

An Examination of Fraud Risk at Oil and Gas Companies

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Introduction

Besides fueling our homes, the vast amount of energy necessary for operating manufacturing, retail, and service companies is the product of oil and gas companies. Economic activity would grind to a virtual standstill without energy from oil and gas. A major challenge facing oil and gas companies, like other companies, is fraud risk. Fraud is defined as “an intentionally deceptive action designed to provide the perpetrator with an unlawful gain or to deny a right to a victim” (Chen, 2020). Fraud is a costly occurrence in business operations, sometimes debilitating. While regulators have increased scrutiny for financial statement fraud, fraud still remains difficult to uncover (Kleinman, Strickland, & Anandarajan, 2020). According to Boyle, DeZoort, and Hermanson (2015, p. 579): “fraud risk assessment...one of the toughest challenges facing auditors.”

The oil and gas industry is one of the largest U.S. industries and contributes significantly to public company revenues. Approximately seven percent of all public company revenues comes from the oil and gas industry (Compustat Daily Updates, Fundamentals Annual, 2020). The US Bureau of Economic Analysis estimates that oil and gas extraction alone contributed 1 percent to US GDP in 2019 (US Bureau of Economic Analysis, 2019). Higher revenues are generally associated with higher risks. Besides high revenues, the oil and gas industry must manage unpredictability, such as the notorious volatility of oil and gas prices. As in other industries, some business managers in the oil and gas industry may be tempted to try to manage earnings or commit outright fraud. Complexities of the oil and gas industry potentially make it easier to conceal fraud schemes.

There are several major categories of fraud, such as asset misappropriation, financial statement fraud, theft of intellectual property, healthcare fraud, and consumer fraud. Within the major categories are specific fraud types. For example, Ponzi schemes, ID theft, and phishing are types of consumer fraud (Larson, 2016). In the case of financial statement fraud, which is of primary concern to accountants and auditors, the cost of fraud is very high, with a median loss of \$954,000 per case. In addition, financial statement fraud cases, compared to other types of fraud cases, are the most likely to result in fines, with a median fine of \$221,000 per case (ACFE, 2020).

We begin this study with anecdotal evidence of fraudulent incidents in business. This is followed by empirical evidence of fraud risk at US oil and gas firms. Several analyses are used to determine fraud risk. First, we analyze revenue volatility of the industry over the past ten years to gauge uncertainty within the industry. Second, we examine a sample of the largest oil and gas firms to identify pressures and risks inherent in the complexity and breadth of their operations. Third, we use sales growth, leverage, and Altman’s Z-scores to assess fraud risk within oil and gas firms. In a company’s effort to avoid fraud, assessing risk is essential (Lachney, 2020). The study concludes with a discussion of accounting and other professionals who can help companies avoid falling prey to fraud schemes.

Examples of Fraud Cases

Some major fraud cases are discussed below to show the intricacies of fraud, its damaging effects, and how the fraud was detected. These cases reveal that all companies need to be aware of the risk of fraudulent practices enacted by unethical employees and business partners.

Petrobras

In 2013, Paulo Roberto Costa received an expensive car as a gift from a Brazilian money launderer. Mr. Costa was an executive at Petrobras, a Brazilian petroleum company (Marcelino and Valle, 2015). The transaction seemed suspicious

to Deltan Dallagnol, a federal prosecutor, who then began investigating Mr. Costa. Mr. Dallagnol gathered enough evidence to arrest Mr. Costa in March of 2014 for taking bribes from construction companies (Connors and Magalhaes, 2015).

With Mr. Costa's cooperation, Mr. Dallagnol and his team realized that they had stumbled upon a very large and lucrative money-laundering scheme which implicated a number of very wealthy and powerful people. The press described the scheme as "the biggest corruption scandal in...the history of the world" (Watts, 2017). It came to light that a small group of Petrobras executives had the authority to award contracts on large construction projects. These executives limited access to the bidding process on these projects to a preselected group of contractors (Connors and Magalhaes, 2015).

