THE ACCOUNTING REVIEW
Vol. 96, No. 4
July 2021
pp. 179–202

American Accounting Association
DOI: 10.2308/TAR-2018-0578

Information Externalities of SFAS 161: Evidence from Supply Chains

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ABSTRACT: Effective in 2009, SFAS 161 requires enhanced disclosures about derivative use and hedging activities. We test for changes to the information environment of firms whose disclosure policy is unaffected by this standard directly. Using a sample of non-users of derivatives, we find an increase in stock liquidity after their critical customers expand derivative disclosures under SFAS 161. The effect persists for one year and becomes insignificant in subsequent years as the firms dial back their voluntary disclosure. The effect is also more salient for firms that have stronger economic links with their customers and for firms whose customers exhibit more significant improvements in derivative disclosures. The findings suggest that the mandatory derivative disclosures due to SFAS 161 lead to short-term positive information externalities along supply chains.

Data Availability: Data are available from the public sources cited in the text.

JEL Classifications: G32; M41; M48.

Keywords: information externalities; disclosure regulation; market liquidity; hedge accounting; SFAS 161; supply chains.

I. INTRODUCTION

A comprehensive evaluation of a disclosure regulation requires understanding its consequences, not only for disclosing firms, but also other institutions as well. One important consequence is information externalities—changes to information asymmetry in capital markets for non-disclosing firms (Dye 1990; Admati and Pfleiderer 2000). In this paper, we provide evidence of these information externalities from a recent disclosure mandate by the Financial Accounting Standards Board (FASB), the Statement of Financial Accounting Standards (SFAS) No. 161: *Disclosures about Derivative Instruments and Hedging Activities,* effective in 2009.

We thank two anonymous reviewers, Brad Badertscher (discussant), Phil Berger, Cristi Gleason, John Jiang, Jeffrey Ng, James Ohlson, Stephen Ryan, Katherine Schipper, Daniel J. Taylor (editor), Isabel Wang, Dan Wangerin, Paul Zarowin, and workshop participants at the U.S. Securities and Exchange Commission, the 2018 American Accounting Association Financial Accounting and Reporting Section Meeting, Yeshiva University, Rutgers, The State University of New Jersey, The Hong Kong Polytechnic University, The George Washington University, George Mason University, New York University, and Michigan State University for helpful advice. We also thank Xiangpei Chen, Menghai Gao, Hyun Jong Na, and Yan Zhao for research assistance.

An earlier version of this paper circulated under the title "Information Externalities of Disclosure Regulation: Evidence from SFAS 161."

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Supplemental material can be accessed by clicking the link in Appendix C.

Editor's note: Accepted by Daniel J. Taylor, under the Senior Editorship of Mary E. Barth.

Submitted: October 2018
Accepted: July 2020
Published Online: October 2020

Corporate use of derivatives for risk management and other purposes has increased rapidly during the last few decades and, thus, raised the demand for derivative transparency.[1] SFAS 161 requires firms to release otherwise unavailable information in financial statement footnotes regarding gains and losses on and fair value of derivatives. The information must be segregated by hedge accounting designation (e.g., derivatives designated as cash flow hedges, fair value hedges, or not designated as hedges) and risk exposure category (e.g., interest rate [IR] risk, foreign exchange [FX] risk) in tabular format. The standard also requires more disclosures on other aspects of derivatives. The purpose of SFAS 161 is to "provide important information on the effect that using derivatives has on an entity's financial position, financial performance, and the timing, amount, and uncertainty of an entity's future cash flows" (FASB 2008).

Documenting the information externalities of SFAS 161 is particularly important. Research shows that, controlling for other summary accounting measures (e.g., earnings and cash flows), new items disclosed under SFAS 161 reveal incremental information regarding firm value and risk and substantially reduce information asymmetry among investors in disclosing firms (Steffen 2015; Manchiraju, Pierce, and Sridharan 2018; Pierce 2020; Campbell, Khan, and Pierce 2021). Despite these benefits, before SFAS 161, firms chose not to release such information, which implies that the private benefits to them were likely dominated by reporting costs. The costs arise from the "exceedingly complex" nature of derivatives (Ryan 2007, 269; Comiskey and Mulford 2008) and from revealing competitively sensitive information (Zou 2019).[2] Indeed, Steffen (2015) and Khan, Li, Rajgopal, and Venkatachalam (2018) find a negative stock price reaction for affected firms on the release dates of the exposure draft and the final standard of SFAS 161. Without understanding information externalities, it is premature to judge the value of SFAS 161 based solely on the net costs to disclosing firms.

We study one key stakeholder of disclosing firms under SFAS 161: suppliers that sell a significant portion of their output to disclosing firms (i.e., critical customers; hereafter, customers for brevity). To isolate information externalities, we focus on supplier firms that did not use derivatives and, therefore, were not directly affected by SFAS 161. Among them, the treatment group consists of firms whose customers experienced an increase in derivative disclosures according to the standard, while the control group consists of firms that had critical customers, none of which were affected by the standard. Our sample spans three years before (the pre-period) and three years after (the post-period) the adoption date, defined as the customer's first 10-K or 10-Q filing, whichever came first, in accordance with SFAS 161. From the first filings, we manually collect segregated gains/losses on derivatives newly disclosed per SFAS 161 and find that they account for 15.53 percent of the absolute value of a median customer's net income.

We develop our hypothesis in two steps. First, an extensive literature finds strong economic links between suppliers and customers (Cohen and Frazzini 2008; Pandit, Wasley, and Zach 2011; Dou, Hope, and Thomas 2013; Guan, Wong, and Zhang 2015; Luo and Nagarajan 2015). We confirm the links by showing that the earnings and stock returns of our sample firms are significantly positively correlated with those of their customers. Thus, a reduction in uncertainty about the fundamentals of customers will reduce uncertainty about the fundamentals of supplier firms and information asymmetry among the investors in these firms. Second, the adoption of SFAS 161 represents a substantial increase in customers' commitment to more derivative disclosures (FASB 2008). Steffen (2015) finds a significant reduction in investor uncertainty for firms affected by SFAS 161 relative to unaffected ones. We also confirm this finding using the customers of our sample supplier firms. Taking these two steps together, we hypothesize that investors in supplier firms experience improvements in their information environment after the adoption of SFAS 161 by the customers. Appendix A provides a case study on the strong economic links between XTO Energy (the customer) and Natural Gas Services Group (the supplier) and how the former's disclosures under SFAS 161 influence the latter's information environment. Investors do not necessarily have to be direct consumers of the enhanced disclosures. As long as the disclosures enlarge the information set of intermediaries (e.g., media and rating agencies) that generate public reports to inform the investors, the information asymmetry is reduced.

Two considerations, however, may prevent the observation of information externalities. First, Cohen and Frazzini (2008) demonstrate that due to investor attention constraints, suppliers' stock prices do not instantly incorporate news about customers. Moreover, disclosures about derivative use and hedging are inherently complex (Campbell 2015). Despite the improved disclosures under SFAS 161, the information processing costs might still be too high for investors in supplier firms (Guay, Samuels, and Taylor 2016). To the extent that the investors are inattentive to or subject to high costs of processing customers' newly disclosed derivative information, we do not expect improvements to the information environment of these investors.

[1] According to the Bank for International Settlements, at the end of December 2008, the notional amount of outstanding interest rate (IR) and foreign exchange (FX) derivatives held by non-financial customers was $38.9 trillion and $9.1 trillion, in contrast to $5.8 trillion and $3.3 trillion at the end of 1998. In its 2009 Derivatives Usage Survey (see: https://www.isda.org/a/LeiDE/press042309der.pdf), the International Swaps and Derivatives Association reports that over 94 percent of the world's largest companies use derivatives to manage risk.

[2] For example, Edison Electric Institute responded in its comment letter that "the proposed disclosures will require significant system and process changes to implement . . . the cost of implementing this ED, as it is presently proposed, may outweigh the benefits" and "[w]e have significant concerns that the extent and granularity of the proposed disclosures would reveal significant competitively sensitive information" (see: http://www.tinyurl.com/253vy2pf).

Second, research shows that firms trade off the benefits and costs of various disclosure levers (e.g., derivative disclosures, management forecasts, 8-K filings, and press releases) to achieve an optimal level of information environment (Verrecchia 1990; Guay et al. 2016). If customers' new disclosures under SFAS 161 better inform investors in supplier firms and, thus, reduce the marginal benefits of their other disclosure levers, then supplier firms may dial back those levers. Consequently, in equilibrium, the standard may not have a detectable spillover effect in capital markets for supplier firms. Therefore, whether there are information externalities along supply chains is ultimately an empirical question.

To capture information asymmetry among investors in supplier firms, we construct a composite measure of stock liquidity as the first principal component of four proxies. The four liquidity proxies are the bid-ask spreads, the proportion of zero returns, the price impact of trades, and total trading costs, all of which are frequently used in the literature to capture capital market benefits from disclosures (Daske, Hail, Leuz, and Verdi 2008, 2013; Cheng, Liao, and Zhang 2013; Christensen, Hail, and Leuz 2013).

We employ a difference-in-differences approach to examine stock liquidity during the pre- and post-periods, for treatment and control firms, controlling for microstructure factors, firm and customer characteristics, and industry-year fixed effects. We find a significant increase in market liquidity for treatment firms following their customers' adoption of SFAS 161, as compared to control firms. This increase does not appear before the adoption, persists for one year after their customers adopt SFAS 161, and becomes insignificant in subsequent years. The findings suggest that investors in firms that were not directly affected by SFAS 161 benefited temporarily from their customers' expanded derivative disclosures.

Next, we examine supplier firms' voluntary disclosure, as captured by an aggregate measure based on the number of management forecasts, the number of 8-K filings, and the number of firm-initiated press releases, around their customers' adoption of SFAS 161. We observe a significant reduction in voluntary disclosure for treatment firms relative to control firms. This reduction does not appear before or one year after the adoption, but becomes significant in subsequent years. The results suggest that the firms adjust other disclosure channels in response to changes in their customers' mandatory derivative disclosures. The adjustment may take time, as the managers of supplier firms need to sort out the extent to which customers' new disclosures under SFAS 161 inform their investors.

