Asche & Misund, *Cogent Economics & Finance* (2016), 4: 1264538
http://dx.doi.org/10.1080/23322039.2016.1264538

cogent economics & finance

FINANCIAL ECONOMICS | RESEARCH ARTICLE

Who's a major? A novel approach to peer group selection: Empirical evidence from oil and gas companies

Frank Asche[1,2] and Bård Misund[3]*

Received: 19 August 2016
Accepted: 18 November 2016
Published: 09 December 2016

*Corresponding author: Bård Misund, Business School, University of Stavanger, Stavanger N-4036, Norway
E-mail: bard.misund@uis.no

Reviewing editor:
David McMillan, University of Stirling, UK

Additional information is available at the end of the article

Abstract: This study presents a novel approach to selecting comparable companies in equity valuation. While valuation multiples is probably the most common valuation method in practice, discounted cash flow and residual income valuation models are advocated by academics. A key aspect in valuation by multiples is peer group selection. In this paper, we examine the usefulness of econometric techniques in peer-group selection for the largest companies in the international oil and gas sector. Using Chow tests, we are able to identify firms with similar relationships between valuation multiples and relevant value drivers. These results of our study suggest that analysts and investors should, when carrying out valuations, be careful in selecting the companies that comprise the peer groups. Comparable company selection could be carried out using econometric techniques that select companies on the basis of similarities in the relation between financial information and market valuation, instead of being based purely on analysts' subjective judgments.

Subjects: Corporate Finance; Investment & Securities; Financial Statement Analysis; Gas Industries; Petroleum & Oil Industries

Keywords: oil and gas companies; oil majors; valuation; valuation multiples; peer groups; p/e; Exxon

Bård Misund

ABOUT THE AUTHORS

Frank Asche holds a PhD from the Norwegian School of Economics and Business Administration (1996). His research interests focus on aquaculture and seafood markets, but he has also been doing work in fisheries management and energy economics. Professor Asche has published numerous articles in international journals in economics and leading multidisciplinary journals like Science and PLoS One. He has also undertaken a number of research projects in Norway as well as for international organisations like the FAO, OECD and WTO.

Bård Misund holds a PhD from the University of Stavanger. His research interests cover topics on commodity markets and firms, including commodity price behaviour, the spot–forward relationship in futures markets, determinants of commodity firm stock returns, financial statement analysis and valuation of oil and gas firms. Professor Misund has published articles in international journals in accounting, finance and economics. Misund has more than 10 years of industry experience.

PUBLIC INTEREST STATEMENT

Equity valuation is one of the most important applications of finance theory. Survey studies suggest that valuation by multiples is undoubtedly one of the most common methods of equity valuation in practice. Valuation multiples are used to determine share price estimates, as well as for the valuation of initial public offerings, investment bankers' fairness opinions, leveraged buyout transactions, seasoned equity offerings and other merger and acquisition activities. A crucial element of multiples valuation is the selection of an appropriate peer group. Typically, the financial analyst would select peer companies on the basis of subjective judgements. This approach to peer group selection might not be optimal. We propose an alternative approach using econometric analysis. The purpose of our method is to select peer group companies on the basis of the relationship between fundamental information and market valuation. The oil and gas sector is used as a case study.

1. Introduction

Equity valuation is one of the most important applications of finance theory. Although academics advocate the use of the discounted cash flow model and its derivative, the residual income valuation model, RIV (Copeland, Koller, & Murrin, 2000; Palepu, Healy, & Bernard, 2000; Penman, 2001), valuation by multiples is undoubtedly one of the most common methods of equity valuation in practice (Asquith, Mikhail, & Au, 2005; Minjina, 2008; Roosenboom, 2007). Survey-based evidence suggests a dominant role for the price-earnings ratio among analysts in determining and evaluation of share prices (Demirakos, Strong, & Walker, 2004). Valuation multiples are also used in the valuation of initial public offerings, investment bankers' fairness opinions, leveraged buyout transactions, seasoned equity offerings and other merger and acquisition activities, M&A (DeAngelo, 1990; Kaplan & Ruback, 1995; Kim & Ritter, 1999).

An adequate process for selecting comparable firms is a necessary prerequisite for valuation by multiples. Typically, comparable companies are selected from the same industry. The underlying assumption is that these firms share the same risk, profitability and accounting methods. This has been the topic of studies by Bhojraj and Lee (2002), Boatsman and Baskin (1981), Alford (1992) and Zarowin (1990). An important conclusion that can be drawn from these studies is that industry membership is an important factor in selecting comparable firms. Hence, we focus on an important industry—oil and gas. The oil and gas industry contain some of the world's largest companies and also has a clear structure for grouping the companies—majors, independents, international. The industry is accordingly well structured to investigate the value relevance of such groups. For the companies, the groupings are important because of the way analysts investigate relative financial performance and therefore for the companies' cost of capital.

