An empirical study of the determinants of UK oil and gas voluntary disclosures

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Abstract

Significant market value of energy firms is derived from their physical oil and gas reserves, assets not recorded on their statements of financial position. This paper provides empirical evidence regarding voluntary disclosure of such reserves in line with UK SORP/OFR guidelines from both a quantitative and qualitative perspective. The paper seeks to inform the IASB's on-going consideration of reporting of mineral resources. The researchers adopt an empirical analysis of the previously un-researched UK reporting environment. Listed companies are considered to evidence forms of reserve disclosure with a logistical regression approach to measure determinants of reporting. The risk associated with mineral reporting reserves is hypothesised as the key disclosure driver whilst controlling for other relevant variables. Motivations for disclosure are considered. The majority of firms disclosed reserve quantities in some form but only a minority disclosed in line with recommended practice. Quality of disclosure is more variable between companies. The findings indicate that a voluntary disclosure approach is ineffective, partially explained by agency related behaviour. Risk, proxied by stage of production, drives reserve disclosure showing that producer firms are more likely to disclose reserve quantum balances and of a significantly higher quality. The qualitative attributes of information reported have not previously been tested.

Key words: Reserve quantum, Voluntary disclosure, Extractive Industry, Risk

JEL classification: G38, M40, Q40

I. Introduction

A significant amount of the value of energy firms is derived from mineral reserves not necessarily recorded in reported financial statements, yet such reserves drive economic activity (Taylor *et al*., 2012). Information on such reserves can provide shareholders with data regarding the likelihood of positive future cash flows (Berry and Wright, 2001), thus affecting the share price and market value (Berry *et al*., 1997). Reserve related key performance indicators (KPIs) also provide information content (Spear and Lee, 1999) such as reserve replacement ratios (RRRs). Oil and gas reserve quantum information can be used for numerous reasons including informing mergers, acquisition and disposition decisions, providing security for principal and interest in debt covenant and lending decisions based on a percentage of proved developed reserves (Haines, 1999). Future corporate success is dependent upon a continuum of mineral reserves, thus numerous stakeholders rely on such reserve data. Research into disclosure behaviour is critical where stakeholders need and use such data (Slack and Shrives, 2010) which is clearly apposite to oil and gas reserves. However, the reliability of reserve quantum data is problematic with uncertainty inherent in its estimation.

The UK's Oil Industry Accounting Committee's SORP (OIAC, 2001), last updated in 2001, provides guidance on a range of additional voluntary disclosures for the industry. Further disclosures were also set out in the Operating and Financial Review (OFR), introduced on a voluntary basis in 1993, made mandatory for listed companies in 2005 but removed as a statutory requirement for quoted companies in 2006 becoming again a voluntary reporting statement of

best practice. However the UK's Companies Act 2006 enhancement of the business review reporting requirements specified the contents of the business review required to be included in the directors' report, becoming effective for financial years beginning on or after 1 October 2007. Thus the financial reporting for year ends in the calendar year 2007 represents one of the few periods that had only voluntary disclosure since the OFR (ASB, 2005) was voluntary and the business review had not yet been enacted. It is for this reason that our study uses data for 2007 year ends as this represents a rare opportunity to examine disclosures in a purely voluntary environment.

This paper provides insight into voluntary reserves disclosure within the UK oil and gas sector by considering firstly information regarding reserve quantum balances seen to be vital to stakeholders (Berry et al., 1997; Berry and Wright, 2001). Disclosure is then considered in regard to recommended practice as detailed in the SORP and OFR which is viewed here as a proxy for qualitative best practice, as outlined below:

- Disclosure of oil and gas reserve balances (required by SORP, s246)
- Disclosure of balances by geographic region (required by SORP, s246)
- Statement of the source of the estimates (required by SORP, s247)
- Disclosure relating to audit of reserves, specifically the name and qualification of an independent expert who reviewed the internal data (required by OFR, p77)
- Disclosure of the basis for arriving at the net quantities (required by SORP, s247)
- Application of an accepted practice for defining reserve quantum (e.g. SORP rules, s12, OFR p77 requiring proved (P1) and probable (P2) reserves)

- Disclosure of the movement in the net quantities of reserves (required by SORP, s249)
- Disclosure of KPIs (required by OFR, p77)