We consider several cross-sectional predictions underlying the information externalities. We predict and find greater increases in market liquidity following the mandate at firms that have stronger economic links with their customers and firms with customers experiencing larger improvements in derivative disclosures. Manchiraju et al. (2018) and Pierce (2020) document that under SFAS 161, gains and losses on designated derivatives are more informative about firm value and risk than those on non-designated derivatives. Based on this insight, we predict and find that the increase in market liquidity is greater for firms whose customers exhibit a larger magnitude of gains and losses on designated derivatives. Such results do not hold when we split the sample based on the magnitude of gains and losses on non-designated derivatives. We also find that the improvement in stock liquidity does not depend on the sign of net gains or losses on the derivatives of customers. This result suggests that merely favorable changes in derivative value in the adoption year are unlikely to explain the increased liquidity of treatment firms. The cross-sectional results collectively alleviate concerns about correlated omitted variables, since such variables would need to explain the primary and all interaction effects simultaneously.

This paper contributes to the mandatory disclosure literature by demonstrating the beneficial information externalities from customers' increased derivative disclosures under SFAS 161. Our estimates may not adequately capture the information externalities of SFAS 161 in two respects. First, since the derivative disclosures may improve market liquidity for firms outside of supply chains (e.g., peer firms in the same industry), we likely understate the total amount of positive information externalities. Second, and conversely, as we examine non-users of derivatives for a strong identification of information externalities, a generalization of our results to an average firm likely overstates the effects to the extent that our sample firms are smaller and exhibit a weaker information environment than an average firm. Nevertheless, this is an important step in informing the cost-benefit analysis of SFAS 161. We also add to the risk management disclosure literature by showing that the increased transparency of customers' derivatives lowers information asymmetry between potential buyers and sellers of suppliers' shares.

There is one caveat to this study: we focus strictly on stock liquidity and do not examine other effects of SFAS 161, such as altering customers' incentives to use derivatives (Zhang 2009). Steffen (2020) estimates each firm's exposure to 17 risk factors before and after SFAS 161. He finds no difference between affected and unaffected firms in changes to their risk exposure, which suggests no changes in derivative use. Campbell et al. (2021) examine a critical item that indicates the dollar consequence of firms' hedging activities: unrealized cash flow hedging gains and losses. They find that this item exhibits similar magnitude and predictive power for future profitability around SFAS 161. Their finding suggests no significant changes in cash flow hedging activities. Future work can advance this literature by examining other economic consequences of SFAS 161.

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II. INSTITUTIONAL BACKGROUND, RELATED RESEARCH, AND HYPOTHESES DEVELOPMENT

Corporations use derivatives for various purposes. Derivatives are used to hedge business and financial risks and smooth performance, and thereby reduce the costs associated with financial distress, external financing, taxes, and managerial risk aversion (Froot, Scharfstein, and Stein 1993; Barton 2001; Allayannis and Weston 2001; Graham and Rogers 2002; Jin and Jorion 2006; Campello, Lin, Ma, and Zou 2011). Surveys and field experience suggest that firms also use derivatives for speculation (Adam and Fernando 2006; Geczy, Minton, and Schrand 2007) and internal budgeting (Brown 2001). The various purposes and complexity of derivatives pose financial reporting challenges to convey their implications on firm value and risk.

Disclosure Regulation—SFAS No. 161

SFAS No. 133 (FASB 1998), as amended by SFAS Nos. 138, 149, and 155 (hereafter, SFAS 133), governs the accounting rules for derivatives.[3] It requires that all derivatives be recognized at fair value on the balance sheet as gross assets or liabilities (not netted against hedged items). Absent special hedge accounting, hedged items and hedging derivatives would be accounted for using different valuation bases (i.e., amortized cost for most hedged items and fair value for derivatives). Addressing this problem, SFAS 133 permits hedge accounting treatment, which means that gains and losses on exposures and effective hedges of those exposures are recognized in earnings in the same period as qualifying hedges. To qualify a hedging relation for hedge accounting, a firm must meet stringent requirements, including (1) specifying the hedged item, (2) identifying the hedging strategy and derivatives, and (3) documenting the basis for expecting the hedge to be "highly effective" in offsetting the designated risk exposure at initiation and on an ongoing basis (Ryan 2007).

SFAS 133 allows two types of hedge accounting for derivative-based hedges. Firms can designate derivatives as fair value hedges or cash flow hedges.[4] For fair value hedges, unrealized gains (losses) arising from changes in the fair values of hedged items are recognized in current earnings, together with the offsetting unrealized losses (gains) resulting from changes in the fair values of hedging derivatives. For cash flow hedges, unrealized gains and losses from the fair value changes of the effective portion of hedging derivatives are initially recognized under Accumulated Other Comprehensive Income (AOCI), and subsequently recycled into earnings when the hedged items affect earnings. The gains and losses on derivatives that do not qualify for hedge accounting treatment (i.e., non-designated derivatives) or that result from hedge ineffectiveness must be recorded in earnings as they occur.

Despite the significant changes to derivative recognition rules brought by SFAS 133, many disclosure requirements from previous standards (i.e., SFAS Nos. 105 and 119) were not carried forward to ease the general acceptance and implementation of SFAS 133. The FASB believed that "the enhanced accounting prescribed in that Statement would obviate the need for additional disclosure requirements" at that time (FASB 2008; Ahmed, Kilic, and Lobo 2011). Furthermore, gains and losses on and fair values of derivatives are often aggregated across risk exposure categories or added to other financial statement items. These practices render the analysis of the implications of derivatives for firm value and risk nearly impossible. The disclosures were found to be inadequate for understanding firms' derivative use and hedging activities (Campbell 2015). For example, William Allen, a CPA and CFA with more than 30 years' experience in derivatives, states in his comment letter: "This weekend I had been asked by a client to try to help them understand just exactly how Liberty Media has used equity derivatives to hedge its positions in or to facilitate its acquisitions of certain equity investments. I spent about 12 hours [poring] through their financial statements and various SEC filings . . . and . . . I had to give up. The disclosure was too opaque and imprecise" (see: http://www.tinyurl.com/4e2ztxjf).

The FASB amended the disclosure (but not recognition) requirements of SFAS 133 by issuing SFAS 161, with objectives to enhance the understanding of how and why an entity uses derivatives and of how derivatives and related hedged items are accounted for under Statement 133 (FASB 2008).[5] Specifically, SFAS 161 requires derivative users to disclose, in a tabular format in footnotes, quantitative information about the realized and unrealized gains and losses on and fair value of derivatives, segregated by hedge accounting designation (e.g., derivatives not designated as hedges versus designated as fair value hedges or cash flow hedges) and risk exposure category (e.g., FX risk, IR risk). These disaggregated gains and losses serve as useful summary measures in value terms of the impacts of derivatives used for different purposes or types of risk.

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[3] SFAS No. 133, *Accounting for Derivative Instruments and Hedging Activities* (1998); SFAS No. 138, *Accounting for Certain Derivatives and Certain Hedging Activities* (2000); SFAS No. 149, *Amendment of Statement 133 on Derivative Instruments and Hedging Activities* (2003), and SFAS No. 155, *Accounting for Certain Hybrid Financial Instruments* (2006).

[4] SFAS 133 also allows companies to designate the hedges of net investment in a foreign operation, for which the accounting treatment follows either fair value hedges or cash flow hedges, depending on the underlying hedged item.

[5] The accounting and disclosure requirements for derivatives and hedging, including SFAS 133 and 161, are now part of Accounting Standards Codification Topic 815.

SFAS 161 also mandates disclosures of the line items on the financial statements affected by derivatives and of other aspects of derivatives, such as the volume of derivative activity and credit risk-related contingent features. Finally, SFAS 161 increases the frequency of derivative disclosures from only annual reporting to quarterly reporting, "given the frequent and often significant changes in derivative fair values" (FASB 2008). Firms must provide all disclosures required by SFAS 161 for annual and quarterly reporting periods beginning after November 15, 2008.[6] In Online Appendix Table A1 (see Appendix C for the link to the downloadable file), we provide an example of disclosures pre- and post-SFAS 161.

Related Research

Using newly disclosed information by oil and gas firms under SFAS 161, Manchiraju et al. (2018) provide evidence suggesting that disaggregation of non-designated derivatives versus derivatives designated as cash flow hedges reveals useful information. Specifically, the former are more likely to be used for opportunistic purposes, while the latter mainly reflect prudent risk management. They find that non-designated derivatives (cash flow hedges) are positively (negatively) associated with firm risk and are not (positively) associated with Tobin's q. Similarly, Pierce (2020) examines nonfinancial firms in the Standard and Poor's (S&P) 500 after 2008 and finds that firm value is negatively (positively) associated with non-designated derivatives (derivatives designated for cash flow/fair value hedges).

Zou (2019) constructs a score for derivative disclosure practices by U.S. airline firms based on authoritative guidance. She finds that these firms significantly increased disclosures after they adopted SFAS 161 and that these enhanced disclosures help competitors make better entry decisions. Chang, Donohoe, and Sougiannis (2016) document increases in analysts' forecast inaccuracy and dispersion for new users relative to non-users of derivatives. They find that the gap in these measures between users and non-users of derivatives does not become smaller post-SFAS 161. Campbell et al. (2021) demonstrate that the enhanced derivative disclosures under SFAS 161 improve investors' and analysts' understanding of the effects of derivatives and hedging activities on future firm performance. They also find that the improvement does not vary with a firm's institutional ownership. Their findings suggest that all investors benefit from the disclosures regardless of their sophistication. Thus, it is unlikely that new disclosures per SFAS 161 increase information asymmetry due to the superior processing abilities of sophisticated investors (Kim and Verrecchia 1994). Consistent with this notion, Steffen (2015) finds a significant increase in market liquidity for firms affected by SFAS 161 relative to unaffected ones. He demonstrates that the increase is higher for firms with more improved derivative disclosures.

Despite these benefits, poor voluntary derivative disclosures before SFAS 161 suggest that reporting costs outweigh the private gains to disclosing firms, which evokes a question as to the necessity of the mandate that forces firms to increase derivative disclosures. Accordingly, Steffen (2015) and Khan et al. (2018) find a negative market reaction by affected firms on the release dates of the exposure draft and final standard of SFAS 161. These authors, however, do not examine the information externalities of this disclosure mandate, an important consideration in its evaluation (Leuz and Wysocki 2016).