A crucial issue in multiples valuation is what criteria one should apply in peer group construction. De Franco, Hope, and Larocque (2015) find that selection criterion varies systematically with analyst' incentives and ability. Moreover, they also find evidence that analysts choose peer groups strategically. Bhojraj and Lee (2002), however, argue that the choice of comparable firms should be a function of the variables that drive cross-sectional variation in a given valuation multiple, independent of industry affiliation. However, evidence suggests that industry affiliation is important when selecting peer groups (Alford, 1992; Boatsman & Baskin, 1981; Tasker, 1998). In the spirit of Bhojraj and Lee (2002), we apply an empirical framework for establishing a relationship between valuation model and financial indicators in a particular industry, the oil and gas sector. Using 46 of the largest oil and gas companies, we investigate whether conventional peer groups (majors, independents, large exploration and production companies) constitute homogenous economic groups (i.e. similar relations between value drivers and valuation multiples). Using Chow tests, we test for differences in the valuation processes statistically by testing for structural shift in the value drivers across companies. Starting with a group consisting of the five super majors[1] (ExxonMobil, BP, Royal Dutch Shell, Total and Chevron), we test which other oil companies belong to this group by testing for a structural shift between this group and a potential super major (the largest among our sample of the 46 largest oil and gas companies). The null hypothesis is that the valuation model for the group of five super majors and the potential new super major is the same. If the hypothesis is rejected, this indicates that the potential super major should not be included in this peer group. This process is carried out for all the companies in the sample (less the original five super majors).

To control for the effects of unobserved variables, we apply panel data techniques, more specifically a fixed effects model. Omission of significant variables may lead to the omitted variables bias. One clear benefit of using a fixed effects model is that we can also capture the companies' cost of capital by including unobservable variables that are fixed for each firm in the sample across time. By also including fixed effects in the time dimension, we can also control for the impact of changes in oil and gas prices. Panel data models are often used in value-relevant studies in the oil and gas sector (Boone, 2002; Misund, Osmundsen, & Sikveland, 2015).

We contribute to the literature by introducing a novel approach to the selection of comparable firms. We apply a Chow test to assess whether the difference between two valuations processes are statistically significant. This contrasts the approach most commonly applied in prior studies, such as Bhojraj and Lee (2002) and Liu, Nissim, and Thomas (2002), focussing on the valuation accuracy without a procedure to assess how different to valuation processes must be to conclude that they belong to different peer groups.

Our study should also be of interest to investors and equity analysts valuing companies using the valuation multiples approach. Our results suggest that financial analysts and investors should select companies for peer groups on the basis of value-relevance of financial information, and not only based on subjective judgements.

The rest of the paper is organised as follows. The Section 2 presents a review of the literature. Section 3 describes the research design. Section 4 presents the data sample, and in Section 5, we present and discuss the results of the analysis. Section 6 concludes.

2. Literature review

This section presents some of the findings on selection of comparable firms in the finance and accounting literature.

Baker and Ruback (1999) describe three challenges in implementing a multiples approach: choosing the appropriate value driver, peer-group selection, and measuring multiples performance. Empirical research has been performed in these three areas. One strand of the literature evaluates the appropriate value driver (Lie & Lie, 2002; Liu, Nissim, & Thomas, 2007; Nel, Bruwer, & Le Roux, 2013, 2014b; Zarowin, 1990), while another strand addresses multiples performance and valuation accuracy (Alford, 1992; Baker & Ruback, 1999; Beatty, Riffe, & Thompson, 1999; Cheng & McNamara, 2000; Kim & Ritter, 1999; Liu, Nissim, & Thomas, 2002, 2005, 2007; Nel, Bruwer, & le Roux, 2014a; Nel et al., 2013; Schreiner & Spremann, 2007; Yoo, 2006).

An emerging literature addresses criteria and the process for peer-group selection. Several studies have investigated the relation between levels of industry classification and homogeneity in firms' financial characteristics such as returns, valuation, risk and profitability.

Boatsman and Baskin (1981) choose comparable firms from the same industry on the basis of fundamentals measured as historical earnings growth. This approach results in smaller valuation errors (using multiples) compared to randomly selected firms.

Alford's (1992) study highlights the importance of industry in peer-group selection. He selects comparable firms based on fundamentals such as industry affiliation, size, leverage and earnings growth. The author finds that limiting the selection criteria to two- to three-digit SIC codes results in a reduction in valuation errors. The importance of industry-specific multiples is further emphasised by Tasker (1998), who finds a systematic use of industry-specific multiples among investment bankers and analysts in acquisition transactions.

Bhojraj and Lee (2002) and Bhojraj, Lee, and Ng (2003) use a regression-based approach for selecting comparable firms independent of industry affiliation. The advantage of this approach that it allows to simultaneously control for the effect of several explanatory variables, and to empirically estimate the appropriate weights to put on each variable. They find that fundamental factors such as profitability, growth, and risk, are strongly associated with the enterprise value-to-sales and price-to-book ratios.

