Modernization Of Oil And Gas Reporting and Voluntary Disclosure

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February 1, 2025

Abstract: This study examines how mandatory disclosure requirements affect firms' voluntary disclosure decisions through the litigation risk channel, using the SEC's 2008 Modernization of Oil and Gas Reporting requirements as the empirical setting. The regulation mandates enhanced transparency around reserves estimation and valuation, creating a natural experiment to investigate how firms adjust their voluntary disclosure practices in response to changes in their litigation risk profile. Using a difference-in-differences research design, we analyze voluntary disclosure patterns before and after the regulation's implementation. Results show that firms significantly reduced their voluntary disclosure activity following the enhanced mandatory requirements, with approximately a 10% decrease in voluntary disclosures. This reduction is more pronounced among firms with higher ex-ante litigation risk, as measured by stock return volatility and loss occurrence. The negative relationship remains robust when controlling for institutional ownership, firm size, and other characteristics. The study provides novel evidence that increased mandatory disclosure requirements can have unintended consequences by reducing voluntary information flow through the litigation risk channel. These findings contribute to our understanding of how firms strategically respond to regulation-induced changes in their legal environment and inform the ongoing debate about optimal disclosure regulation design.

INTRODUCTION

The Modernization of Oil and Gas Reporting requirements, implemented by the SEC in 2008, represents a significant shift in the disclosure landscape for energy companies. This regulatory change mandates enhanced transparency around reserves estimation and valuation, responding to long-standing concerns about information asymmetry in the oil and gas sector (Dye 2001; Verrecchia 2001). The regulation's focus on standardizing technical reporting requirements creates an ideal setting to examine how mandatory disclosure rules affect firms' voluntary disclosure decisions through the litigation risk channel. While prior research documents the general effects of disclosure regulation on reporting quality (Leuz and Wysocki 2016), the specific mechanism through which mandatory rules influence voluntary disclosure choices remains unclear.

The intersection of mandatory disclosure requirements and litigation risk presents a particularly compelling research opportunity in the oil and gas sector. We examine how the 2008 modernization affects voluntary disclosure decisions through changes in firms' litigation exposure. Specifically, we investigate whether enhanced mandatory technical disclosures lead firms to adjust their voluntary disclosure practices in response to shifts in their litigation risk profile. This analysis addresses a fundamental gap in our understanding of how firms strategically respond to regulation-induced changes in their legal environment.

The theoretical link between mandatory disclosure requirements and voluntary disclosure decisions operates through several channels, with litigation risk serving as a key mechanism. Enhanced mandatory disclosures can increase firms' litigation exposure by providing additional verification points against which voluntary disclosures can be scrutinized (Rogers and Van Buskirk 2009). This increased scrutiny may lead firms to adjust their voluntary disclosure practices to manage legal liability. Drawing on analytical models of

disclosure choice under litigation risk (Skinner 1994; Field et al. 2005), we predict that firms will reduce voluntary disclosures when mandatory requirements increase their litigation exposure.

The litigation risk channel suggests that firms face a trade-off between transparency benefits and legal exposure costs when making voluntary disclosure decisions. As mandatory requirements become more stringent, the marginal litigation risk of voluntary disclosure increases, potentially leading firms to become more selective in their voluntary communications (Kothari et al. 2009). This relationship is particularly salient in the oil and gas sector, where technical complexity and measurement uncertainty create significant litigation risk around forward-looking disclosures.

The economic mechanism operates through the interaction between mandatory and voluntary disclosure choices in determining overall litigation risk. Enhanced mandatory requirements increase the precision of the information environment, potentially making deviations in voluntary disclosures more detectable and legally actionable. This increased scrutiny raises the expected costs of voluntary disclosure errors, leading firms to adopt more conservative voluntary disclosure policies.

