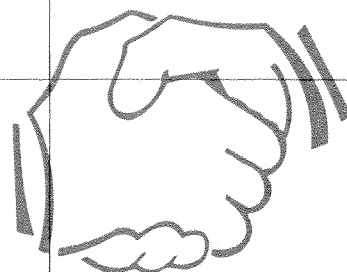
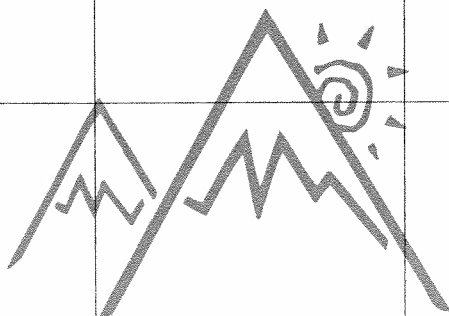
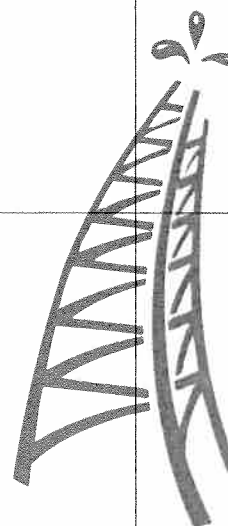


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OIL AND GAS ASSET IMPAIRMENT BY FULL COST AND SUCCESSFUL EFFORTS FIRMS

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This study provides empirical evidence on reported write-downs associated with asset impairment by oil and gas firms during the sample period 1995-2001. During this sample period, full cost (FC) firms were required to test their oil and gas assets for potential impairment according to the ceiling test rules outlined in Regulation SX 4-10. Successful efforts (SE) firms, on the other hand, were required to test for potential impairment according to the rules outlined in SFAS 121. While FC firms have been required to test for asset impairment and recognize write-downs since 1978, SE firms were not formally required to do so until 1995 when SFAS 121 became effective. The presence of divergent asset impairment rules for FC vis-à-vis SE firms during our sample period may result in magnitude and frequency differences in reported write-downs. Our study aims to provide evidence on the reported magnitude and frequency of write-downs associated with asset impairment by FC and SE firms. We also provide evidence on the impact of write-downs on key financial and operating variables for both groups of firms.

Background

In the oil and gas industry, firms may follow either the SE accounting method according to SFAS No. 19, "Financial Accounting and Reporting by Oil and Gas Producing Companies", or the FC accounting method according to Accounting Series Release (ASR) No. 258, "Oil and Gas Producers—Full Cost Accounting Practices".¹ The main differences between these two methods

¹ In 1977 the FASB issued SFAS 19 that initially eliminated the FC method and required all oil and gas firms to follow the SE method. However, in 1978 the SEC issued ASR 258 which permitted the continuing use of the FC method. The FASB then issued SFAS No. 25, "Suspension of Certain Accounting Requirements for Oil and Gas Producing Companies" in 1979 which suspended the SFAS 19's requirement that all oil and gas firms follow the SE method. Acknowledging limitations of the SE and FC

relate to the way they account for exploration costs and the way they account for impairment of oil and gas assets. The SE accounting method expenses exploration costs associated with unsuccessful wells and capitalizes only those related to successful (i.e., commercially viable) exploration. On the other hand, the FC accounting method capitalizes exploration costs associated with both successful and unsuccessful wells. The capitalized costs are then written off against future income.² On average, SE accounting methods relative to FC accounting methods result in more conservative accounting numbers for total assets and net earnings.

Although FC firms are permitted to capitalize unsuccessful exploration costs and include them in their oil and gas assets, the SEC places a ceiling on the total costs FC firms can capitalize. Since 1978, the SEC has required FC firms under ASR 258 (Regulation SX 4-10) to perform a stringent quarterly impairment test, called the ceiling test. This test ensures that the capitalized costs for a cost center, defined as a country, do not exceed the cost center ceiling. The amount of the cost center ceiling is the sum of: (1) the present value of future net revenue from proved reserves, discounted at a uniform rate of 10% and based on end of quarter oil and gas prices and costs; plus (2) the cost of properties not being amortized; plus (3) the lower of cost or market of unproved properties being amortized; less (4) the tax effects associated with differences between the book and tax basis of properties. If the cost center's capitalized costs exceed the cost center's ceiling, the excess is written down, and an ordinary loss equal to that excess is recognized.

SEC issued ASR 253 and ASR 269. These releases proposed a new accounting method for the oil and gas industry—the reserve recognition accounting (RRA) method. The RRA proposed the recognition of the value of oil and gas reserves in financial statements upon the discovery of such reserves. However, because of concerns over its reliability, the SEC abandoned the RRA in 1981. In 1982, the FASB issued SFAS No. 69, "Disclosures About Oil and Gas Producing Activities," which requires oil and gas firms to present reserve-based disclosures.