It should be noted that the UK stance differs from that of other jurisdictions most notably the Securities and Exchange Commission (SEC). The IASB's IFRS 6 *Exploration for and Evaluation of Mineral Resources* (IASB, 2004) "did little to regularise varied accounting practice…..enabling companies to continue reporting in their preferred mode" (Cortese *et al*., 2010, p. 76). The IASB established a working group that released a discussion paper in April 2010 (IASB, 2010) with reserve quantum reporting still not standardised nor mandatory. Managers may therefore voluntarily disclose information where perceived benefits exceed costs (Ferguson *et al.*, 2002) for example weighing the benefits of reducing the organisation's cost of capital (Verrecchia, 1983) with the proprietary cost of providing information to competitors (Ellis *et al*., 2012).

Healy and Palepu (2001) argue that disclosure is likely to differ among industries reflecting their own unique characteristics, with leading firms in an industry providing a mimetic effect. Prior cross-sectoral studies on voluntary disclosure provide inconclusive and contradictory relationships between industrial sectors and the level of voluntary disclosure (Eng and Mak, 2003) explained by specialised and unique accounting (Shevlin, 1996) and industry-specific contexts. This paper considers factors influencing reserve quantum within one single industrial context, in a distinctive industry with its inherent high-risk and geological specialism.

This paper makes a number of contributions to previous research. Firstly, prior studies are limited in number, are Australian centric and are broader extractive industry studies (e.g. Taylor *et al.*, 2012). This paper considers the characteristics and determinants of disclosure in the hitherto unresearched UK oil and gas context. Second, the paper introduces a new measure for the quality of reserve quantum disclosure locating our analysis within the context of the voluntary SORP/OFR guidelines, recognising the risks inherent in the industry and identifying the determinants of disclosure. Finally, the IASB project on extractive industries is long-running and has made very little progress (Cortese *et al.*, 2010) resulting in disparate global reserve quantum reporting practice, a mix of voluntary and mandatory disclosure and of varying quality. The paper in exploring the current practice of UK companies aims to inform potential future regulation of reserves disclosures.

The paper is structured as follows. Section II reviews relevant literature and develops the research hypotheses. Section III describes our research design. Section IV reports on the current reserve disclosure practices of 86 UK companies. Section V reports the empirical analysis for the determinants of the voluntary disclosure of oil and gas reserves. Drawing on these findings, implications for the future regulation of reserves disclosure are discussed in Section VI. Section VII concludes and offers suggestions for future research.

II. Hypotheses development: theory and prior research

Agency theory is considered to be a suitable theoretical framework for examining reserve reporting in annual reports of oil and gas companies (Taylor *et al.*, 2012).

Voluntary disclosure of reserve information can reduce information asymmetry (Boone, 1998) management discretion weighing the agency-related costs and benefits of disclosure. Agency costs include providing the reserve information of an appropriate quality which is a non-trivial cost particularly when reducing data uncertainty through incurring significant monitoring costs including data verification by qualified geologists (Mirza and Zimmer, 2001). Proprietary costs must also be considered regarding competitors or dissident shareholders (Craswell and Taylor, 1992) using the information adversely to the firm's prospects as well as stakeholders in litigation cases. Agency related benefits include a reduction in the organisation's cost of capital by reducing risk (Verrecchia, 1983) and reducing contracting costs with agents (Craswell and Taylor, 1992).

An understanding of the risks related to reserve quantum is fundamental to the debate on recognition and reporting. The industry is regarded as being high risk along the entire value chain with investors requiring a related high return. Stakeholders recognise that reserve quantum information provided is inherently uncertain, with risk being highest at the exploration stage and reducing once production has commenced (Wise and Spear, 2002) as often estimates are updated by continuous information upgrades. Certainty regarding the reserves needs to be considered regarding the feasibility of oil and gas reservoirs from various standpoints including technical (mining, metallurgical and environmental aspects) and commercial (such as economic, legal, marketing, social and governmental) viability. At one end of the spectrum, reserves can be regarded as contingent resources and, at the other, they can be classified as proved developed reserves with a high probability of being produced and marketed. Companies

attempt to reduce and manage their exposure to risk through for example diversification, such as holding broad portfolios of projects and participating in joint ventures to share the risk.