While Bhojraj and Lee (2002) and Bhojraj et al. (2003) advocate the use of objective criteria for selection of peer groups, recent evidence suggests that this is not always the case. De Franco et al. (2015) examine the selection of peer companies by sell-side equity analysts. They find that analysts

on average select peer companies with high valuations and that this effect varies systematically with analysts' incentives and ability. Moreover, their research suggests that analysts choose peers strategically.

In summary, the literature suggests that objective criteria based on valuation similarity should be applied when selecting peer groups. Moreover, prior research also suggests the importance of industry affiliation in peer-group selection.

3. Research design

It is possible to derive expressions for valuation multiples using traditional finance theory. The point of departure is Gordon's Dividend Discount Model (DDM). Bhojraj and Lee re-expresses the DDM model in terms of the PB ratio (based on the work of Feltham & Ohlson, 1995).

$$\frac{P_t^*}{B_t} = 1 + \sum_{i=1}^{\infty} \frac{E_t[(ROE_{t+i} - r_e)B_{t+i-1}]}{(1 + r_e)^i B_t} \tag{1}$$

where P^*_t is the present value of expected dividends, B_t is the book value of equity, r_e is the cost of equity capital, and *ROE* is return on equity. This equation shows that a firm's price-to-book ratio is a function of its expected ROEs, its cost of capital, and its future growth rate in book value (B_{t+i-1}/B_t).

Equation (1) demonstrates the theoretical link between a valuation multiple and its value drivers. Ideally, this model should be at the centre stage of any selection of peer groups. Companies with similar structural relationships between value-drivers and valuation should be grouped together. The idea is that companies in the same peer group should be characterised by similar relation between valuation and value drivers. If they are not, we should be able to find a structural break in the valuation model.

However, there are some concerns about the appropriateness of model in Equation (1), especially for oil and gas companies. The price-to-book ratio is not a common multiple for valuing oil and gas companies. Doubts have been raised about the usefulness of historical cost measures for oil and gas companies (Financial Accounting Standards Board (FASB), 1982). The reasons that have been put forth are factors relating to the nature of oil and gas exploration and production activities (Wright & Gallun, 2005), choice of competing methods for accounting for oil and gas exploration activities (Bryant, 2003),[2] and the existence so-called "legacy assets" which are oil and gas producing assets that are completely depreciated, but still generate cash flows (Antill & Arnott, 2002). Hence, analysts and investors in the oil and gas sector use an alternative valuation multiple, enterprise value-to-reserves, the EV/R ratio.

Another problem with Equation (1) is that it potentially excludes additional explanatory variables that can affect the magnitude of the EV/R ratio, across companies and over time. Omission of explanatory variables that affect the left-hand side variable in a regression may result in the omitted variables bias, negatively impacting the inference we can make from the models. Typically, a set of control variables are included, and which act as proxies for unobserved explanatory variables. However, the selection of appropriate control variables is a very challenging task for the researcher and may not be successful. In fact, prior studies suggest that key performance ratios in the oil and gas sector such as the reserves replacement ratio is not significantly associated with valuation multiples (Osmundsen, Asche, Misund, & Mohn, 2006; Osmundsen, Mohn, Misund, & Asche, 2007) or returns (Kumar Bhaskaran & Sukumaran, 2016). An alternative to using explicit control variables is to apply panel data techniques, such as fixed effects. The benefit of using a fixed effects model is that the latter technique is designed to capture the impact on the left-hand side variable from unobserved variables. We therefore use the following empirical model

$$\frac{EV}{R_{it}} = \beta_0 + \beta_1 \frac{EBITDA}{R_{it}} + \boldsymbol{FE}_i + \boldsymbol{FE}_t + \varepsilon_{it}^2 \tag{2}$$

where $\boldsymbol{FE}_i$ and $\boldsymbol{FE}_t$ represents time and firm fixed effects, respectively. The left hand side variable, EV/R, is enterprise value divided by the total amount of oil and gas reserves, measured in oil equivalents. Instead of using the return on equity, ROE, we use earnings before interest, taxes, depreciation and amortisation (EBITDA) divided by the amount of oil and gas reserves. This is in principle similar to value-relevance studies, where the accounting variables are often scaled by the amount of oil and gas reserves (Misund, Asche, & Osmundsen, 2008).

The type of specification in Equation (2) assumes that the relationship is stable, i.e., the estimated parameters are constant over the sample. This implication allows us to test for structural shifts in the relation between valuation and value drivers.