Studies show horizontal (i.e., intra-industry) and vertical (i.e., within-supply chain) information transfer for both voluntary and mandatory disclosures.[7] None of these studies, however, investigate changes to non-disclosing firms' information asymmetry in capital markets around the *adoption* of any particular disclosure mandate. As such, their evidence offers limited insight on evaluating disclosure and reporting regulation directly (Leuz and Wysocki 2016). In contrast, we provide direct evidence on the changes in market liquidity along supply chains around a recent disclosure mandate, SFAS 161.

Hypothesis Development

We develop our hypothesis in two steps. First, an extensive literature demonstrates strong economic links between suppliers and customers (Cohen and Frazzini 2008; Pandit et al. 2011; Dou et al. 2013; Guan et al. 2015; Luo and Nagarajan 2015). The financial positions and operating performance of customers significantly influence their demand and, thus, the performance of suppliers. From customers with healthy financial conditions and good performance, suppliers would expect to earn stable revenue and timely payments (Dou et al. 2013). In contrast, during difficult times, customers may renegotiate supply contracts and accounts receivable terms, which reduces the revenue and cash flow of suppliers. Indeed, Hertzel, Li, Officer, and Rodgers (2008) find a negative association between customers' distress and suppliers' returns. Cunat (2007) shows that customers use trade credit as a type of "insurance" when experiencing temporary liquidity shocks. Cohen and Frazzini (2008)

[6] The quarterly interim includes the fourth quarter. For example, a firm with a fiscal year-end of March 31 should provide the disclosures for its fourth quarter in its 2009 annual report.

[7] See Foster (1981), Olsen and Dietrich (1985), Baginski (1987), Han, Wild, and Ramesh (1989), Han and Wild (1990), Xu, Najand, and Ziegenfuss (2006), Gleason, Jenkins, and Johnson (2008), Durnev and Mangen (2009), Pandit et al. (2011), Badertscher, Shroff, and White (2013), Beatty, Liao, and Yu (2013), Baginski and Hinson (2016), Ma (2017), Shroff, Verdi, and Yost (2017), Hann, Kim, and Zheng (2019), and Cho, Kim, and Zang (2020).

find that the monthly returns of customers and suppliers have a significant positive correlation. In light of these economic connections, Madsen (2017) finds evidence consistent with the acquisition of customer information by suppliers' shareholders. We confirm the economic links by showing that the earnings and stock returns of our sample firms are significantly positively correlated with those of their customers (see Online Appendix Table A2). Thus, a reduction in uncertainty about the fundamentals of customers will reduce uncertainty about the fundamentals of supplier firms and, thus, decrease the information asymmetry among investors in these firms.

Second, the adoption of SFAS 161 represents a substantial increase in customers' commitment to more derivative disclosures. Many new disclosures are unavailable under SFAS 133: the breakdown of gains/losses on and fair value of derivatives, the disclosures of the breakdown every quarter, the volume of derivative activity, and the credit risk-related contingent features of derivatives. Designated versus non-designated derivatives typically have different economic meanings (Manchiraju et al. 2018; Pierce 2020), and derivatives often have different per-unit deltas (i.e., sensitivities) on the target risk exposure (Wong 2000). Consequently, disaggregation of derivatives' impacts on financial statements and more frequent disclosures per SFAS 161 improve the transparency of customers' use of derivatives (Barth and Landsman 2010; Fu, Kraft, and Zhang 2012). The tabular format for all disaggregated information under SFAS 161 further increases the usefulness of the information by making derivative users more comparable (Hodder and McAnally 2001; FASB 2008). As a typical user of financial reports, Standard and Poor's (2007) comments: "The disclosures mandated by the Proposed Statement would provide important information to analysts in areas where disclosures substantially lacked in the past . . . The proposed Statement will make financial statements more complete, understandable, and useful for analysis of financial information." Steffen (2015) finds a significant reduction in investor uncertainty for firms affected by SFAS 161 relative to firms that are unaffected. We confirm this finding using the customers of our sample firms.[8]

Together, these two steps suggest that derivative disclosures provide useful information for the valuation of customers, which, in turn, reduces the uncertainty of investors in suppliers. As a result, more enhanced disclosures of customers' derivatives alleviate information asymmetry among investors in supplier firms and increase market liquidity. We hypothesize that firms whose customers adopt SFAS 161 experience an increase in stock liquidity.

III. DATA AND VARIABLES

We use data from various sources. Stock price and market liquidity data are from CRSP, financial statement data are from Compustat, 10-K/Q and 8-K filings are from the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system, management forecasts are from I/B/E/S, press releases are from RavenPack, credit default swap (CDS) trading data are from Datastream, and outstanding derivative data are from the Bank for International Settlements.

Table 1 shows the sample selection procedure. To identify the non-users of derivatives, we use Steffen's (2015) textual analysis approach augmented with manually collected data. First, we download all 10-Ks and 10-Qs filed between March 1, 2008 and December 31, 2009, which represent 4,767 unique firms. We use a Perl program to search the filings for (1) derivative and hedging words or phrases, and (2) references to SFAS 161.[9] Among these firms, 1,463 are identified as non-users of derivatives because they either do not mention SFAS 161, which applies to all derivative users, or include less than ten derivative and hedging words or phrases in the pre-SFAS 161 10-Ks.

Second, we collect data on these firms' critical customers from the Compustat Segments file. The same dataset has been used in numerous studies (Kale and Shahrur 2007; Hertzel et al. 2008; Patatoukas 2012; Kim, Song, and Zhang 2015). These data are then merged with the Compustat data based on the customers' names. Using the same Perl program-based approach discussed above, we identify customers that are affected by SFAS 161. When customers exposed to market risks do not use derivatives and explicitly state that they are not impacted by SFAS 161, the algorithm likely misclassifies these customers as affected. Therefore, we manually check 10-K/Q filings immediately preceding the SFAS 161 effective date of all customers identified as affected by the algorithm and reclassify 13 misclassified customers as unaffected. The 1,463 non-users of derivatives in Table 1 are then split into two groups based on whether the firm had an affected customer in 2008–2010. The treatment group consists of 310 firms with affected customers, while the control group consists of 1,153 firms.

Third, we require firms in the treatment group in Table 1 to have a relationship with the same affected customer during 2008–2010. We also require firms in the control group to have at least one critical customer in the same period to ensure a comparable control sample. We consider a customer's adoption date as the filing date of the first 10-K/Q in accordance with

[8] Using a two-year window around the adoption of SFAS 161, Steffen (2020) documents a significant increase in stock liquidity in the year after the adoption for affected firms relative to unaffected ones. Using the customers of our sample firms, we find a similar result for affected versus unaffected customers. The findings suggest that the new disclosures under SFAS 161 improve the information environment of investors in customer firms. The results are reported in Online Appendix Table A3.

[9] See Steffen (2015, Appendix B) for regular expressions regarding SFAS 161 and the derivative and hedging dictionary.

TABLE 1
Sample Selection

	Number Unique Firms	Number Firm-Years
Firms with 10-K/Q filed between March 1, 2008 and December 31, 2009 (before SFAS 161)	4,767	
Firms unaffected by SFAS 161	1,463	
Treatment firms:		
Firms ever having an affected critical customer during 2008–2010	310	
Firms having a relationship with the same affected critical customer during 2008–2010	180	
Require non-missing data on all variables in the three years before and after SFAS 161	140	840
Control firms:		
Firms without an affected critical customer during 2008–2010	1,153	
Firms with an unaffected critical customer during 2008–2010	548	
Require non-missing data on all variables in the three years before and after SFAS 161	369	2,214
Final sample (i.e., treatment and control firms)	509	3,054

Table 1 presents the sample selection procedure. We identify non-users of derivatives as unaffected firms following Steffen (2015), in which firms are unaffected if SFAS 161 is not mentioned in any of its 10-K/Q filed between March 1, 2008 and December 31, 2009, or less than ten derivative and hedging words or phrases are mentioned in its pre-SFAS 161 10-K filing. The total unaffected firms are then split into two groups based on whether the firm has an affected customer during 2008–2010. We identify affected customers using two steps. First, we follow Steffen (2015), in which firms are affected if SFAS 161 is mentioned in any of its 10-K/Q filed between March 1, 2008 and December 31, 2009, and more than ten derivative and hedging words or phrases are mentioned in its pre-SFAS 161 10-K filing. Second, we manually check these customers' 10-Ks and 10-Qs between March 1, 2008 and December 31, 2009 and drop customers that are unaffected by SFAS 161. We require non-missing data on all variables in the three years before and after SFAS 161. The final 140 treatment firms have 137 affected customers in total.

SFAS 161. Figure 1 shows the distribution of adoption dates. Unsurprisingly, more than 80 percent of customers adopted SFAS 161 in the first calendar quarter of 2009, with 10-Qs filed in April or May 2009. Four firms are early adopters. We adjust their adoption dates accordingly. Nevertheless, deleting these early adopters does not alter any of our inferences.

For a treatment firm, the adoption date (*INITIAL_DATE*) is its affected customer's adoption date. If a treatment firm has relationships with more than one adopting customer, then we use the earliest adoption date. For a control firm, we use its customer's 10-K/Q filing date for the first reporting period beginning after the effective date of SFAS 161. The sample spans three years (36 months) before *INITIAL_DATE* as the pre-period and three years (36 months) after *INITIAL_DATE* as the post-period. This long window allows us to evaluate the validity of the parallel-trends assumption before SFAS 161 and examine the persistence of its information externalities. Finally, there are 140 treatment firms and 369 control firms in Table 1 with non-missing data for the variables described below. The treatment firms have relationships with 137 affected customers in total.

To assess the economic importance of newly disclosed information, we manually collect derivative disclosures of the 137 affected customers from their first filings (10-K/Q) under SFAS 161. Among the 137 customers, 90 use derivatives to manage exposure to foreign currency risk, 71 to manage interest rate risk, 38 to manage commodity risk, and 26 to manage other risks, such as credit risk and equity risk. They sum up to more than 137 because firms often use derivatives to manage more than one type of risk. Table 2 presents the summary statistics of the gains/losses on derivatives, as well as a breakdown by hedge accounting designation and risk type. The absolute value of gains/losses exhibits a mean of $668 million (a median of $32 million) and represents 75.47 (15.53) percent of the absolute value of net income for the same fiscal period. These figures are similar to those in Manchiraju et al. (2018). Since the data are highly skewed, we focus on the median. The magnitude of the gains or losses on designated derivatives (19.19 percent of |net income|) is greater than that on non-designated derivatives (9.80 percent of |net income|). Derivatives designated as fair value hedges exhibit slightly greater impacts than cash flow hedges across all risk categories. Overall, the statistics confirm that customers' derivatives are economically important during our sample period.

