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The Value-Relevance of Accounting Figures in the International Oil and Gas Industry – Cash flows or Accruals?

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Abstract
Analysts often rely on a given set of accounting figures for evaluating the financial performance and relative valuation of oil and gas exploration companies. However, the relative importance of these various measures in the equity valuation process is unclear. The aim of our study is to determine the relative value-relevance of accounting figures using regression analysis of market and accounting data for 15 of the largest international oil and gas companies in the period 1990-2003. The results show that accounting figures calculated before the expensing of depreciation are more value-relevant than net figures. This indicates that investors have more confidence in profits before depreciation and in cash flows, than they have in net income.

1. Introduction

Analysts covering the petroleum industry often focus on various accounting figures in their analyses of the financial performance and valuation of oil and gas exploration companies. Typically, they use earnings before interest, taxes, depreciation and amortization (EBITDA), net operating profit after tax (NOPAT), net income (NI) and debt-adjusted cash flow (DACF). These accounting figures have several applications; for example, they are used in the numerator in performance measures, such as return on equity (ROE), and in the denominator in valuation multiples, such as the price-to-earnings ratio (P/E). Presumably, these accounting amounts are chosen because they are thought to be relevant both to performance measurement, and especially to valuation. However, there has been little academic research to substantiate the relative value-relevance of these particular accounting amounts. This is what our study seeks to determine.

The petroleum industry is an important global industry. The largest international oil and gas companies specialising in oil and gas exploration activities, commonly referred to as the majors, operate in many countries around the world. Because of their size and importance, these companies are followed by scores of investors and financial analysts, whose primary concern is to attempt to successfully predict the companies' future stock price developments. To estimate equity value, analysts have various valuation methods at their disposal; theoretical models, such as the discounted cash flow model (DCF), the residual income valuation model (RIV), and option pricing models, as well as more practical methods, such as valuation multiples. According to the discounted cash flow model (DCF), by academics considered the ideal theoretical valuation model, the value of a firm's equity is found by discounting its future cash flows by a relevant discount factor. However, the forecasting of cash flows from the present to eternity is quite a daunting task indeed. For this reason, analysts and investors tend to focus more on the firms' contemporaneous cash flows, and profitability. It is not surprising, therefore, that the price-earnings model is the primary valuation model used by investors and analysts (Barker, 1999). For investors and analysts, the best clues as to the development in the firms' future financial performance may be found in the patterns of the present or historical financial statements. Thus, there is a need to relate contemporaneous financial performance to valuation.

Ohlson (1995, 1999) and Feltham and Ohlson (1995, 1996) developed a theoretical valuation model where contemporaneous accounting information as measured by the residual income, and the book value of equity, is coupled to valuation. This valuation model has resulted in a substantial body of research, especially value-relevance studies. Value-relevance aims to assess whether accounting figures reflect information that is used by investors in valuing firm's equity. We apply the value-relevance methodology to study how contemporaneous accounting information affects investors' investment decisions, and ultimately, the market value of equity.

Although some studies have concluded that accounting information, such as net income and the book value of equity are value-relevant in cross-sectional studies, the dominating view has been that historical cost accounting is inappropriate for accurately conveying the oil and gas companies' financial performance to the financial markets. Consequently, this view has resulted in oil and gas producing companies being required to disclose additional financial and operational data (cf. the FASB Statement No. 69, and the SEC Statement SX 210.4-10).

There are several reasons for the lack of confidence in historical cost accounting in the oil and gas industry. Firstly, oil and gas companies have unique operating characteristics, such as the risk of drilling a dry well, the lengthy time between discovery and sale of reserves, and the lack of a predictable correlation between exploration costs and reserve value (Quirin *et al.*, 2000). These operating characteristics make it difficult for historical cost-based financial statements to be as relevant in the petroleum industry as in other industries (Deakin and Deitrick, 1982). Second, particular accounting methods such as successful efforts accounting, the unit-of-production depreciation method and pooling-of-accounts merger and acquisition accounting, can result in measurement errors that may affect the reliability of accounting figures. Moreover, since only costs incurred from the exploration and development of oil and gas reserves are capitalized, these costs may not necessarily correlate with any economic value of the reserves (Koester, 1990). A major shortcoming, therefore, of historical cost accounting for mineral industries is that the added value as a result of the discovery of new reserves is only included in the income when the oil and gas volumes are produced and sold in subsequent years. Consequently, accounting figures may be insufficient for evaluating oil

and gas company performance. Indeed, recent studies by Osmundsen *et al.* (2004) failed to find a significant relationship between the valuation multiple EV/DACF and the accounting based performance measure return on average capital employed, ROACE for 12 of the largest international oil and gas companies. Their study found that only non-financial information was significant in explaining valuation. Other recent value relevance studies on US oil and gas exploration companies, however, have indicated significant relationships between market value and accounting figures such as net income and book equity (Berry *et al.*, 2001; Quirin *et al.*, 2001; Bryant 2003).