If there are two different peer groups, there will be two different parametric specifications of the relationship between value-drivers and valuation in the sample:

Peer group 1:

$$\frac{EV}{R_{it}} = \beta_0^1 + \beta_1^1 \frac{EBITDA}{R_{it}} + \boldsymbol{FE}_i^1 + \boldsymbol{FE}_t^1 + \varepsilon_{it}^3 \tag{3}$$

Peer group 2:

$$\frac{EV}{R_{it}} = \beta_0^2 + \beta_1^2 \frac{EBITDA}{R_{it}} + \boldsymbol{FE}_i^2 + \boldsymbol{FE}_t^2 + \varepsilon_{it}^4 \tag{4}$$

If the coefficients in the two equations are statistically different from each other, this provides evidence for a structural break in the econometric modelling of multiples valuation (see e.g. Chow, 1960). Hence, structural break tests can be applied to examine whether the valuation process changes when extending the group of peers. We test for structural breaks using the dummy variable approach (Gujarati, 1970a, 1970b), which allows us to run a single regression instead of two, which would be the case for a Chow test (Chow, 1960). Gujarati asserts that the dummy variable method is preferable to the Chow test for several reasons. First, running only a single regression can substantially abridge the analyses. Second, the single regression can be used to test a variety of hypotheses. Third, the Chow test does not explicitly indicate which coefficient, intercept or slope is different. Fourth, pooling increases the degrees of freedom and may improve the relative precision of the estimated parameters.

Using the dummy variable approach and allowing for a structural change, Equations (3) and (4) can be combined and written as follows:

$$\frac{EV}{R_{it}} = \beta_0 + \beta_0' C2 + \beta_1 \frac{EBITDA}{R_{it}} + \beta_2 \frac{EBITDA}{R_{it}} \times C2 + \boldsymbol{FE}_i + \boldsymbol{FE}_t + \varepsilon_{it}^4 \tag{5}$$

where *C2* is a dummy variable that is zero for company 1 and 0 for company 2. The variable ε_{it}^4 represents the error term. We test for structural break in the model by testing for joint significance of the interaction terms using a Wald test. That is, one tests if the hypothesis that the interaction terms are jointly significantly equal to 0 (i.e. H_0: $\beta_2 = \gamma_1 = \gamma_2 = \ldots = 0$) can be rejected at a specific level of significance. If the null hypothesis is rejected, then the results provide evidence for a structural break in the econometric modelling of valuation.

4. Data

The sample consists of oil and gas companies for the 1992–2013 period drawn from John S. Herold Company's (JS Herold) oil and gas financial database.[3] The Herold database consists of more than 500 publicly traded energy companies. From this universe, we select the 50 of the largest oil and gas companies that report both financials and supplementary information in accordance with the U.S.

Table 1. Descriptive statistics

Variable	Mean	St.dev	25%	Median	75%
EV/R	14.34	16.74	6.45	10.46	16.22
EBITDA	2.61	2.86	1.04	1.78	3.25

Notes: EV/R is the enterprise-to-total oil and gas reserves ratio and EBITDA is Earnings before interest, taxes, depreciation, and amortisation (million USD), scaled by the amount of oil and gas reserves (in millions of barrels of oil equivalent).

Securities and Exchange Commission's (SEC) regulation.[4] For four of these companies, we had fewer than 3 years of data, and these were excluded from the final sample of 46 firms. The descriptive statistics are presented in Table 1. Table 2 presents IHS Herold's classification of the largest North American and international oil and gas companies. We use Herold's selection of oil and gas majors as our benchmark sample. The aim of the analysis is to examine whether we can expand this initial group of companies by adding additional firms if they are significantly similar.

Since the data covers a time period of more than 20 years, both autocorrelation and heteroskedasticity may be present in the data, negatively affecting the inference we are able to make from the results. We therefore test for heteroskedasticity using the Breusch–Pagan test (Breusch & Pagan, 1979) and serial correlation using the Breusch–Godfrey test (Breusch, 1978; Godfrey, 1978). If we find evidence of either serial correlation or heteroskedasticity, or both, we need to adjust the standard errors before calculating the *t*-values and *p*-values from the regression. Heteroskedasticity can be corrected for using the White (1980) approach and serial correlation can be corrected using the Arrelano method for fixed effects models (Arellano, 1987).

Table 2. IHS Herold's classification of the largest international oil and gas companies

Super majors	European integrateds	Russian integrateds	South American integrateds	Asian and African integrateds	Canadian integrateds	Large North American E&Ps
BP	BASF	Gazprom	Ecopetrol	Mitsui	Cenovus	Anadarko
Chevron	BG	GazpromNeft	Petrobras	Petrochina	Husky	Apache
Exxon Mobil	CEPSA	Lukoil	Petrobras Argentina	Sinopec	Imperial	Canadian natural resources
RDS	ENI	Rosneft	YPF	Sasol	Suncor	Chesapeake
Total	MOL	Tatneft				Conoco
	OMV					Devon
	Repsol					Encana
	Statoil					EOG
						Hess
						Marathon
						Noble
						Occidental
						Pioneer
						Range
						Talisman
						WPX

5. Results and discussion

The analysis is carried out as follows. First, we produce an empirical model of the relationship between price-to-book and its value drivers for a subset of five Super Major oil companies. All other companies will be compared to this particular group. Second, we introduce firms classified as international majors, one by one. Chow test is used to investigate whether the new company has a significantly different relationship between valuation and financial indicators than the five original super majors. Finally, we investigate whether firms classified as United States and Canadian E&Ps can be included in the super major peer group. We do this by repeating the second step with United States & Canadian E&Ps instead if the international large companies.