The preselected contractors formed a cartel and coordinated their bids so that a predetermined contractor would be awarded the contract. The submitted bids were all inflated so that the contract winner would be overcharging Petrobras. In exchange for approving the bloated winning bid, the corrupt Petrobras executives were paid kickbacks worth roughly three percent of the contract value. The contractors used shell companies to launder the money that was used to pay executives at Petrobras, the construction firms, and politicians (Connors and Magalhaes, 2015). Over \$5 billion was paid out illegally to these parties over the life of the scheme (Watts, 2017).

The Petrobras fraud has had significant and far-reaching implications. Petrobras investors and the Brazilian people lost billions of dollars as a result of the scandal.

Widespread publicity of the fraud seeded mistrust and political instability in Brazil (Watts, 2017). Petrobras has conceded responsibility for violations of internal controls provisions in the fraud (Mandl, 2018). All the damage caused by the scandal could have been prevented, or at least mitigated, had internal controls provisions been honored.

Shell and Eni in Nigeria

Shell is a large conglomeration of energy and petrochemical firms that employs more than 80,000 people in over 70 countries (Shell Global, 2020). Shell is the largest oil and gas company operating in Nigeria (Reed, 2017). Eni is also a large energy company, employing roughly 32,000 workers in 66 different countries (Eni, 2020). In addition to engaging in traditional oil and gas exploration, refining, and distribution activities, Shell and Eni are both active in pursuing the development of renewable energy programs (Shell Global, 2020; Eni, 2020).

In 2011 Shell and Eni jointly paid \$1.3 billion for the large Deepwater oil field, OPL 245 (The Economist, 2017). In 2016, Dutch police raided Shell's offices in search of evidence confirming that Shell officials bribed Nigerian officials to have access to OPL 245 (Reed, 2017). The allegation is that over \$1 billion of the \$1.3 billion price tag went to Nigerian officials and ex-officials. The \$1 billion in question went to a shell company owned by Dan Etete, a former Nigerian oil minister and convicted money-launderer (The Economist, 2018). From there, large sums flowed suspiciously to other individuals of influence. Prosecutors in the case claim that Shell and Eni executives received kickbacks for their role in the transaction. One Eni executive is alleged to have received \$50 million in kickbacks (The Economist, 2017).

The events that followed the sale of OPL 245 raised suspicion among officials in Nigeria, the Netherlands, and Italy that a large part of the payment may have constituted a bribe. After a damning email leak, Shell acknowledged in 2017 that company executives knew that a large portion of the \$1.3 billion price tag would go to Mr. Etete and possibly his political allies (The Economist, 2018).

In December of 2017, an Italian judge announced that Shell and Eni were to be tried on charges of corruption. Executives from both companies were tried, including Eni's CEO, Mr. Descalzi, and Mr. Brindel from Shell. Mr. Brindel had worked as a chief of exploration and production at Shell (Reed, 2017). Emeka Obi of Nigeria and Gianluca Di Nardo of Italy were convicted of international corruption in September of 2018 (Husseini, 2018).

Nigeria claims that the two companies used fraudulent practices and corruption to divert billions of dollars from the Nigerian people. The claim is based off of a Resources for Development Consulting (RDC) report in which RDC estimates that the Shell/Eni deal would result in a loss of about \$6 billion in potential royalty revenues for Nigeria (Husseini, 2018). Nigeria has asked an Italian court to order Shell and Eni to pay \$1.092 billion as an advance payment for damages. The Italian case is still pending (Parodi, 2020).

PdVSA

Petróleos de Venezuela, S.A. (PdVSA) is the state-owned oil and gas company of Venezuela. From 2004 until 2014, the company was managed by Rafael Ramírez, with substantial help from his cousin, Diego Salazar (United Nations, 2015;

Córdoba and Forero, 2015). While in office, the cousins developed a reputation for great wealth and expensive tastes. Mr. Salazar drove a Ferrari, enjoyed trips on private jets, often gifted Rolex watches to friends who attended his parties, and kept his own entourage of bodyguards. Observers may have suspected that the cousins' lifestyles exceeded the bounds of their legitimate income.

