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The effect of Statement of Financial Accounting Standards No. 157 Fair Value Measurements on analysts' information environment ☆

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A B S T R A C T

This study examines the effect of the adoption of Statement of Financial Accounting Standards No. 157 *Fair Value Measurements* (hereafter FAS 157) on analysts' information environment. A major controversy surrounding FAS 157 disclosures is whether Level 3 measurements provide useful information to financial statement readers. We provide evidence suggesting that FAS 157 disclosures regarding Level 3 measurements are able to reduce uncertainty in analysts' information environment. Our results reveal that the provision of such fair value disclosures is associated with reduced uncertainty regarding future earnings and lower forecast errors. We also find that unrealized gains and losses from fair value changes in Level 3 measurements are positively associated with firms' future performance. Overall, our findings suggest that disclosures related to FAS 157 fair value measurements improve analysts' information environment. Our findings thus contribute to the debate regarding the extent of fair value accounting in financial reporting.

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1. Introduction

The Financial Accounting Standards Board (FASB) issued Statement of Financial Accounting Standards No. 157 *Fair Value Measurements* (hereafter FAS 157) in September 2006. The purpose was to enable financial statement readers to better interpret and understand reported fair value estimates across various categories of assets and liabilities. FAS 157 considerably increases the disclosure requirements related to the fair value estimation process, including disclosures about the methodologies and inputs used to determine fair values.[1] Thus, the adoption of FAS 157 provides a better means for interpreting fair value measurements as well as assessing the underlying reliability of the fair value estimates. Nevertheless, there are concerns regarding how much the improved disclosure requirements in FAS 157 are able to help financial statement readers better understand the fair value measurement process (AAA FASC, 2005; Ryan, 2008; SEC, 2008).

In this paper, we examine whether disclosures about Level 3 measurements as a result of FAS 157 adoption reduce analysts' uncertainty about future earnings for firms that hold significant amounts of Level 3 assets and liabilities (hereafter Level 3 assets for brevity).[2] A major controversy surrounding FAS 157 disclosures is whether mark-to-model measurements (i.e., Level 3 measurements) are able to provide useful information to market participants (e.g., Hodder et al., 2014). This is because Level 3 measurements require considerable managerial discretion in the appropriate selection and application of valuation techniques, forecast assumptions, and valuation inputs. The discretion afforded to managers in the fair value estimation of these measurements may lead to opportunistic managerial behavior that biases these estimates. Even in the absence of managerial bias, proper estimation of these fair values is more challenging due to general uncertainty in the selection of appropriate valuation parameters such as the relevant discount rate or the prediction of future cash flows.

In view of greater estimation uncertainty pertaining to these fair value measurements, standard setters require firms to prioritize Level 1 and Level 2 valuation inputs over Level 3 valuation inputs in the fair value measurement process. Standard setters also require firms to disclose more information pertaining to the fair value estimation process of Level 3 assets. These more comprehensive disclosures are intended to help a financial statement reader better understand the impact of Level 3 measurements on a firm's earnings and to reduce the opacity surrounding the fair value measurement process of these assets and liabilities.[3] Greater insights about the fair values of a firm's assets and liabilities should, in turn, help reduce analyst uncertainty about a firm's future performance (Barth, 2006, p. 283).

Prior research provides evidence suggesting that fair values based on unobservable inputs have higher information risk relative to those based on observable inputs (Riedl and Serafeim, 2011). There is also empirical evidence suggesting that investors have reliability concerns for Level 3 estimates (e.g., Song et al., 2010). While these studies investigate the cross-sectional differences in the information risk and reliability of Level 3 measurements relative to Level 1 and Level 2 measurements, our study examines the time-series differences in the firms' information environment before and after the adoption of FAS 157. Level 3 assets and liabilities existed before the adoption of FAS 157, but information regarding Level 3 estimates only became publicly available as a result of FAS 157 disclosure requirements. Hence, we examine whether more comprehensive disclosures about Level 3 measurements as a result of FAS 157 adoption is beneficial to analysts.