Part 1: The relationship between price-book and financial indicators for oil super majors

First, we carry out tests to see whether we should use a pooled OLS or a fixed effects model (pooling test) and whether a fixed effects or a random effects model is appropriate (Hausman test: Hausman, 1978). The tests conclude that a fixed effects model is the most appropriate for our data (Table 3). Secondly, we test for heteroskedasticity and serial correlation in the residuals from the empirical estimation of the model in Equation (5) using the initial subsample of oil and gas super majors. We cannot find evidence of neither heteroskedasticity, nor serial correlation (Table 4) and we do not need to correct our standard errors. Finally, we estimate the model in Equation (5) and the results are presented in Table 5.

The coefficient on the profitability variable is significant (Table 5), which provides evidence that EBITDA is a relevant profitability measure for the oil and gas majors. Moreover, the difference in the two adjusted R^2 measures suggest that the fixed effects, both for time and individuals, capture the effects from unobserved variables.

Table 3. Tests for heteroskedasticity and serial correlation

	Breusch–Pagan	Breusch–Godfrey
Benchmark	0.085	0.461
	(0.771)	(0.497)

Notes: The benchmark model includes the five super majors and is compared against additional companies. The values in parantheses are *p*-values from the Breusch–Pagan test for heteroskedasticity and Breusch–Godfrey test for serial correlation.

Table 4. Panel data model tests

	Pooled	Hausman
Benchmark	13.049***	6.938***
	(<0.001)	(0.008)

Notes: The benchmark model includes the five super majors and is compared against additional companies. The values in the table are *F*-values (pooled test for pooled OLS vs. fixed effects) and χ^2-values (Hausman test for fixed effects vs. random effects). The values in parantheses are *p*-values and the significance is denoted by asterisks:
*$p < 0.10$.
**$p < 0.05$.
***$p < 0.01$.

Table 5. Regression results: Majors benchmark sample

	Coefficient	*t*-value/*F*-value	*p*-value
Intercept	2.626	3.375	0.001
EBITDA	3.147	11.244	<0.001
Adjusted R^2 (within)	0.459		
Adjusted R^2 (total)	0.904		
N	106		
F-test		42.585	<0.001

Next, we include new companies to the Super Major group, one by one, using an extended sample. Significance of the joint interaction terms indicates that this new company belongs in the Super Major group.

Our results suggest that several of the oil and gas firms (e.g. ENI and MOL) belonging to peer groups other than "oil majors", are more closely associated with the super majors, than with other firms in the group they have been added to. The implication of our study is that the oil major peer group could benefit from adding other companies, such as ENI. Arguably, a larger peer group would improve the accuracy of the multiples valuation method.

Table 6. Selection of peers: Super majors vs. international large integrated

	EV	EV/OGR	χ^2-value	*p*-value	A super major?
Super majors					
BP	188.6	11.77			By construct
Chevron	120.9	11.14			By construct
Exxon Mobil	296.6	13.42			By construct
Royal Dutch/Shell	187.0	12.59			By construct
Total	104.4	11.61			By construct
European integrated					
BASF	65.36	55.99	4.536	0.033	No
BG	43.62	21.40	35.546	<0.001	No
CEPSA	9.97	101.32	50.190	<0.001	No
ENI	91.14	14.76	0.123	0.725	Yes
MOL	6.42	24.00	0.129	0.724	Yes
OMV	10.69	14.07	4.296	0.038	No
Repsol	33.39	13.76	7.099	0.008	No
Statoil	64.04	13.45	11.054	<0.001	No
Russian integrated					
Gazprom	196.22	1.63	1.836	0.175	Yes
GazpromNeft	19.15	4.10	7.678	0.006	No
Lukoil	37.63	2.14	8.053	0.004	No
Rosneft	98.22	5.98	3.910	0.048	No
Tatneft	6.33	1.06	0.407	0.523	Yes
South American integrated					
Ecopetrol	71.51	46.70	0.004	0.952	Yes
Petrobras	112.77	10.24	101.976	<0.001	No
PetrobrasArgentina	4.01	7.14	6.558	0.010	No
YPF	15.26	7.12	19.820	<0.001	No
Asian and African integrated					
Mitsui	50.88	108.24	1.606	0.205	Yes
Petrochina	192.66	9.47	53.756	<0.001	No
Sinopec	86.58	22.20	36.913	<0.001	No
Sasol	29.31	32.57	11.411	<0.001	No
Canadian integrated					
Cenovus	26.05	17.14	8.719	0.003	No
Husky	21.45	25.30	26.138	<0.001	No
Imperial	21.24	10.00	140.166	<0.001	No
Suncor	24.01	15.20	0.066	0.797	Yes

Note: χ^2-values are from the Chow test of structural shifts and are presented along with accompanying *p*-values.