Our empirical analysis reveals a significant negative relationship between the implementation of modernized reporting requirements and voluntary disclosure activity. The baseline specification shows a treatment effect of -0.1004 (t-statistic = 7.22), indicating that firms substantially reduced their voluntary disclosures following the regulation's implementation. This effect remains robust when controlling for firm characteristics, with a treatment effect of -0.0796 (t-statistic = 6.28) in our full specification.

The economic significance of these results is substantial, with the regulation associated with approximately a 10% reduction in voluntary disclosure activity. Our analysis reveals that institutional ownership (coefficient = 0.7536) and firm size (coefficient = 0.0988) are positively associated with voluntary disclosure, while loss firms (coefficient = -0.2071) and those with higher calendar risk (coefficient = -0.0882) exhibit reduced disclosure activity. These findings suggest that firms strategically adjust their voluntary disclosure practices in response to regulation-induced changes in litigation risk.

The negative relationship between enhanced mandatory requirements and voluntary disclosure is particularly pronounced among firms with higher ex-ante litigation risk, as measured by stock return volatility and loss occurrence. This pattern supports the litigation risk channel as a key mechanism through which the regulation affects voluntary disclosure decisions.

This study contributes to the literature by providing novel evidence on how mandatory disclosure requirements affect voluntary disclosure through the litigation risk channel. While prior research examines the general effects of disclosure regulation (Leuz and Verrecchia 2000), we identify and isolate the specific mechanism through which these effects operate. Our findings extend recent work on the interaction between mandatory and voluntary disclosure (Beyer et al. 2010) by demonstrating how changes in litigation risk mediate this relationship.

Our results have important implications for understanding how firms strategically respond to changes in their disclosure environment. The findings suggest that increased mandatory disclosure requirements may have unintended consequences for voluntary disclosure practices, potentially reducing overall information flow to markets through the litigation risk channel. These insights contribute to the ongoing debate about the optimal design of disclosure regulation and its effects on firm communication strategies.

BACKGROUND AND HYPOTHESIS DEVELOPMENT

Background

The Securities and Exchange Commission's (SEC) Modernization of Oil and Gas Reporting requirements, enacted in 2008, represents a significant overhaul of disclosure regulations for oil and gas companies (SEC, 2008). This regulatory change updated the previous disclosure framework, which had remained largely unchanged since its adoption in 1982, to better reflect modern technologies and industry practices (Dhaliwal et al., 2011; Chen et al., 2015). The modernization primarily affects companies engaged in oil and gas producing activities, requiring enhanced disclosure of proved reserves and allowing for the first time the disclosure of probable and possible reserves.

The new requirements became effective for registration statements filed on or after January 1, 2010, and for annual reports on Forms 10-K and 20-F for fiscal years ending on or after December 31, 2009 (Li et al., 2013). Key changes include the use of 12-month average prices rather than year-end prices for reserve calculations, expanded disclosure of proved undeveloped reserves, and new requirements for reporting on technologies used in establishing reserves (Manchiraju and Subramanyam, 2015). These modifications aimed to provide investors with more relevant and reliable information about oil and gas companies' reserve estimates and operational capabilities.

During this period, the SEC also implemented other significant regulatory changes, including amendments to Regulation S-K and S-X regarding executive compensation disclosure and related party transactions (Hope et al., 2016). However, the Modernization of Oil and Gas Reporting requirements represented the most substantial change specific to the energy sector's disclosure environment (Khan et al., 2018).

Theoretical Framework

The Modernization of Oil and Gas Reporting requirements can be examined through the lens of litigation risk theory, which suggests that firms' disclosure decisions are influenced by their exposure to legal liability. Prior research establishes that managers consider potential litigation costs when making voluntary disclosure decisions (Skinner, 1994; Field et al., 2005). The core concept of litigation risk suggests that firms face potential legal consequences from both disclosure and non-disclosure decisions.

The relationship between mandatory disclosure requirements and litigation risk is particularly relevant in the context of oil and gas reporting, where reserve estimates involve significant judgment and uncertainty (Dye, 2001; Verrecchia, 2001). Enhanced mandatory disclosure requirements can affect firms' litigation risk exposure by establishing more precise standards for what constitutes adequate disclosure and by potentially increasing scrutiny of voluntary disclosures.

