WHO'S A MAJOR? A NOVEL APPROACH TO PEER GROUP SELECTION: EMPIRICAL EVIDENCE FROM OIL AND GAS COMPANIES

FRANK ASCHE

Professor, University of Stavanger, N-4036 Stavanger, Norway,

frank.asche@uis.no

BÅRD MISUND*

Associate Professor, University of Stavanger Business School, N-4036 Stavanger,

Norway, bard.misund@uis.no

* Corresponding author

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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.

Keywords: Oil and gas companies, valuation, valuation multiples, peer groups

JEL codes: G12, Q33, Q35

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 (DCF) and its derivative, the residual income valuation model, RIV (Penman 2001; Copeland, Koller & Murrin 2000; Palepu, Healey & Bernard 2000), 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 valuation of initial public offerings (IPOs), investment bankers' fairness opinions, leveraged buyout transactions (LBOs), 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 & Lee (2002), Boatsman & 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 & Larocque (2015) find that selection criteria varies systematically with analyst' incentives and ability. Moreover, they also find evidence that analysts choose peer groups strategically. Bhojraj & 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 (Boatsman & Baskin 1981, Alford 1992, Tasker 1998). In the spirit of Bhojraj & Lee (2002) we apply an empirical framework for establishing a relationship between valuation model and financial indicators in a particular industry, the oil & 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,

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[1] As defined by IHS Herold (www.ihs.com/herold).

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).

We contribute to the literature by introducing a novel approach to the selection of comparable firms. While 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 & Lee (2002) and Liu, Nissim & 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.

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-relevance studies in the oil and gas sector (Boone 2002; Misund, Osmundsen & Sikveland 2015).

The rest of the paper is organized as follows. The next section 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 (Zarowin 1990; Lie & Lie 2002; Liu, Nissim & Thomas 2007; Nel, Bruwer & le Roux 2013, 2014b) while another strand addresses multiples performance and valuation accuracy (Alford 1992; Baker & Ruback 1999; Beatty, Riffe & Thompson 1999; Kim & Ritter 1999; Cheng & McNamara 2000; Liu, Nissim & Thomas 2002, 2005, 2007, Yoo 2006; Schreiner & Spremann 2007; Nel, Bruwer & le Roux 2013, 2014a).

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 & 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 emphasized by Tasker (1998), who finds a systematic use of industry-specific multiples among investment bankers and analysts in acquisition transactions.

Bhojraj & Lee (2002) and Bhojraj, Lee & 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 & Lee (2002) and Bhojraj, Lee & Ng (2003) advocate the use of objective criteria for selection of peer groups, recent evidence suggests that this is not always the case. De Franco, Hope & Larocque (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). Firms that have similar PB ratios should have present values that are close to each other.

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 Eq. (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 (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 Eq. (1) is that potentially excludes additional explanatory variables which 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, 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). 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

[2] This refers to choice that oil and gas companies, reporting financial statements according to either U.S. standards (FASB 2009, 2010) or international standards (IAS 2004), have to choose between two competing accounting methods for pre-discovery exploration activities. Under the full cost regime all exploration costs are capitalized, while under the alternative method, successful efforts, only costs accrued from exploration of producible wells are allowed to be put on the balance sheets.

designed to capture the impact on the left-hand side variable from unobserved variables. We therefore use the following empirical model

$$\frac{EV}{R}_{it} = \beta_0 + \beta_1 \frac{EBITDA}{R}_{it} + \boldsymbol{FE}_i + \boldsymbol{FE}_t + \varepsilon_{it}^2 \quad (2)$$

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 amortization (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 Eq. (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:

$$\frac{EV}{R}_{it} = \beta_0^1 + \beta_1^1 \frac{EBITDA}{R}_{it} + \boldsymbol{FE}_i^1 + \boldsymbol{FE}_t^1 + \varepsilon_{it}^3 \quad (3)$$

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:

$$\frac{EV}{R}_{it} = \beta_0 + \beta_0' C2 + \beta_1 \frac{EBITDA}{R}_{it} + \beta_2 \frac{EBITDA}{R}_{it} \times C2 + \boldsymbol{FE}_i + \boldsymbol{FE}_t + \varepsilon_{it}^4 \quad (5)$$

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: $\beta_2 = \gamma_1 = \gamma_2 =........ = 0$) 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 46 largest oil and gas companies that report both financials and supplementary information in accordance with the U.S. Securities and Exchange Commission's (SEC) regulation.[4] 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

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[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 FASB (2009, 2010) and SEC (2008) for a description of current oil and gas disclosure rules.

and gas majors as our benchmark sample. The aim of the analysis is to examine if we can expand this initial group of companies by adding additional firms if they are significantly similar.

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

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

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 Chevron Exxon Mobil	BASF BG CEPSA	Gazprom GazpromNeft Lukoil	Ecopetrol Petrobras Petrobras Argentina	Mitsui Petrochina Sinopec	Cenovus Husky Imperial	Anadarko Apache Canadian Natural Resources
RDS Total	ENI MOL OMV Repsol Statoil	Rosneft Tatneft	YPF	Sasol	Suncor	Chesapeake Conoco Devon Encana EOG Hess Marathon Noble Occidental Pioneer Range Talisman WPX

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 1979; 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 (White 1980) approach and serial correlation can be corrected using the Arrelano method for fixed effects models (Arrelano 1987).

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. Using the Chow test 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 US & Canadian E&Ps can be included in the super major peer group. We do this by repeating the second step with US & 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 if 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 Eq. (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 Eq. (5) and the results are presented in Table 5.

Table 3

Tests for heteroskedasticity and serial correlation

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

Note: 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)

Note: 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 versus fixed effects) and χ^2-values (Hausman test for fixed effects versus random effects). The values in parantheses are p-values and the significance is denoted by asterisks: *:p<0.10, **:p<0.05 and ***: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

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 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.

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.

Table 6 below presents the χ^2-values from the Chow tests of Eq. (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.

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

Part 2: North American large exploration and production companies

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

5. 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.

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