Analysts covering the petroleum sector typically consider a wide range of accounting figures, both accruals and cash flows, and both leveraged and unleveraged values. One of the accounting figures they use is NOPAT, which is used as the numerator in the performance measure return on average capital employed (ROACE). Perhaps they consider NOPAT a more value relevant accounting figure than net income. Hence, the case may be that certain non-GAAP accounting amounts are in fact more value relevant than net income, and should therefore be the preferred choice in applications, such as performance measures. In fact, there are indications that cash flows (Cormier and Magnan, 2002) and discretionary cash flows[1] (Quirin *et al.*, 2001) may be more value relevant than accounting earnings in the oil and gas industry. The main aim of our study is to determine the value relevance of accounting information other than net income and book equity.

In our study, we analyse figures that are typically found in financial analysts' reports such as EBITDA, earnings before interest and taxes (EBIT), NOPAT, NI and DACF. We also consider cash flow from operations (CFO) and funds from operations (FFO), since these can readily be found, or easily calculated from financial statements.

We use financial information for 15 international oil and gas companies over the period 1990-2003. First, using cross-sectional time-series regression, we study the value relevance of accounting figures over the whole period. However, since 1997, the industry has witnessed a substantial restructuring, resulting in a series of mega-mergers among the majors. As this may have affected the relation between accounting figures and valuation, we also group the data into two panel data sets, one for the period 1990-1996 and one for the period 1997-2003. This will enable us to study the change in value-relevance prior and after this particular restructuring period.

We find that the accounting figures we study are more value relevant than net income during 1990-2003 (benchmark model). This indicates that expenses such as interest expenses and accruals are value relevant. Furthermore, we find that accounting numbers prior to expensing of depreciation, depletion and amortization charges (such as EBITDA) are more value relevant than after subtraction of these expenses (i.e. EBIT). This indicates that investors have more confidence in accounting figures that are prior to expensing of DD&A (depreciation, depletion and amortization). This is not surprising given that oil and gas companies reporting to SEC are allowed to use two different accounting methods, i.e. the full cost and successful efforts. The existence of two accounting methods, which result in two substantially different calculations of profit, can potentially confuse investors trying to measure oil and gas firm profitability. Since part of the difference between net income calculated under full cost and successful efforts methods relates to the depreciation charge, this may explain why profits calculated before depreciation is subtracted are more value relevant than net figures.

Additionally, we find that the size of oil and gas reserves becomes more important during 1997-2003 than in the previous six years. Apparently, investors have recently started paying more attention to the size of oil and gas companies than to their profitability. This result may be explained by the importance that size may have for oil and gas companies' ability to generate cash flows in the future. Alternatively, this may also be an effect of the extensive industry restructuring activity that took place among the majors during 1998-2002.

The results of the study should be of interest to oil and gas companies, investors and analysts wishing to use the most value relevant financial performance measures. Our study provides insight into which accounting metric to use. Our results suggest that financial performance indicators or valuation multiples should be chosen from the accounting figures that are prior to the expensing of DD&A.

2. Research design

2.1 Value relevance

Ever since Ball and Brown's (1968) and Beaver's (1968) seminal works on the topic some 35 years ago, researchers have tried to determine the relationship between accounting figures and valuation using statistical methods. Feltham and Ohlson's revitalization of the residual income valuation model, RIV (Ohlson, 1995, 1999; Feltham and Ohlson, 1995, 1996), however, enabled a better understanding of how accounting information could be linked to valuation more formally. Ohlson (1995) shows how market value is related to abnormal earnings, book value, and other information[3], in the following manner[4]:

$$(1) \qquad MV_t = \alpha_0 + \alpha_1 BV_t + \alpha_1 NI_t^a + \alpha_2 \upsilon_t$$

where *MV* is the market value of equity, *BV* is the book value of equity, NI^a is abnormal earnings and υ is a vector of other value relevant information. By linking of market value closer to the fundamentals, i.e. earnings and book value of equity, this method has resulted in a considerable amount of capital markets research, especially within the value relevance literature. An accounting amount is deemed value relevant if it has a significant association with equity market values. Value relevance studies are important in that they try to assess whether particular accounting amounts reflect information that is used by investors in valuing firm's equity.