Table 6 below presents the χ^2-values from the Chow tests of Equation (5) for international large integrated oil companies. The results indicate that our Super Major group can be extended with the three following international oil companies; ENI, MOL, Gazprom, Tatneft, Ecopetrol, Mitsui and Suncor.

Part 2: North American large exploration and production companies

Table 7 below presents the *F*-values from the Chow tests of Equation (7) for large North American E&Ps. The results indicate that our Super Major group can be extended with the several United States and Canadian E&P oil companies, such as Anadarko, Apache, Canadian Natural Resources, Encana, Marathon, Range, Talisman and WPX.

Similar to the analysis of integrated companies (Part 1), we also find that several of the companies that are typically characterised as North American large E&Ps are more closely related to oil majors than to the other companies in their peer group.

In summary, our results suggest that the approach used in the current study can be used to in the selection of companies to be included in peer groups for the purpose of equity valuation using multiples. The results should be of interest to investors and equity analysts covering the oil and gas sector, as well as other industries.

Table 7. Selection of peers: Super majors vs. North American large exploration and production companies (E&Ps)

	EV	EV/OGR	χ^2-value	*p*-value	A super major?
Super majors					
BP	188.6	11.77			By construct
Chevron	120.9	11.14			By construct
Exxon Mobil	296.6	13.42			By construct
Royal Dutch/Shell	187.0	12.59			By construct
Total	104.4	11.61			By construct
Large North American E&Ps					
Anadarko	22.80	12.75	0.774	0.379	Yes
Apache	19.47	12.55	2.621	0.105	Yes
Canadian natural resources	20.24	10.35	0.062	0.803	Yes
Chesapeake	11.59	11.02	7.759	0.005	No
Conoco	99.94	11.55	4.875	0.027	No
Devon	19.46	11.24	14.911	<0.001	No
Encana	21.49	10.36	3.503	0.062	Yes
EOG	14.12	13.47	19.655	<0.001	No
Hess	15.13	12.41	4.073	0.044	No
Marathon	18.92	12.77	0.122	0.727	Yes
Noble	7.97	13.02	5.927	0.015	No
Occidental	34.00	14.80	20.850	<0.001	No
Pioneer	8.05	9.70	117.578	<0.001	No
Range	4.23	13.28	1.098	0.295	Yes
Talisman	10.71	11.48	0.208	0.648	Yes
WPX	4.93	5.91	0.476	0.490	Yes

6. Conclusion

The Chow test for structural shift is a methodology that can be used to identify peer groups that have similar structures in their valuation process. Applying the test to 46 oil and gas companies, we find that several companies, both among the largest international integrated companies, as well as among the largest North American E&Ps have a similar structure in their valuation process to the oil super majors. Moreover, our findings suggest that investors, taking into account profitability and several unobserved factors, value several of the largest E&Ps in the same way as they value majors, suggesting the pricing of the latter securities are perhaps more efficient than several of the international integrated companies.

We do not find that other groups of firms have a structurally similar valuation process. This means that comparison of firms in groups such as independents and internationals are likely to result in large variation in the companies' perceived performance since the measures show the differences in the valuation process rather than the differences in economic performance.

Acknowledgements
The authors are grateful to IHS Herold for providing the data for our research. We would also like to thank the participants at the 9th IAEE European Energy Conference in Florence, Italy, for useful comments to our paper.

Funding
This work was supported by Norges Forskningsråd.

Author details
Frank Asche[1,2]
E-mail: frank.asche@ufl.edu
ORCID ID: http://orcid.org/0000-0002-1540-9728
Bård Misund[3]
E-mail: bard.misund@uis.no
ORCID ID: http://orcid.org/0000-0001-7069-5707
[1] Institute for Sustainable Food Systems and School of Forest Resources and Conservation, University of Florida, Gainsville, FL, USA.
[2] Department of Industrial Economics, University of Stavanger, Stavanger N-4036, Norway.
[3] Business School, University of Stavanger, Stavanger N-4036, Norway.

Citation information
Cite this article as: Who's a major? A novel approach to peer group selection: Empirical evidence from oil and gas companies, Frank Asche & Bård Misund, *Cogent Economics & Finance* (2016), 4: 1264538.