²Advocates of the SE method believe that expensing unsuccessful exploration costs is a better practice than capitalizing them. They argue that capitalizing unsuccessful exploration expenditures introduces an asset that has no direct future economic benefits. Advocates of the FC method, on the other hand, contend that exploration expenditures associated with unsuccessful wells are needed to find successful wells; hence both successful and unsuccessful exploration expenditures should be capitalized.

On the other hand, SE firms were encouraged but not formally required to adopt the SEC ceiling test rules. However, since 1995, SE firms are required to apply SFAS 121 to test whether a long-lived asset such as proved oil and gas reserves has been impaired when events or changes in circumstances suggest "the carrying amount of an asset may not be recoverable" (paragraph 4).³ Such events in the oil and gas industry may include significant decreases in oil and gas prices or significant increases in costs (see Gallun, Wright, Nichols and Stevenson, 2001). The existence of such events triggers the impairment process under SFAS 121.⁴ The impairment process under SFAS 121 starts by requiring SE firms to screen for impairment by comparing the carrying amount of an asset to the undiscounted future net revenue associated with the asset. If the undiscounted future net revenue is less than the carrying amount of the asset, the asset is considered to be impaired and an impairment loss must be recognized. The impairment loss is measured as the excess of the asset's carrying amount over the asset's fair value. The fair value of the asset is measured by the market value. If the asset's market price is not available, alternative methods such as the discounted future net revenue that the asset is expected to generate could be used to determine the fair value. In calculating future net revenue, SE firms apply future oil and gas prices as well as future costs.⁵

³Gallun and Nichols (1995) point out that the FASB acknowledged informally that FC firms need not apply SFAS 121 to their oil and gas properties. However, it should be noted that FC firms should apply SFAS 121 to their non-oil and gas assets.

⁴It should be noted that SE firms should account for impairment of unproved oil and gas properties in accordance with SFAS 19. That is, within the context of oil and gas properties, SFAS 121 covers only impairment of proved oil and gas properties while SFAS 19 is still to be used for impairment of unproved oil and gas properties (Morris and Eikner, 1996).

⁵In October 2001, the Financial Accounting Standards Board (FASB) issued SFAS 144, "Accounting for the Impairment or Disposal of Long-Lived Assets". SFAS 144 supersedes SFAS 121. SFAS 144 retains the SFAS 121's rules for long-lived assets held for use. It also establishes a single accounting model for long-lived assets to be disposed of. SFAS 144 is effective for fiscal years beginning after December 15, 2001. SFAS 121 was the applicable standard during the sample period covered by this study (1995-2001).

Ceiling Test Impairment Rules vs. SFAS121 Impairment Rules

While neither set of impairment rules allows the reinstatement of a write-down once recorded, the ceiling test is generally considered more stringent than SFAS 121 for several reasons. First, the ceiling test must be performed every quarter as opposed to testing for impairment only when events warrant it under SFAS 121. As a result of this difference, a temporary oil and gas price decline may force, at interim dates, FC firms (but not SE firms) to record an impairment write-down. Second, while the ceiling test must be performed using discounted net revenue, SFAS 121 screens for impairment using undiscounted net revenue. Third, the ceiling test must be performed using end-of-quarter oil and gas prices whereas SFAS 121 is applied using future oil and gas prices. The use of discounted net revenue based on “depressed” end-of-quarter oil and gas prices, as opposed to undiscounted net revenue based on future prices, will produce a smaller cost center ceiling which in turn could increase the likelihood of incurring more and/or bigger ceiling test write-downs. Fourth, another difference between the ceiling test and SFAS 121 relates to the use of different types of reserves when determining future net revenue. Gallun et al. (2001) indicate that under the ceiling test, future net revenue includes net revenue related to proved reserves only. However, under SFAS 121, future net revenue may include net revenue related to probable and possible reserves in addition to those related to proved reserves.⁶ Gallun and Nichols (1997) report that 24% and 6% of the SE firms surveyed in 1997 included net revenue of probable and possible reserves respectively in the calculation of their future net revenue under SFAS 121. Excluding net revenue associated with probable and possible reserves from the calculation of future net revenue under the ceiling test will produce a smaller cost center ceiling which in turn could contribute to more frequent and/or larger ceiling test write-downs.