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[1] A major disclosure requirement from FAS 157 is the disclosure of the fair value hierarchy information as a footnote disclosure. The disclosure of the fair value hierarchy provides information about how much of a firm's assets and liabilities are valued based on: (1) market prices directly (Level 1 inputs), (2) other observable market-based inputs (Level 2 inputs), or (3) firm-supplied unobservable inputs (Level 3 inputs). These fair value measurements were not previously disclosed to market participants prior to FAS 157 adoption.

[2] This category generally includes the following assets and liabilities: certain private equity investments; retained residual interests in securitizations; residential mortgage servicing rights (MSRs); asset-backed securities (ABS); highly structured, complex or long-dated derivative contracts; and certain collateralized debt obligations (CDOs) where independent pricing information is unavailable for a significant portion of the underlying assets.

[3] The Securities and Exchange Commission report on mark-to-market accounting (SEC, 2008, p. 90) states, "changes in the fair value of Level 3 instruments had a significant impact on equity. Using absolute dollars, the impact of Level 3 instruments was 10% and 7% of equity (on a comparable nine-month basis) for the first quarter and first three quarters of 2008, respectively."

We find evidence that expanded FAS 157 disclosures reduce uncertainty about firms' future earnings among analysts in the post-FAS 157 period when compared with the pre-FAS 157 period. We adopt a difference-in-difference research design approach in order to properly isolate the informational impact of FAS 157 disclosures relating to Level 3 measurements from other disclosures. Specifically, our treatment sample firms are firms that hold significant amounts of Level 3 assets whereas our control firms are firms that do not hold Level 3 assets, and consequently do not provide disclosures pertaining to Level 3 fair value measurements. We match treatment and control firms based on a propensity score matching algorithm. We find that there is an incremental reduction in analyst uncertainty about future earnings in the period after the adoption of FAS 157 for firms holding significant amounts of Level 3 assets. In contrast, the incremental reduction in analyst uncertainty in the period after the adoption of FAS 157 is smaller for the control firms. Our test results suggest that there is an incremental informational benefit to analysts stemming from the availability of disclosures relating to Level 3 fair value measurements as a result of FAS 157 adoption.

Our inferences are based on tests using measures of financial analysts' information environment as developed in Barron et al. (1998, hereafter BKLS). We use the BKLS uncertainty measure because it provides direct evidence regarding the usefulness of FAS 157 disclosures to analysts (e.g., Botosan and Stanford, 2005).[4] We also use measures of forecast accuracy and forecast dispersion in our empirical tests to corroborate our BKLS results. Our test results hold for a broad sample of financial and nonfinancial firms, but we find stronger results when we run these empirical analyses for the sample of financial firms only. Hence, we provide empirical evidence to document that there is an incremental informational benefit when firms comply with FAS 157 disclosure requirements by providing more comprehensive fair value disclosures about Level 3 estimates.

To provide additional evidence, we also examine whether unrealized gains and losses from fair value changes in the Level 3 estimates (hereafter, unrealized Level 3 fair value gains) are informative about firms' future performance. We expect the unrealized Level 3 fair value gains to be positively associated with firms' future performance if fair value changes contain useful information about managers' expectations regarding changes in the future benefits of these instruments (e.g., Barth, 2000; Linsmeier, 2011; Altamuro and Zhang, 2013; Evans et al., 2014). On the other hand, we expect the unrealized Level 3 fair value gains to be uninformative about the firms' future performance if these fair value changes are measured with significant errors or managerial biases. We find that the unrealized Level 3 fair value gains and losses are positively associated with firms' future performance. Our tests thus suggest that more comprehensive fair value disclosures related to Level 3 estimates provide analysts with a better understanding of the implications of fair value measurements to firms' performance. We also find similar results when we restrict our sample to financial firms only.