We apply this framework in our study of the value relevance of various accounting figures in the oil and gas industry. Instead of using abnormal earnings, we use net income as reported in the financial statements. Additionally, as our proxy for *v*, other information we use the natural logarithm of oil and gas reserves[5]. This model represents our benchmark model, and is estimated as follows:

$$(7) \qquad MV_{it} = \chi_0 + \chi_1 NI_{it} + \chi_2 BV_{it} + \chi_3 OGR_{it} + \varepsilon_t$$

where OGR is the total proven oil and gas reserves (MMBOE) as reported in the 10-k SEC reports.

2.2 The value-relevance of different accounting figures

Net income can be disaggregated into cash flow and accrual components as follows:

Net income = Cash flow + Accruals

By rearranging the above equation, cash flow can be made a function of net income and accruals. Additionally, we can make other accounting figures functions of net income. This approach of rearranging the accounting figures allows us to test the value-relevance of different accounting figures, while preserving the linear information dynamics of the Feltham-Ohlson model as follows:

(8) $$MV_{it} = \chi_0 + \chi_1 X_{it} + \chi_2 (NI_{it} - X_{it}) + \chi_3 BV_{it} + \chi_3 OGR_{it} + \varepsilon_{it}$$

By expanding model (7) in this way, we can determine the value-relevance of accounting figures other than net income. Further, if the parameter on (NI - X) is significantly different from 0, then we can conclude that the difference is also value relevant.

2.3 Accounting figures:

We consider seven different accounting figures (in addition to book value of equity). These can be grouped as income statement figures, cash flow figures or pseudo cash flows.

i) Income statement based accounting figures

The income statement based accounting figures that are used are either figures as reported by the companies in their financial statements, such as revenues or net income, or calculated from reported accounting figures, such as net operating profit after tax, NOPAT.

The income statement variables that are used are the following:
- Earnings before interest and taxes (EBIT). Used as reported in the financial statements.
- Net operating profit after taxes (NOPAT). Calculated as the sum of net income and after tax net interest expense. The tax rate used is the recurring tax rate on earnings before tax.
- Net income (NI), Used as reported in the financial statements.

While EBIT and NOPAT are unleveraged profit measures[6], PRETAX and NI are leveraged.

ii) Pseudo cash flows

Pseudo cash flows are not true cash flows, but are calculated from income statement figures. Whereas real cash flow measures, such as cash flow from operations[7], are adjusted for all relevant non-cash flow elements, pseudo cash flows such as EBITDA are not. EBITDA is just the sum of EBIT and depreciation[8].

The pseudo cash flows that are used in our study are:
- Funds from operation (FFO). Calculated as the sum of NI and depreciation.
- Debt-adjusted cash flow (DACF). Calculated as the sum of NOPAT and depreciation.
- Earnings before interest, taxes, depreciation, depletion and amortization (EBITDA). Calculated as the sum of EBIT and depreciation

EBITDA and DACF are unleveraged, while FFO is a leveraged measure.

iii) Cash flows
The cash flows we use are:
- Cash flow from operation (CFO). Used as reported in the financial statements.

2.4 Time periods
First we analyse the whole period 1990-2003 to examine the value relevance of different accounting figures in this period. Then, we divide the data set into two time periods, 1990-1996 and 1997-2003. While a series of cross-sectional regressions might provide a better understanding of the change in value relevance over time, the low number of firms might present a problem regarding the power of the models. The split at around 1997 is carried out because after this date, a series of mergers took place that effected 6 of the largest companies on the list. The 1990-1996 data set includes 69 observations, while the 1997-2003 data set includes 101 firm-year observations.

3. Data

Accounting data were retrieved from the corporate financial statements of the 15 largest international oil and gas companies (table 1). The amounts of proven oil and gas reserves were obtained the companies 10-K reports.