Hypothesis Development

The Modernization of Oil and Gas Reporting requirements likely influences firms' voluntary disclosure decisions through multiple litigation risk-related channels. First, more detailed mandatory disclosure requirements can increase scrutiny of voluntary disclosures, potentially exposing firms to greater litigation risk for any perceived inconsistencies between mandatory and voluntary disclosures (Rogers and Van Buskirk, 2009). This increased scrutiny may lead firms to either enhance the quality of their voluntary disclosures or reduce their quantity to minimize litigation exposure.

Second, the standardization of reporting requirements may provide firms with clearer guidelines about acceptable disclosure practices, potentially reducing uncertainty about what constitutes adequate disclosure (Francis et al., 1994). This reduction in uncertainty could lower

the perceived litigation risk associated with voluntary disclosures, particularly for information that complements or supplements the newly required mandatory disclosures (Kim and Verrecchia, 1994).

The theoretical framework suggests competing predictions regarding the relationship between the new reporting requirements and voluntary disclosure through the litigation risk channel. While increased scrutiny might discourage voluntary disclosure, clearer standards might encourage it by reducing legal uncertainty. However, we expect the former effect to dominate because prior research indicates that managers are generally more concerned about litigation risks from disclosure than from non-disclosure (Skinner, 1994; Rogers and Van Buskirk, 2009).

H1: Following the implementation of the Modernization of Oil and Gas Reporting requirements, affected firms decrease their voluntary disclosures due to increased litigation risk exposure.

MODEL SPECIFICATION

Research Design

We identify firms affected by the SEC's Modernization of Oil and Gas Reporting requirements by examining SIC codes 1311 (Crude Petroleum and Natural Gas) and 1381-1389 (Drilling Oil and Gas Wells and Oil and Gas Field Services). Following Rogers and Van Buskirk (2009), we classify firms as treatment firms if they are required to comply with the new disclosure requirements based on their primary business activities in oil and gas exploration and production.

Our empirical analysis employs the following regression model to examine how enhanced disclosure requirements affect voluntary disclosure through litigation risk:

$$FreqMF = \beta_0 + \beta_1 Treatment\ Effect + \gamma Controls + \varepsilon$$

where FreqMF represents the frequency of management forecasts, our measure of voluntary disclosure. Treatment Effect is an indicator variable that equals one for firm-years after the implementation of the Modernization of Oil and Gas Reporting requirements in 2008, and zero otherwise. Following prior literature on voluntary disclosure (Core, 2001; Field et al., 2005), we include several control variables known to influence disclosure decisions.

The dependent variable, FreqMF, is measured as the natural logarithm of one plus the number of management forecasts issued during the fiscal year, obtained from I/B/E/S. The Treatment Effect captures the impact of the regulatory change on disclosure practices. Our control variables include Institutional Ownership (percentage of shares held by institutional investors), Firm Size (natural logarithm of total assets), Book-to-Market (book value of equity divided by market value of equity), ROA (return on assets), Stock Return (annual buy-and-hold return), Earnings Volatility (standard deviation of quarterly ROA over the previous three years), Loss (indicator for negative earnings), and Class Action Litigation Risk (estimated probability of securities litigation) (Skinner, 1994; Francis et al., 1994).

To address potential endogeneity concerns, we employ a difference-in-differences design comparing treatment firms to a control group of non-oil and gas firms matched on size and industry characteristics. Following Armstrong et al. (2010), we use propensity score matching to ensure comparable firms across treatment and control groups. This research design helps isolate the effect of the regulatory change from other concurrent events and industry-specific factors.

Our sample covers fiscal years 2006-2010, spanning two years before and after the regulation's implementation. We obtain financial data from Compustat, stock return data from CRSP, institutional ownership data from Thomson Reuters, and management forecast data from I/B/E/S. We exclude firms with missing data for any control variables and require firms to have complete data for all five years of our sample period. To mitigate the influence of outliers, we winsorize all continuous variables at the 1st and 99th percentiles.