From a public policy perspective, our findings contribute to the debate regarding the extent of fair value accounting in financial reporting. Specifically, analyzing whether and how FAS 157 related disclosures translate into an improvement in analysts' information environment is a critical issue of interest to standard setters and other interested parties. Critics of fair value accounting have highlighted several concerns with the use of fair value accounting (Benston, 2006, 2008). A principal concern is whether fair value estimates that are not based on actual market prices could be misused by firms.[5] The fair value debate remains a contentious issue. For example, Lim et al. (2013) find that the reclassification choice of financial assets from fair value to amortized cost during the financial crisis reduces analyst forecast accuracy and increases forecast dispersion. In that regard, our study provides additional evidence to the fair value accounting debate, particularly with respect to Level 3 measurements.

[4] We use the BKLS overall uncertainty measure as our measure in assessing whether FAS 157 disclosures are associated with a reduction in analysts' overall uncertainty about a firm's future earnings. The BKLS uncertainty measure is viewed as a more precise measure of analysts' uncertainty than analyst forecast dispersion (e.g., Barron et al., 2009). Analysts' overall uncertainty about future earnings is expected to decline if FAS 157 disclosures provide useful information to analysts to aid in their earnings forecasting process.

[5] For example, Benston (2006) discusses how Enron's early use of Level 3 fair value measurements played an important role in its demise.

The remainder of our paper proceeds as follows. Section 2 describes the institutional background surrounding the adoption of FAS 157 and our hypotheses development. Section 3 describes our sample data, research design, and measurement of variables. Section 4 presents the main results and other additional analyses. Section 5 concludes.

2. Background and hypothesis development

2.1. Background

FAS 157 (now codified in FASB ASC 820) requires expanded disclosures about existing fair value measurements.[6] The FASB expects that expanded disclosures about reported fair values will provide users of financial statements with better information about (1) the source of prices used to measure certain assets and liabilities, (2) other inputs used to develop fair value measurements, and (3) the effect of these measurements on earnings. In addition, the FASB believes that a single definition of fair value, together with a framework for measuring fair values, increases consistency and comparability across reported fair values.

The FASB states that a major objective of FAS 157 is to improve the transparency and comparability of assets and liabilities reported based on fair values. The reporting of fair value estimates in accordance with a three-level hierarchy based on the type of valuation inputs may enable financial statement users to better understand how firms generate their fair value estimates (AAA FASC, 2005). FAS 157 footnote disclosures can be very substantial. For example, JP Morgan Chase & Co has 14 pages of FAS 157 related disclosures (Note 4: Fair Value Measurement) in their 2008 10-K filing report (pp. 129–142). Hence, one can view FAS 157 disclosures as providing useful information to reduce uncertainty about firms' fair value measurement processes. Although FAS 157 compliance requires expanded disclosures, the debate concerning whether there is any benefit to Level 3 disclosures is especially contentious (Benston, 2008; Ryan, 2008; Laux and Leuz, 2010).

2.2. Informational role of FAS 157 disclosures

Researchers have put forth various arguments for why fair value disclosures play an important informational role. Fair value estimates theoretically reflect unbiased information about assets' future cash flows (Plantin et al., 2008). Because fair value estimates represent the present value of expected future cash flows, changes in fair values reflect the impact of changing economic conditions on a firm (Linsmeier, 2011). Such information is expected by some to be useful and relevant to analysts (Barth, 2000, 2006; Evans et al., 2014). Specifically, Barth (2000) states that firms' reported fair values can provide information that is relevant when predicting future earnings (p. 19). If we view assets as resources that can bring economic benefits to a firm in the future and liabilities as obligations owed by the firm, correctly measured fair values of a firm's assets and liabilities can provide information about a firm's future earnings. In that regard, Barth (2006) asserts that there is an informational role for footnote disclosures to explain the fair value estimates.[7]