The specific risks affecting the industry and reserve estimation occur from the point of exploration to the final marketplace, including extractive risks and commercial, political and financing risks. In regard to extractive risk, exploration is regarded as the greatest risk as most acquisitions and exploration activities prove to be non-productive (Brooks, 1987), although this risk can be reduced by engineering studies and actual production history. Geological risk relates to the location of the reserves e.g. an offshore shallow reservoir is less risky than a deep-water reservoir. Production risk is a failure to produce the quantity or quality required from the exploration sampling readings whilst logistical risk relates to the movement of oil and gas reserves from remote geographical sites.

Commercial risk recognises the problem of selling the reserves at a profitable price with oil companies being price takers and the market being unpredictable, reserves not being considered proved if commercially non-viable and corporations postponing activities in a low price environment (Haines, 1999). Political risk may be a critical factor to many oil fields where contractual arrangements exist with host governments where political instability provides a real threat to mineral extraction. Financing risk refers to a company's ability to raise capital and the downside impact of interest rates, inflation, and exchange rate variations.

This paper hypothesises that there is an inverse relationship between the risk relating to reserve quantum and the level of disclosure. Stage of extraction is used to proxy for the risks attached to reserve quantum disclosure as previously tested on reserve quantum in the Australian extractive industries (e.g. Mirza, 1999). Mirza and Zimmer (2001) linked the stage of production with the level of uncertainty surrounding the reserve estimates distinguishing between those organisations in production with relatively low levels of uncertainty as compared to those in pre-production, a methodology that is also adopted in this study. This assumes that firms at the production stage of the value chain are less uncertain of their reserve quantum and are thus more willing to disclose data as the agency costs e.g. litigation costs and reputational loss are outweighed by the benefits. In categorising firms re stage of production a distinction is made between those not yet at production stage (purely exporation) and those who have some level of production, with its related greater certainty of data re quantum, recognising that these firms may also be simultaneously explorers in other geographic areas.

Our dependent variables, represented by the disclosure of reserve quantum balances and the quality of reserves disclosures in UK annual reports, are thus set in relation to uncertainty as proxied by stage in the value chain:

H1: Producer firms are more likely to disclose reserve quantum balances than developer firms in the in the oil and gas industry.

H2: The quality of reserves disclosure for the producer firms is likely to be significantly greater than the quality of reserves disclosure for the developer firms in the oil and gas industry.

III. Research design

Sample

All forms of data reaching the public can be considered as part of the accountability discharge activities of an entity with annual reports signalling to the readers important issues to both internal and external stakeholders (Guthrie *et al*., 2004). The annual report is seen as a statutory report, within the public domain, regularly produced and regarded as an important document in the construction of the entity's social imagery (Neimark, 1992). Therefore, the annual report is used in this paper to analyse oil and gas information. This study focuses on one industrial sector due to the unique nature of the resource base under consideration. It also focuses on one geographic region in order to avoid global differences with respect to such factors as culture, banking and finance systems, legislative and accounting systems. The analysis is undertaken for the annual reports of 2007 because that year represents a rare opportunity to examine disclosures in a purely voluntary environment. In addition, this period is not complicated by variables relating to the subsequent financial crisis potentially impacting upon disclosure.

Companies were selected from the London Stock Exchange (LSE) industry classification code 533 (oil and gas) and the PLUS SX market in London. This

resulted in a final sample of 86 companies: 18 listed on the main LSE, 65 companies listed on the AIM and 3 on the PLUS stock market. This selection of all public limited companies in the UK allows for a wide spread regarding size, stage of production and profitability as suggested by Clatworthy and Jones (2006) who argue that qualitative studies should include all companies.

Dependent variables

The disclosure of reserve quantity balances is measured by depicting factual information regarding whether reserves are recorded in the company annual report. Therefore, we use a dichotomous variable coded as one for firms that disclose reserves information reports and zero otherwise. Instances where companies have not discovered reserves and have stated so are regarded as disclosers as this information is valuable to users (Craswell and Taylor, 1992).

Quality of reserve disclosure is measured by capturing all qualitative attributes of information per the recommended practice outlined in the SORP/OFR (as detailed in section 2). The quality of reserve disclosure is derived by considering these dimensions and categorising each company in terms of whether the company disclosed in line with the SORP/OFR requirements, whether they provided only the reserve balances or did not provide any reserve quantum information. The scoring system is summarised as:

Score 0: No information provided on reserves

Score 1: Information provided shows only balances of reserves

Score 2: Information as required by SORP and OFR (as included substantively in the bullet points in section 2)

This scoring methodology is similar to that used in other disclosure work (e.g. Eng and Mak, 2003).

