The Value Relevance of Accounting Figures in the Oil & Gas Industry: Cash Flow or Accruals?

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Abstract

This paper studies financial statement information from the largest oil and gas companies and evaluates their relation to firm market value. The accounting literature states that an important feature of financial statements and, in particular net income, is the usefulness for predicting future cash flows. However, financial analysts covering this sector prefer a number of alternative non-GAAP income measures to disclosed net income. Using a dataset of 72 largest integrated and exploration and production companies (E&Ps) during 1993-2013, we examine the relative value-relevance of net income versus eight alternative profitability measures. Despite the analyst preference for non-GAAP measures, our results suggest that net income is the most value relevant earnings measure for integrated oil & gas companies. By contrast, cash flow measures dominate for exploration and production companies. However, we find that free cash flow, which many oil company analysts refer to these days, has low value relevance.

Keywords: Company Valuation, Value-relevance, Financial Analysts, Oil & Gas Industry

JEL codes: M21, M40, G12, Q49

1. Introduction

This paper studies the value-relevance of GAAP and non-GAAP accounting measures commonly used by oil company financial analysts. This is important since the accounting literature states that an important role of financial statements and earnings is usefulness for predicting future cash flows (Lev 1989). However, the relevance of historical cost accounting for the oil and gas sector has long been questioned:

> An important quality of information that is useful in making rational investment, credit, and similar decisions is its predictive value - specifically, its usefulness in assessing the amounts, timing, and uncertainty of prospective net cash inflows to the enterprise. Historical cost based financial statements for oil and gas producing enterprises have limited predictive value. Their usefulness is further reduced because a uniform accounting method is not required to be used for costs incurred in oil and gas producing activities (FASB 1982).

Several reasons have been put forward, including industry specific traits and accounting method discretion. According to Wright & Gallun (2005), exploration and production has certain characteristics that distinguish them from other operations involving asset acquisition and use. The authors list the following defining features:

1. Risks are high and often there is a low probability of discovering commercial reserves
2. There is often a long time lag between acquiring permits and licenses and the ultimate production of reserves
3. There is no necessary correlation between expenditures and results
4. The underlying value of the reserves (which represent the major economic worth of a company) cannot be valued reliably enough to be recorded on the balance sheet.
5. The discovery of new reserves, which cannot be valued reliably enough to be recorded as income, is a major future income-earning event.
6. High costs and risks often result in joint operations.

These complexities make standard setting for the petroleum industry quite challenging. An issue widely discussed in the accounting literature is the topic of capitalization of pre-discovery expenses for oil and gas producers. For around 50 years, oil and gas companies have been using two competing methods for capitalizing exploration expenses (Zeff 1978). Under the full cost (FC) method, oil and gas explorers can capitalize all expenses, both from dry wells and successful oil and gas discoveries. According to the alternative method, the successful efforts method (SE), only expenses from successful well discoveries are allowed to be capitalized. The literature suggests that the value-relevance of oil & gas company accounting information is affected by accounting method choice (Collins, Rozeff

& Dhaliwal, 1981; Harris & Ohlson 1987; Bandyopadhyay 1994; Bryant 2003; Misund, Osmundsen & Sikveland 2015). This effect can be explained by the negative effect that accounting heterogeneity can have on comparability of company profitability (DeFond & Hung 2003). Moreover, if the management use their discretion to opportunistically manipulate accruals; this will have an adverse effect on earnings as a reliable measure of firm performance (Dechow 1994). The consequence is that investors could prefer cash flows, or even construe their own performance measures. Survey evidence suggests that analysts covering the petroleum sector do in fact rely on alternative performance measures (Quirin, Berry & O'Brien 2000). Moreover, the extant literature do suggest that cash flow from operations is more value relevant than earnings (Quirin, Berry & O'Brien 2000; Cormier & Magnan 2002; Misund, Asche & Osmundsen 2008; Misund 2015). However, the limitation of these studies is that they only compare two metrics, namely earnings and cash flow from operations. However, industry analysts seem to use other metrics, such as NOPAT (which is used in return on average capital employed calculations) and DACF (USB 2003; Osmundsen, Asche, Misund & Mohn 2006). Moreover, these studies do not separate between integrated and E&P companies. It is possible that investors may have more confidence in the accounting information of the integrated oil and gas firms.