On the other hand, SFAS 121 is considered more stringent than the ceiling test in one aspect. SE firms are required to group their assets when applying SFAS 121 “at the lowest level [such as a field or reservoir level] for which there are identifiable cash flows that are largely independent of the cash flows of other groups of assets” (SFAS 121, paragraph 8). However, FC firms, in applying the ceiling test, group their assets at a country level. Grouping assets at a field or reservoir level under SFAS 121, as opposed to a countrywide level

⁶The terms *proved*, *probable*, and *possible* reserves are commonly identified in the industry as petroleum reserves that have a recoverability probability of at least 90%, 50%, and 10% respectively.

under the ceiling test, will result in fewer losses on some of the grouped assets being offset by gains on others. As a result, the level of asset grouping required by SFAS 121 represents a more stringent requirement than that of the ceiling test. This has led Gallun et al. (2001, p. 244) to conclude that because of the level of asset grouping under SFAS 121, "the effect of the FC ceiling test may be much less dire than SFAS No. 121."

Sample Selection and Data Sources

The sample includes US oil and gas firms that are classified as "domestic exploration and production" in the Herold database and that have significant oil and gas exploration and production activities. This criterion ensures the exclusion of firms with major non-exploration and production activities. The criterion is applied by including only firm-year observations that have more than or equal to 50% of their operating revenue generated by oil and gas exploration and production activities.⁷

After excluding outliers, the final sample consisted of 1623 firm-quarter observations of 46 SE and 48 FC firms in the period 1995-2001. Key financial data were collected from the Compustat database and the write-down data were hand collected from firms' 10-Q filings.

⁷Many prior studies have used the firm's standard industrial classification (SIC) codes to proxy for the extent to which a firm is engaged in oil and gas exploration and production activities. However, several concerns have been raised regarding the usefulness of the SIC codes. For example, Kahle and Walkling (1996, p. 309) note that because the SIC codes change over time, the latest SIC codes used can "be quite different from the SIC codes appropriate for previous years". Moreover, Clarke (1989) indicates that the SIC codes are not very successful in classifying firms into groups of firms with similar characteristics. As a result, the use of operating revenue generated by oil and gas exploration and production activities is a more direct and more accurate proxy for the firm's level of exploration and production activities.

Table 1
Descriptive Statistics for the Key Financial Variables
for All Quarterly Intervals

	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentiles	
							25	75
mv_t	1620	669.533	152.865	1335.433	1.264	10886.235	44.480	590.785
bv_t	1623	0.522	0.495	1.037	-20.348	6.169	0.357	0.704
x_t	1623	-0.008	0.007	0.084	-0.912	0.177	-0.009	0.021
Δx_t	1623	0.000	0.001	0.095	-0.646	0.648	-0.011	0.011
oa_t	1623	1.255	0.893	1.660	0.073	29.558	0.554	1.392
Δoa_t	1623	0.053	0.020	0.224	-0.948	4.154	-0.008	0.062
Δoa_{t-1}	1620	0.038	0.019	0.180	-1.204	1.497	-0.009	0.058
Δci_t	1623	0.008	0.004	0.176	-1.004	1.198	-0.026	0.036

mv_t is the market value of equity (in millions of dollars). bv_t is common equity. Δx_t is the change in earnings ($x_t - x_{t-1}$). oa_t is operating assets which are calculated as common equity minus cash and marketable securities plus short-term debt plus long-term debt plus preferred stock plus minority interest. Δoa_t is the change in operating assets ($oa_t - oa_{t-1}$). ci_t is cash investments which are the negative of cash flows from investing activities. Δci_t is the change in cash investments ($ci_t - ci_{t-1}$). All variables except for mv_t are deflated by the beginning market value of equity (p_{t-1}).

Descriptive Statistics of Key Financial Variables

Table 1 presents descriptive statistics for key financial variables for all quarterly intervals. These variables are defined as:⁸

- mv_t is the market value of equity (in millions of dollars);
- bv_t is common equity. Δx_t is the change in earnings ($x_t - x_{t-1}$);
- oa_t is operating assets which are calculated as common equity minus cash and marketable securities plus short-term debt plus long-term debt plus preferred stock plus minority interest;
- Δoa_t is the change in operating assets ($oa_t - oa_{t-1}$);
- ci_t is cash investments which are the negative of cash flows from investing activities; and
- Δci_t is the change in cash investments ($ci_t - ci_{t-1}$).

The data reveal a wide size range with a minimum market value of equity (mv_t) of \$1.264 million and a maximum of \$10,886.235 million. The sample has an average market value of \$669.533 million and a median of \$152.865 million. Thirty-three percent of the observations have negative earnings (x_t) leading to an average x_t of -0.8% (of the beginning market value of equity) and a median of 0.7%. The median change in earnings (Δx_t) is 0.1% of the beginning market value of equity reflecting a very small growth in profitability on average.

Table 1 also reports that operating assets (oa_t) have a mean (median) of 125.5 % (89.3%) of the beginning market value of equity. Moreover, the book value of equity (bv_t) has a mean (median) of 52.2% (49.5%) of the beginning market value of equity. The larger operating assets, in comparison to the book value of equity, indicate that the sample firms are financially leveraged on average. The average change in operating assets (Δoa_t) and the average change in cash investments (Δci_t) are positive, reflecting growth in operating assets and capital expenditures respectively.