Independent variable

Following Mirza and Zimmer (2001), we classify firms in our sample as producers (firms that have started production and earned revenue from the sale of the product) and developers (firms that have neither started production nor derive revenue from the sale of the product). We use a dichotomous variable coded either one for producer firms or zero for developer firms.

Control variables

From prior studies, four variables can be seen to be influential in oil and gas reserve accounting and are therefore controlled for in the multivariate analyses. ***Firm size*** is a widely used variable in prior research on determinants of corporate reporting (e.g. Marshall and Weetman, 2007). It can be conjectured that larger firms may provide more reserve information due to the costs of collecting the information being relatively greater for smaller firms affecting their disclosure (Singhvi and Desai, 1971). Prior empirical studies consistently find a positive association between levels of reserve quantum disclosure and firm size (e.g. Taylor *et al*., 2012). ***Stock exchange listing*** was previously only tested as a predictor of reserve quantum disclosure based on overseas listings (Mirza and Zimmer, 2001; Taylor et al 2011) with companies listed on major stock exchanges more likely to disclose due to greater information requirements set by such institutions. This concurs with prior general studies where companies

attaining Stock Exchange listing status, whether domestically or internationally, provide higher quantities of disclosure reflecting regulatory requirements for more information (Ahmed and Courtis, 1999). This study will focus on the variability of disclosure between different levels of exchange within the one country testing to consider if this influence is also found domestically for oil and gas reserve reporting.

The quality of external audit is also considered a factor affecting disclosure (e.g. Abdelsalam and Weetman, 2007). Auditors may play a role in improving firms' reporting strategies, aware of reputational loss of being associated with clients with poor reporting practices, this being more prevalent amongst brand conscious higher quality audit firms. Companies may choose a high quality audit firm and proper disclosure simultaneously, signalling to the market high quality information disclosure. According to prior research on oil and gas reserves disclosure, the association between the quality of external auditor and reserves reporting is mixed, ranging from a positive relationship (Taylor *et al*., 2012) to no statistically significant association e.g. Mirza and Zimmer (2001). ***Gearing*** has been tested in prior accounting disclosure studies, the relationship being found to be inconsistent (e.g. Marshall and Weetman, 2007; Bharath *et al*., 2009). A positive relationship can be postulated regarding reduced debt related costs, but alternatively high gearing companies may share private information with lenders and reduce public disclosure. Within the oil and gas reserves arena the research points to a negative relationship (e.g. Mirza and Zimmer, 2001). Table 1 details the descriptive statistics for all variables.

Enter table 1 here

Validity and reliability

A central problem of content analysis is related to the data reduction stage when the whole text of a report is classified into a much smaller set of content categories. Weber (1990, p. 12) argues that "to make valid inferences from the text, it is important that the classification procedure be reliable in the sense of being consistent: different people code the same text in the same way". Following Marshall and Weetman (2007) we controlled for consistency for scoring annual reports by having the principal researcher score all disclosures using an agreed questionnaire instrument, and controlled for errors of judgement by having the second and fourth researchers carry out sample checking (eight companies). Any differences were noted and amendments were made where necessary to the questionnaire instrument.

A second problem of content analysis deals with the validity of variables used to identify the content classifications, the study accurately assessing the specific concept the researcher is attempting to measure. Following prior disclosure studies (e.g.. Botosan, 1997), we identify the correlation between our disclosure scores and firm characteristics identified in prior studies to be associated with the level of corporate disclosures. We find that our disclosure measures are highly correlated with stage in production, firm size, UK stock listing, gearing and audit quality (see section 6.1).

Basic regression model

Following prior disclosure literature, we use logistic regression analysis to measure the determinants of reserve balance reporting. We also use the ordinary least squares (OLS) regression analysis to measure the determinants of the quality of reserve reporting. We use the following formula to test our research hypothesis for disclosure of reserve quantum (*DISC)* and reserve quality (*DISC QUALITY*) the former shown as:

$$DISC = a + b_1 EXPRO + b_2 TA + b_3 EXCH + b_4 DE + b_5 AUD + e$$

Where:

DISC is the reserve disclosure score, a dichotomous variable is coded as one for firms that disclose reserves information in their annual reports and zero otherwise.