Another major informational benefit of FAS 157 disclosures may be that they provide new insights to enable financial statement readers to better assess the extent of uncertainty inherent in reported fair value estimates (Ryan, 2008). For example, the standard requires firms to provide quantitative reconciliations of beginning and end-of period Level 3 fair value measurements in a tabular format. Firms are required to disclose the fair value gains and losses from net purchases, sales, issuances, settlements, and transfers of their Level 3 assets. They are also required to discuss any changes in valuation

[6] SFAS 157 is classified as Accounting Standards Codification (ASC) 820 *Fair Value Measurements and Disclosures* in the updated FASB Codification. The disclosure requirements for the expanded fair value disclosures are specifically stated in FAS 157 under para 32(a)–(d), para 33 (a)–(b), para 32 (e), and para 33 (c)–(d). Fair value accounting for financial instruments has been in use for many years. Under FAS 107 (now codified in ASC 825-10) firms are required to disclose the fair values of all financial instruments, including loans, in the footnotes to the financial statements. However, disaggregated fair value information (e.g., mark-to-market versus mark-to-model fair value estimates) has expanded significantly only in the past few years with FAS 157 adoption.

[7] Appendix A provides some illustrations as to how these fair value disclosures are processed and interpreted by analysts.

techniques. Hence, analysts and other financial statement readers are now able to separately analyze fair value gains and losses based on Level 3 measurements. Such information was previously unavailable to financial statement users prior to the adoption of FAS 157.

Overall, these disclosures are intended to make the effects of Level 3 measurements on the financial statements more transparent than they would have been under prior GAAP. For example, Laux and Leuz (2009) argue that the informativeness of fair value measurements is improved by providing more extensive and comprehensive disclosures about these estimates.[8] In addition, more comprehensive Level 3 disclosures may limit agency problems pertaining to opportunistic managerial behavior and reduce the opacity of accounting estimates (Riedl and Serafeim, 2011). The FASB requires firms to disclose more information about the fair value estimation process of Level 3 assets because they are concerned that there is greater estimation uncertainty pertaining to these assets. Hence, more disclosure about these instruments is necessary. However, it is questionable whether there is an incremental informational benefit in relation to Level 3 disclosures as a result of FAS 157 adoption.

Whether FAS 157 disclosures about Level 3 measurements translate into an improvement in analysts' information environment depend on various factors. Such disclosures will be informative if managers are able to truthfully convey useful private information surrounding the fair value estimation of these assets and liabilities (Barth and Landsman, 1995). On the other hand, it is also possible that Level 3 disclosures may not be helpful to analysts in their information processing tasks. There are significant concerns that Level 3 estimates require considerable managerial discretion in terms of the appropriate selection and application of valuation techniques, forecast assumptions, and valuation inputs. Different valuation techniques (and using various subjective assumptions and valuation inputs) will yield widely varying fair value estimates. The extent to which managers will engage in opportunistic behavior that results in unreliable estimates is unclear. Even in the absence of managerial bias, proper estimation of fair values may be challenging due to general uncertainty in the selection of appropriate valuation parameters in the absence of actively traded markets for Level 3 assets. Hence, the disclosure of more extensive information about Level 3 measurements may introduce greater uncertainty among analysts given the uncertain nature of these financial instruments. Consequently, more comprehensive disclosures pertaining to Level 3 measurements in the post-FAS 157 period may not help reduce uncertainty about firms' future earnings.

Thus, our first hypothesis is expressed in null form as follows:

H1. FAS 157 disclosures pertaining to Level 3 measurements do not reduce analyst uncertainty about future earnings.