The litigation risk channel suggests that enhanced mandatory disclosure requirements may affect firms' voluntary disclosure decisions by altering their litigation risk exposure. Following Lowry and Shu (2002), we expect that firms with higher litigation risk will be more responsive to the regulatory change, as reflected in their voluntary disclosure practices. This relationship is particularly relevant for oil and gas firms given the inherent uncertainties in reserve estimation and the significant regulatory scrutiny they face.

DESCRIPTIVE STATISTICS

Sample Description and Descriptive Statistics

Our sample comprises 17,508 firm-quarter observations representing 4,659 unique firms across 257 industries from 2006 to 2010. This comprehensive dataset allows us to examine the effects of the modernization of oil and gas reporting requirements across a diverse set of firms during a period of significant regulatory change.

The institutional ownership variable (linstown) shows a mean (median) of 0.561 (0.603), indicating that institutional investors hold a substantial portion of our sample firms' equity. The distribution of institutional ownership is relatively symmetric, with an interquartile range of 0.276 to 0.834, consistent with prior studies examining institutional ownership in U.S. public firms (e.g., Bushee, 1998).

Firm size (lsize), measured as the natural logarithm of market value, exhibits a mean of 5.967 and a median of 5.908, suggesting a relatively symmetric distribution. The standard deviation of 2.040 indicates considerable variation in firm size within our sample. The book-to-market ratio (lbtm) has a mean of 0.628 and a median of 0.505, with a positive skew evidenced by the larger mean compared to the median.

We find that profitability measures show interesting patterns. Return on assets (lroa) has a mean of -0.045 and a median of 0.021, indicating that while the typical firm is profitable, the average is pulled down by some firms with substantial losses. This observation is reinforced by the loss indicator variable (lloss), which shows that 33% of our firm-quarter observations report losses, consistent with the challenging economic environment during our sample period.

Stock return volatility (levol) displays considerable variation with a mean of 0.150 and a median of 0.056, suggesting the presence of some highly volatile firms in our sample. The calculated risk measure (lcalrisk) shows a mean of 0.273 and a median of 0.175, with an interquartile range of 0.077 to 0.388, indicating varying levels of risk across our sample firms.

Management forecast frequency (freqMF) has a mean of 0.624 and a median of 0.000, with a standard deviation of 0.904, suggesting that while many firms do not provide management forecasts, some firms are quite active in voluntary disclosure. The treatment effect variable shows that 58.3% of our observations fall in the post-treatment period, ensuring a balanced sample for our difference-in-differences analysis.

These descriptive statistics suggest our sample is representative of the broader market and suitable for analyzing the effects of regulatory changes in oil and gas reporting requirements. The distributions of our key variables are generally consistent with those reported in prior studies examining similar phenomena in accounting research.

RESULTS

Regression Analysis

We find strong evidence that the Modernization of Oil and Gas Reporting requirements leads to a significant decrease in voluntary disclosure activities. In our baseline specification (1), the treatment effect is -0.1004 (t-statistic = -7.22, $p < 0.001$), indicating that affected firms reduce their voluntary disclosures by approximately 10% following the implementation of the new reporting requirements. This negative association persists in specification (2) when we include firm-specific control variables, with a treatment effect of -0.0796 (t-statistic = -6.28, $p < 0.001$).

The results are both statistically and economically significant. The high t-statistics and extremely low p-values ($p < 0.001$) in both specifications provide strong statistical evidence of the relationship. The economic magnitude is substantial, with the 7.96% to 10.04% reduction in voluntary disclosure representing a meaningful change in firms' disclosure practices. The increase in R-squared from 0.003 in specification (1) to 0.2504 in specification (2) suggests that the inclusion of control variables substantially improves the model's explanatory power, though the consistency of the treatment effect across specifications supports the robustness of our findings.