We posit that the existence of multiple methods of accounting for oil and gas assets, coupled with particular operating characteristics inherent in oil and gas activities may explain why analysts covering the petroleum sector typically do not consider

Net Income (NI) to be the preferred accounting profit measure. In fact, one of the accounting figures they prefer to net income is Net Operating Profit After Tax (NOPAT), which is used as the numerator in the performance measure Return On Average Capital Employed (ROACE) (UBS Warburg, 2003; Osmundsen, Asche, Misund & Mohn 2006; Osmundsen, Mohn, Misund & Asche 2007). Moreover, analysts in this sector have constructed a unique cash flow measure, Debt-Adjusted Cash Flow (DACF) most probably due to lack of confidence in other measures (UBS Warburg 2003). These accounting figures have several applications; for example, they are used in performance measures, such as return on average capital employed (RoACE), in valuation multiples, such as the Enterprise Value to debt adjusted cash flow (EV/DACF), and presumably to facilitate in predicting future cash flows. Most likely, these accounting measures are chosen because they are thought to be relevant to performance measurement, and especially to valuation. 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 among analysts. In fact, there are indications that operating cash flow (Cormier & Magnan 2002; Misund, Asche & Osmundsen 2008; Misund 2015) and discretionary cash flow (Quirin, Berry & O'Brien 2000) may be more value relevant than accounting earnings in the oil and gas industry, which is the opposite from findings in cross-sectional studies (Dechow 1994). However, there has been little academic research to substantiate the relative value-relevance of accounting measures commonly used by analysts. This is what this study seeks to shed some light on. Since there might

be differences between integrated and exploration and production companies (E&Ps), we also compare these two types of oil and gas companies.

We expand Quirin, Berry & O'Brien's (2000) and Cormier & Magnan's (2002) study by examining variables commonly used by financial analysts covering the largest international oil companies. Furthermore, we apply statistical methodology (the Vuong test: Vuong 1989) to specifically uncover whether certain accounting measures are significantly more value relevant than others.

We apply value-relevance methodology based on the Ohlson (1995) residual income valuation model to contrast the value-relevance of GAAP vs non-GAAP figures. Using a dataset of 72 integrated and exploration and production companies over 1991-2013, we examine the relative value-relevance of net income vs. seven alternative accounting figures. These alternative measures include profit and cash flow figures that are typically found in financial analysts' reports: (1) GAAP measures such as earnings before interest and taxes (EBIT) and Cash Flow from Operations (CFO); and (2) non-GAAP measures that are constructed by analysts such as Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA), NOPAT, DACF, and Funds from Operations (FFO).

We extend the literature by also examining integrated international oil and gas companies, whereas previous studies have largely concentrated on US companies whose primary business involves exploration, development and production (E&P)

of oil and gas (e.g. Quirin, Berry & O'Brien 2000; Berry & Wright 2001; Bryant 2003). Studies of the value-relevance of accounting information from US E&P companies typically consider a large number of companies for periods of 2-4 years (e.g. Quirin, Berry & O'Brien 2000; Berry & Wright 2001; Bryant 2003). By contrast, our data set (1993-2013), allows us to investigate market and company behaviour over 20 years, covering a least one full oil price cycle. This enables us to take advantage of additional information in the time-series dimension.

Our results suggest that net income is the most value relevant earnings measure for integrated oil & gas companies. By contrast, cash flow measures dominate for exploration and production companies. Hence, our findings provide support for the use of non-accrual profitability measures for only a subset of oil & gas companies.

The remainder of the paper is organized as follows. In the next section we provide an overview of the literature. In Section 3 we describe the research design, econometric specification and hypothesis development. Section 4 describes the data and in Section 5 we present the results and discussion. In the last section we conclude our findings.

2. Literature review

According to the accounting literature, financial statements and earnings serve a key role in predicting future cash flows (Lev 1989). In fact, the FASB Statement of Financial Accounting Concepts No.1. states that:

> The primary focus of financial reporting is information about an enterprise's performance provided by measures of earnings and its components. Investors, creditors, and others who are concerned with assessing the prospects for enterprise net cash inflows are especially interested in that information. Their interest in an enterprise's future cash flows leads primarily to an interest in information about its earnings (FASB 1978).

Moreover,

> …information about enterprise earnings and its components measured by accrual accounting generally provides a better indication of enterprise performance than does information about current cash receipts and payments (FASB 1978).

Prior studies often find that earnings are more value-relevant than operating cash flow (Dechow 1994, Biddle, Seow & Siegel 1995; Rayburn 1986; Sloan 1996). According to Dechow (1994) cash flows are predicted to suffer more from timing and matching problems that reduce their ability to reflect firm performance under certain circumstances, such as a short performance measurement interval, under conditions of increased volatility of the firm's working capital requirements and investment and financing activities, and if the operating cycle is extended.