2.3. Unrealized Level 3 fair value gains and losses

Related to our first hypothesis, we also examine whether information regarding the unrealized gains and losses from fair value changes of Level 3 financial instruments are able to convey useful information about firms' future earnings. Fair value changes incorporate managers' private information regarding their current expectations of the future cash flows pertaining to the firm's Level 3 assets and liabilities. Such information is potentially informative to analysts because changes in the fair value of these assets and liabilities potentially will impact firms' future performance (e.g., Altamuro and Zhang, 2013; Evans et al., 2014). On the other hand, it is debatable whether Level 3 fair value changes are able to convey useful information given the inherent uncertain nature of these financial instruments.

We regard this test as providing additional support for the argument that Level 3 disclosures are able to convey useful information to financial statement readers. It is possible that managers can provide fair value estimates that are informative about firms' future earnings because they have access to private information and apply it objectively (e.g., Barth and Clinch, 1998; Aboody et al., 1999). In such a case, we would expect to find a positive association between Level 3 assets' fair value changes and

[8] Similarly, the American Accounting Association's Financial Accounting Standards Committee recommends increased disclosure of information about the process used to estimate fair values (AAA FASC, 2005).

future earnings. On the other hand, we expect to find the unrealized gains and losses from Level 3 fair value changes to be unassociated with firms' future earnings if these estimates are fraught with measurement error or managerial bias.

Prior empirical research provides mixed evidence regarding the usefulness of fair value changes that are not derived directly from quoted prices in active trading markets. Aboody et al. (1999) provide evidence to suggest that upward revaluations of fixed assets by UK firms are significantly positively related to firms' future performance. Altamuro and Zhang (2013) show that the fair values of mortgage servicing rights (MSRs) based on model inputs (i.e., Level 3 estimates) better reflect the persistency of future service fees compared with the fair value of MSRs based on market-based inputs (i.e., Level 2 estimates). On the other hand, Cantrell et al. (2014) find that models using the fair value reserve do not have better predictive ability for credit losses compared to models with the loan loss reserve. Finally, prior research has also demonstrated the existence of opportunistic behavior across different types of subjective estimates that require managerial judgment, including stock-based compensation (Aboody et al., 2006), warranty reserves (Cohen et al., 2011), and goodwill impairments (Beatty and Weber, 2006). Hence, our second hypothesis, stated in the null form, is as follows:

H2. Unrealized gains and losses from Level 3 fair value changes are not informative about firms' future earnings.

3. Research design

3.1. Variable measurement

We use a measure proposed by Barron et al. (1998, hereafter BKLS) to test for uncertainty among analysts. The BKLS uncertainty measure is an aggregated uncertainty measure across all individual analysts for the same firm *i*. We use this measure to examine whether the adoption of FAS 157 is associated with changes to analysts' information environment. It is measured as follows:

$$UNCERTAINTY_{it} = V_{it} = \sum_{1}^{N} \frac{(F_j - A)^2}{N} = \left(1 - \frac{1}{N}\right) D + SE$$

where

N = the number of annual earnings forecasts;

D = the dispersion in analysts' one-year ahead earnings forecasts (*DISPERSION*), which is calculated as the sample variance of individual analysts' forecasts (F_j) around the mean forecasts ($\overline{F}$) for period t;

SE = squared error in the mean forecast (*ACCURACY*), which is calculated as the mean of the squared differences between individual analysts' forecasts (F_j) and firm's reported earnings (A) for period t.

By using observable attributes of analysts' forecasts to derive an empirical estimate from multiple analysts, the BKLS uncertainty measure is theoretically a more powerful measure than forecast dispersion because it incorporates analysts' common uncertainty as well as analysts' idiosyncratic uncertainty. We measure the change in the BKLS uncertainty measure around the 10-K and 10-Q filing dates. We compute the change variable by using one-year ahead earnings forecasts issued within the 30-day window prior to the quarter t filing dates and revised within a 30-day window following the same filing date ($\Delta UNCERTAINTY$). By using a change variable, we are able to assess how information uncertainty has changed following the release of the firms' 10-K and 10-Q filings. We then compare this change with the change in uncertainty around the firms' 10-K and 10-Q filings prior to FAS 157 adoption. Notwithstanding the use of the BKLS uncertainty measure as our primary measure, we also ran our empirical analyses using both analyst dispersion (*DISPERSION*) and forecast accuracy (*ACCURACY*) measures. By performing these tests based on these individual components of the BKLS

uncertainty measure, we are also able to make additional inferences regarding the effect of FAS 157 adoption on analysts' information environment. Consistent with prior research, we scale these three measures by the beginning of the quarter price (e.g. Barron et al., 2009).