⁸All variables except for mv_t are deflated by the beginning market value of equity (p_{t-1})

Table 2
Descriptive Statistics for Key Financial Variables for Successful Efforts Versus Full Cost Firms

Panel A: Successful Efforts Firms									
	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentile		
							25	75	
mv_i	839	770.650	174.777	1529.672	1.264	10886.235	33.162	643.326	
bv_i	840	0.561	0.479	0.630	-7.591	6.169	0.355	0.681	
x_i	840	-0.008	0.006	0.081	-0.912	0.177	-0.016	0.022	
Δx_i	840	-0.001	0.000	0.086	-0.553	0.624	-0.016	0.013	
oa_i	840	1.227	0.842	1.506	0.073	24.737	0.553	1.373	
Δoa_i	840	0.043	0.013	0.207	-0.948	1.775	-0.014	0.046	
Δoa_{i-1}	838	0.028	0.012	0.179	-1.204	1.133	-0.015	0.045	
Δci_i	840	0.006	0.003	0.179	-1.004	1.198	-0.028	0.031	

Table 2, continued

Panel B: Full Cost Firms								
	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentile	
							25	75
mv_t	781	560.907	133.907	1079.333	2.800	7874.706	55.927	545.128
bv_t	783	0.480	0.508	1.343	-20.348	5.345	0.359	0.723
x_t	783	-0.008	0.009	0.087	-0.911	0.140	-0.004	0.021
Δx_t	783	0.000	0.001	0.103	-0.646	0.648	-0.008	0.009
d_{t-1}	783	-0.012	0.000	0.046	-0.339	0.037	0.002	0.000
oa_t	783	1.285	0.963	1.811	0.096	29.558	0.555	1.413
Δoa_t	783	0.063	0.033	0.241	-0.902	4.154	-0.002	0.078
Δoa_{t-1}	782	0.048	0.031	0.181	-0.0838	1.497	-0.003	0.074
Δci_t	783	0.010	0.005	0.172	-0.938	1.138	-0.025	0.039

mv_t is the market value of equity (in millions of dollars). bv_t is common equity. Δx_t is the change in earnings ($x_t - x_{t-1}$). d_{t-1} is dividends which are calculated as dividends to common shareholders plus purchases of common and preferred stock minus sales of common and preferred stock. oa_t is operating assets which are calculated as common equity minus cash and marketable securities plus short-term debt plus long-term debt plus preferred stock plus minority interest. Δoa_t is the change in operating assets ($oa_t - oa_{t-1}$). ci_t is cash investments which are the negative of cash flows from investing activities. Δci_t is the change in cash investments ($ci_t - ci_{t-1}$). All variables except for mv_t are deflated by the beginning market value of equity (p_{t-1}).

Table 2 presents descriptive statistics for key financial variables for the SE firms (Panel A) and FC firms (Panel B). The average book value of equity, operating assets and earnings of the SE firms (56.1 %, 122.7%, and -0.8% of the beginning market value of equity respectively) are not significantly different from those of the FC firms (48.0%, 128.5%, and -0.8% respectively) according to both the Wilcoxon Z-statistic test and the *t*-test for the mean difference.⁹ The average change in operating assets is positive for both SE and FC firms reflective of growth in operating assets for both SE and FC firms. Finally, the SE average market value of equity (\$770.650 million) is significantly higher than that of FC firms (\$560.907 million) with a *t*-statistic for the mean difference of 3.168. Consistent with previous studies, this statistic suggests that SE firms in the sample tend to be larger than FC firms.

Descriptive Statistics of Key Financial Variables during Write-Down Periods

Table 3 reports descriptive statistics for the primary variables for the quarters that did not witness a SFAS 121 or a ceiling test write-down (quarters of no write-down, hereafter) and quarters in which SFAS 121 or ceiling test write-downs were taken (quarters of write-down, hereafter). The average earnings of quarters of no write-down are significantly larger than that of quarters of write-down with a *t*-statistic for the mean difference of 14.234 and Wilcoxon's Z-statistic of -10.447, reflective of the impact of write-downs on earnings. Moreover, the mean book value of equity and operating assets of quarters of no write-down are larger than those of quarters of write-down. However, the difference in these variables is not significant according to Wilcoxon Z-statistic or the *t*-tests.

⁹ The advantage of the Wilcoxon nonparametric test over the *t*-test is that the former does not make any assumptions about the distributions of the sub-samples' populations. In addition, the Wilcoxon test mitigates the influence of outlying observations.