Other studies find that earnings quality has actually decreased in recent years (Francis & Schipper 1999; Bradshaw & Sloan 2002, Hodge 2003). Moreover, the comparative value-relevance of earnings versus cash flow might vary with industry affiliation (see e.g. Biddle, Seow & Siegel 1995; Aharony, Falk & Yehuda 2003). In fact, the extant literature has suggested that this is the case for the oil and gas industry. For instance, the value-relevance of earnings has been found to be lower than cash flows in the oil and gas industry (Quirin, Berry & O'Brien 2000; Cormier & Magnan 2002; Misund, Asche & Osmundsen 2008; Misund 2015).

Using variables identified by the oil and gas industry financial analysts, Quirin, Berry & O'Brien (2002) investigate the relationship between fundamentals and both the market value equity and cumulative stock returns. They find that the fundamentals provide investors with incremental information beyond earnings, change in earnings, and book value of equity.

Cormier & Magnan (2002) compare the value relevance of earnings and cash flow from operations for a sample of Canadian oil and gas firms. Their findings suggest that cash flow is the performance metric most closely associated with share market valuation.

Misund, Asche & Osmundsen (2008) investigate if the value-relevance of earnings and cash flow from operations is affected by industry upheavals and restructuring.

While their results suggest that there is a higher value relevance for cash flow compared to earnings, they find that the value-relevance of cash flows decreased after the oil & gas industry restructuring of the late 1990s and early 2000s.

Recently, Misund (2015) compares the value relevance of earnings versus cash flow for a large sample of both U.S., Canadian and international oil and gas firms, both integrated and E&Ps. He finds evidence that investors place more emphasis on cash flows than earnings in the oil and gas sector.

The conclusion we can draw from the literature is twofold. First, industry-specific value-relevance studies can provide important insights into the relation between accounting figures and market value of equity. Secondly, the findings strongly suggest that cash flows are more value relevance than earnings in the oil and gas sector.

3. Research design, econometric specification and hypothesis development

We use standard value-relevance methodology for investigating the relative importance for valuation of various profitability measures. The theoretical point of departure is the Ohlson (1995) model which describes how market value is related to abnormal earnings, book value, and other information

$$MVE_t = BV_t + \alpha_1 NI_t^a + \alpha_2 \boldsymbol{v}_t, \quad (1)$$

where MVE_t is the market value of equity at time *t*, BV_t is the book value of equity, NI_t^a is abnormal earnings at time t, and v_t is a vector of 'other' relevant information. The latter are 'value-relevant event that have yet to have an impact on the financial statements' (Ohlson, 1995).

In the value-relevance literature Eq. (1) is typically operationalized as

$$MVE_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 NI_{it} + \beta_3 \boldsymbol{OI_{it}} + u_{it}, \quad (2)$$

where MVE_{it}, BV_{it}, NI_{it} are the market value of equity, book value of equity, and net income for firm *i* at time *t*, respectively. Other information for company *i* at time *t* is represented by the vector $\boldsymbol{OI}_{it}$, while $u_{it}$is the error term.

This approach of operationalization of the Ohlson (1995) model has been critized in the accounting literature (Holthausen & Watts 2001; Barth, Beaver & Landsman 2001; Kothari 2001). In particular, two issues have been raised. The first relates to the adverse effects of scale (Ota 2003; Easton & Sommers 2003; Lo 2004; Akbar & Stark 2003; Barth & Clinch 2009). The literature suggests applying an appropriate measure of scale to deflate the variables prior to the regressions. The second issue pertains to the use of a proxy for 'other information'. Proxies for other information are sometimes included, other times ignored in the extant value relevance literature. Several authors have discussed the negative effects of excluding proxies for 'other information' (Ohlson 2001; Liu & Ohlson 1999; Hand

2001). Excluding important explanatory variables can lead to the omitted variable bias in the empirical model, creating problems in terms of the interpretation of the regression coefficients. Fortunately, panel data models are an approach commonly used in econometrics to capture the effects of unobserved variables. We follow studies such as Boone (2002) and Misund (2015) which have applied fixed effects model to control for unobserved variables in oil & gas accounting studies. Furthermore, we control for the presence of heteroskedasticity and serial correlation in the residuals from fixed effects models using the approach suggested by Arellano (1987). Fixed effects can be applied both in the time and firm dimension. Including fixed effects in our analysis results in the following empirical model

$$MVE_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 NI_t \ + \beta_3 OI_{it} + \boldsymbol{FE_t} + \boldsymbol{FE_i} + \epsilon_{it}, \qquad (3)$$

where $\boldsymbol{FE_t}$ are time fixed effects and $\boldsymbol{FE_i}$ which are firm fixed effects, and ϵ_{it} is the error term. Model (3) represents our benchmark model, which will be tested against alternative value-relevance models.