Venezuela has the world's largest crude oil reserves (Parraga, 2018). As Venezuela's state-owned oil and gas firm, PdVSA has traditionally provided an enormous amount of work and opportunities for other companies. Leaders at PdVSA have used their power within the firm to elicit bribes from business partners. For example, in 2006, Mr. Salazar met with the director of a large construction company in Spain to discuss the company's bid on a \$1.5 billion project for PdVSA. In that meeting, Mr. Salazar is reported to have told his counterpart that the Spanish company would have to pay no fewer than \$150 million in kickbacks to even be considered for the contract. The director of the Spanish company did not comply with Mr. Salazar's request. Not all of PdVSA's potential business partners have acted with that level of integrity. Documents from an investigation of an Andorran bank, where much of the illicitly obtained money has been laundered, suggest that five Chinese firms that have done business with PdVSA deposited more than \$150 million into accounts owned by Mr. Salazar's shell companies. The money is labeled compensation for consulting contracts, but there is no evidence that consulting actually occurred (Córdoba and Forero, 2015).

The fraudulent behavior at PdVSA was not limited to a select few corporate leaders. Rather, it appears to have been prevalent throughout the organization. In 2020, the US Justice Department charged Jose Luis De Jongh Atencio, a procurement officer for a PdVSA subsidiary, with accepting over \$2.5 million in bribe payments and gifts from businessmen who then got preferential treatment in obtaining contracts (Sun, 2020). Another midlevel official, Lennys Rangel, recently plead guilty to attempting to launder millions of dollars' worth of bribes through a real estate purchase in Florida (Sun, 2020).

The widespread fraud at PdVSA and the resulting costs to the Venezuelan people could have been prevented. Current and former PdVSA employees say that the company had insufficient financial controls (Córdoba and Forero, 2015). In 2005, Venezuela's president, Hugo Chávez, established off-budget funds from PdVSA proceeds that were used to fund various projects. These funds were not subject to audit. As a result, as much as 20 percent of the \$15 billion that PdVSA paid for services and equipment every year ended up getting kicked back to PdVSA officials and their accomplices (Córdoba and Forero, 2015).

Enron

Perhaps the most well-known corporate fraud in history occurred in 2001, when a gargantuan fraud was discovered at Enron, the infamous energy firm based in Houston, Texas. Top managers employed a diverse range of techniques to hide the firm's poor financial health, obfuscating revenue and misrepresenting earnings. Subsequent to the fraud's discovery, the firm's stock price fell precipitously from about \$90 to below \$1 in slightly over a year. Following the bankruptcy, the firm's employees lost their jobs and saw their equity disappear. The Enron corporate scandal played a major role in the passage of the Sarbanes-Oxley Act of 2002 (Crumbley et al., 2021; Chen, 2020).

In all of these cases, fraud could have been uncovered earlier or even prevented if strict internal controls had been followed. These occurrences of unethical behavior are reminders that the risk of fraud occurring is often inherent in business operations. Awareness of fraud risk can be a motivator for implementing and monitoring internal controls.

Examination of Fraud Risk of Major United States Oil and Gas Companies

After the review above about actual fraud cases, this section examines empirical evidence for potential fraud risk among major US oil and gas firms. First, industry revenue is observed for the past ten years to determine its volatility, since this instability can affect fraud risk among oil and gas firms. Next, we take a look at revenue, assets, and company operations for some of the largest oil and gas firms in order to identify pressures that may prompt the occurrence of fraud. Lastly, the Altman's Z-score is used to ascertain potential fraud risk.

Industry Revenue

While there can be substantial revenues in the oil and gas industry, there are also substantial risks that cause revenues to be unpredictable. Volatile revenues can result in management pressure to manipulate earnings or commit fraud. We compare the average revenue volatility of oil and gas firms to the average volatility in all other industries, using a measure that accounts for firm size. Specifically, we examine the standard deviation of total revenues divided by total assets. A

higher standard deviation indicates a higher probability for fraud in an industry. As shown in Table 1, revenue volatility is examined over the past ten years. [See Table 1, pg. 84]

From 2010 through 2014, revenue volatility in the oil and gas industry is about twice the volatility observed in other industries (based on the standard deviation of total revenues to total assets). In 2015, volatility in the oil and gas industry drops to approximately equal that in other industries, but it again increases beginning in 2018. These changes in volatility correspond to changes in the mean revenues in the industry. As revenues decline, oil and gas firms engage in risk mitigation strategies to reduce losses. For example, a firm may reduce exploration activities or engage in a larger number of joint operations to share risk. During down cycles, some firms may even cease operations. In general, oil and gas firms attempt to reduce business risk through hedging activities, geographical dispersion, and risk-sharing through joint operations with other firms. Such strategies help to smooth operating income, but they also increase business complexity making it potentially easier to conceal fraud.