Table 3

Descriptive Statistics for Key Financial Variable for Quarters That Witnessed No SFAS 121
or Ceiling Test Write-Down Versus Quarters That Witnessed a SFAS 121 or Ceiling Test Write-Down

Panel A: Quarters that witnessed no write-down

	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentile	
							25	75
mv_t	1389	678.610	156.276	1353.733	1.264	10886.235	46.915	598.805
bv_t	1392	0.523	0.499	1.106	-20.348	6.169	0.358	0.710
x_t	1392	0.003	0.009	0.064	-0.912	0.177	-0.003	0.022
Δx_t	1392	0.010	0.002	0.079	-0.524	0.624	-0.007	0.012
oa_t	1392	1.277	0.900	1.747	0.073	29.558	0.555	1.398
Δoa_t	1392	0.062	0.023	0.228	-0.948	4.154	-0.005	0.065
Δoa_{t-1}	1389	0.038	0.020	0.176	-1.204	1.497	-0.008	0.059
Δci_t	1392	0.008	0.004	0.179	-1.004	1.167	-0.026	0.035

Table 3, continued

Panel B: Quarters that witnessed a write-down							
	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentile
							25 75
mv_t	231	614.953	126.447	1220.929	2.800	7140.508	31.786 500.870
bv_t	231	0.515	0.463	0.442	-3.067	2.896	0.336 0.622
x_t	231	-0.077	-0.025	0.140	-0.690	0.165	-0.124 0.011
Δx_t	231	-0.064	-0.023	0.143	-0.646	0.648	-0.118 0.001
oa_t	231	1.122	0.829	0.976	0.162	7.445	0.542 1.377
Δoa_t	231	-0.004	0.005	0.195	-0.569	1.092	-0.069 0.039
Δoa_{t-1}	231	0.035	0.017	0.199	-1.007	1.133	-0.013 0.053
Δci_t	231	0.005	0.004	0.153	-0.821	1.198	-0.028 0.037

mv_t is the market value of equity (in millions of dollars). bv_t is common equity. Δx_t is the change in earnings ($x_t - x_{t-1}$). oa_t is operating assets which are calculated as common equity minus cash and marketable securities plus short-term debt plus long-term debt plus preferred stock plus minority interest. Δoa_t is the change in operating assets ($oa_t - oa_{t-1}$). ci_t is cash investments which are the negative of cash flows from investing activities. Δci_t is the change in cash investments ($ci_t - ci_{t-1}$). All variables except for mv_t are deflated by the beginning market value of equity (p_{t-1}).

Descriptive Statistics for Key Accounting Method Differentiating Variables

Prior literature shows that oil and gas firms' characteristics such as leverage, degree of concentration in oil and gas activities, exploration intensity, and success in recovering investments in oil and gas activities are factors that differentiate between SE and FC firms. Similar to prior literature (see, for example, Bandyopadhyay, 1994, and Chen and Lee, 1995), these characteristics are defined as follows:

- Leverage: long-term debt divided by total assets;
- Degree of concentration in oil and gas activities: oil and gas revenue divided by total sales and operating revenue;
- Exploration intensity or aggressiveness: exploration costs divided by oil and gas revenue;¹⁰ and
- Success in recovering investments in acquisition, exploration, and development: [the sum of net change in standardized measure of discounted net cash flows due to extension, discoveries and improved recoveries (less related costs) plus net reserve purchases] divided by the total costs incurred in acquisition, exploration and development. (Bandyopadhyay's (1994) measure of success is modified by adding net reserve purchases to the numerator. Spear (1994) notes that oil and gas firms, during the period 1984-1988, tended to purchase reserves rather than explore to meet their production requirements. Accordingly, adding net reserve purchases will reflect whether firms are successful in recovering investments associated not only with exploration and development but also with acquisition).

The evidence reported in the extant literature suggests that leverage is a significant factor that differentiates between SE and FC firms (Deakin, 1979; Dhaliwal, 1980; and Malmquist, 1990). Panel A of Table 4 shows that the ratio of long-term debt to total assets for SE firms (a mean of 0.339 and a median of 0.341) is not significantly different from that of FC firms (a mean of 0.339 and a median of 0.322). These results indicate no difference in leverage between SE and FC firms in the sample.

Prior research also suggest that FC firms earn more of their total revenue from oil and gas activities than SE firms (Bandyopadhyay, 1994). Statistics on the degree of concentration in oil and gas activities reported in Panel A show

¹⁰Similar conclusions are obtained when proxying for intensity using the ratio of total costs incurred in acquisition, exploration, and development to oil and gas revenue.

that, on average, FC firms earn 92.2% and SE firms earn 88.2% of their total sales and operating revenue from oil and gas activities. The statistics indicate that the activities of both FC and SE firms in the sample are highly concentrated in oil and gas. The statistics also indicate that FC firms earn a slightly higher proportion of their sales and operating revenue from oil and gas activities relative to SE firms. The difference is statistically significant according to both the Wilcoxon and t-tests.