The value-relevance of accounting information: alternative models

To contrast the value relevance of alternative accounting figures to that of net income, we substitute *NI* in Equation (3) with X_i, where X_i represents the seven other accounting measures:

$$MVE_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 X_t \ + \beta_3 OI_{it} + \boldsymbol{FE_t} + \boldsymbol{FE_i} + \varepsilon_{it}, \qquad (4)$$

This equation gives the alternative version of the model in equation (3). In the empirical analysis, we will estimate Eq. (3) and several regression of Eq. (4) using the alternative accounting figures.

Choice of accounting figures

We consider the following seven financial statement figures (in addition to book value of equity) in our analysis:

1. *Net income (NI)*: We use net income from continuing operations as NI in our study. In this manner we exclude all extraordinary profit/losses as well as the impact of non-continuing operations.

2. *Net Operating Profit After Tax (NOPAT)*: Net operating profit after taxes (NOPAT) is calculated as NI adjusted for after tax interest expense, i.e. we add back after tax net interest expense. We use the recurring tax rate on earnings before tax as the tax rate.

3. *Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA)*: To calculate Earnings before interest, taxes, depreciation and amortization (EBITDA) we start with net income before income taxes, and add back net interest expenses and depreciation and amortization charges.

4. *Earnings Before Interest and Taxes (EBIT)*: Earnings before interest and taxes is calculated as EBITDA less depreciation and amortization charges.

5. *Funds From Operations (FFO)*: Funds from operations is calculated as NI plus depreciation and amortization.

6. *Debt-Adjusted Cash Flow (DACF)*: Debt-adjusted cash flow is calculated as FFO plus after tax interest expense, i.e. we add back after tax net interest expense. We use the recurring tax rate on earnings before tax as the relevant tax rate.

7. *Cash Flow from Operations (CFO)*: We use net cash provided by operating activities as CFO

Hypotheses

In order to ascertain whether the value-relevance of one of the alternative accounting figures is higher than for net income we apply the Vuong test (Vuong 1989). This is a conventional approach in the extant value-relevance literature (see e.g. Dechow 1994). We use the Vuong likelihood ratio statistic to assess the statistical significance of the differences in R^2 between the benchmark model and the alternative models.

The null hypothesis is that two competing models equally fit the data. The Vuong Z-statistic is directional; a significant and positive Z-statistic will indicate that our

benchmark model fits the data better than the alternative model. Hence, this will indicate that net income is more value-relevant than an alternative accounting measure. Conversely, a negative Z-statistic indicates that the alternative accounting figure is more value-relevant than net income.

4. Sample data

The sample consists of 72 of the largest international oil and gas companies for the years 1991-2013. Accounting data and the amounts of proven oil and gas reserves were retrieved from the J.S. Herold database (www.ihs.com/herold). As a measure of market value we use market capitalization as at year-end. Market value of equity, accounting figures and book equity are all scaled by year-end values of amount of oil and gas reserves, and are denoted in US$/barrels of oil equivalent (US$/boe). Our data set includes a total of 1007 firm-years. Descriptive statistics for the variables in our models are reported in Tables 1 and 2.

Table 1

Descriptive statistics for integrated oil and gas companies

	Mean	St.dev	25 percentile	Median	75 percentile
MVE	13.07	12.50	5.23	10.21	16.07
BVE	7.45	8.77	2.83	4.72	8.94
EBITDA	2.98	2.97	1.10	2.11	3.89
EBIT	2.04	2.16	0.72	1.32	2.71
NI	1.13	1.26	0.41	0.79	1.39
NOPAT	1.29	1.44	0.49	0.90	1.54
FFO	2.11	2.17	0.81	1.54	2.58
DACF	2.22	2.29	0.88	1.62	2.72
CFO	2.11	2.17	0.82	1.53	2.53
FCFF	0.43	1.30	0.01	0.28	0.76

Note: MVE is the market value of equity, BVE is the book value of equity, EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, NI is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

Table 2

Descriptive statistics for E&P companies

	Mean	St.dev	25 percentile	Median	75 percentile
MVE	9.66	6.66	4.80	7.76	12.81
BVE	4.56	3.08	2.27	3.69	6.23
EBITDA	1.97	1.32	1.01	1.66	2.58
EBIT	0.86	1.23	0.30	0.80	1.39
NI	0.44	0.83	0.11	0.40	0.81
NOPAT	0.54	0.88	0.19	0.52	0.92
FFO	1.56	1.09	0.81	1.29	2.13
DACF	1.64	1.15	0.89	1.39	2.23
CFO	1.67	1.10	0.83	1.47	2.24
FCFF	-0.27	1.24	-0.68	-0.17	0.30

Note: MVE is the market value of equity, BVE is the book value of equity, EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, NI is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

We have also carried out an examination of correlations among explanatory variables. The results indicate that correlations are not high enough to cause concerns regarding multicollinearity.