Market Liquidity

We construct a composite measure (*ILLIQUIDITY*) using principal component analysis of four market liquidity proxies. These proxies have been used individually or collectively in numerous studies on the capital market effects of disclosure policies (e.g., Leuz 2003; Daske et al. 2008, 2013; Cheng et al. 2013; Christensen et al. 2013). The first proxy, bid-ask spreads (*SPREAD*), is the yearly median of daily quoted spreads, measured at the end of each trading day as the difference between the

FIGURE 1
Distribution of Customers' Adoption Date

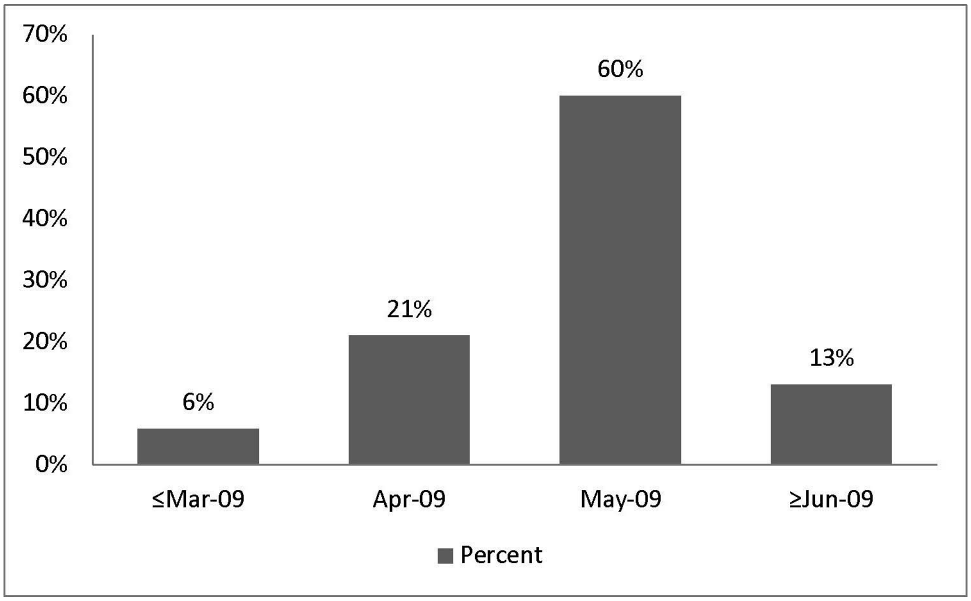

Figure 1 shows the distribution of affected customers' adoption date for SFAS 161. The adoption date is the date on which the customer's first 10-K/Q in accordance with SFAS 161 is filed.

bid and ask prices divided by the midpoint. The spread is used to address the adverse selection problem in trading shares in the presence of asymmetrically informed investors and, thus, increases with the level of information asymmetry and illiquidity (Callahan, Lee, and Yohn 1997). The second proxy is the proportion of trading days with zero daily stock returns out of all potential trading days in a year (*ZERORET*). Since transaction costs deter marginal investors from trading, yielding a zero return, the frequency of zero returns signals the level of illiquidity and information asymmetry. The third proxy is the yearly median of the Amihud (2002) illiquidity measure, defined as the daily absolute stock return divided by US$ trading volume, multiplied by 1,000,000 (*PRCIMPACT*). A high price impact indicates the low ability of an investor to trade a stock without moving its price and, thus, low stock liquidity. The fourth proxy is an estimate of the total round-trip transaction costs (*TRANCOST;* Lesmond, Ogden, and Trzcinka 1999) including bid-ask spreads, commissions, and implicit costs from short-sale constraints or taxes based on a yearly time-series regression of daily stock returns on the aggregate market returns. The estimation of implied transaction costs is based on the logic that informed investors do not trade when the transaction costs exceed the value of new information.

We report the descriptive statistics of the four proxies and the first common factor (*ILLIQUIDITY*) based on these proxies in Online Appendix Table A4. The means of *SPREAD, ZERORET, PRCIMPACT,* and *TRANCOST* are 0.008, 0.031, 0.349, and 0.046, respectively. The four proxies are highly correlated with one another, with the coefficients ranging from 0.405 (Pearson correlation between *ZERORET* and *PRCIMPACT*) to 0.948 (Spearman correlation between *SPREAD* and *PRCIMPACT*). Only the first common factor has an eigenvalue greater than 1, and this factor explains 62.6 percent of the total variation of the proxies. The construction of this factor helps to mitigate the concern that each of these individual proxies measures the underlying concept of interest with error.

Control Variables

Prior studies suggest that market liquidity is associated with market capitalization, share turnover, return variability, and stock momentum (Leuz and Verrecchia 2000; Sadka 2006; Daske et al. 2008; Christensen et al. 2013). In following regression analysis, we control for firm size (*SIZE*), share turnover (*TURNOVER*), return volatility (*STDRET*), and current and past size and book-to-market adjusted annual stock returns (*ABRET* and *PRABRET*).

Firm characteristics that likely affect the information environment and, thus, market liquidity (Kim, Shroff, Vyas, and Wittenberg-Moerman 2018) are included in the regression analysis: debt-to-equity ratios (*LEVERAGE*), book-to-market ratios (*BTM*), and returns on assets (*ROA*). We also control for customer characteristics that pertain to supplier transparency following

TABLE 2

Gains or Losses on Derivatives of Customers Disclosed under SFAS 161

		In US$ Millions					As Percent of |Net Income|				
	n	**Mean**	**SD**	**P25**	**Median**	**P75**	**Mean**	**SD**	**P25**	**Median**	**P75**
Absolute value of gains/losses on derivatives	137	668	2,642	1	32	225	75.47	196.51	1.73	15.53	45.91
Designated	82	793	2,844	13	47	396	95.70	238.35	8.65	19.19	68.44
Commodity risk	25	432	1,105	12	22	162	76.35	206.64	1.63	5.20	28.45
Cash flow hedge	22	487	1,17	12	42	336	86.10	219.01	1.38	9.85	38.13
Fair value hedge	2	33	33	10	33	56	5.51	5.93	1.32	5.51	9.71
Unidentified	2	9	9	3	9	15	1.74	0.91	1.10	1.74	2.38
Foreign currency risk	61	619	2,241	19	42	316	61.76	180.48	6.62	14.80	35.55
Cash flow hedge	57	308	764	10	33	192	49.12	171.62	4.42	9.94	29.18
Fair value hedge	11	860	1,701	6	36	1,155	31.33	58.77	1.25	10.81	38.80
Net investment hedge	10	1,020	2,598	12	39	588	52.93	90.62	1.48	21.89	45.06
Unidentified	2	272	337	34	272	510	46.89	48.36	12.69	46.89	81.08
Interest rate risk	46	348	1,208	3	13	92	45.36	106.49	1.91	5.78	20.49
Cash flow hedge	36	97	305	1	10	40	39.37	109.94	0.71	3.75	19.34
Fair value hedge	21	590	1365	4	34	342	30.92	51.53	1.68	6.59	45.25
Unidentified	3	40	45	14	15	92	6.57	4.87	2.38	5.40	11.92
Other risks	7	67	67	3	44	116	12.05	15.49	0.74	1.04	29.51
Cash flow hedge	5	50	75	3	21	44	6.49	12.87	0.74	0.96	1.04
Fair value hedge	1	101	—	101	101	101	36.86	—	36.86	36.86	36.86
Unidentified	1	116	—	116	116	116	15.03	—	15.03	15.03	15.03
Non-designated	81	327	1,213	4	24	144	30.77	55.74	3.19	9.80	31.48
Commodity risk	26	103	139	4	33	145	25.30	66.68	1.64	6.09	15.71
Foreign currency risk	57	84	171	5	20	53	12.19	14.18	2.07	7.74	16.67
Interest rate risk	26	515	1543	4	14	141	27.30	50.14	0.95	6.17	32.76
Other risks	19	294	558	6	42	158	22.60	33.15	1.48	8.33	36.13

We identify 137 affected customer firms and present in Table 2 the magnitude of gains/losses on their derivatives segregated by hedge accounting designation and risk exposure category, made available under the disclosure requirements of SFAS 161.

the literature (Hui, Klasa, and Yeung 2012; Li and Tang 2016): percentage of sales to critical customers (*SALE_TO_KEY%*), average customer size (*CSIZE*), average customer leverage (*CLEVERAGE*), and an indicator variable for having a CDS-referenced customer (*CWITHCDS*).

Finally, we recognize that treatment and control firms differ in their exposure to derivative markets due to customers' use/non-use of derivatives. The recent financial crisis may precipitate treatment firms' liquidity in 2007–2008 by disturbing derivative markets, and the subsequent recovery for these firms coincides with the adoption of SFAS 161.[10] To address this issue, we control for the firm-specific impact of each derivative market using the product of the percentage of sales to customers that use derivatives to manage a specific type of risk, and the average total market value of outstanding derivatives for that type of risk at the beginning and end of a year for the pre- and post-periods (*FXIMPT, IRIMPT, CMIMPT,* and *OTHIMPT*). Naturally, these variables are set to 0 for control firms.

Following the market microstructure literature, we lag all control variables by one year. Figure 2 shows a timeline of variable measurement. Variable definitions are in Appendix B.

VI. EMPIRICAL TESTS AND RESULTS

In this section, we examine whether suppliers' market liquidity increases around their customers' adoption of SFAS 161. We also investigate the suppliers' voluntary disclosure and conduct several cross-sectional analyses.

[10] The Bank for International Settlements provides semiannual statistics about the size of the over-the-counter (OTC) derivatives market. We take the average total market value of derivative contracts outstanding at the beginning and end of a year and plot the average value for each type of risk (i.e., FX derivatives, IR derivatives, commodity derivatives, and other derivatives for equity and credit risk) for 2007–2010. As shown in Online Appendix Figure A1, there is no evidence of a decline in 2007–2008 or a subsequent recovery.