Moreover, prior literature provides evidence that FC firms tend to be more aggressive in exploration relative to SE firms (Lilien and Pastena, 1982; Malmquist, 1990; and Bandyopadhyay, 1994). Panel A of Table 4 shows that the average ratio of exploration costs to oil and gas revenue for the FC firms (0.384) is higher than that of the SE firms (0.196). This difference is statistically significant according to both the Wilcoxon and t-tests. The results provide evidence that the FC firms in the sample devote more resources to exploration activities than SE firms.

Finally, Bandyopadhyay (1994) provides evidence that FC firms are more successful than SE firms in recouping their oil and gas investments. Panel A reveals that both FC and SE firms in the sample are able, on average, to recoup their investments in acquisition, exploration and development activities. Panel A also reports that FC firms have a higher average success rate in recovering their investments in the oil and gas activities (1.203) relative to the SE firms (1.113). However, the difference in the success rate is not statistically significant. This implies that there is no difference between FC and SE firms in their ability to recover their investments.

Descriptive Statistics for Key Accounting Methods Differentiating Variables during Write-Down Periods

Panel B of Table 4 presents descriptive statistics for the sample characteristics classified by years that did not witness a SFAS 121 or a ceiling test write-down (years of no write-down, hereafter) versus years in which SFAS 121 or ceiling test write-downs were taken (years of write-down, hereafter). Panel B shows that firms in the years of write-down tend to be more leveraged (a mean of 0.386) than in the years of no write-down (a mean of 0.311), reflective of the impact of write-down on the assets of firms that reported write-downs. This difference is statistically significant according to both Wilcoxon's test and the t-test. This implies that taking a write-down in a particular year poses greater risk of violating debt covenants, as accounting variables specified in covenants are influenced by the write-down.

Table 4

Descriptive statistics for the following sample characteristics: leverage, degree of concentration in oil and gas activities, exploration intensity, and success in recovering investments

Panel A: Successful efforts (SE) versus full cost (FC) firms							
		#	Mean	Median	Std. deviation	t-statistic for mean difference	Wilcoxon's Z-statistic
Leverage	SE firms	222	0.339	0.341	0.229		
	FC firms	215	0.339	0.322	0.246	-0.002	-0.37
Concentration	SE firms	222	0.882	0.977	0.169		
	FC firms	214	0.922	1.000	0.133	-2.70*	-2.70*
Exploration intensity	SE firms	222	0.196	0.125	0.335		
	FC firms	214	0.384	0.169	0.713	-3.542*	-3.432*
Success	SE firms	222	1.113	0.846	1.130		
	FC firms	215	1.203	0.913	1.508	-0.71	-0.73

Table 4, continued

Panel B: Years that witnessed no SFAS 121 or ceiling test write-down vs. years that witnessed SFAS 121 or ceiling test write-down							
		# obs	Mean	Median	Std. deviation	t-statistic for mean difference	Wilcoxon's Z-statistic
Leverage	No write-down	202	0.311	0.316	0.224		
	Write-down	178	0.386	0.378	0.241	-3.17*	-2.79*
Concentration	No write-down	202	0.903	0.979	0.233		
	Write-down	178	0.927	0.998	0.154	-1.15	-1.97
Exploration intensity	No write-down	202	0.213	0.118	0.281		
	Write-down	178	0.300	0.164	0.599	-1.842	-2.882*
Success	No write-down	202	1.577	1.270	1.508		
	Write-down	178	0.755	0.606	1.013	6.15*	-6.65*

Leverage is long-term debt divided by total assets. Degree of concentration in oil and gas activities is oil and gas revenue divided by total sales and operating revenue. Exploration intensity is exploration costs divided by oil and gas revenue. Success in recovering investments in acquisition, exploration and development is [the sum of net change in standardized measure of discounted net cash flows due to extension, discoveries and improved recoveries (less related costs) plus net reserve purchases] divided by the total costs incurred in acquisition, exploration and development. Significance levels (two-tail test): * < 0.01, ** < 0.05.

Panel B also shows that although years of write-down yield greater exploration intensity, there will be far less success in recovering their investment in the acquisition, exploration, and development activities. The average success rate for years of no write-down (1.577) is significantly higher than that of years of write-down (0.755). These statistics imply that less success in recovering oil and gas investments is associated with more write-downs. Gallun and Nichols (1997) report that 88% of the SE firms surveyed in 1997 considered significant increases in costs which in turn lead to a lower success rate (as the value of denominator increases), an event that warrants testing for impairment. Finally, Panel B of Table 4 indicates that the degree of concentration in oil and gas activities does not exhibit a significant statistical difference between years of no write-down and years of write-down.¹¹

Descriptive Statistics for Write-Down Amounts and Frequencies

Panel A of Table 5 indicates that the mean pre-tax (median) write-down amount recorded by the entire sample firms is 9.0% (2.5%) of the beginning market value of equity.¹² This suggests that write-downs constitute economically significant amounts that have an important effect on firms' value. When write-downs are broken down by the accounting method (Panel B), the average ceiling test write-downs taken by the FC firms (19.2%) are significantly higher than the average SFAS 121 write-downs taken by the SE firms (5.2%), with a t-statistic for the mean difference of -7.845.