Firm
ExxonMobil Corporation
BP Ltd
Royal Dutch Petroleum Company / The Shell Trading and Transport Company Ltd
ChevronTexaco Corporation
Total S.A.
ConocoPhillips Corporation
Eni S.A.
Repsol S.A.
Statoil ASA
Occidental Petroleum Corporation
Hydro ASA
Petro-Canada
Marathon
Amerada-Hess
OMV

4. Results

4.1 The value-relevance of accounting figures during 1991-2003

The variables in our benchmark model, net income, book value and amount of reserves, are all statistically significant in explaining the variation in the market values of equity (Table 4.1). This result provides support against the claim that historical cost accounting conveys little relevant information to the financial markets. We find that the fundamentals, i.e. net income and book equity, are indeed important in the equity valuation process. But, it is also

crucial to acknowledge the importance of non-financial data such as the size of oil and gas reserves to the equity valuation process.

We also find that all the accounting measures we study are significant, with DACF showing the highest t-value (and adjusted-R^2 value). An interesting result refers to the value-relevance of accruals, and in particular the depreciation expense. If accounting figures calculated prior to depreciation are compared to the equivalent figures after depreciation is expensed, e.g. FFO vs NI, DACF vs NOPAT and EBITDA vs EBIT, it is apparent that the pre-depreciation figures are more significant (higher t-values) than the figures where depreciation has been expensed. Indeed, the difference between net income and funds from operations, i.e. depreciation, is significant at the 1% level.

Table 4.1. The value relevance of accounting figures 1990-2003.

General model: $MV_{it} = \chi_0 + \chi_1 YR_t + \chi_2 X_{it} + \chi_3 (NI_{it} - X_{it}) + \chi_4 BV_{it} + \chi_5 OGR_{it} + \varepsilon_{it}$, where X represents different accounting figures (see legend below).

	NI	EBITDA	EBIT	NOPAT	FFO	DACF	CFO
X	1.31 **	2.05 ***	2.10 ***	2.63 ***	1.52 ***	2.76 ***	2.41 ***
	(2.24)	(3.24)	(3.10)	(3.26)	(2.60)	(3.82)	(3.56)
NI - X		-1.19 ***	-1.30 **	-2.32 **	-2.78 **	-2.26 ***	-1.31 ***
		(-2.78)	(-2.36)	(-2.34)	(-2.46)	(-3.25)	(-3.01)
BV	1.48 ***	1.19 ***	1.33 ***	1.32 ***	1.11 ***	1.03 ***	1.13 ***
	(9.17)	(6.34)	(7.75)	(7.70)	(5.07)	(4.92)	(5.86)
OGR	1.29 ***	1.43 ***	1.34 ***	1.33 ***	1.51 ***	1.52 ***	1.41 ***
	(9.68)	(10.22)	(10.02)	(10.06)	(9.48)	(10.31)	(10.26)
intercept	-10.29 ***	-12.2 ***	-11.2 ***	-11.2 ***	-12.7 ***	-13.2 ***	-11.7 ***
	(-7.31)	(-7.93)	(-7.73)	(-7.77)	(-7.47)	(-8.08)	(-7.96)
YR91	-0.088	0.355	0.399	0568	-0.101	0.541	0.212
	(-0.10)	(0.40)	(0.44)	(0.62)	(-0.12)	(0.61)	(0.24)
YR92	0.189	0.634	0.638	1.11	0.283	1.16	0.548
	(0.21)	(0.72)	(0.71)	(1.15)	(0.32)	(1.27)	(0.63)
YR93	0.521	1.05	0.866	1.19	0.664	1.29	0.887
	(0.59)	(1.18)	(0.93)	(1.29)	(0.76)	(1.44)	(1.01)
YR94	0.380	0.829	0.784	1.06	0.553	1.18	0.892
	(0.44)	(0.96)	(0.89)	(1.17)	(0.64)	(1.34)	(1.03)
YR95	0.995	1.20	1.22	1.42 *	0.982	1.40 *	1.05
	(1.19)	(1.45)	(1.45)	(1.67)	(1.19)	(1.69)	(1.28)
YR96	1.524 *	1.82 **	1.75 **	2.01 **	1.67 **	2.13 **	1.75 **
	(1.78)	(2.15)	(2.04)	(2.31)	(1.99)	(2.50)	(2.08)
YR97	3.170 ***	3.39 ***	3.28 ***	3.65 ***	3.42 ***	3.83 ***	3.32 ***
	(3.83)	(4.17)	(4.00)	(4.34)	(4.17)	(4.63)	(4.11)
YR98	2.540 ***	3.08 ***	3.01 ***	3.19 ***	2.76 ***	3.36 ***	2.86 ***
	(3.09)	(3.71)	(3.53)	(3.72)	(3.39)	(4.01)	(3.48)
YR99	2.818 ***	3.21 ***	3.16 ***	3.45 ***	2.97 ***	3.56 ***	3.09 ***
	(3.42)	(3.93)	(3.82)	(4.03)	(3.66)	(4.29)	(3.83)
YR00	1.408	1.19	1.06	1.51 **	1.58 *	1.65 *	1.38
	(1.62)	(1.39)	(1.21)	(1.76)	(1.85)	(1.95)	(1.62)
YR01	0.853	0.651	0.570	1.16	0.945	1.23	0.788
	(1.03)	(0.80)	(0.68)	(1.40)	(1.16)	(1.51)	(0.97)
YR02	-0.037	-0.000327	-0.00611	0.368	-0.0357	0.359	0.168
	(-0.04)	(-0.00)	(-0.01)	(0.44)	(-0.04)	(0.44)	(0.21)
YR03	0.255	0.0806	0.0446	0.477	0.240	0.459	0.244
	(0.29)	(0.09)	(0.05)	(0.54)	(0.27)	(0.53)	(0.28)
N	170	170	168	170	170	170	169
Adjusted R^2	0.650	0.665	0.658	0.660	0.661	0.670	0.667