FIGURE 2
Timeline of Variable Measurement

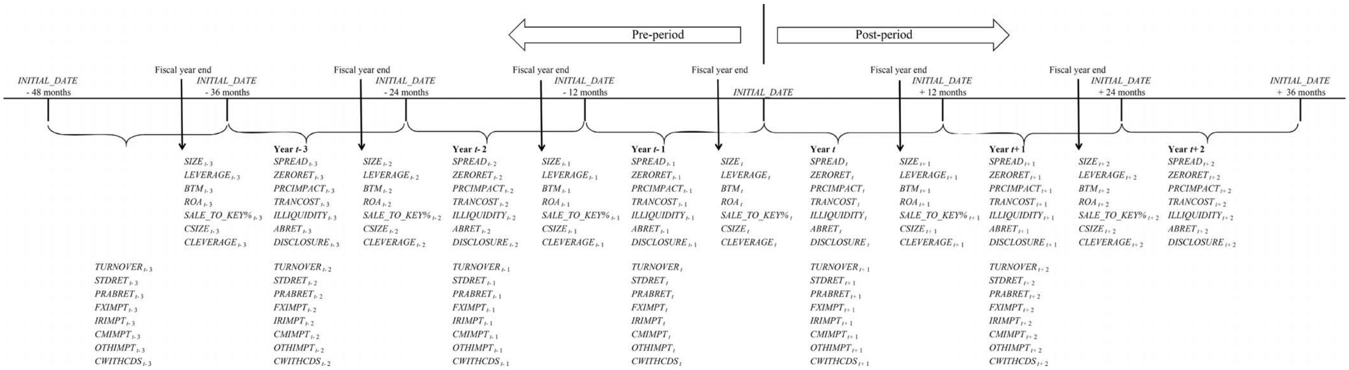

Figure 2 illustrates when each variable is measured relative to the *INITIAL_DATE* for the pre-SFAS 161 period (years t–3 to t–1) and the post-SFAS 161 period (years t to t+2). For the treatment firm, *INITIAL_DATE* is the date on which its affected customer's first 10-K/Q in accordance with SFAS 161 is filed. If the treatment firm has relationships with more than one affected customer in the post-period, the earliest filing date is used as *INITIAL_DATE*. For a control firm, *INITIAL_DATE* is its customer's 10-K/Q filing date for the first reporting period under SFAS 161.

Variable definitions are in Appendix B.

Suppliers' Market Liquidity around Customers' Adoption of SFAS 161

We start by comparing the characteristics of treatment and control firms in the pre-period (years t–3 to t–1), as reported in Panel A of Table 3. All the market microstructure factors (except for *PRABRET*) and firm characteristics are statistically indistinguishable between these two groups of firms. Regarding customer characteristics, treatment firms generate a higher percentage of sales to critical customers (*SALE_TO_KEY%*), tend to have customers with higher leverage (*CLEVERAGE*), and are less likely to have a CDS-referenced customer (*CWITHCDS*). The difference in customer leverage is consistent with Guay's (1999) finding that derivative users exhibit higher leverage than non-users (i.e., customers of treatment firms have higher leverage than those of control firms). Unsurprisingly, derivative markets' impacts on treatment firms (*FXIMPT, IRIMPT, CMIMPT,* and *OTHIMPT*) are significantly higher than those on control firms, for which these impacts are set to zero. Overall, the differences in customer characteristics highlight the importance of controlling for these variables throughout our analyses. Panel B of Table 3 shows the summary statistics for the 3,054 firm-years in the sample. Panel C presents the sample distributions for the 12 Fama-French industries.

The regression specification takes the following form:

$$ILLIQUIDITY_{i,y} = \theta_1 + \theta_2 TREAT_i + \theta_3 TREAT_i \times POST_y + \sum \theta_j Controls_{j,i,y-1} + d_{s,y} + v_{i,y}, \quad (1)$$

where *ILLIQUIDITY* is the composite measure of stock illiquidity based on the four liquidity proxies described earlier; i indexes the firm; y indexes the year (years t–3 to t+2); s indexes the Fama-French industry; and j indexes the jth control for $j >$ 3. *TREAT* is equal to 1 for treatment firms, and 0 otherwise. *POST* is equal to 1 for the post-period, and 0 for the pre-period. The regressions include all control variables discussed above and industry-year fixed effects ($d_{s,y}$). The primary independent variable of interest is *TREAT* × *POST*. Because of the inclusion of *TREAT* and industry-year fixed effects, the coefficient on the interaction term captures the difference-in-differences in market liquidity. This specification differs slightly from the traditional difference-in-differences design in that we allow *POST* to vary across years and industries (i.e., *POST* is absorbed by industry-year fixed effects). Following the microstructure literature, we estimate the liquidity models in a log-linear specification (Christensen et al. 2013). Specifically, we lag the control variables by one year and take the natural log of the continuous microstructure variables (*TURNOVER, STDRET, 1 + ABRET, 1 + PRABRET*).[11]

Treatment firms may be in industries where customers often use derivatives, whereas control firms may be in sectors where derivative use is uncommon. Consequently, the two groups of firms are subject to different industry-specific shocks that influence stock liquidity. The inclusion of industry-year fixed effects mitigates this concern, as it allows us to compare liquidity within the same industry-year across treatment and control firms. To correct for cross-sectional (within an industry-year) and

[11] We do not lag *ABRET* since the lagged variable *PRABRET* is already included in the regressions. Nevertheless, dropping *ABRET* does not alter our inferences.

TABLE 3

Descriptive Statistics

Panel A: Firm Characteristics before SFAS 161

	Pre-SFAS 161					
	Treat		Control		Difference	
Variable	n	Mean	n	Mean	Mean	p-value
SIZE	420	5.795	1,107	5.903	−0.109	0.275
TURNOVER	420	2.437	1,107	2.284	0.153	0.288
STDRET	420	0.029	1,107	0.028	0.000	0.535
ABRET	420	−0.010	1,107	−0.018	0.008	0.710
PRABRET	420	0.062	1,107	0.017	0.045	0.075
LEVERAGE	420	0.501	1,107	0.563	−0.062	0.529
BTM	420	0.464	1,107	0.437	0.028	0.129
ROA	420	0.005	1,107	0.018	−0.013	0.201
SALE_TO_KEY%	420	0.727	1,107	0.529	0.199	<0.001
CSIZE	420	10.452	1,107	10.516	−0.065	0.270
CLEVERAGE	420	0.680	1,107	0.517	0.163	0.001
CWITHCDS	420	0.810	1,107	0.922	−0.113	<0.001
FXIMPT	420	0.065	1,107	0.000	0.065	<0.001
IRIMPT	420	0.096	1,107	0.000	0.096	<0.001
CMIMPT	420	0.057	1,107	0.000	0.057	<0.001
OTHIMPT	420	0.003	1,107	0.000	0.003	<0.001

Panel B: Summary Statistics for Variables in Regressions

Variable	n	Mean	Std. Dev.	25th Pctl.	Median	75th Pctl.
LIQUIDITY	3,054	−0.021	0.856	−0.569	−0.326	0.241
TREAT	3,054	0.275	0.447	0.000	0.000	1.000
POST	3,054	0.500	0.500	0.000	0.500	1.000
SIZE	3,054	5.710	1.841	4.425	5.723	6.913
TURNOVER	3,054	2.366	2.627	0.708	1.587	2.947
STDRET	3,054	0.035	0.018	0.023	0.031	0.042
ABRET	3,054	0.037	0.513	−0.251	−0.022	0.180
PRABRET	3,054	0.061	0.538	−0.241	0.000	0.200
LEVERAGE	3,054	0.513	1.721	0.000	0.069	0.452
BTM	3,054	0.560	0.483	0.260	0.444	0.720
ROA	3,054	−0.005	0.197	−0.023	0.041	0.089
SALE_TO_KEY%	3,054	0.646	0.568	0.150	0.545	1.000
CSIZE	3,054	10.427	1.064	10.270	10.666	10.755
CLEVERAGE	3,054	0.641	0.992	0.439	0.555	0.616
CWITHCDS	3,054	0.889	0.314	1.000	1.000	1.000
FXIMPT	3,054	0.020	0.063	0.000	0.000	0.000
IRIMPT	3,054	0.028	0.089	0.000	0.000	0.000
CMIMPT	3,054	0.012	0.072	0.000	0.000	0.000
OTHIMPT	3,054	0.001	0.005	0.000	0.000	0.000
DISCLOSURE	3,054	−0.003	0.983	−0.783	−0.116	0.602

(continued on next page)

time-series (within a firm) dependence, we two-way cluster standard errors by firm- and industry-year (Bernard 1987; Gow, Ormazabal, and Taylor 2010).

We posit that treatment firms whose customers expand derivative disclosures per SFAS 161 experience an increase in stock liquidity compared to control firms. Table 4, column (1) shows coefficients, and t-statistics in parentheses, from the estimation of Equation (1). We observe a statistically insignificant coefficient on *TREAT*, which suggests indistinguishable

TABLE 3 (continued)

Panel C: Distribution by the 12 Fama-French Industry Classification

	Treat		Control	
Industry	**n**	**Percent**	**n**	**Percent**
Consumer non-durables	96	11.4%	48	2.2%
Consumer durables	36	4.3%	48	2.2%
Manufacturing	72	8.6%	210	9.5%
Energy	30	3.6%	84	3.8%
Chemicals and allied products	12	1.4%	18	0.8%
Business equipment	204	24.3%	510	23.0%
Telecommunications	24	2.9%	48	2.2%
Utilities	6	0.7%	48	2.2%
Wholesale and retail	18	2.1%	210	9.5%
Healthcare, medical equip., drugs	138	16.4%	348	15.7%
Finance	96	11.4%	198	8.9%
Other	108	12.9%	444	20.1%
	840		2,214	

Table 3 shows descriptive statistics for treatment and control firms. Figure 2 shows when each variable is measured in the pre-SFAS 161 period (years *t*–3 to *t*–1) and the post-SFAS 161 period (years *t* to *t*+2). Panel A provides firm characteristics before SFAS 161 (i.e., years *t*–3 to *t*–1) for treatment and control firms. Panel B shows descriptive statistics of all variables used in the regressions. Panel C shows the distribution by the 12 Fama-French industries. Detailed variable definitions are provided in Appendix B.

market liquidity between treatment and control firms in the pre-period, holding the control variables constant. Our test variable *TREAT* × *POST* loads significantly negatively (two-tailed p-value < 0.1). Thus, after the adoption of SFAS 161 by their customers, treatment firms experience a reduction in *ILLIQUIDITY* in comparison to control firms. The signs of the coefficients on the other independent variables are consistent with our expectations. For example, *SIZE* and *TURNOVER* load negatively, whereas *STDRET* loads positively. *ROA* is negatively associated with *ILLIQUIDITY,* which suggests that better-performing firms are more transparent and, thus, exhibit higher liquidity.