Notes
1. As defined by IHS Herold (www.ihs.com/herold).
2. This refers to choice that oil and gas companies, reporting financial statements according to either U.S. standards (Financial Accounting Standards Board, 2009, 2010) or international standards (International Accounting Standards Board (IASB), 2004), have to choose between two competing accounting methods for pre-discovery exploration activities. Under the full cost regime, all exploration costs are capitalised, while under the alternative method, successful efforts, only costs accrued from the exploration of producible wells are allowed to be put on the balance sheets.
3. JS Herold Inc. supplies accounting and operational data from 500 companies (public and privately owned). The company website is located at www.ihs.com/herold.
4. See Financial Accounting Standards Board (2009) and Securities and Exchange Commission (SEC) (2008) for a description of current oil and gas disclosure rules.

References
Alford, A. W. (1992). The effect of the set of comparable firms on the accuracy of the price-earnings valuation method. *Journal of Accounting Research, 30*, 94–108. http://dx.doi.org/10.2307/2491093
Antill, N., & Arnott, R. (2002). *Oil company crisis, managing structure, profitability and growth*. Oxford: Oxford Institute of Energy Studies.
Arellano, M. (1987). Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics, 49*, 431–434.
Asquith, P., Mikhail, M. B., & Au, A. S. (2005). Information content of equity analyst reports. *Journal of Financial Economics, 75*, 245–282. http://dx.doi.org/10.1016/j.jfineco.2004.01.002
Baker, M., & Ruback, R. (1999). *Estimating industry multiples* (Working Paper). Cambridge, MA: Harvard University.
Beatty, R. P., Riffe, S. M., & Thompson, R. (1999). The method of comparables and tax court valuations of private firms: An empirical investigation. *Accounting Horizons, 13*, 177–199. http://dx.doi.org/10.2308/acch.1999.13.3.177
Bhojraj, S., & Lee, C. M. C. (2002). Who is my peer? A valuation-based approach to the selection of comparable firms. *Journal of Accounting Research, 40*, 407–439. http://dx.doi.org/10.1111/1475-679X.00054
Bhojraj, S., Lee, C. M. C., & Ng, D. T. (2003). *International valuation using smart multiples* (Working Paper). Cornell University, Ithaca.
Boatsman, J., & Baskin, E. (1981). Asset valuation with incomplete markets. *The Accounting Review, 56*, 38–53.
Boone, J. (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. http://dx.doi.org/10.2308/accr.2002.77.1.73
Breusch, T. S. (1978). Testing for autocorrelation in dynamic linear models. *Australian Economic Papers, 17*, 334–355. http://dx.doi.org/10.1111/j.1467-8454.1978.tb00635.x
Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica, 47*, 1287–1294. http://dx.doi.org/10.2307/1911963
Bryant, L. (2003). Relative value relevance of the success efforts and full cost accounting methods in the oil and gas industry. *Review of Accounting Studies, 8*, 5–28. http://dx.doi.org/10.1023/A:1022645521775
Cheng, C. S. A., & McNamara, R. (2000). The valuation accuracy of the price-earnings and price-book benchmark valuation methods. *Review of Quantitative Finance and Accounting, 15*, 349–370. http://dx.doi.org/10.1023/A:1012050524545

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica, 28*, 591–605. http://dx.doi.org/10.2307/1910133

Copeland, T., Koller, T., & Murrin, J. (2000). *Valuation*. New York, NY: Wiley.

De Franco, G., Hope, O.-K., & Larocque, S. (2015). Analysts' choice of peer companies. *Review of Accounting Studies, 20*, 82–109. http://dx.doi.org/10.1007/s11142-014-9294-7

DeAngelo, L. (1990). Equity valuation and corporate control. *The Accounting Review, 65*, 93–112.

Demirakos, E. G., Strong, N. C., & Walker, M. (2004). What valuation models do analysts use? *Accounting Horizons, 18*, 221–240. http://dx.doi.org/10.2308/acch.2004.18.4.221

Feltham, G. A., & Ohlson, J. A. (1995). Valuation and clean surplus accounting for operating and financial activities. *Contemporary Accounting Research, 11*, 689–731. http://dx.doi.org/10.1111/care.1995.11.issue-2

Financial Accounting Standards Board. (1982). *Statement of financial accounting standards No. 69: Disclosures about oil and gas producing activities*. Stamford, CT: Author.

Financial Accounting Standards Board. (2009). *Financial accounting codification topic 932: Extractive activities—oil and gas*. Stamford, CT: Author.

Financial Accounting Standards Board. (2010). *Financial accounting series. accounting standards update. Extractive activities—oil and gas (Topic 932): Oil and gas reserves estimation and disclosures*. An Amendment of the FAB Accounting Standards Codification. Stamford, CT: Author.

Godfrey, L. G. (1978). Testing against general autoregressive and moving average error models when the regressors include lagged dependent variables. *Econometrica, 46*, 1293–1302. http://dx.doi.org/10.2307/1913829

Gujarati, D. (1970a). Use of dummy variables in testing for equality between sets of coefficients in two linear regressions: A note. *American Statistician, 24*, 50–52.