* = significant at the 10% significance level, ** = significant at the 5% significance level, *** = significant at the 1% significance level, t-values in parenthesis

REV is revenue, EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, PRETAX is earnings before taxes, NI is earnings after taxes and minorities, NOPAT is net operating profit after tax, calculated as NI plus after tax interest expense (the tax rate used is the recurring tax rate on earnings before tax), FFO is funds from operations, calculated as net income plus depreciation, DACF is debt-adjusted cash flow, calculated as NOPAT plus depreciation, CFO is cash flow from operating activities, and FCF is free cash flow, calculated as CFO less capital expenditure. Variables are scaled by year-end amount of proven oil and gas reserves.

BV is year-end book value of equity (total shareholders' equity)

OGR is the natural logarithm of the year-end total reserves of oil and gas, as reported to SEC.

yr91 is the year dummy for 1991, yr92 is the year dummy for 1992, yr93 is the year dummy for 1993, yr94 is the year dummy for 1994, yr95 is the year dummy for 1995, yr96 is the year dummy for 1996, yr97 is the year dummy for 1997, yr98 is the year dummy for 1998, yr99 is the year dummy for 1999, yr00 is the year dummy for 2000, yr01 is the year dummy for 2001, yr02 is the year dummy for 2002, yr03 is the year dummy for 2003.

4.2 The value-relevance of accounting figures during 1991-1996 and 1997-2003

With regards to the 1990-1996 period, we find similar results as for the whole time period (Table 4.2). Since the parameter on the difference between NI and FFO is significant, this result indicates that depreciation was value-relevant in this specific time period. Apparently, the investors, in the equity valuation process, relied more accounting figures, such as EBITDA, that are calculated prior to expensing of DD&A, than on figures such as net income.

Table 4.2. The value relevance of accounting figures 1990-1996.