EXPRO represents the stage of the value chain in the oil and gas production process. A dichotomous variable is coded as one for producer firms and zero for developer firms.

TA is total assets, using the logarithm of total assets.

EXCH represents UK stock listing being a dichotomous categorical variable with a score of 1 for firms listed in LSE, 2 for firms listed in AIM and 3 for firms listed in PLUS.

DE represents gearing and is the debt to equity ratio.

AUD is the audit quality variable with auditor size being used to proxy quality, specifically Big Four (coded as 1) versus non-Big Four (coded as 0).

a is the intercept. *e* is the standard error of residual for firm *i* in year *t.*

IV. Current reserve disclosure practices of 86 oil and gas UK companies

Reporting of oil and gas reserves balances

The dependent variable in this study is disclosure of reserves in the firm's annual report. Table 2 indicates that 75.9% of the companies disclose their reserves (excluding those stating they had zero reserves) which is slightly higher than Mirza (1999) who recorded 69% of firms disclosing. The quality of disclosure is skewed towards the lower end of information provision. Excluding the companies that stated they have no reserves, 24.1% provided no disclosure whatsoever, 50.6% only partially met SORP/OFR requirements and 25.3% disclosed within the SORP/OFR requirements.

Table 2 about here

Reporting by geographic region

Panel A Table 3 reports on the disclosure of commercial oil and gas reserves by geographic region. The analysis ignores those companies where there are either no reserves to disclose or where companies have decided not to show the reserve quantum. Of those who disclose their reserves 77.8% also disaggregate the information by geographic area.

Table 3 about here

Statement of the source of the estimates

Disclosing the source provides the reader with confidence regarding the expertise of the preparers such as outside consulting firms qualified in the preparation of data but also providing an independent assessment. The majority of companies (68.2%) that disclosed their reserves also disclosed the source as detailed in Panel B Table 3.

Audit of reserve quantum

Of particular interest regarding the source of the estimates, particularly in the light of recent reserve overstatements, is the level of independent review of the quantum figures. Panel C Table 3 indicates that of those disclosing reserves, 52.3% used outside independent advisers whilst 38.1% appeared to have no audit of the figures.

Disclosure of basis for arriving at reserves

Detailing the basis of the estimates allows users to gauge the level of certainty surrounding these estimates. Of the companies disclosing reserves 67.7% also stated their basis of arriving at their estimates regarding the definitions being applied (Panel D Table 3).

The application of an accepted practice for defining reserve quantum

Panel E Table 3 shows the differing definitions adopted by disclosers of reserve quantum. The results show that 84.1% of those disclosing reserves apply definitions commensurate with the SORP/OFR requirements, with 38.1% providing additional information in addition to the SORP/OFR definitions. This would suggest that more standardisation of disclosure is warranted in order to assist the users of the information.

Movement in the net quantities

The SORP/OFR recommends that the changes to the reserves within a year should also be reported with a supporting narrative of significant changes e.g. extensions, discoveries and production. Of the companies disclosing their reserve balances, only 21 (33.3%) broke these figures down further regarding in-year movements per Panel F Table 3.

Disclosure of Key Performance Indicators

Table 4 shows that the majority of companies made no attempt to disclose any of the key indicators. For the RRR, 94.0% did not disclose; for proved developed/proved undeveloped and years of oil reserves the non-disclosure is 100.0% and 98.8% respectively.

Table 4 about here

V. Empirical analysis: Determinants of the extent and the quality of reserves disclosure

Correlation analysis

A Kolmogorov-Smirnov test shows the distribution of variables is not normally distributed, thus requiring non-parametric statistical tests. An initial test for correlation is conducted that examines the simple relationships between the dependent variables (disclosure) and the independent variables. The common test for correlations using Spearmen's correlation coefficient is considered inappropriate as this method is not suitable in measuring the association between binary variables. Therefore a two-tailed Kendall's tau-a is applied this being a non-biometric test. Table 5 shows the correlation analysis.