Largest U.S. Oil and Gas Firms

Next, we examine the ten largest US oil and gas firms by total revenues. In order, these firms are Exxon Mobil Corporation, Chevron Corporation, Marathon Petroleum Corporation, Phillips 66, Valero Energy Corporation, Energy Transfer LP, World Fuel Service Corporation, Plains GP Holdings LP, Schlumberger LTD, and Enterprise Product Partners LP. Table 2 presents the revenues of these firms along with their assets and company headquarters. [See Table 2, pg. 84]

Closer examination of the risk management enacted by the two largest US oil and gas firms reveals the complexity and breadth of their operations. Exxon Mobil Corporation, the largest firm, describes its risk management approach as relying heavily on a strong capital structure, geographic diversity, and its integration of upstream, midstream, and downstream markets (Exxon Mobil Corporation, 2020). Exxon has upstream activities in North and South America, Europe, Asia, Africa, and Australia. The firm makes extensive use of leases and joint ventures to limit its exposure to risk from its various drilling operations. The firm's refining downstream operations are similarly diverse, with operations in the US, Canada, Europe, Australia, China, Singapore, Thailand, and Saudi Arabia.

As a result of Exxon Mobil's efforts to limit risk exposure, there is an increase in the complexity of financial reporting and, thereby, to the risk of financial statement fraud. Increased financial reporting complexity increases the potential value of internal controls, including an independent audit. For example, Exxon Mobil uses the successful efforts and units of production method to calculate its depreciation, depletion, and amortization expense. Due to the firm's expansive upstream operations and its use of the successful efforts method for allocating costs, internal controls over the accurate tracking of proven reserves are critical to reliable financial reporting.

Exxon Mobil describes two related internal controls for maintaining accurate proven reserve estimates. First, it maintains a separate Global Reserves and Resources Group independent from its operations. The Group provides independent expertise and oversight for the company's reserves. As an additional layer of control, the Group maintains a centralized database containing the company's official reserve estimates. The Group requires that any change in estimate receive the authorization of both the geoscience and engineering experts of the operating unit. For changes exceeding certain thresholds, the Group also requires specific authorization by the operating unit's senior management.

The second largest US oil and gas firm, Chevron Corporation, identifies its upstream segment as having the greatest impact on its net income. Prices of crude oil and natural gas are the main determinants of the profitability of its upstream segment. The firm uses derivative commodity instruments to hedge against commodity price risk. Specifically, the firm uses Monte Carlo simulation methods in a Value-at-Risk (VaR) to estimate the maximum potential loss it would incur from an adverse change in market conditions given its derivative strategy (Chevron Corporation, 2020).

From a financial reporting perspective, Chevron's auditors identify reserve estimates as the most significant audit risk. Like Exxon Mobil, Chevron uses the unit-of-production depreciation method based on successful efforts to calculate its depreciation, depletion, and amortization expense. The firm's expansive upstream operations also extend to South America, Africa, Asia, Australia, and Europe. As an internal control over financial reporting for valuing proven reserves, Chevron uses a Reserves Advisory Committee to provide independent oversight over its upstream operating units' reserve estimates. The Committee also determines appropriate estimation policies and procedures to maintain consistent and standardized procedures throughout the company. Increased financial reporting complexity increases the potential value of

an audit. With due care, financial statement audits are an internal control that can help reduce risk from financial statement fraud. Their importance may be especially impactful in the oil and gas industry (Chevron Corporation, 2020).

Fraud Measures

For the top ten US oil and gas firms, we examine three factors identified by prior literature as having a strong association with fraud: sales growth, Altman's Z-score, and leverage (MacCarthy, 2017; Spathis, 2002; Dechow et al., 1996). We examine industry averages for the three fraud factors and also calculate firm-specific factors for the top ten largest oil and gas firms to provide insight into fraud risk.