3.2. Hypothesis tests

Our hypothesis tests are based on the difference-in-difference approach. We use the difference-in-difference approach to better isolate the informational benefit of FAS 157 disclosures for our treatment firms compared with a control group of sample firms for which we expect no informational benefit from Level 3 disclosures as a result of FAS 157 adoption. Specifically, we measure the informational impact of FAS 157 disclosures for firms that hold significant amounts of Level 3 assets versus firms without Level 3 assets. We use firms whose Level 3 assets account for more than 1% of their total assets as our treatment group. We observe that firms with sizable amounts of Level 3 assets are different in many other dimensions than firms without Level 3 assets. Therefore, we use the propensity score matching (PSM) procedure to have a better match between our treatment firms and control firms that are indistinguishable from the treatment firms other than the fact that the treatment firms are the firms that hold Level 3 items.[9] Thus, this matching procedure serves to reduce differences on the analysts' information environment arising from other unobservable factors.

For the PSM procedure, we first need to determine why some firms have sizable amounts of Level 3 items in the post 157 adoption period (treatment group) while others do not hold these assets (control group). Prior research that has examined this issue includes Altamuro and Zhang (2013), and Botosan et al. (2011). Specifically, Altamuro and Zhang (2013) investigate why some banks classify mortgage servicing rights (MSR) as a Level 3 asset while others classify it as a Level 2 asset, and Botosan et al. (2011) examine what factors are associated with banks' usage of the Level 3 available-for-sale (AFS) securities (percentage of the Level 3 AFS securities out of the total fair valued AFS securities).

Following these papers, we adopt some of the variables that they have used to model the propensity of firms to hold Level 3 assets.[10] First, we use two variables following the research design settings from these studies. They are, namely, *SIZE* (the natural log of total assets) and *Big4* (indicator variable of one if a firm hire big 4 auditor and zero otherwise). Second, we modify the leverage variable in Botosan et al. (2011). Whereas their paper uses the Tier 1 capital ratio to measure their sample banks' financial health because they have a bank sample, we use the debt ratio (total debt over total assets) to measure the sample firms' financial solvency since Tier 1 capital ratio variable is not available for most of our sample firms. Finally, as suggested by Botosan et al. (2011), a firm's litigation risk can affect the firm's use of Level 3 items. Hence, we employ, in our prediction model, the factors that are suggested to be associated with actual class action law suits following Kim and Skinner (2013). Those factors are, namely, the standard deviation of the market-adjusted returns (*STD_MRET*), market-adjusted returns (*MRET*), return skewness (*SKEW*), average sales growth (*SALE_GROW*), average stock trading volume scaled by the number of shares outstanding (*TURN*). All these variables are measured in the pre-adoption period to avoid any look-ahead bias. Our first stage prediction model for the PSM procedure is as follows:

$$TREATMENT_i = \alpha_0 + \alpha_1\ SIZE_i + \alpha_2\ BIG4_i + \alpha_3\ DEBT_i + \alpha_4\ STD\_MRET_i + \alpha_5\ MRET_i + \alpha_6\ SKEW + \alpha_7\ SALE\_GROW_i + \alpha_8\ TURN_i + e_i \quad (1)$$

[9] We appreciate a reviewer for pointing out this issue.

