from the debt level of the nonhedgers.

Panel C of Table 2 provides mean and median values of total debt ratio. The results are similar to that of long-term debt ratio. We find that the hedgers are more leveraged than the nonhedgers prior to introduction. In year -3, both mean and median values of the hedgers are significantly higher than that of the nonhedgers.

Overall the results in Table 2 suggest that oil and gas firms introduce derivatives in response to higher debt levels. The findings that there is no difference in financial leverage between hedgers and nonhedgers after introduction are consistent with that of Tufano (1996) and Mian (1996), but inconsistent with Gezcy et al. (1997) and Haushalter (2000).

Table 3 provides results on short-term liquidity. Following Gezcy et al. (1997) and Haushalter (2000), we use quick ratio and dividend payout ratio to measure short-term liquidity. Quick ratio is computed as cash and short-term investments divided by current liabilities and dividend payout ratio is computed as dividends divided by net income. We predict that the hedgers have a lower quick ratio and a higher dividend payout than the nonhedgers.

The data in Panel A of Table 3 show that the mean values of the quick ratio for the hedgers are lower than that of the nonhedgers in years -1, year 0, and year 1. Additionally, there is no difference in median quick ratio between the hedgers and the nonhedgers.

Panel B of Table 3 provides the mean and median values of dividend payouts. Although the majority of the oil and gas firms did not pay dividends around introduction, out results show that the hedgers have higher dividend payouts than the nonhedgers primarily in the year of introduction and in subsequent years. For example, mean payout is 47.11 percent for the hedgers and only 5.48 percent for the nonhedgers in year 0. To provide a meaningful analysis of the dividend data, we examine the percentage of dividend paying firms. The results in Panel C show that the percentage of hedge firms paying dividends is significantly higher than the nonhedge firms in year 1, year 2, and year 3.

Our results in Table 3 are generally consistent with those in prior empirical studies (Gezcy et al., 1997; Haushalter, 2000) that hedgers have higher dividends. The payouts and number of firms paying dividends are higher primarily in and after the introduction year.

Table 3

This table reports the short-term liquidity ratios for the hedge and nonhedge oil and gas firms. Year 0 is the year of introduction for the hedge firms and the year of the first major decline in oil price for the nonhedge firms

	Nonhedge Firms			Hedge Firms		
Year	N	Mean	Median	N	Mean	Median
			Panel A: Quick Ratio[1]			
-3	36	3.62	1.12	23	1.00	0.89
-2	39	5.05	1.28	29	1.45	1.02
-1	43	2.51	1.21	33	1.52[a]	1.17
0	43	2.36	1.06	43	1.40[a]	1.02
1	45	1.74	0.91	46	1.20[b]	1.04
2	45	1.65	0.96	47	1.06	0.94
3	45	1.28	0.84	48	0.98	0.86
			Panel B: Dividend Payout (%)			
-3	33	4.21	0.00	23	9.14	0.00
-2	36	3.92	0.00	27	5.52	0.00
-1	38	3.69	0.00	34	12.92[a]	0.00
0	37	5.48	0.00	41	47.11[a]	0.00[a]
1	38	2.35	0.00	40	23.49[b]	0.00[a]
2	37	1.85	0.00	41	31.28	0.00[a]
3	36	17.01	0.00	42	61.62	0.00[b]
			Panel C: Number and Percentage of Firms Paying Dividends			
		Number	Percentage		Number	Percentage
-3	33	4	12.12	23	6	26.09
-2	36	5	13.90	27	5	18.52
-1	38	5	13.16	34	9	26.47
0	37	7	18.92	41	12	29.27
1	38	5	13.16	40	11	27.50[*]
2	37	4	10.81	41	10	24.29[*]
3	36	4	11.11	42	13	30.95[*]

[a]Significantly different from the mean or median of the nonhedge firms at the 0.10 level.
[b]Significantly different from the mean or median of the nonhedge firms at the 0.05 level.
[*]Pearson Chi-Square significant at the 0.10 level.

V. CONCLUSIONS

The purpose of this study is to examine the financial distress indicators around the time oil and gas firms introduce derivative instruments. We examine leverage and short-term liquidity from three years before to three years after the introduction of derivative instruments during the period, 1994 – 2010. The findings of our study will provide further evidence whether hedging is motivated by financial distress, specifically in the oil and gas industry.

Our data indicate that the hedgers have higher debt than the nonhedgers in the years immediately before derivatives are used. The level of debt decreases for the hedge firms and is no different from that of the nonhedge firms beginning year 0. We also find that short-term liquidity is lower for the hedge firms as compared to the nonhedge firms. The dividend payout and the number of firms paying dividends increase in the year of introduction and in subsequent years.

The findings of our study are consistent with prior findings that the hedgers in the oil and gas industry experience financial distress. The debt ratio indicator is more pronounced before the introduction of derivative instruments and dividend payout indicator is more pronounced in the year of introduction and in subsequent years.

ENDNOTES

1. Another hypothesis is based on the agency theory that focuses on managerial incentive to manage risk (e.g., Stulz, 1984).
2. We recognize that a risk management program is more comprehensive than the use of derivative instruments for hedging.
3. The earliest year of the SEC filings reported on Edgar is 1994. For many firms, the first filings are available on SEC Edgar after 1994.
4. For firms whose derivative activities are reported in the first year of filing, we could not determine if hedging is introduced in the filing year or in a prior year.

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