Sales revenue is the most important performance indicator in companies' financial statements. Dechow et al. (1996) find evidence that management most frequently manipulates revenues to positively manage earnings and that revenues are most subject to SEC scrutiny. Furthermore, Myers et al. (2007) provide evidence that management faces pressure to report consistent nondecreasing earnings streams. Therefore, long chains of persistent sales growth may indicate that management faces increased pressure to maintain consistent growth.

Prior research suggests that firms in financial distress are significantly more likely to experience financial misstatements (Kreutzfeldt and Wallace 1986) and that management is more likely to engage in earnings management or even fraud to attempt to disguise potentially temporary poor performance (e.g., Kinney and McDaniel 1989; Stice 1991). Altman's Z-score is widely known for its ability to predict bankruptcy or other financial distress (MacCarthy, 2017). Spathis (2002), in a study examining financial statement fraud in Greece, provides evidence that Altman's Z-score can also be used to help detect financial statement fraud. We use the Z-score to examine the financial pressures currently faced by firms the oil and gas industry that might impact fraud risk.

We calculate the Altman Z-score as follows:

$$Z=0.012X_1+0.012X_2+0.033X_3+0.006X_4+0.999X_5,$$

where X_1 = working capital / total assets,

X_2 = retained earnings / total assets,

X_3 = earnings before interest and taxes / total assets,

X_4 = market value equity / book value of total liabilities, and

X_5 = sales / total assets.

In general, a Z-score above 3.0 indicates a safe balance sheet, between 1.81 and 2.99 indicates a "caution" zone, and below 1.81 indicates financial distress (Faulkenberry, 2020). Management may also be incentivized to commit financial statement fraud to avoid violating debt covenants (Dechow et al. 1996). As a proxy for closeness to debt covenants, we examine financial leverage (total debt to total assets).

Using data from Compustat, each fraud factor is measured for the top ten largest oil and gas firms, listed in Table 3 in descending order by firm size. The factors are measured for 2018 and 2019 to examine current values and short-term trends. At the bottom of Table 3, we present the factor averages for the top ten firms along with the overall industry average. [See Table 3, pg. 85]

Indicators suggest that the top ten largest firms have below industry average sales growth, above industry average leverage, and Altman Z-scores indicating potential financial distress. For the largest firms, sales growth declined in 2019 (-2 percent) relative to the average firm in the industry (+8 percent), declining from 25 percent to -2 percent. The yearly trend in sales growth for the entire industry, a decline of 36 percentage points (44 percent less 8 percent), suggests that sales are substantially slowing compared to 2018.

The largest firms are highly leveraged, making them more susceptible to declines in financial performance. While this suggests that these larger firms are more at risk of violating debt covenants and perhaps of managing earnings to satisfy debt covenants, the short-term trend in leverage among many of these firms remains stable despite the downturn in sales. Therefore, the firms seem able to manage these debt levels, at least in the short-term. However, other US oil and gas firms' debt structures are under increased pressure associated with the decline in sales. According to short-term trends in leverage, a decline from 48 percent to 23 percent, many smaller industry firms appear to be de-leveraging to guard against declining sales.

Altman's Z-score indicates the largest oil and gas firms and the industry as a whole are at risk for fraud. The average Z-scores are below 1.81, indicating a position of distress for both the industry and the largest firms. Industry average Z-scores (.52 and .56) in both years are substantially lower than the average for the top ten largest firms (1.70 and 1.65). This indicates that the top ten firms are in a better position than the industry overall, but their Z-scores are still well under the 3.0 that indicates a safe balance sheet. Z-scores between 3.0 and 1.81 indicate a "caution" zone (Faulkenberry, 2020).

Oil and gas firms are at risk for fraud. Knowing this fact, firms should seek help in safeguarding their operations and financial reports from the disastrous effects of fraud. Where does a company find such help?

Where to Find Help

There are several types of accountants and experts who can help a company detect and prevent fraud. Many companies maintain an internal audit department, whose internal auditors are responsible for ensuring that the components of internal control structure, especially those parts concerning financial reporting, are functioning effectively (Gaspar et al., 2020).