Consistent with prior literature, the magnitude of write-down is also measured by the ratios of the pre-tax write-down amount: to pre-write-down operating assets (w_i^*/oa_i^{**}), to pre-write-down book value of equity (w_i^*/bv_i^{**}) and to pre-write-down earnings (w_i^*/x_i^{**}).¹³ Panel C of Table 5 shows that the ceiling test write-downs resulted in greater reduction of operating assets than the SFAS 121 write-downs. The mean (median) w_i^*/oa_i^{**} under the ceiling test is 13.4% (11.3%) compared to 3.7% (1.3%) under SFAS 121. The difference

¹¹ Aboody (1996) compares FC firms recording a ceiling test write-down to SE firms disclosing enough data to calculate an as-if write-down. He reports that FC firms are more financially leveraged, more aggressive in exploration, more successful in exploration, and less diversified.

¹² Write-down amounts are entered as positive numbers.

¹³ Using operating assets in w_i^*/oa_i^{**} is more relevant than using total assets because the other component of total assets (i.e. financial assets) is not subject to SFAS 121 or the ceiling test rules.

is statistically significant with a t -statistic of -8.81 and a Wilcoxon's Z -statistic of -7.51. Similarly, the ceiling test write-downs reduced common equity by an average of 22.6% (a median of 17.4%) versus an average of 7.0% (a median of 1.9%) for SFAS 121. The difference is statistically significant according to the t -test ($t = -6.98$) and Wilcoxon test ($Z = -7.14$). In addition, Panel C shows a higher w_i^*/x_i^{**} ratio under the ceiling test than under SFAS 121. However, the difference in w_i^*/x_i^{**} is not statistically significant according to the t or Wilcoxon tests. The statistics suggest the write-downs that resulted from the application of the ceiling test have greater magnitude than those of SFAS 121. This could be attributed to the fact that the ceiling test applies more stringent rules when measuring impairment than SFAS 121.

The statistics on the ceiling write-downs reported in Panel C are comparable with those of previous studies. Chen and Lee (1995), for instance, report median ratios of the ceiling test write-down amount to pre-write-down total assets and equity of 12% and 29% respectively for their sample of 60 write-downs during 1985-1986. Alciatore et al. (2000) report that the ceiling test write-downs represent an average of 23.9% (a median of 12.7%) of pre-write-down total assets for their sample of 148 write-downs during 1985-1986. Frost and Bernard (1989) report an average ratio of write-down to pre-write-down assets (equity) of 11 % (41%) for their sample of 18 FC firms that recorded a write-down in the first quarter of 1986.

Table 5

Descriptive statistics for the write-down amounts

Panel A: Write-down amounts (WD_i) in the entire sample firms

	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentiles	
							25	75
WD_i	231	0.090	0.025	0.137	0.0001	0.712	0.006	0.124

Panel B: Write-down amounts (WD_i) for successful efforts (SE) and full cost (FC) firms

	# obs	Mean	Median	Std. Deviation	Minimum	Maximum	Percentiles	
							25	75
FC-Ceiling test	64	0.192	0.140	0.174	0.0003	0.712	0.046	0.283
SE-SFAS 121	167	0.052	0.012	0.094	0.0001	0.522	0.003	0.051

Table 5, continued

Panel C: Write-down ratios for successful efforts (SE) vs. full cost (FC) firms

	w_t^*/oa_t^{**}		w_t^*/bv_t^{**}		w_t^*/x_t^{**}	
	FC Ceiling Test	SE SFAS 121	FC Ceiling Test	SE SFAS 121	FC Ceiling Test	SE SFAS 121
# obs	64	167	64	167	64	167
Mean	0.134	0.037	0.226	0.070	4.587	0.916
Median	0.113	0.013	0.174	0.019	1.226	0.168
Std. Deviation	0.107	0.059	0.190	0.133	28.165	32.820
Minimum	0.001	0.0002	0.001	0.0002	-62.062	-257.891
Maximum	0.490	0.415	0.671	1.031	185.714	331.250
Percentiles: 25	0.038	0.005	0.065	0.007	-1.887	-0.149
75	0.212	0.044	0.380	0.069	3.337	0.838

Write-down amounts are entered as positive numbers. WD_t is the impairment pre-tax write-down amount deflated by the beginning market value of equity (mv_{t-1}). w_t^*/oa_t^{**} is pre-tax write-down amount for quarter t divided by [operating assets at t after adding back write-down amounts up through quarter t during the period 1995-2001]. w_t^*/bv_t^{**} is pre-tax write-down amount for quarter t divided by [book value of common equity at t after adding back write-down amounts up through quarter t during the period 1995-2001]. w_t^*/x_t^{**} is pre-tax write-down amount for quarter t divided by [earnings for quarter t after adding back the write-down amount recorded in quarter t].