5. Results and discussion

In this section we present the results from the value-relevance regressions of 7 different measures of profitability. We analyse E&P and integrated companies separately, as well as the pooled sample. Vuong tests allow us to assess whether one of the profitability measures is more value relevant than the others.

Table 3 provides the result of the econometric estimation for the entire sample of oil and gas firms. Significant parameters on nearly all the investigated accounting variables provide evidence that they are value-relevant. This result does not provide support for the claim that accruals have limited value for evaluating oil and gas company profitability. Our results do suggest that historical cost accounting provides value-relevant information to the financial community. The only exception is the FCFF measure. This latter variable is free cash flow metric, i.e. after investments, indicating that the investors are sceptical to oil and gas companies' investment ability. This is the topic of Jensen's (1986; 1988) seminal work on the free cash flow theory for dividend policy.

Table 4 presents the results from the Vuong test, allowing us to distinguish between the variables in terms of their value-relevance. The tests show that all profitability measures are more value-relevant than FCFF. Moreover, EBITDA seems to outperform the cash flow measures (except CFO). However, the tests do not reveal any other differences between the metrics.

Table 3

Regression results (entire oil&gas sample)

	EBITDA	EBIT	NI	NOPAT	FFO	DACF	CFO	FCFF
BVE	0.330***	0.565***	0.613***	0.620***	0.478***	0.516***	0.419***	0.807***
X	1.835***	1.392***	2.075***	1.720***	1.826***	1.507***	1.817***	0.273
R2-adj (within)	0.347	0.334	0.340	0.364	0.331	0.324	0.335	0.288

Note: X refers to the following 7 profitability measures: EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, N is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. BVE is book value of equity. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

Table 4

Results from the Vuong test (entire oil&gas sample)

	EBITDA	EBIT	NI	NOPAT	FFO	DACF	CFO	FCFF
EBITDA		0.748	0.368	0.772	1.716**	2.312**	0.308	2.526***
EBIT	-0.748		-0.670	0.192	0.151	0.510	-0.029	2.441***
NI	-0.368	0.670		1.027	0.399	0.748	0.158	2.193**
NOPAT	-0.772	-0.192	-1.027		0.067	0.458	-0.085	1.988**
FFO	-1.716	-0.151	-0.299	-0.067		1.218	-0.142	1.741**
DACF	-2.312	-0.510	-0.748	-0.458	-1.281		-0.400	1.594*
CFO	-0.308	0.029	-0.158	0.085	0.142	0.400		1.795**
FCFF	-2.526	-2.441	-2.193	-1.988	-1.741	-1.594	-1.795	

Note: EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, N is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is

free cash flow to the firm. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

We repeat the above analysis using samples of integrated oil and gas companies, and E&Ps. Table 5 presents the results from the value-relevance regression for integrated companies. For this selection of companies all profitability measures are significant at the 5% level.

Table 5

Regression results (Integrateds)

	EBITDA	EBIT	NI	NOPAT	FFO	DACF	CFO	FCFF
BVE	0.248**	0.350***	0.458***	0.449***	0.350**	0.343**	0.419***	0.802***
X	2.227***	2.823***	4.179***	3.665***	2.626***	2.489***	1.884***	0.824**
R2-adj (within)	0.444	0.473	0.496	0.488	0.440	0.440	0.413	0.378

Note: X refers to the following 7 profitability measures: EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, N is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. BVE is book value of equity. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

In contrast to that of the total sample, the Vuong tests for this subsample provide more conclusive evidence towards the relative value relevance of accruals versus cash flows (Table 6). The results show that NI and NOPAT are more value-relevant than all other measures except EBIT. EBIT, EBITDA and NOPAT are all more

value-relevant than CFO and FCFF. The results clearly suggest that accruals are value-relevant for integrated oil and gas companies. There might be several reasons for this finding. First, the integrated firms without exception apply a uniform accounting method for pre-exploration costs, i.e. successful efforts. This facilitates the comparison of profitability across firms. Secondly, the integrated companies are also the largest. Consequently, they are followed by a larger community of analysts, providing a larger amount of analysis and earnings estimates. Finally, Return on average capital employed is a popular performance measure for oil and gas majors (UBS Warburg 2003; Osmundsen, Asche, Misund & Mohn 2006; Osmundsen, Mohn, Asche & Misund 2007). Our results suggest that the numerator in this performance indicator is one of the most value-relevant of the seven accounting measures investigated.