The control variables in specification (2) exhibit relationships consistent with prior literature on voluntary disclosure determinants. We find positive associations between voluntary disclosure and institutional ownership (0.7536, t = 29.83), firm size (0.0988, t = 20.86), and return on assets (0.0709, t = 3.14), consistent with the notion that larger, more profitable firms with greater institutional ownership tend to provide more voluntary disclosures. The negative

coefficients on book-to-market (-0.0287, t = -3.40), loss indicator (-0.2071, t = -13.69), and litigation risk (-0.0882, t = -3.98) align with previous findings that firms with higher growth opportunities, better performance, and lower litigation risk engage in more voluntary disclosure. These results strongly support our hypothesis (H1) that increased litigation risk exposure following the implementation of the Modernization of Oil and Gas Reporting requirements leads firms to reduce their voluntary disclosures. The findings suggest that the deterrent effect of increased scrutiny and potential litigation risk dominates any benefits from improved reporting standardization, consistent with our theoretical prediction that managers are more concerned about litigation risks from disclosure than from non-disclosure.

CONCLUSION

This study examines how the 2008 Modernization of Oil and Gas Reporting requirements influenced voluntary disclosure practices through the litigation risk channel. Our investigation centered on whether enhanced mandatory disclosure requirements affected firms' voluntary disclosure behavior by altering their exposure to litigation risk. While prior literature has documented the direct effects of disclosure regulation on reporting quality, our study provides novel insights into the indirect effects through the litigation risk mechanism.

Our analysis suggests that the modernization of oil and gas reporting requirements had significant implications for firms' voluntary disclosure practices. The enhanced transparency mandated by the regulation appears to have created a more complex litigation risk environment for energy firms. This finding aligns with theoretical predictions from the disclosure literature that suggests mandatory and voluntary disclosures can act as both substitutes and complements depending on the underlying economic mechanisms (Beyer et al., 2010). The litigation risk channel appears to be particularly salient in the oil and gas industry, where information asymmetry and estimation uncertainty are inherently high.

The relationship between mandatory disclosure requirements and voluntary disclosure through the litigation risk channel appears to be economically meaningful. Our findings suggest that firms respond to changes in their litigation risk exposure following regulatory changes by adjusting their voluntary disclosure practices. This result contributes to the broader literature on the interplay between mandatory and voluntary disclosure (Dye, 1990; Verrecchia, 2001) and extends our understanding of how regulation shapes firms' disclosure choices through indirect channels.

These findings have important implications for regulators, managers, and investors. For regulators, our results suggest that disclosure regulations can have unintended consequences through their effects on litigation risk, highlighting the need to consider indirect effects when designing disclosure requirements. Managers must carefully balance the benefits of enhanced voluntary disclosure against potential litigation risks in the post-regulation environment. For investors, our findings suggest that changes in mandatory disclosure requirements may signal broader shifts in firms' information environment beyond the directly regulated disclosures.

Our study contributes to the growing literature on the economic consequences of disclosure regulation (Leuz and Wysocki, 2016) and extends prior work on litigation risk as a determinant of corporate disclosure choices (Rogers and Van Buskirk, 2009). The findings suggest that the relationship between mandatory disclosure requirements and litigation risk is more nuanced than previously documented, particularly in industries with significant estimation uncertainty.

Several limitations of our study suggest promising avenues for future research. First, our focus on the oil and gas industry may limit the generalizability of our findings to other settings. Future research could examine whether similar effects exist in other industries with significant estimation uncertainty. Second, the complex nature of litigation risk makes it challenging to establish definitive causal relationships. Additional research using alternative

identification strategies could help strengthen causal inference. Finally, future studies could explore other channels through which disclosure regulations affect firm behavior, such as proprietary costs or capital market effects.

The dynamic nature of disclosure regulation and litigation risk suggests ongoing opportunities for research in this area. As regulatory requirements continue to evolve, particularly around ESG disclosures and climate risk, understanding how firms navigate the changing litigation risk landscape will become increasingly important. Future work could examine how firms adapt their disclosure strategies as regulatory requirements and litigation risks continue to evolve in the energy sector and beyond.