In addition to internal auditors, external auditors play a part in fraud detection and prevention. Publicly traded companies are required to have their financial statements audited annually, the audit being done by an external auditor, that is, a Certified Public Accountant (CPA). In the process of carrying out the financial statement audit, a CPA has a fraud detection responsibility. According to Auditing Standard AU Section 110, "Responsibilities and Functions of the Independent Auditor," an auditor:

... has a responsibility to plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether caused by error or fraud. Because of the nature of audit evidence and the characteristics of fraud, the auditor is able to obtain reasonable, but not absolute, assurance that material misstatements are detected (PCAOB, 2020).

Of course, if the fraud is immaterial, then the external auditor would not be expected to detect it.

A company may need to hire someone who specializes in fraud detection and prevention. One option is a CPA who is Certified in Financial Forensics (CFF). This certificate is earned upon passing a forensics exam and meeting the requirements set forth by the American Institute of Certified Public Accountants. A forensic certification also is offered by the American Board of Forensic Accounting, called Certified Forensic Accountant (CRFAC). Besides fraud auditing, this type of accountant specializes in asset misappropriation schemes, government auditing, and Internal Revenue Service valuation procedures (Domino, Giordana, and Webinger, 2017). One study found that these two certifications, CFF and CRFAC, are perceived to be the most useful for forensic work (Domino, Giordana, and Webinger, 2017).

A company may enlist the aid of a Certified Fraud Examiner (CFE) to search for fraud in its company records. The professional organization, Association of Certified Fraud Examiners, provides specialized training to its members for investigating, detecting, and preventing fraud and white-collar crime (Gaspar et al., 2020).

The Forensic Certified Public Accounting Society supports continuing education and competence in the area of forensic accounting. The certification it offers, Forensic Certified Public Accountant (FCPA), equips a CPA with knowledge in corporate fraud, forensic accounting, financial investigation, and criminal interrogation (Domino, Giordana, and Webinger, 2017).

Another key professional who can help detect and prevent fraud is a Master Analyst in Financial Forensics (MAFF). Besides fraud risk management, the MAFF specializes in commercial damages, business and intellectual property damages, business valuation, and bankruptcy (Domino, Giordana, and Webinger, 2017). The MAFF is sponsored by the National Association of Certified Valuators and Analysts.

A company will benefit greatly in the long run by enlisting the aid of a professional who can help the company protect itself from fraudulent schemes. Process mining is a tool that can help accountants detect fraud in financial statements. Process mining is a systematic procedure that examines records in the accounting information system, looking for abnormal transactions and process patterns that could be fraudulent (Chiu, Wany, and Vasarhelyi, 2020). Best practices for guarding a company against fraud include the following: establish internal controls; assess risk; provide anti-fraud training to employees; maintain approval processes and authorization levels; enforcing a code of conduct; and separation of duties (Lachney, 2020).

Summary and Conclusions

This article provides anecdotal evidence of some major fraud cases, analyzes fraud risk at major U.S. oil and gas firms, and describes professionals who can help a company detect and prevent fraud. Three specific measures used to estimate fraud risk are sales growth, leverage, and Altman Z-scores. The top ten largest oil and gas firms have below industry average sales growth, above industry average leverage, and low Altman Z-scores. These fraud factors indicate that managers at oil and gas firm should be concerned about the risk of fraud.

The risk of fraud does not mean that fraud is occurring, but it does mean that oil and gas firm managers should be watchful of fraud risk and take steps to prevent fraud in their operations and financial reporting. Professionals who can help a firm protect itself from fraud include internal auditors, external auditors, CPAs who are CFFs, CRFACs, CFEs, FCPAs, and MAFFs.

Limitations and Future Research

The study was limited to examining three fraud factors: sales growth, leverage, and Altman's Z-score for the oil and gas industry as a whole and for the average of the top ten largest oil and gas firms. Future studies could examine and/or provide detailed data for other samples of oil and gas firms, such as small firms, medium-sized firms, or all firms. This study assesses fraud risk using three predictors, which may result in different findings from other fraud prediction models. Future studies could use other fraud predictive models, such as the model used by Beneish (1999) to examine Securities and Exchange Commission (SEC) investigations of U.S. public companies. Another option for future research is to use the quality of earnings ratio and the quality of revenues ratio as fraud predictors. Future research could examine in more detail some of the fraud risks peculiar to the oil and gas industry, specifically, drill risk, production risk, and commodity price risk.