Table 5 about here

Table 5 shows that the disclosure of reserve balances and quality of reserve quantum disclosure is positively related to whether the company is at an exploration or production stage. The correlation between the stage in production and reserve balance disclosure is 0.393 with a p-value of less than 0.01, while the correlation between the stage in production and disclosure quality is 0.455 with a p-value of less than 0.01. The table also shows that the reserve balance disclosures are positively associated with firm size, UK stock exchange listing and audit quality and are statistically significant at the 1% level. Gearing is positively correlated with both the reserve balance and the quality of disclosure but is only statistically significant with our measure of reserve quantum disclosure quality at the 1% level and statistically insignificant with our measure of reserve quantum balance disclosure. Table 5 shows that the correlation

between the independent variables is not of the significant magnitude of .8 (Field, 2005) and thus there is not a multi-collinearity problem although there are significant relationships particularly related to size and listing (TA) and (EXCH) ($r = 0.527$, $p < .01$) and siza and audit (TA) and (AUD) ($r = 0.524$, $p < .01$) which may affect the understanding of the multivariate test output. A further test checked the variance inflation factors in regard to the regression diagnostics. The highest VIF was 2.49 for TA with Field (2005) indicating that values above ten would give cause for concern regarding multicollinearity.

Regression analyses

Determinants of reserve balance disclosure. We use binary logistic regression because our dependent variable of the reserve quantum disclosure is dichotomous (e.g. disclosure/non-disclosure of reserves) and the predictor variables are either continuous (for example total assets) or categorical (e.g. exploration/production). Binary logistical regression modelling allows for the calculation of a simple proportion or probability that depicts the correct prediction of a response category for an individual case (the likelihood of disclosure of reserve quantum occurring, given the different independent variables of an organisation). The regression equation thus formed reads:

$$p = \frac{e^{\alpha + \beta 1X1 + \beta 2X2 + \ldots.\beta kXk}}{1 + e^{\alpha + \beta 1X1 + \beta 2X2 + \ldots.\beta kXk}}$$

Where p = probability that the outcome Y (disclosure) equals 1, $0 < p < 1$

α = "intercept", the probability when all explanatory variables are 0

βi = regression coefficients, i = 1, 2…..k

Xi = explanatory variable *i*

Using this methodology it is possible to establish which variable coefficients (β) are influential in predicting the categorical outcome. This study, as with prior studies into reserve quantum, is not seeking to predict the probability *per se* of disclosure given a company's independent variable characteristics, but rather to understand the strength and significance of the different independent variables in influencing the probability/likelihood of such disclosure. The regression results are reported in Table 6.

Table 6 about here

Panel A Table 6 shows that reserve balance disclosure is positively associated with EXPRO (coefficient =1.741, p-value = 0.014) thus disclosure for producer firms is greater than developer firms. Therefore we accept hypothesis one. TA and AUD are statistically significant but only at p<.10, all with a positive relationship with the reserve quantum disclosure. We find that the gearing ratio is negatively associated with the reserve quantum disclosure but is statistically not significant. We finally find that there is a positive, but statistically insignificant, association with EXCH which is intuitively concerning but may be explained by the strong univariate relationships formed by TA with the latter being the stronger variable leaving EXCH with little to add to the model once TA is included.

Determinants of the quality of reserve quantum disclosure. Panel B Table 6 presents the regression results for the quality of reserve quantum disclosure. In regard to quality of disclosure the risk of heteroskedasticity was considered in

regard to the residuals of the predictor variables and the analysis adjusted accordingly. It shows that the quality of disclosure is influenced by EXPRO having a positive relationship and being statistically significant ($p = .001$). This indicates that the quality of reserves disclosure for the producer firms is greater than for developer firms. Therefore we accept hypothesis two. For the control variables, we note that only TA is statistically significant ($p = .002$) suggesting strong evidence that large companies are interested in following SORP and OFR disclosure quality guidance on reserve quantum in their annual reports.

VI. Discussion

Drivers of disclosure

When considering the more basic provision of the reserve balances at the year-end there is not only a more significant take-up regarding disclosure (75.9%) but also several influencing variables. Of the five variables considered, the coefficient for EXPRO is statistically the strongest in multivariate tests and is of the expected sign. In addition TA and AUD are also significant but only at $p < .1$. The results suggest that non-mandatory reserve disclosure compliance is higher in companies at a more advanced stage in their development cycle but also, albeit with less statistical robustness, among larger companies and ones that are audited by the Big Four. Disclosure quality is seen again to be related to both stage of production and company size and significant at $p<.01$.