	NI	EBITDA	EBIT	NOPAT	FFO	DACF	CFO
X	0.320	1.628 ***	1.49 ***	1.27 *	0.520	1.90 ***	1.33 **
	(0.81)	(3.88)	(2.89)	(1.94)	(1.52)	(3.67)	(2.46)
NI - X		-0.156	-0.214	0.0448	-3.05 ***	-0.00335	0.167
		(-0.45)	(-0.53)	(0.11)	(-3.81)	(-0.01)	(0.44)
Book	1.10 ***	0.679 ***	0.958 ***	1.04 ***	0.548 ***	0.706 ***	0.845 ***
	(7.68)	(4.64)	(6.75)	(7.14)	(3.19)	(4.43)	(5.01)
BOE	0.408 ***	0.572 ***	0.388 ***	0.401 ***	0.782 ***	0.597 ***	0.503 ***
	(3.83)	(6.01)	(3.90)	(3.83)	(6.41)	(5.68)	(4.65)
intercept	-2.14 **	-4.57	-2.75 ***	-2.45 **	-5.76 ***	-4.56 ***	-3.36 ***
	(-2.12)	(-4.70)	(-2.87)	(-2.44)	(-4.94)	(-4.26)	(-3.14)
YR91	-0.030	0.612	0.577	0.292	-0.0173	0.480	0.222
	(-0.07)	(1.58)	(1.30)	(0.63)	(-0.05)	(1.18)	(0.52)
YR92	0.051	0.726 *	0.635	0.551	0.183	0.901 **	0.366
	(0.12)	(1.58)	(1.44)	(1.08)	(0.49)	(2.06)	(0.85)
YR93	0.471	1.26 ***	1.11 **	0.8127 *	0.661 *	1.11 ***	0.795 *
	(1.08)	(3.17)	(2.43)	(1.75)	(1.75)	(2.68)	(1.83)
YR94	0.381	1.02 ***	0.871 **	0.703	0.638 *	1.02 **	0.822 *
	(0.89)	(2.69)	(2.05)	(1.54)	(1.71)	(2.49)	(1.86)
YR95	1.059 **	1.31 ***	1.27 ***	1.23 ***	1.12 ***	1.35 ***	1.07 ***
	(2.53)	(3.69)	(3.22)	(2.91)	(3.09)	(3.57)	(2.68)
YR96	1.929 ***	2.27 ***	2.10 ***	2.07 ***	2.24 ***	2.32 ***	2.08 ***
	(4.33)	(5.98)	(5.03)	(4.66)	(5.76)	(5.71)	(4.84)
N	69	69	68	69	69	69	69
Adjusted R^2	0.688	0.780	0.734	0.700	0.769	0.755	0.716

* = significant at the 10% significance level, ** = significant at the 5% significance level, *** = significant at the 1% significance level, t-values in parenthesis

REV is revenue, EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, PRETAX is earnings before taxes, NI is earnings after taxes and minorities,

NOPAT is net operating profit after tax, calculated as NI plus after tax interest expense (the tax rate used is the recurring tax rate on earnings before tax), FFO is funds from operations, calculated as net income plus depreciation, DACF is debt-adjusted cash flow, calculated as NOPAT plus depreciation, CFO is cash flow from operating activities, and FCF is free cash flow, calculated as CFO less capital expenditure. Variables are scaled by year-end amount of proven oil and gas reserves.

BV is year-end book value of equity (total shareholders' equity)

OGR is the natural logarithm of the year-end total reserves of oil and gas, as reported to SEC.

yr91 is the year dummy for 1991, yr92 is the year dummy for 1992, yr93 is the year dummy for 1993, yr94 is the year dummy for 1994, yr95 is the year dummy for 1995, yr96 is the year dummy for 1996, yr97 is the year dummy for 1997, yr98 is the year dummy for 1998, yr99 is the year dummy for 1999, yr00 is the year dummy for 2000, yr01 is the year dummy for 2001, yr02 is the year dummy for 2002, yr03 is the year dummy for 2003.

In the last period of our study, 1997-2003, however, interpretation of the value-relevance of the depreciation expense is not as straightforward as in for the previous time period. The difference between net income and funds from operations is found to be not significant even at the 10% level (Table 4.3). On the other hand, we find that cash flow from operations, CFO, is the most value relevant accounting figure in this period. This result in conjunction with a significant parameter on the difference between net income and cash flow shows that accruals are significantly value-relevant, also in this time period.

With regards to the value relevance of non-financial information, we find that the size of oil and gas reserves becomes more significant after 1997 than before the industry restructuring started.

Table 4.3. The value relevance of accounting figures 1997-2003.