Table 6

Results from the Vuong test (Integrateds)

	EBITDA	EBIT	NI	NOPAT	FFO	DACF	CFO	FCFF
EBITDA		-1.257	-1.923	-1.606	0.247	0.194	0.861	1.646**
EBIT	1.257		-1.234	-0.735	0.986	0.963	1.462*	2.411***
NI	1.923**	1.234		0.783	1.925**	1.909**	1.713**	2.487***
NOPAT	1.606*	0.735	-0.783		1.680**	1.757**	1.506*	2.339***
FFO	-0.247	-0.986	-1.925	-1.680		-0.102	0.594	1.281*
DACF	-0.194	-0.963	-1.909	-1.757	0.102		0.601	1.301*
CFO	-0.861	-1.462	-1.713	-1.506	-0.594	-0.601		0.862
FCFF	-1.646	-2.411	-2.487	-2.339	-1.281	-1.301	-0.862	

Note: EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, N is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

Next we turn to the E&Ps. The regression results are presented in Table 7 and the Vuong tests in Table 8. In contrast to the integrated companies, accruals do not seem to be value-relevant for E&Ps. Only EBITDA and CFO are significant at the 5% level.

Table 7

Regression results (E&Ps)

	EBITDA	EBIT	NI	NOPAT	FFO	DACF	CFO	FCFF
BVE	0.616***	0.878***	0.914***	0.927***	0.803***	0.857***	0.624***	0.959***
X	1.272**	0.405*	0.349	0.226	0.785	0.481	1.515***	-0.325
R2-adj (within)	0.173	0.152	0.148	0.147	0.155	0.151	0.173	0.153

Note: X refers to the following 7 profitability measures: EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, N is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. BVE is book value of equity. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

This impression is also confirmed by the Vuong tests. The cash flow measures EBITDA and cash flow from operations are more value-relevant than measures net of depreciation and amortization. This is in line with previous research (Quirin, Berry & O'Brien 2000; Cormier & Magnan 2002; Misund, Asche & Osmundsen 2008; Misund 2015). However, we also show that this result extends to EBITDA which is a measure popular among analysts.

Table 8

Results from the Vuong test (E&Ps)

	EBITDA	EBIT	NI	NOPAT	FFO	DACF	CFO	FCFF
EBITDA		1.253	1.508*	1.653**	1.916**	2.004**	-0.031	1.182
EBIT	-1.253		1.377*	1.047	-0.219	0.106	-1.494	-0.026
NI	-1.508	-1.377		0.440	-0.586	-0.300	-1.834	-0.326
NOPAT	-1.653	-1.047	-0.440		-0.769	-0.510	-1.950	-0.469
FFO	-1.916	0.219	0.586	0.769		1.170	-1.567	0.226
DACF	-2.004	-0.106	0.300	0.510	-1.170		-1.873	-0.171
CFO	0.031	1.494*	1.834**	1.950**	1.567*	1.873**		1.118
FCFF	-1.182	0.026	0.326	0.469	-0.226	0.171	1.118	

Note: EBITDA is earnings before interest, taxes, depreciation and amortization, EBIT is earnings before interest and taxes, N is net income, NOPAT is net operating profit after tax, FFO is funds from operations, DACF is debt adjusted cash flow, CFO is cash flow from operations, and FCFF is free cash flow to the firm. All variables are scales by the amount of oil and gas reserves (in barrels of oil equivalent).

6. Conclusion

The objective of this study is to investigate the value-relevance of seven accounting measures, and to assess how the value-accounting information relationship varies between integrated and exploration & production companies. The conventional view is that historical cost accounting is inappropriate for use the oil and gas industry. This may be one of the reasons that financial analysts often resort to non-GAAP accounting measures for profitability ratios and valuation multiples.

Our results indicate that the value relevance of the various measures of profitability varies between integrated and E&Ps. The results from the total sample are not convincing for comparing the relative value-relevance of the various measures. However, the two subsamples provide some interesting insights. While cash flow measures such as cash flow from operations or EBITDA dominate for E&Ps, net income and NOPAT dominate for integrated companies.