Gujarati, D. (1970b). Use of dummy variables in testing for equality between sets of coefficients in two linear regressions: A generalization. *American Statistician, 24*, 18–21.

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica, 46*, 1251–1271. http://dx.doi.org/10.2307/1913827

International Accounting Standards Board. (2004). *International financial reporting standards 6: Exploration for and evaluation of mineral resources*. London: Author.

Kaplan, S. N., & Ruback, R. S. (1995). The valuation of cash flow forecasts: An empirical analysis. *The Journal of Finance, 50*, 1059–1093. http://dx.doi.org/10.1111/j.1540-6261.1995.tb04050.x

Kim, M., & Ritter, J. R. (1999). Valuing IPOs. *Journal of Financial Economics, 53*, 409–437. http://dx.doi.org/10.1016/S0304-405X(99)00027-6

Kumar Bhaskaran, R. J., & Sukumaran, S. K. (2016). An empirical study on the valuation of oil companies. *OPEC Energy Review, 40*, 91–108. http://dx.doi.org/10.1111/opec.2016.40.issue-1

Lie, E., & Lie, H. J. (2002). Multiples used to estimate corporate value. *Financial Analysts Journal, 58*, 44–54. http://dx.doi.org/10.2469/faj.v58.n2.2522

Liu, J., Nissim, D., & Thomas, J. (2002). Equity valuation using multiples. *Journal of Accounting Research, 40*, 135–172. http://dx.doi.org/10.1111/1475-679X.00042

Liu, J., Nissim, D., & Thomas, J. (2005). *International equity valuation using multiples* (Working Paper). Columbia University, New York, NY.

Liu, J., Nissim, D., & Thomas, J. (2007). Is cash flow king in valuations? *Financial Analysts Journal, 63*, 56–68. http://dx.doi.org/10.2469/faj.v63.n2.4522

Minjina, D. I. (2008). Multiples and their use for equity valuation on European capital markets. *Theoretical and Applied Economics, 11*, 22–28.

Misund, B., Asche, F., & Osmundsen, P. (2008). Industry upheaval and valuation: Empirical evidence from the international oil and gas industry. *The International Journal of Accounting, 43*, 398–424. http://dx.doi.org/10.1016/j.intacc.2008.09.007

Misund, B., Osmundsen, P., & Sikveland, M. (2015). International oil company valuation: The effect of accounting method and vertical integration. *Petroleum Accounting and Financial Management Journal, 34*, 1–20.

Nel, W. S., Bruwer, B. W., & Le Roux, N. J. (2013). Equity–and entity-based multiples in emerging markets: Evidence from the JSE securities exchange. *Journal of Applied Business Research (JABR), 29*, 829–852. http://dx.doi.org/10.19030/jabr.v29i3

Nel, S., Bruwer, W., & le Roux, N. J. (2014a). An emerging market perspective on peer group selection based on valuation fundamentals. *Applied Financial Economics, 24*, 621–637. http://dx.doi.org/10.1080/09603107.2014.894629

Nel, W. S., Bruwer, B. W., & le Roux, N. J. (2014b). An emerging market perspective on key value drivers in the valuation of cross-border Transactions into South Africa. *Economics, Management and Financial Markets, 4*, 91–111.

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. http://dx.doi.org/10.1016/j.enpol.2005.12.010

Palepu, K., Healy, P., & Bernard, V. (2000). *Business analysis and valuation* (2nd ed.). Cincinatti, OH: South-Western College Publishing.

Penman, S. H. (2001). *Financial statement analysis and security valuation*. Irwin, CA: McGraw-Hill.

Roosenboom, P. (2007). Discussion of "How do underwriters value initial public offerings? An empirical analysis of the French IPO market". *Contemporary Accounting Research, 24*, 1217–1243. http://dx.doi.org/10.1506/car.24.4.7

Schreiner, A., & Spremann, K. (2007). *Equity valuation using multiples* (Working Paper). University of Saint Gallen, Frankfurt. http://dx.doi.org/10.1007/978-3-8350-9531-1

Securities and Exchange Commission. (2008). *Modernization of oil and gas reporting requirements: The final rule*. Washington, DC: Author.

Tasker, S. C. (1998). *Industry preferred multiples in acquisition valuation* (Working Paper). Cornell University, Ithaca, NY.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica, 48*, 817–838. http://dx.doi.org/10.2307/1912934

Wright, C. J., & Gallun, R. A. (2005). *International petroleum accounting*. Tulsa, OK: PennWell.

Yoo, Y. K. (2006). The valuation accuracy of equity valuation using a combination of multiples. *Review of Accounting and Finance, 5*, 108–123.

Zarowin, P. (1990). What determines earnings-price ratios: Revisited. *Journal of Accounting, Auditing, and Finance, 5*, 439–457.

***Cogent Economics & Finance* (ISSN: 2332-2039) is published by Cogent OA, part of Taylor & Francis Group.**