The findings relating to the stage of production are consistent with Mirza (1999) and Mirza and Zimmer (2001) who contend that producer firms are more likely to

disclose than developer firms due to the greater levels of risk and uncertainty. This is despite the fact that at the developer stage there may be a greater need to reduce the cost of capital and to gain extra funds through reducing stakeholder uncertainty via disclosure, but the downside of uncertainty, potential loss of reputation and risk of litigation outweighs this incentive. As noted by Craswell and Taylor (1992) the decision to disclose reserves may not be as significant for explorer companies which, by definition, may not have substantial reserves.

The findings relating to size in regard to reserve disclosure per se and quality of information disclosed are consistent with Mirza (1999), Mirza and Zimmer (2001) and Taylor *et al*. (2012). This can be explained regarding the relative costs of collecting the information in relation to the company's size and resources (Singhvi and Desai, 1971). It is also likely that larger firms' broader exposure to financial markets enforces higher disclosure requirements.

The statistically significant positive relationship with the quality of external audit is consistent with Mirza (1999) and Taylor *et al*. (2012). Craswell and Taylor (1992, p295) suggest that, "the demand for differentiated audit quality has been shown to reflect agency-cost variables used in the disclosure model" and that auditors will strongly encourage comprehensive disclosure to preserve their reputation. A further explanation of the positive relationship may be related to the highly complex nature of oil and gas reserve estimation. It is more likely that within the larger audit firms there is expertise to cope with such specialised areas as they have greater depth and breadth of expertise and resources than smaller firms (Mirza, 1999), with audit firm size and extent of audit work undertaken being positively related. Thus companies disclosing oil and gas reserves may

select large audit firms due to their capability in dealing with such a complex area.

In the prior literature, gearing is inconsistent in direction and statistical significance. Our findings confirm this inconsistency in that whilst prior reserve balance research points to a negative statistically significant relationship with disclosure (Mirza, 1999; Mirza and Zimmer, 2001), this study shows similar signage but is not statistically significant.

When companies with no reserves are excluded, only 25.3% of the companies in our sample achieved the disclosure recommended by the SORP/OFR. This therefore raises the question of the efficacy of voluntary regulation companies showing an unwillingness to disclose beyond that strictly required. These findings support Craswell and Taylor's (1992) conclusions that considerable management discretion is being applied with corporations eager to maintain any such discretion (Cortese *et al.*, 2010).

IASB Discussion Paper

IFRS 6 (IASB, 2004) is an interim standard issued pending completion of further investigative work with the working group's discussion paper (IASB, 2010). representing the views of researchers but not having been endorsed by the IASB. Since the publication of the discussion paper, the IASB has consulted on the topics that it should include in its new agenda/workplan and reporting by extractive industries is not included. The project has therefore been paused. In

this section, we draw on our findings to critique some aspects of the ideas presented in the discussion paper.

The discussion paper emphasises that reserve quantum reporting is, "the most important information about an entity conducting extractive activities" (IASB, 2010, p19) and recognises the lack of relevance of historic cost accounting information and fair value procedures (IASB, 2010, p21). We note that approximately 42% of the volume of the discussion paper is given over to discussion of the definition and disclosure of reserve quantum, whereas previous deliberations have been dominated by asset recognition and valuation. This change in emphasis accords with the findings in the literature regarding the importance of reserve quantum but has been criticised by Russell and Jenkins (2010) for its failure to bring clarity to the definitions.

The discussion paper recognises that at present there is, "no single set of disclosure requirement internationally" and that, "there is a wide variation in the quantity and type of information disclosed as well as in how that information has been compiled and presented" making, "it difficult for users to analyse and compare entities" (IASB, 2010, p106). This is corroborated by the findings of the UK reporting as detailed in this study. Standardisation is advocated in line with the existing standards of the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) from a mineral perspective and the Petroleum Resource Management System (PRMS) from an oil and gas perspective, recognising differences relating to the scope, definitional specificity and assumptions applied to the estimation and classification of reserves, and advocating the use of consistent definitions compatible with financial reporting

requirements. Concern has however been expressed about the suitability of a single standard to cover the unique requirements of oil and gas reporting under the umbrella of the extractive industries (Russell and Jenkins, 2010).