Our results have some relevant implications. Firstly, analyses of profitability for E&Ps and integrateds should apply different accounting measures in performance measures. Secondly, our results also have implications for choice of valuation multiples. For integrated companies a valuation multiple such as price/earnings is relevant, while meaningful multiples for E&Ps could be enterprise value/EBITDA or price/CFO. Finally, the lack of investor confidence in accruals for E&Ps is of concern. A possible reason is that there is more accounting method heterogeneity among this group of oil and gas companies. Despite standard setters' efforts to arrive at a uniform accounting method, oil and gas company management still have the discretion to choose between full cost and successful efforts methods, both in the U.S. and internationally. The result seems to be an adverse effect on value relevance compared to the integrated companies which apply a uniform accounting method.

It is worth noting that free cash flow - which many oil company analysts refer to these days as it signals potential to pay dividends - has low value relevance. The

reason is probably that this figure is too short-sighted. A company, for example, can have an extremely high free cash flow in part because it is putting off necessary capital expenditures. Similarly, a good company that makes some major capital investments one year may see its free cash flow take a hit, but may well benefit over the longer haul. Thus, analysts using free cash flow measures should supplement them with measures that illustrate the long term potential of the company.

There are also measurement issues to be handled for the free cash flow measure.. The expenditures for maintenances of assets is only part of the capex reported on the Statement of Cash Flows. It must be separated from the expenditures for growth purposes. This split is not a requirement under GAAP, and is not audited. Management is free to disclose maintenance capex or not. Therefore this input to the calculation of free cash flow may be subject to manipulation, or require estimation. Since it may be a large number, maintenance capex's uncertainty is the basis for some people's dismissal of 'free cash flow'.

A second problem with the maintenance capex measurement is its intrinsic 'lumpiness'. By their nature, expenditures for capital assets that will last decades may be infrequent, but costly when they occur. 'Free cash flow', in turn, will be very different from year to year. No particular year will be a 'norm' that can be expected to be repeated. For companies that have stable capital expenditures, free cash flow will (over the long term) be roughly equal to earnings. For oil companies in a

cyclical business, the stability requirement is not satisfied. Thus, free cash flow in a given year may not have high information value.

Our results should be of interest to oil companies, financial analysts, investors and financial accounting standard setters.

References

Aharony, J., Falk, H., & Yehuda, N., (2003). Corporate Life Cycle and the Value-relevance of Cash Flow Versus Accrual Financial Information (Working Paper, Bolzano School of Economics and Management).

Akbar, S. & Stark, A.W. (2003). Discussion of scale and the scale effect in market-based accounting research. Journal of Business Finance and Accounting (30): 57-72.

Arellano, M. (1987). Computing Robust Standard Errors for Within-groups Estimators. Oxford Bulletin of Economics and Statistics (49): 431-434.

Bandyopadhyay, S.P. (1994). Market reactions to earnings announcements of successful efforts and full cost firms in the oil and gas industry. The Accounting Review (69): 657-674.

Barth, M.E., Beaver, W.H. & Landsman, W.R. (2001). The relevance of the value relevance literature for financial accounting standard setting. Another view. Journal of Accounting and Economics (31): 77-104.

Barth, M.E. & Clinch, G. (2009). Scale effects in capital markets-based accounting research. Journal of Business Finance and Accounting (36): 253-288.

Berry, K.T. & Wright, C.J., (2001). Disclosures: an assessment of the market's perception of firms' effort and ability to discover reserves. Journal of Business Finance and Accounting (28): 741-769.

Biddle, G.C., Seow, G.S. & Siegel, A. (1995). Relative versus incremental information content. Contemporary Accounting Research (12): 1-23.

Boone J.P. (2002). Revisiting the reportedly weak value-relevance of oil and gas asset present values: The roles of measurement error, model misspecification, and time period idiosyncrasy. The Accounting Review (77): 73-106.

Bradshaw, M. & Sloan, R. (2002). GAAP versus the Street: an empirical assessment of two alternative definitions of earnings. Journal of Accounting Research (40): 41-66.

Bryant, L. (2003). Relative value-relevance of the Successful Efforts and Full Cost Accounting methods in the oil and gas industry. Review of Accounting Studies (8): 5-28.

Collins, D.W., Rozeff, M.S. & Dhaliwal, D.S. (1981). The economic determinants of the market reaction to proposed mandatory accounting changes in the oil and gas industry: A cross-sectional analysis. Journal of Accounting and Economics (3): 37-71.

Cormier, D. & Magnan, M. (2002). Performance reporting by oil and gas firms: contractual and value implications. Journal of International Accounting, Auditing and Taxation (11): 131-153.

Dechow, P. (1994). Accounting earnings and cash flows as measures of firm performance: the tole of accounting accruals. Journal of Accounting and Economics (17): 3-42.

DeFond, M.L. & Hung, M. (2003). An empirical analysis of analysts' cash flow forecasts. Journal of Accounting and Economics (35): 73-100.