Table 6

Description of the quarterly write-down activity under the ceiling test versus SFAS 121 for firms that have full accounting data for each quarter in the entire sample period (1995-2001)

	All	1995	1996	1997	1998	1999	2000	2001	Avg. per quarter
	%	No.							
Ceiling test (number of FC firms = 48):									
First quarter	3%	2		1	1				
Second quarter	16%	10	1	1	6	1		1	
Third quarter	16%	10			5		2	3	
Fourth quarter	66%	42		9	20	3		10	
Total	100%	64	1	0	11	32	4	2	14
	%age	2%	0%	17%	5-%	6%	3%	22%	2.29
SFAS 121 (number of SE firms = 46):									
First quarter	6	10	1		2		4	3	
Second quarter	13%	22	1	1	3	2	7	7	
Third quarter	15%	25	3	2	4	3	4	9	
Fourth quarter	66%	110	13	9	15	24	16	14	19
Total	100%	167	18	10	18	33	21	29	38
	%age	11%	6%	11%	20%	13%	17%	23%	5.96

Moreover, Table 6 shows both FC and SE firms took the majority of the reported write-downs (66%) during the fourth quarters of the sample period. Interestingly, the number of write-downs taken by FC firms during 1998 (2001) accounted for 50% (22%) of the total number of write-downs taken by these firms over the entire sample period. While the number of write-downs taken by SE firms during 1998 and 2001 are higher than those of other periods, it is not as high as that of FC firms. In fact, the write-downs taken by SE firms were observed over the entire sample period. These statistics could be attributed to (1) weaker oil prices in 1998 and 2001 relative to those of preceding years in the sample period,¹⁴ and (2) the fact that the ceiling test must be performed using end-of-quarter oil and gas prices, whereas SFAS 121 is applied using future oil and gas prices. As noted earlier, the use of discounted net revenue

¹⁴ The spot price per barrel for West Texas Intermediate crude oil as published by the U.S. Energy Information Administration for the sample period is as follows:

Year	Price at year-end (p_t)	Change in price ($p_t - p_{t-1}$)	Minimum price for the year
1995	\$19.54	\$1.77	\$16.86
1996	\$25.90	\$6.36	\$17.33
1997	\$17.65	-\$8.25	\$17.60
1998	\$12.14	-\$5.51	\$10.82
1999	\$25.76	\$13.62	\$11.38
2000	\$26.72	\$0.96	\$23.91
2001	\$19.96	-\$6.76	\$17.50

The wellhead price mcf of natural gas for the sample period is as follows:

1995	\$1.84	-\$0.04	\$1.43
1996	\$3.26	\$1.42	\$1.85
1997	\$2.28	-\$0.98	\$1.79
1998	\$1.95	-\$0.33	\$1.70
1999	\$2.24	\$0.29	\$1.70
2000	\$5.77	\$3.53	\$2.60
2001	\$2.38	-\$3.39	\$2.38

based on “depressed” end-of-quarter oil and gas prices, as opposed to undiscounted net revenue based on future prices, will produce a smaller cost center ceiling which in turn could increase the likelihood of incurring larger ceiling test write-downs.

Summary and Conclusion

The empirical results in this paper show that during 1995-2001 impairment write-downs had significantly affected the reported earnings of oil and gas firms. However, the impact of the ceiling test impairment rules for FC firms was significantly higher than that of SFAS 121 impairment rules for SE firms. Interestingly, in an after impairment write-down environment, the average values of reported net equity, operating assets, and earnings of FC firms are not statistically different from those of SE firms. This evidence suggests that the impairment rules do eliminate the perceived varying degree of accounting conservatism (or aggressiveness) inherent in the accounting method choice by oil and gas firms.

The empirical results also show that both groups of firms took most of the write-downs during the fourth quarter. While the magnitude of the average write-down taken by FC firms is significantly higher than that of SE firms, SE firms reported on average more frequent write-downs. This evidence suggests that either (1) SE firms were able to use the relative flexibility inherent in SFAS 121 to smooth the effect of fluctuating oil and gas prices or (2) FC firms were forced to take higher write downs during the quarters in which average oil and gas prices dropped significantly during our sample period. Either way, this evidence reflects the divergent stringency associated with the application of the FC ceiling test rules vis-à-vis those of SFAS 121.

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