Next, we examine the persistence of the information externalities. We break down *POST* into two indicators, *POST0* and *POST1+*, that are set to 1 for year *t* and years *t*+1 to *t*+2, respectively (i.e., *POST* = *POST0* + *POST1+*) and interact them with *TREAT*. After replacing *TREAT* × *POST* with the two new interaction terms, we find a significant negative coefficient on *TREAT* × *POST0* (two-tailed p-value < 0.01) and an insignificant coefficient on *TREAT* × *POST1+* (two-tailed p-value > 0.1), as shown in column (2) of Table 4. Thus, the positive externalities along supply chains persist for one year after customers' adoption of SFAS 161 and disappear in the subsequent two years.[12]

A key assumption underlying our identification strategy is that treatment and control firms would have exhibited parallel trends in liquidity in the absence of SFAS 161. To assess the validity of this assumption, we create an indicator *PRE1* (*PRE2*) set to 1 for year *t*–1 (*t*–2) and interact it with *TREAT*. Adding these two interactions makes the first year of our sample period (i.e., year *t*–3) the benchmark period. The insignificant coefficients on *TREAT* × *PRE1* and *TREAT* × *PRE2* in Table 4 suggest that the treatment effects in years *t*–1 and *t*–2 are small and statistically indistinguishable from the benchmark period. Thus, the continuation of a trend that began in prior years and carried into the post-adoption period is unlikely to explain the finding.

To further rule out the possibility that time-invariant firm attributes explain our results, we add firm fixed effects to Equation (1), which absorb the main effect of *TREAT*. As reported in Online Appendix Table A6, we continue to find a significant negative coefficient on *TREAT* × *POST* (two-tailed p-value < 0.05). Thus, omitted firm characteristics that do not vary over time cannot explain our findings.

Collectively, the results in Table 4 are consistent with the hypothesis that mandatory adoption of SFAS 161 by customers is associated with an increase in the market liquidity of suppliers, since higher transparency of customers' use of derivatives improves suppliers' information environment and lowers information asymmetry in secondary markets.

[12] The results are robust to one-way clustering the standard errors by industry and by firm and two-way clustering by industry and year and by firm and year (see Online Appendix Table A5).

TABLE 4

Stock Liquidity of Suppliers and Customers' Adoption of SFAS 161

	ILLIQUIDITY		
	(1)	**(2)**	**(3)**
TREAT	0.041	0.038	0.029
	(1.02)	(0.96)	(0.46)
TREAT × *POST*	−0.070*		
	(−1.78)		
TREAT × *POST0*		−0.150***	−0.138*
		(−4.34)	(−1.87)
TREAT × *POST1+*		−0.030	−0.019
		(−0.75)	(−0.29)
TREAT × *PRE2*			−0.015
			(−0.21)
TREAT × *PRE1*			0.046
			(0.51)
SIZE	−0.168***	−0.167***	−0.167***
	(−9.69)	(−9.57)	(−9.60)
log(*TURNOVER*)	−0.223***	−0.224***	−0.224***
	(−10.09)	(−10.10)	(−10.06)
log(*STDRET*)	0.579***	0.584***	0.583***
	(10.11)	(10.10)	(10.10)
log(*1* + *ABRET*)	−0.200***	−0.200***	−0.200***
	(−4.70)	(−4.70)	(−4.70)
log(*1* + *PRABRET*)	−0.199***	−0.199***	−0.199***
	(−6.98)	(−6.99)	(−7.02)
LEVERAGE	0.014*	0.014*	0.014*
	(1.95)	(1.88)	(1.95)
BTM	0.122***	0.122***	0.122***
	(3.18)	(3.20)	(3.19)
ROA	−0.383***	−0.382***	−0.383***
	(−4.71)	(−4.70)	(−4.71)
SALE_TO_KEY%	0.010	0.011	0.011
	(0.41)	(0.41)	(0.42)
CSIZE	0.002	0.001	0.002
	(0.12)	(0.10)	(0.12)
CLEVERAGE	−0.008	−0.009	−0.009
	(−0.88)	(−0.93)	(−0.96)
CWITHCDS	0.003	0.003	0.003
	(0.06)	(0.06)	(0.06)
FXIMPT	0.132	0.159	0.137
	(0.39)	(0.47)	(0.41)
IRIMPT	0.190	0.192	0.194
	(0.84)	(0.85)	(0.86)
CMIMPT	−0.322**	−0.317**	−0.321**
	(−2.20)	(−2.15)	(−2.14)
OTHIMPT	−2.766	−2.667	−2.712
	(−1.42)	(−1.34)	(−1.36)
Industry-Year FE	Yes	Yes	Yes
Clustered by Firm, Industry-Year	Yes	Yes	Yes
n	3,054	3,054	3,054
R^2	0.672	0.672	0.672

*, **, *** Denote two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
Table 4 presents coefficients and t-statistics in parentheses, from pooled regressions of the dependent variable, *ILLIQUIDITY*, on the independent variable listed, using both the pre-SFAS 161 period (years t–3 to t–1) and the post-SFAS 161 period (years t to t+2). Figure 2 shows when each variable is measured. Industry-year fixed effects correspond to the 12 Fama-French industries interacted with each year in the sample period. Standard errors are two-way clustered by firm and industry-year.
Detailed variable definitions are provided in Appendix B.

TABLE 5

Changes in Voluntary Disclosure of Suppliers

	DISCLOSURE		
	(1)	**(2)**	**(3)**
TREAT	−0.090	−0.090	−0.076
	(−1.13)	(−1.13)	(−0.95)
TREAT × *POST*	−0.100*		
	(−1.98)		
TREAT × *POST0*		−0.095	−0.109
		(−1.61)	(−1.42)
TREAT × *POST1+*		−0.103*	−0.117*
		(−1.96)	(−1.95)
TREAT × *PRE2*			−0.020
			(−0.36)
TREAT × *PRE1*			−0.023
			(−0.27)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Clustered by Firm, Industry-Year	Yes	Yes	Yes
n	3,054	3,054	3,054
R^2	0.302	0.302	0.302

*, **, *** Denote two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
Table 5 presents coefficients and t-statistics in parentheses, from pooled regressions of the dependent variable, *DISCLOSURE,* on the independent variable listed, using both the pre-SFAS 161 period (years *t*–3 to *t*–1) and the post-SFAS 161 period (years *t* to *t*+2). Controls represent all control variables in Table 4. Industry-year fixed effects correspond to the 12 Fama-French industries interacted with each year in the sample period. Standard errors are two-way clustered by firm and industry-year.
Detailed variable definitions are provided in Appendix B.

Suppliers' Voluntary Disclosure around Customers' Adoption of SFAS 161

Economic theory demonstrates that firms trade off the benefits and costs of various disclosure levers (e.g., derivative disclosures, management forecasts, 8-K filings, and press releases) to achieve an optimal level of information environment (Jung and Kwon 1988; Verrecchia 1990; Einhorn 2005; Bagnoli and Watts 2007; Frenkel, Guttman, and Kremer 2020). To the extent that customers' new disclosures under SFAS 161 better inform investors in supplier firms and, thus, reduce the marginal benefits of their other disclosure levers, supplier firms may dial back on those levers. The adjustments can offset the positive information externalities and make the spillover effect undetectable in equilibrium. To reconcile our findings with this theoretical prediction, we examine supplier firms' voluntary disclosure. As Guay et al. (2016) point out that the theory provides little guidance on voluntary disclosure mediums or the timing of disclosure changes, our analyses are exploratory.

To provide insight into changes in supplier firms' disclosure, we follow Guay et al. (2016) and compute the number of management forecasts (including annual, quarterly, and earnings and non-earnings forecasts) issued in each year, *MFFRQ,* the number of 8-K filings in each year, *8KFRQ*, and the number of firm-initiated press releases in each year, *PRFRQ*. To mitigate the influence of measurement error in any given measure, we extract the first principal component of the three measures. Only the first common factor has an eigenvalue greater than 1, and this factor explains 60.9 percent of the total variation of the measures. The descriptive statistics of the three measures and the first common factor (*DISCLOSURE*) are in Online Appendix Table A7. All three measures are highly correlated with *DISCLOSURE,* with the coefficient ranging from 0.612 (Spearman correlation between *MFFRQ* and *DISCLOSURE*) to 0.766 (Spearman correlation between *PRFRQ* and *DISCLOSURE*).

We replace *ILLIQUIDITY* with *DISCLOSURE* as the new dependent variable and reestimate the specifications in Table 4. As shown in Table 5, column (1), *TREAT* × *POST* loads significantly negatively (two-tailed p-value < 0.1), which suggests a reduction in voluntary disclosure by treatment firms relative to control firms. Table 5, column (2) shows that *TREAT* × *POST0* does not load (two-tailed p-value > 0.1), whereas *TREAT* × *POST1+* loads significantly negatively (two-tailed p-value < 0.1). The results suggest that the managers of supplier firms take a full accounting cycle (i.e., a year) to sort out the extent to which their investors are informed by customers' new disclosures under SFAS 161. Afterward, the supplier firms reduce other disclosure channels in response to increases in customers' mandatory disclosure. The reduction in voluntary disclosure in years

TABLE 6

Cross-Sectional Tests

Panel A: Partition by the Strength of the Economic Link and Changes in Customers' Disclosure

	ILLIQUIDITY *HIGH* = 1 for . . . (0 otherwise)		
	Above Median of Earnings Correlations with Customers (1)	**Above Median of Customers' Decrease in *ILLIQUIDITY* (2)**	**Above Median of Customers' Change in Derivative Word Count (3)**
TREAT	0.033	0.056	0.002
	(0.68)	(1.37)	(0.03)
TREAT × *POST*	−0.114***	−0.098**	−0.089*
	(−3.07)	(−2.53)	(−1.93)
TREAT_HIGH	−0.035	−0.099*	0.056
	(−0.54)	(−1.81)	(0.84)
TREAT_HIGH × *POST*	−0.135*	−0.114**	−0.214***
	(−1.91)	(−2.34)	(−3.23)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Clustered by Firm, Industry-Year	Yes	Yes	Yes
n	2,036	2,036	2,036
R^2	0.677	0.693	0.677

(continued on next page)

t+1 and *t*+2 offers an explanation for the undetectable liquidity effect during these years in Table 4.[13] Table 5, column (3) shows that the reduction does not appear before the adoption of SFAS 161.