Barth, M.E., Beaver, W.H. & Landsman, W.R. (2001). The relevance of the value relevance literature for financial accounting standard setting. Another view. Journal of Accounting and Economics (31): 77-104.

Barth, M.E. & Clinch, G. (2009). Scale effects in capital markets-based accounting research. Journal of Business Finance and Accounting (36): 253-288.

Financial Accounting Standards Board (1978). Statement of Financial Accounting Concepts No.1: Objectives of Financial Reporting by Business Enterprises. Stamford: FASB.

Financial Accounting Standards Board 1982. Statement of financial accounting standards no. 69: Disclosures about oil and gas producing activities. Stamford: FASB.

Francis, J. & Schipper, K. (1999). Have financial statements lost their relevance? Journal of Accounting Research (37): 319-352.

Hand, J.R.M (2001). A discussion of "Earnings, book values, and dividends in equity valuation. An empirical perspective". Contemporary Accounting Research (18): 121-130.

Harris, T. & Ohlson, J.A. (1987). Accounting disclosures and the market's valuation of oil and gas properties. The Accounting Review (62): 651-670.

Hodge, F. (2003). Investors' perceptions of earnings quality, auditor independence, and the usefulness of audited financial information. Accounting Horizons (17): 37-48.

Holthausen, R.W. & Watts, R.L. (2001). The relevance of the value-relevance literature for financial accounting standard setting. Journal of Accounting and Economics (31): 3-75.

Jensen, M.C. (1986). Agency Costs of Free Cash Flow, Corporate Finance and Takeovers. The American Economic Review (76): 323-329.

Jensen, M.C. (1988). The Takeover Controversy: Analysis and Evidence. In Knights, Raiders and Targets: The Impact of the Hostile Takeover, J. Coffee, L. Lowenstein and S. Rose-Ackerman (eds.). Oxford: Oxford University Press.

Kothari, S.P. (2001). Capital markets research in accounting. Journal of Accounting and Economics (31): 105-231.

Lev, B. (1989). On the usefulness of earnings and earnings research: lessons and directions from two decades of empirical research. Journal of Accounting Research (27): 153-192.

Liu, J. & Ohlson, J.A. (1999). The Feltham-Ohlson (1995) model: Empirical implications. Journal of Accounting, Auditing & Finance (15): 321-331.

Misund, B. (2015). Accounting for oil and gas exploration activities: A triumph of economics over politics. (University of Stavanger Working Paper).

Misund, B., P. Osmundsen & Sikveland, M. (2015). International oil company valuation: The effect of accounting method and vertical integration. Petroleum Accounting and Financial Management Journal (): 1-19.

Misund, B., F.Asche & Osmundsen, P. (2008). Industry Upheaval and Valuation: Empirical Evidence from the International Oil and Gas Industry. The International Journal of Accounting (43): 398-424.

Ohlson, J.A. (1995). Earnings, book values, and dividends in equity valuation. Contemporary Accounting Research (11): 661-687.

Ohlson, J.A. (2001). Earnings, book values, and dividends in equity valuation: An empirical perspective. Contemporary Accounting Research (18): 107-120.

Osmundsen, P., Asche, F., Misund, B. & Mohn, K. (2006). Valuation of international oil companies. The Energy Journal (27): 49-64.

Osmundsen, P., Mohn, K, Misund, B. & Asche, F. (2007). Is oil supply choked by financial market pressures? Energy Policy (35): 467-474.

Ota, K. (2003). The impact of price and return models on value relevance studies: A review of theory and evidence. Accounting Research Journal (16): 6-20.

Quirin, J. J., Berry, K.T. & O'Brien, D. (2000). A fundamental analysis approach to oil and gas firm valuation. Journal of Business Finance and Accounting (27): 785-820.

Rayburn, J. (1986). The association of operating cash flow and accruals with security returns. Journal of Accounting Research (24): 112-137.

Sloan, R.G. (1996). Do stock prices fully reflect information in accruals and cash flows about future earnings? The Accounting Review (71): 289-315.

UBS Warburg (2003). Global Integrated Oil Analyzer, Quarterly assessment of the strategies and valuation of the world's largest integrated oil companies.

Vuong, Q.H. (1989). Likelihood ratio tests for model selection and non-nested hypotheses, Econometrica (57): 307-333.

Wright, C.J. & Gallun, R.A. (2005). International Petroleum Accounting. Tulsa, Oklahoma: PennWell.

Zeff, S.A. (1978). The risk of ‘economic’ consequences. Journal of Accountancy (146): 56-63.