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Table 1: Total Revenues Divided by Total Assets (Numbers in Millions of U.S. Dollars)

Year	Oil and Gas		Other Industries	
	Mean	Standard Deviation	Mean	Standard Deviation
2010	3,961.95	22,573.42	2,270.30	10,554.08
2011	4,991.28	28,552.26	2,431.29	11,096.93
2012	4,269.08	24,723.52	2,452.90	11,425.52
2013	4,353.96	23,436.84	2,463.25	11,626.68
2014	4,606.52	22,673.34	2,605.42	12,082.76
2015	3,342.82	15,219.37	2,680.24	12,717.29
2016	2,837.34	13,007.59	2,774.15	13,198.76
2017	3,624.85	16,315.62	2,991.28	13,937.63
2018	4,734.91	20,875.56	3,277.70	15,117.68
2019	5,021.41	20,910.85	3,616.59	16,857.99

Source: Compustat Daily Updates, Fundamentals Annual, 2020.

Table 2: Ten Largest Oil and Gas Companies by 2019 Total Revenues (Numbers in Millions of U.S. Dollars)

Name	Headquarters	Total Revenue	Total Assets
Exxon Mobil Corp	Irving, TX	255,583	362,597
Chevron Corp	San Ramon, CA	139,865	237,428
Marathon Petroleum Corp	Findlay, OH	123,949	98,556
Phillips 66	Houston, TX	107,293	58,720
Valero Energy Corp	San Antonio, TX	102,729	53,864
Energy Transfer LP	Dallas, TX	54,213	98,880
World Fuel Service Corp	Miami, FL	36,819	5,992
Plains GP Holdings LP	Houston, TX	33,669	29,969
Schlumberger LTD	Houston, TX	32,917	56,312
Enterprise Product Partners LP	Dallas, TX	32,789	61,733

Source: Compustat Daily Updates, Fundamentals Annual, 2020.

Table 3: Fraud Risk Measures for Top Ten Oil and Gas Firms (Numbers in Millions of U.S. Dollars)

Name	2018			2019		
	Sales Growth %	Leverage %	Altman Z	Sales Growth %	Leverage %	Altman Z
Exxon Mobil Corp	18%	43%	0.83	-9%	45%	0.73
Chevron Corp	25%	39%	0.65	-12%	39%	0.61
Marathon Petroleum Corp	44%	52%	1.05	28%	56%	1.27
Phillips 66	25%	50%	2.07	-4%	54%	1.84
Valero Energy Corp	26%	55%	2.24	-8%	58%	1.92
Energy Transfer LP	33%	64%	N/A*	1%	65%	N/A
World Fuel Service Corp	18%	68%	4.57	-7%	68%	4.57
Plains GP Holdings LP	30%	50%	N/A	-1%	52%	N/A
Schlumberger LTD	8%	48%	0.48	0%	57%	0.60
Enterprise Product Partners LP	25%	57%	N/A	-10%	58%	N/A
Top Ten Firm Average	25%	53%	1.70	-2%	55%	1.65
Industry average	44%	48%	0.52	8%	23%	0.56

Notes: Prior research suggests that sales growth, leverage, and Altman’s score are associated with an increased probability for fraud. The table presents these factors for 2018 and 2019 for the top ten largest oil and gas firms, listed in ascending order by total revenues scaled by total assets. Sales growth equals the year-over-year change in sales revenue divided by the prior year’s sales revenue. Leverage equals total debt to total assets. Both sales growth and leverage are multiplied by 100 and presented as percentages. Altman’s Z-score combines working capital, retained earnings, earnings before interest and taxes, market equity leverage, and sales to derive a measure of bankruptcy risk. N/A’s indicate that a firm does not have public equity; the traditional Altman’s Z-score is valid only for public equity firms. For comparison, the table also presents averages for the top ten firms and the oil and gas industry overall.

Source: Compustat Daily Updates, Fundamentals Annual, 2020.