Cross-Sectional Tests

We conduct several cross-sectional tests motivated by the two steps of hypothesis development, as well as insight from the derivative disclosure literature. Specifically, we partition the treatment firms into two subsets and examine whether one subset exhibits greater improvements in liquidity than the other subset, compared with the control firms.[14] Since Table 4, column (2) shows the one-year persistence of the information externalities, we drop the observations in years *t*+1 and *t*+2 to carry out the cross-sectional tests.

The first test is motivated by the idea that when firms have stronger economic links with their customers, customers' disclosures are more useful to alleviate information asymmetry among investors in these firms. As such, we expect greater increases in market liquidity following customers' adoption of SFAS 161. For each treatment firm, we measure the economic link as the correlation coefficient between its quarterly return on equity before extraordinary items and the affected customer's over the five-year period immediately preceding the initial date of SFAS 161 adoption (*INITIAL_DATE*). For treatment firms with more than one affected customer, we take the average of the coefficient weighted by sales to that customer. In column (1) of Table 6, Panel A, *TREAT_HIGH* is set to 1 if a treatment firm's economic link is above the sample median, and 0 otherwise (for below-the-sample-median treatment firms and control firms). We find that *TREAT_HIGH* × *POST* loads significantly

[13] We also use each voluntary disclosure measure as the dependent variable and find that *TREAT* × *POST1+* loads significantly negatively for *8KFRQ* and *PRFRQ*, but not for *MFFRQ*. Notably, we do not argue that changes in the three voluntary disclosure measures are the only reason for the absence of the information externalities in years *t*+1 and *t*+2. Adjustments on other dimensions in these years may also contribute to it. Quantifying the effects of these adjustments on the persistence of the information externalities is beyond the scope of this paper.

[14] We do not split control firms since many partition variables as discussed below (e.g., changes in affected customers' derivative disclosures and gains/losses on designated/non-designated derivatives) are unavailable for them.

TABLE 6 (continued)

Panel B: Partition by the Content of Customers' Disclosure

	ILLIQUIDITY *HIGH* = 1 for ... (0 otherwise)		
	Above Median of Magnitude of Customers' G&L on Designated Derivatives/ |Net Income| (1)	**Above Median of Magnitude of Customers' G&L on Non-Designated Derivatives/ |Net Income| (2)**	**Average Customers' Net Gains or Losses on Derivatives/ |Net Income| is Positive (3)**
TREAT	0.028	0.011	0.025
	(0.89)	(0.18)	(0.57)
TREAT × *POST*	−0.035	−0.165***	−0.130**
	(−1.07)	(−2.80)	(−2.26)
TREAT_HIGH	0.009	0.001	−0.024
	(0.21)	(0.02)	(−0.36)
TREAT_HIGH × *POST*	−0.117*	−0.026	−0.101
	(−1.83)	(−0.87)	(−1.07)
Controls	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Clustered by Firm, Industry-Year	Yes	Yes	Yes
n	1,880	1,820	2,036
R^2	0.747	0.676	0.676

*, **, *** Denote two-tailed statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.
Table 6 presents coefficients and t-statistics in parentheses, from pooled regressions of *ILLIQUIDITY* on the independent variable listed. Controls represent all control variables in Table 4. Industry-year fixed effects correspond to the 12 Fama-French industries interacted with each year in the sample period. Standard errors are two-way clustered by firm and industry-year.
Detailed variable definitions are provided in Appendix B.

negatively (two-tailed p-value < 0.1), consistent with greater improvements in market liquidity for treatment firms that have stronger economic links with affected customers.

The second cross-sectional test is motivated by the idea that for customers with more increases in derivative disclosures per SFAS 161, the positive spillover effects along supply chains are larger. Two variables are used to capture the changes in customers' derivative disclosures. For the first variable, we compute the decrease in *ILLIQUIDITY* for a customer from the year before to the year after its adoption of SFAS 161. For the second one, we calculate the change in the count of derivative and hedging words or phrases, defined in Steffen (2015), between the first 10-K/Q under SFAS 161 and the previous 10-K/Q of the same fiscal period. We scale both variables by the customer's market capitalization. For treatment firms with more than one affected customer, we take the average of each variable weighted by sales to that customer. In column (2) (column (3)) of Table 6, Panel A, *TREAT_HIGH* is set to 1 for a treatment firm if the customers' liquidity improvement (change in the derivative word count) is above the sample median, and 0 otherwise. The significant negative coefficient on *TREAT_HIGH* × *POST* (two-tailed p-value < 0.05 or 0.01) suggests that firms experience greater increases in market liquidity when their customers disclose more about the use of derivatives after SFAS 161 adoption.

In the next two cross-sectional tests, we examine whether the information externalities vary with the content of enhanced disclosures under SFAS 161. When customers disclose a higher magnitude of gains/losses on derivatives, the disclosures are more important in reducing the information asymmetry among investors in supplier firms. Research documents that under SFAS 161, gains and losses on designated derivatives are more informative about firm value and risk than those on non-designated derivatives (Manchiraju et al. 2018; Pierce 2020). Based on this insight, we expect greater increases in liquidity for firms whose customers exhibit a larger magnitude of gains and losses on designated derivatives. This interaction effect should be weaker or undetectable for the magnitude of gains and losses on non-designated derivatives. We calculate the sum of the absolute value of gains or losses on designated (non-designated) derivatives disclosed by each affected customer on the adoption date of SFAS 161, scaled by its absolute value of net income for the same fiscal period. For treatment firms with more than one affected customer, we take the average of each variable weighted by sales to that customer. In column (1) (column (2)) of Table 6, Panel B, *TREAT_HIGH* is set to 1 for treatment firms with an above-median magnitude of customers' gains and losses on designated (non-designated) derivatives, and 0 otherwise.[15] Consistent with our expectation, $TREAT\_HIGH \times POST$ loads significantly negatively in column (1) (two-tailed p-value < 0.1), but does not load in column (2). Thus, the results suggest that the newly disclosed gains and losses on the designated derivatives of customers matter more than those on non-designated derivatives in the information externalities.

Kothari, Li, and Short (2009) argue that disclosure content has a directional effect on investor uncertainty and, thus, information asymmetry in capital markets, with more favorable (unfavorable) news reducing (increasing) the cost of capital. Using textual analysis to measure the content of corporate disclosures, analyst reports, and the business press, they find consistent results for the business press, but *not* for corporate disclosures or analyst reports. In the last cross-sectional test, we examine whether our results are solely driven by favorable derivative-related news in the SFAS 161 adoption year (e.g., changes in commodity prices that benefit the affected customers) rather than the new disclosures under SFAS 161. Our control variables related to derivative markets' impacts on treatment firms (*FXIMPT, IRIMPT, CMIMPT,* and *OTHIMPT*) and industry-year fixed effects mitigate this issue to some extent. Nevertheless, we conduct an additional test based on the intuition that the net gains/losses on derivatives serve as a summary measure of the aggregate effect of current price changes across all the firm's derivatives (Campbell 2015). We calculate the net gains or losses on all derivatives disclosed by each affected customer on the SFAS 161 adoption date, scaled by its absolute value of net income for the same fiscal period. For treatment firms with more than one affected customer, we take the average weighted by sales to that customer. In column (3) of Table 6, Panel B, *TREAT_HIGH* is set to 1 for a treatment firm if its customer reports net gains on derivatives, and 0 otherwise. The mean of net gains (losses) is 0.226 (−0.309) for treatment firms with $TREAT\_HIGH = 1$ (0). While $TREAT \times POST$ loads significantly negatively (two-tailed p-value < 0.05), $TREAT\_HIGH \times POST$ does not load (two-tailed p-value > 0.1). The results suggest that the improvement in stock liquidity of supplier firms does not depend on the sign of net gains or losses on derivatives of customers. As such, merely favorable changes in the derivative value in the SFAS 161 adoption year are unlikely to explain the increased liquidity of treatment firms.

V. CONCLUSION

We present evidence on the information externalities along supply chains of a derivative disclosure mandate, SFAS 161. Using a sample of firms that are non-users of derivatives (thus, not directly affected by the mandate), we find an increase in firms' stock liquidity after their customers expand derivative disclosures under SFAS 161, in comparison to firms whose customers are unaffected by the standard. The increase in stock liquidity does not appear before customers adopt SFAS 161, persists for one year after the adoption, and then becomes insignificant in subsequent years as the firms dial back their voluntary disclosure. The information externalities are more salient for firms that have stronger economic links with the affected customers and firms with customers who experience greater increases in derivative disclosures after SFAS 161. Overall, the evidence suggests that mandated disclosures under SFAS 161 improve short-term stock liquidity along supply chains. The study contributes to the evaluation of SFAS 161 specifically, and an evidence-based approach to disclosure and reporting regulation broadly.