	NI	EBITDA	EBIT	NOPAT	FFO	DACF	CFO
X	3.18 ***	3.70 ***	4.22 ***	4.18 ***	3.22 ***	3.75 ***	4.36 ***
	(3.46)	(3.93)	(4.30)	(3.87)	(3.48)	(3.74)	(4.43)
NI - X		2.66 ***	2.64 ***	1.26	2.45	2.30 **	2.95 ***
		(2.83)	(2.65)	(0.87)	(1.40)	(2.05)	(3.28)
Book	1.57 ***	1.34 ***	1.41 ***	1.45 ***	1.48 ***	1.33 ***	1.20 ***
	(7.32)	(5.59)	(6.44)	(6.48)	(5.03)	(4.78)	(4.81)
BOE	1.88 ***	2.01 ***	1.99 ***	1.97 ***	1.93 ***	2.02 ***	2.02 ***
	(10.76)	(10.9)	(11.4)	(10.9)	(9.36)	(9.92)	(11.3)
Intercept	-12.81 ***	-14.4 ***	-14.29 ***	-13.7 ***	-13.4 ***	-14.3 ***	-14.2 ***
	(-7.19)	(-7.50)	(-7.85)	(-7.46)	(-6.35)	(-6.92)	(-7.80)
YR98	-0.46	-0.197	-0.180	-0.315	-0.468	-0.403	-0.332
	(-0.64)	(-0.28)	(-0.25)	(-0.44)	(-0.65)	(-0.57)	(-0.47)
YR99	-0.44	-0.286	-0.162	-0.251	-0.461	-0.387	-0.308
	(-0.62)	(-0.41)	(-0.23)	(-0.36)	(-0.65)	(-0.55)	(-0.45)
YR00	-2.62 ***	-2.97 ***	-3.24 ***	-2.90 ***	-2.63 ***	-2.78 ***	-2.82 ***
	(-3.46)	(-3.88)	(-4.19)	(-3.78)	(-3.46)	(-3.64)	(-3.82)
YR01	-2.84 ***	-3.19 ***	-3.36 ***	-2.97 ***	-2.88 ***	-2.97 ***	-3.08 ***
	(-4.01)	(-4.45)	(-4.69)	(-4.22)	(-4.03)	(-4.18)	(-4.46)
YR02	-3.59 ***	-3.76 ***	-3.73 ***	-3.69 ***	-3.66 ***	-3.76 ***	-3.54 ***
	(-5.12)	(-5.40)	(-5.44)	(-5.30)	(-5.10)	(-5.31)	(-5.20)
YR03	-4.064 ***	-4.38 ***	-4.54 ***	-4.21 ***	-4.13 ***	-4.26 ***	-4.23 ***
	(-5.32)	(-5.71)	(-5.94)	(-5.54)	(-5.13)	(-5.51)	(-5.70)
N	101	101	100	101	101	101	100
Adjusted R^2	0.677	0.687	0.694	0.683	0.674	0.680	0.696

* = significant at the 10% significance level, ** = significant at the 5% significance level, *** = significant at the 1% significance level, t-values in parenthesis

REV is revenue, EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, PRETAX is earnings before taxes, NI is earnings after taxes and minorities,

NOPAT is net operating profit after tax, calculated as NI plus after tax interest expense (the tax rate used is the recurring tax rate on earnings before tax), FFO is funds from operations, calculated as net income plus depreciation, DACF is debt-adjusted cash flow, calculated as NOPAT plus depreciation, CFO is cash flow from operating activities, and FCF is free cash flow, calculated as CFO less capital expenditure. Variables are scaled by year-end amount of proven oil and gas reserves.

BV is year-end book value of equity (total shareholders' equity)

OGR is the natural logarithm of the year-end total reserves of oil and gas, as reported to SEC.

yr91 is the year dummy for 1991, yr92 is the year dummy for 1992, yr93 is the year dummy for 1993, yr94 is the year dummy for 1994, yr95 is the year dummy for 1995, yr96 is the year dummy for 1996, yr97 is the year dummy for 1997, yr98 is the year dummy for 1998, yr99 is the year dummy for 1999, yr00 is the year dummy for 2000, yr01 is the year dummy for 2001, yr02 is the year dummy for 2002, yr03 is the year dummy for 2003.

5. Discussion

Our results show that investors have more confidence in accounting figures calculated before expensing of depreciation. This is not surprising given that petroleum companies reporting to SEC are allowed to use two different accounting methods, either the successful efforts method or the full cost method. These two methods result in different calculations of net income. The largest sources of difference in the calculations of net income under these two methods stem from the depreciation charge and the exploration expense (for successful efforts firms). Full cost firms capitalize all costs; costs which are amortized according to the unit-of-production method. Successful efforts firms, on the other hand, capitalize only costs incurred from drilling successful oil wells. The other costs are expensed immediately as exploration expenses, while the capitalized costs are amortized according to the unit-of-production method[8]. This variety of methods may influence investors' confidence in net income as an appropriate measure of financial performance of oil and gas companies. They may therefore rely more on pre-depreciation figures, as our results indicate. This finding is in line with the results of other researchers. Quirin et al. (2001) found that discretionary cash flows were more value-relevant than net income for US oil and gas firms, and, similarly, Cormier and Magnan (2002) who found that cash flows were more significant than net income for Canadian oil and gas firms.