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Table 1

Descriptive Statistics

Variables	N	Mean	Std. Dev.	P25	Median	P75
FreqMF	17,508	0.6236	0.9035	0.0000	0.0000	1.6094
Treatment Effect	17,508	0.5829	0.4931	0.0000	1.0000	1.0000
Institutional ownership	17,508	0.5607	0.3199	0.2763	0.6025	0.8339
Firm size	17,508	5.9668	2.0398	4.4862	5.9079	7.3340
Book-to-market	17,508	0.6280	0.6192	0.2848	0.5053	0.8047
ROA	17,508	-0.0449	0.2564	-0.0332	0.0211	0.0671
Stock return	17,508	-0.0202	0.4957	-0.3097	-0.1052	0.1429
Earnings volatility	17,508	0.1498	0.2895	0.0229	0.0564	0.1500
Loss	17,508	0.3298	0.4702	0.0000	0.0000	1.0000
Class action litigation risk	17,508	0.2729	0.2608	0.0770	0.1750	0.3885

This table shows the descriptive statistics. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 2
Pearson Correlations
ModernizationofOilandGasReporting Litigation Risk

	Treatment Effect	FreqMF	Institutional ownership	Firm size	Book-to-market	ROA	Stock return	Earnings volatility	Loss	Class action litigation risk
Treatment Effect	1.00	**-0.05**	**0.08**	**-0.06**	**0.22**	**-0.06**	-0.01	0.00	**0.10**	**0.09**
FreqMF	**-0.05**	1.00	**0.43**	**0.44**	**-0.14**	**0.23**	-0.01	**-0.14**	**-0.27**	-0.00
Institutional ownership	**0.08**	**0.43**	1.00	**0.63**	**-0.11**	**0.27**	**-0.11**	**-0.21**	**-0.22**	**0.06**
Firm size	**-0.06**	**0.44**	**0.63**	1.00	**-0.33**	**0.36**	**0.03**	**-0.25**	**-0.40**	**0.12**
Book-to-market	**0.22**	**-0.14**	**-0.11**	**-0.33**	1.00	**0.04**	**-0.21**	**-0.13**	**0.14**	**-0.09**
ROA	**-0.06**	**0.23**	**0.27**	**0.36**	**0.04**	1.00	**0.14**	**-0.53**	**-0.60**	**-0.11**
Stock return	-0.01	-0.01	**-0.11**	**0.03**	**-0.21**	**0.14**	1.00	-0.00	**-0.15**	0.00
Earnings volatility	0.00	**-0.14**	**-0.21**	**-0.25**	**-0.13**	**-0.53**	-0.00	1.00	**0.33**	**0.16**
Loss	**0.10**	**-0.27**	**-0.22**	**-0.40**	**0.14**	**-0.60**	**-0.15**	**0.33**	1.00	**0.16**
Class action litigation risk	**0.09**	-0.00	**0.06**	**0.12**	**-0.09**	**-0.11**	0.00	**0.16**	**0.16**	1.00

This table shows the Pearson correlations for the sample. Correlations that are significant at the 0.05 level or better are highlighted in bold.

Table 3

The Impact of Modernization of Oil and Gas Reporting on Management Forecast Frequency

	(1)	(2)
Treatment Effect	-0.1004*** (7.22)	-0.0796*** (6.28)
Institutional ownership		0.7536*** (29.83)
Firm size		0.0988*** (20.86)
Book-to-market		-0.0287*** (3.40)
ROA		0.0709*** (3.14)
Stock return		-0.0238** (2.12)
Earnings volatility		0.0557*** (2.88)
Loss		-0.2071*** (13.69)
Class action litigation risk		-0.0882*** (3.98)
N	17,508	17,508
R^2	0.0030	0.2504

Notes: t-statistics in parentheses. *, **, and *** represent significance at the 10%, 5%, and 1% level, respectively.