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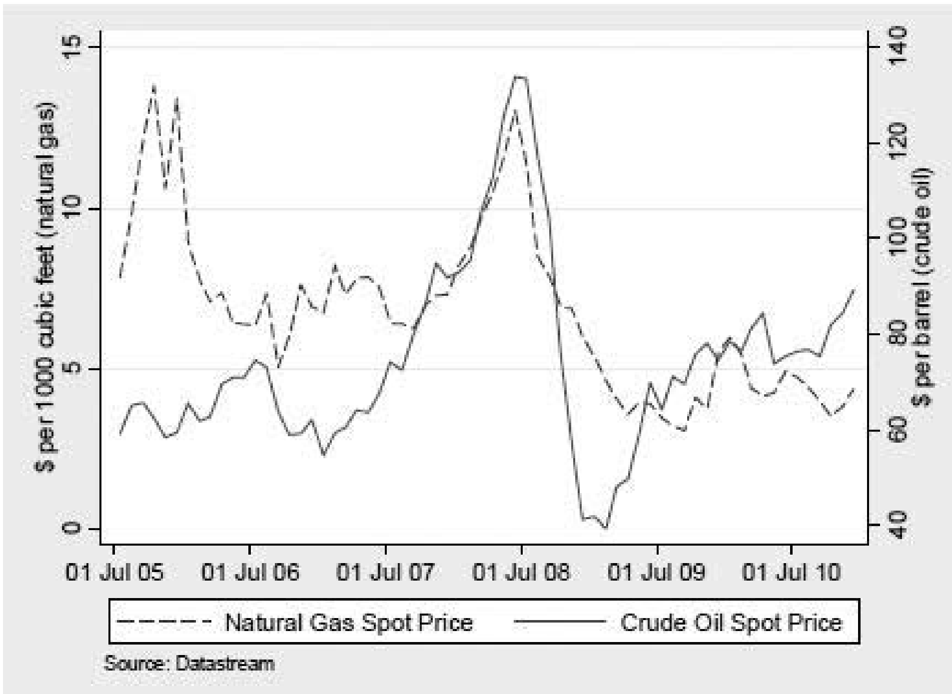
APPENDIX A

New Disclosures under SFAS 161 Help Investors in Supplier Firms

We provide a case study in the energy industry to illustrate how new disclosures under SFAS 161 improve the information environment for investors in supplier firms.



Natural Gas Services Group (NYSE: NGS) provides gas compression equipment and services to the natural gas and oil industry in the United States. Naturally, the company's revenue heavily depends on energy prices. As shown in the graph, oil and gas prices plummeted in mid-2008 and did not recover as of 2010. In its 2008 10-K, the company warned investors: "the erosion of the financial condition of our customers could adversely affect our business." It further explained: "Many of our customers finance their exploration and development activities through cash flow from operations, the incurrence of debt or the issuance of equity. During times when the oil or natural gas markets weaken, our customers are more likely to experience a downturn in their financial condition. Many of our customers' equity values have substantially declined in recent months, and the capital markets have been unavailable as a source of financing to these customers. The combination of a reduction in cash flow resulting from declines in commodity prices, a reduction in borrowing bases under reserve-based credit facilities and the lack of availability of debt or equity financing will result in a reduction in our customers' spending for our products and services in 2009. For example, our customers could seek to preserve capital by canceling month-to-month contracts, canceling or delaying scheduled maintenance of their existing natural gas compression equipment or determining not to enter into any new natural gas compression service contracts or purchase new compression equipment." NGS's total revenue dropped from $85 million in 2008 to $68 million in 2009.

Sales to XTO Energy Inc. (NYSE: XTO) amounted to 26 percent of NGS's revenue in 2008. XTO heavily use natural gas futures and basis swaps and crude oil futures to manage exposures to commodity price fluctuations. For example, the change in hedge derivative fair value, net of income tax, was $2,444 million, or 32 percent of total revenue in 2008. Most of these derivatives are designated as cash flow hedges. Realized gains/losses on these hedge derivatives are recognized in oil and gas revenue. Unrealized gains/losses on the derivatives are recognized in other comprehensive income and will be reclassified to revenue when the hedged transactions occur (i.e., sales of oil and gas). Thus, the unrealized gains/losses significantly influence XTO's future performance and, thus, demand for NGS's equipment and services.

Prior to SFAS 161, XTO did not disclose quarterly unrealized gains/losses on hedge derivatives, segregated by natural gas versus crude oil. Except for the first half-year of 2008, their prices did not commove closely and sometimes diverged, representing different types of risk. For example, while the crude oil price rose by 17 percent from December 15, 2008 to March 15, 2009, the natural gas price decreased by 32 percent during the same period. XTO did report the quarterly unrealized gains/losses in aggregate in the statement of comprehensive income, but it offers little insight on the sensitivities of XTO's performance *in value terms* to these two types of risk separately.

XTO adopted SFAS 161 in 2009Q1. As disclosed in the 10-Q filed on May 6, 2009, XTO had $1,309 million unrealized gains on natural gas derivatives and $54 million unrealized gains on crude oil derivatives. The $1,309 million is a sizable amount, in comparison to the total revenue of $2,161 million in 2009Q1, suggesting that XTO is well protected from the drop in natural gas prices. Investors can also estimate the sensitivity of XTO's performance to natural gas prices and use it to better value NGS when natural gas prices change. NGS's stock price was closed at $11.60 on May 6, 2009 (XTO's 2009Q1 10-Q filing date), representing a 6 percent increase from the close price of $10.98 on May 5, 2009. The reduction in uncertainty also improved market liquidity. The means (medians) of NGS's daily bid-ask spreads during the 12 months preceding and after May 6, 2009 are 1.29 (1.17) and 0.68 (0.60), respectively.

APPENDIX B

Variable Definitions

Variable	Definition	Source
ILLIQUIDITY	The first common factor from principal component analysis of the four liquidity measures: *SPREAD, ZERORET, PRCIMPACT,* and *TRANCOST*.	CRSP
SPREAD	The yearly median of daily quoted spreads, measured at the end of each trading day as the difference between the bid and ask prices divided by the midpoint.	CRSP
ZERORET	The proportion of trading days with zero daily stock returns out of all potential trading days in a given year.	CRSP
PRCIMPACT	The yearly median of the Amihud (2002) illiquidity measure (i.e., the daily absolute stock return divided by US$ trading volume), multiplied by 1,000,000.	CRSP
TRANCOST	An estimate of total round-trip transaction costs (including bid-ask spreads, commissions, as well as implicit costs from short-sale constraints or taxes) based on a yearly time-series regression of daily stock returns on the aggregate market returns, following Lesmond et al. (1999).	CRSP
TREAT	An indicator set to 1 if the firm's customer is affected by SFAS 161, and 0 otherwise.	EDGAR/ Compustat
POST	An indicator set to 1 for the post-SFAS 161 period (years t to $t+2$), and 0 for the pre-period (years $t-3$ to $t-1$). We define the pre-period as the 36-month period that ends one day before *INITIAL_DATE,* and the post-period as the 36-month period starting on *INITIAL_DATE*. For a treatment firm, *INITIAL_DATE* is the filing date of its affected customer's first 10-K/Q adopting SFAS 161. If the treatment firm has relationships with more than one affected customer in the post-period, the earliest filing date is used. For a control firm, *INITIAL_DATE* is its customer's 10-K/Q filing date for the first reporting period beginning after the effective date of SFAS 161 (November 15, 2008).	EDGAR
PRE1	An indicator set to 1 for year $t-1$, and 0 otherwise.	EDGAR
PRE2	An indicator set to 1 for year $t-2$, and 0 otherwise.	EDGAR
POST0	An indicator set to 1 for year t, and 0 otherwise.	EDGAR
POST1+	An indicator set to 1 for years $t+1$ and $t+2$, and 0 otherwise.	EDGAR
SIZE	Log of market cap (CSHO $*$ PRCC_F) as of a fiscal year-end.	Compustat
TURNOVER	The annual US$ trading volume divided by the market cap for a year.	CRSP
STDRET	The standard deviation of daily stock returns during a year.	CRSP
ABRET	Cumulative size and book-to-market adjusted stock return during a year.	CRSP
PRABRET	Cumulative size and book-to-market adjusted stock return during the previous year.	CRSP
LEVERAGE	The debt (DLC + DLTT) to equity (CEQ) ratio as of a fiscal year-end.	Compustat
BTM	The book (CEQ) to market (CSHO $*$ PRCC_F) ratio as of a fiscal year-end.	Compustat
ROA	Income before extraordinary items (IB) divided by total assets (AT).	Compustat
SALE_TO_KEY%	The percentage of sales to all key customers (SALECS) out of net sales (SALE) during a fiscal year.	Compustat
CSIZE	Log of the average of each customer's market cap as of a fiscal year-end, weighted by sales to the customer (SALECS).	Compustat
CLEVERAGE	Average of each customer's debt to equity ratio as of a fiscal year-end, weighted by sales to the customer (SALECS).	Compustat
CWITHCDS	An indicator set to 1 if the firm's customers are referenced in CDS trading during a year, and 0 otherwise.	Datastream
FXIMPT	The percentage of sales to key customers (SALECS) that use derivatives to manage foreign exchange risk out of net sales (SALE) times the average total market value of foreign exchange derivative contracts outstanding in trillion US$ at the beginning and end of a year.	EDGAR/ Compustat/ Bank for International Settlements

(continued on next page)

APPENDIX B (continued)

Variable	Definition	Source
IRIMPT	The percentage of sales to key customers (SALECS) that use derivatives to manage interest rate risk out of net sales (SALE) times the average total market value of interest rate derivative contracts outstanding in trillion US$ at the beginning and end of a year.	EDGAR/ Compustat/ Bank for International Settlements
CMIMPT	The percentage of sales to key customers (SALECS) that use derivatives to manage commodity risk out of net sales (SALE) times the average total market value of commodity derivative contracts outstanding in trillion US$ at the beginning and end of a year.	EDGAR/ Compustat/ Bank for International Settlements
OTHIMPT	The percentage of sales to key customers (SALECS) that use derivatives to manage equity and credit risk out of net sales (SALE) times the average total market value of equity and credit derivative contracts outstanding in trillion US$ at the beginning and end of a year.	EDGAR/ Compustat/ Bank for International Settlements
DISCLOSURE	The first principal component of three disclosure proxies, *MFFRQ*, *8KFRQ,* and *PRFRQ*.	EDGAR/ I/B/E/S
MFFRQ	The number of management forecasts (including annual, quarterly, earnings and non-earnings forecasts) issued in a year.	I/B/E/S
8KFRQ	The number of 8-K filings in a year.	EDGAR
PRFRQ	The number of firm-initiated press releases.	RavenPack

APPENDIX C

accr-53022_Online Appendix: http://dx.doi.org/10.2308/accr-53022.s01