The discussion paper suggests a baseline of separate disclosure of P1 (proven) and P2 (proven and probable) disclosure. Our findings show that of those companies with reserves balances, 84.1% provide the information in terms of at least P1 and P2 with others going beyond this (e.g. proven, probable and possible data), indicating that the suggested baseline should not present difficulties for the industry. The discussion paper recognises the risk inherent in the estimation and reporting of reserves via its recommended application of confidence intervals (proved/ probable); the distinction between different projects requiring disclosure where risks (for example, geological, geographical and geopolitical) vary significantly; required information on assumptions applied such as price and production profiles; and sensitivity analysis (for example sensitivity to balances regarding changes in oil and gas prices). This underlines the importance of risk in regard to reserve quantum reporting from external stakeholders' perspective. Risk is also critical to the providers of such information as shown by our findings where risk is seen as influential to firms' disclosure of reserves.

Table 7 compares the IASB discussion paper's suggestions with our UK findings. It should be remembered that our data in Table 7 is stated after recognising that 23 of the companies do not disclose their reserves. Geographical disaggregation is useful in order to gauge country-specific risks, with our findings showing that, of those companies that disclose their reserve balances, 77.8% provide this information. The discussion paper suggests a reconciliation of movements in

reserves in the year, explaining the causes for change in reserves. Our research study shows that of the companies disclosing reserves, only 33.3% performed such a reconciliation. The discussion paper suggests that the basis of estimation as well as details of the personnel involved in the estimation, including qualifications and level of experience, should be disclosed. In the UK at present, of those companies disclosing their reserve quantum, 68.2% disclose the source of the estimates whilst 67.7% disclose the basis of arriving at the figures.

Table 7 about here

An area of contention regarding the reserve disclosures is that of ensuring reliability. The discussion paper, whilst recognising the influence of reserve information, does not advocate an audit opinion on those reserves despite having made earlier positive indications (Wright and Skousen, 2010). The discussion paper argues that audit is unnecessary because of the high cost and the degree of imprecision and subjective judgement involved. Like the OFR, the discussion paper argues that having estimates prepared by suitably qualified personnel should be sufficient in terms of validation of the figures. Whilst the OFR specifies the disclosure of the name and qualification of an independent expert who reviewed the internal data, we have found that 31.8% of those companies that disclosed balances did not provide information on the source. Given the level of management discretion in both the measurement of the reserves quantum and the discernment of commerciality, it is desirable that due governance is followed.

The OFR and literature recognise the usefulness of the disclosure of KPIs such as the RRR. Our findings in Table 4 show that few UK corporations choose to

disclose such data. The discussion paper recognises that oil and gas entities, "should usually be capable of replacing reserves" (IASB, 2010, p106) but does not make specific reference to disclosing the RRR KPI, the non-disclosure of which is in line with current industry practice.

VII. Conclusions

Our findings suggest that in a completely voluntary environment, disclosures contained in the UK's SORP and OFR were not being complied with by the majority of companies. As companies have weighed up the agency benefits and costs they may have recognised higher proprietary and political costs in comparison with the agency benefits, thus choosing not to disclose. This is true not only of the disclosure/non-disclosure decision but also of the level of disclosure.

Oil and gas reserves are subject to inherent risk and uncertainty. We have found that risk and uncertainty, as proxied by stage of production, drives the disclosure of reserve balances. Our results show that producer firms are more likely to disclose reserve quantum balances than developer firms in the same sector and that the quality of reserves disclosure for the producer firms in the oil and gas industry is significantly greater than the disclosure of the developer firms in the same sector.

The suggestions in the IASB's discussion paper are broadly similar to those contained in the UK's SORP. While recognising that these suggestions have not been endorsed by the IASB but are simply research findings, our own findings

suggest that those companies that currently disclose reserve data should have no difficulty in complying with the suggestions in the discussion paper. However, our findings show that many UK companies chose not to follow the SORP and OFR recommendations and therefore indicate that a voluntary approach to disclosure will be ineffective. The authors would agree with Hussainey and Mouselli (2010) who argue that where information contains significant value relevance for stock market participants then regulators may need to make the OFR obligatory. The UK experience also shows the limited willingness of companies to provide information of the source of the information, its basis of calculation and KPIs, so the discussion paper's suggestions not to require audit and the disclosure of KPIs would codify current custom and practice but not, in our view, best practice.

Topics for further research include studies into the mineral extraction, as opposed to the oil and gas, industry; studies in a wider range of geographical areas to complement the prior Australian and current UK studies; studies that examine disclosure over larger sample sizes and over extended periods of time; and case studies of individual companies to explore the determinants of reserve disclosures and agency factors such as the incremental costs of providing further information.

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