In addition to the fundamentals, we found that the size of petroleum reserves is important in explaining the market valuation of the largest international oil and gas firms. This result indicates that it is necessary for oil and gas firms to report their petroleum reserves to the financial markets, as it is a necessary input for the equity valuation process. Many analysts argue that company size plays an important part in pricing of international oil companies. Various practical and theoretical reasons have been provided to explain this fact. We will mention some of them. Larger companies may have a larger growth potential in their portfolios. Company size may have a positive reputational effect on governments' discretionary licensing decisions for oil and gas deposits. Large and prospective operatorships, which also are skill and resource demanding, are often awarded to the largest companies. A larger opportunity set in terms of geological deposits may also allow large firms to pursue a cream-skimming strategy. Finally, the largest international oil companies have the best opportunities to pursue tax shifting. On the other hand, large companies may be slow and face higher co-ordination costs, and may miss out on benefits of focusing strategies and specialisation.

From 1990-1996 to 1997-2003, a non-accounting variable, namely the size of oil and gas reserves, became increasingly more important in explaining valuation. During 1998-2001 the

industry underwent a substantial restructuring, which ultimately affected their market valuations (Weston, 2001). Among the nine mergers Weston studied, most were value increasing for both targets and acquirers, leading to higher valuations for firms that underwent mergers. This may explain the increasing importance of non-accounting information that serve as a measure of size, during 1997-2003.

The result that size matters in the pricing of oil and gas companies makes their theoretical valuation difficult. Equity value estimates calculated using theoretical valuation models such as DCF, or practical models such as valuation multiples, may not agree with market values, unless the effects of size are corrected for.

6. Endnotes

[1] Discretionary cash flow was defined as the sum of earnings and depreciation, but is referred to as a *pseudo* cash flow in our paper.
[2] Although it can be argued that the FC method can be more conservative than the SE method (see Al-Jabr and Spear, 2004). This pertains to instances where there is a substantial decrease in oil and/or gas prices. The reason for this lies in the impairment rules for FC firms; rules that are more stringent for FC firms than for SE firms.
[3] This relation holds under the assumptions of the clean surplus property and certain time-series properties (see Ohlson 1995).
[4] As heteroscedasticity typically results in inefficient OLS estimators, we scale the explanatory variables using a proxy for size. However, there is no consensus among researchers as to what 'scale' is. Recently, Akbar and Stark (2003), comparing various scale variables, replicated Easton & Sommers's approach on UK data. They found that the previous year's price per share did not perform better than other scale variables, such as book value or assets, or other size proxies. However, when considering balance sheet based scale variables such as book value or total assets, it is important to take into the account the possible negative effects of measurement errors on the model estimation that these particular accounting figures may have. Accounting conservatism combined with legacy assets may result in asset values not being a good unbiased measure of size. We therefore include a non-accounting measure of size in our models, the amount of proven reserves of oil and gas. We believe that this novel approach is a better and a more objective measure of size than balance sheet measures, the number of shares or the previous year's price per share. Bryant (2003) used the number of shares as the deflator in her model. She also tested two other deflators, book value and oil and gas reserves and found that changing deflators did not affect the results. The use of total reserves of oil and gas as a deflator has been done by several authors in capital markets based accounting research (cf. Boone 2002 and Harris and Ohlson, 1987). However, questions could be raised as to the appropriateness of using the combined oil and gas reserves, and especially to how the amounts of reserves of oil and reserves of gas should be weighed and summed together. This can be done by two possible methods, either by energy content (BOE-energy), or according to the respective prices of oil and gas (BOE-revenue). Since Berry *et al*. (1998) show that the sum of oil and gas reserves using the BOE-energy method is more value relevant than BOE-revenue. We therefore scale all our variables using oil and gas reserves according to the BOE-energy method.
[6] Unleveraged figures refers to accounting amounts before subtraction of net interest expenses.
[7] As reported according to USGAAP
8 The unit of production method for amortization of capitalized exploration costs differ somewhat under the full cost and successful efforts accounting methods.
[8] By depreciation we mean depreciation, depletion and amortization.

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