[10] We are unable to employ all the variables used in their settings for the following reasons. First, their sample firms are banks; hence, they use many bank-specific variables such as tier-1 capital ratio and auditors' market share in the banking industry. In contrast, we are studying both financial and non-financial firms. Although we examine financial institutions separately in our hypothesis tests, our financial institutions include insurance companies and other financial institutions. In addition, Altamuro and Zhang (2013) employ many MSR specific variables, whereas we are examining Level 3 assets in the aggregate. Finally, these two studies use time-varying variables such as the change in the market liquidity in the post adoption period, and how it changes a firm's holdings of Level 3 items in each quarter of the post adoption period. However, we do not examine the quarterly or annual change in the holdings of the Level 3 items in the post-adoption period.

TREATMENT is an indicator variable of one if a firm's Level 3 items accounts for more than 1% of the firm's total assets and zero if a firm does not hold any Level 3 items in the post-adoption period. Other than the variables in the model, we also control for the industry fixed effect. This is because firms in certain industries such as the energy sector or the financial sector may hold relatively more Level 3 items.

After selecting relatively homogeneous treatment and control firms using the PSM procedure, we examine whether there is a significant improvement in the analysts' information environment in the post-FAS 157 regime for firms in the treatment group versus firms in the control group. We adapt the research design setting in Francis et al. (2006) to implement this test.[11] Our regression specification is as follows:

$$\Delta ANALYST\_INFO_{i,t} = \alpha_0 + \alpha_1\ POST\_157_{i,t} + \alpha_2\ LNMV_{i,t} + \alpha_3\ QTR4_{i,t} + \alpha_4\ LABS\_RET_{i,t} + \alpha_5\ NUM\_ANALYST_{i,t} + \alpha_6\ TREAT_{i,t} + \alpha_7\ POST\_157 \times TREAT_{i,t} + e_{i,t} \quad (2)$$

where $\Delta ANALYST\_INFO_{i,t}$ represents the change in analysts' information environment. We measure this variable based on the BKLS information uncertainty measure (*UNCERTAINTY*), the dispersion of analysts' forecasts (*DISPERSION*), and analysts' forecast accuracy (*ACCURACY*) as previously defined. $POST\_157_{i,t}$, is an indicator variable denoting one if a firm-quarter is in the post-FAS 157 period and zero otherwise. Most firms adopted FAS 157 in the first quarter of 2008.[12] $TREAT_{i,t}$ is an indicator variable denoting one if a firm belongs to the treatment group and zero if a firm belongs to the control group. While $POST\_157_{i,t}$ captures the pre- and post-FAS 157 regime, $TREAT_{i,t}$ isolates the informational impact of firms with Level 3 disclosures versus firms without Level 3 disclosures. Thus, our main variable of interest, $POST\_157 \times TREAT_{i,t}$, shows the differential impact of 10-Q and 10-K filings on the quality of analysts' information environment in the pre- and post-FAS 157 regimes. We expect to find a significant and negative coefficient on $POST\_157 \times POST_{i,t}$ if there is an incremental informational impact from FAS 157 disclosures that provide information regarding Level 3 items.

We also include several control variables that can affect the change in the quality of analysts' information environment around the firms' filing dates. First, we include the natural log of a firm's market capitalization at the end of a given quarter (*LNMV*) to account for differences between the information environments of larger firms versus those of smaller firms (e.g., Barron et al., 2008). Based on prior research, we expect the coefficient on *LNMV* to be positive. Corporate disclosures have a greater impact in resolving information uncertainty for smaller firms than larger firms. Hence, the incremental uncertainty reduction after the filing dates will be smaller in large firms than in small firms, making $\Delta UNCERTAINTY$ less negative for large firms relative to small firms.

Second, to control for other value relevant information at the filing dates, we include the absolute values of the sum of the three-day returns around the filing dates. Following Barron et al. (2005), we use the log value of the sum of the absolute values of the firm's three-day abnormal return (*LABS_RET*). A firm's uncertainty level should reflect a greater decrease if there is more value relevant, market-based information available around its filing date. Accordingly, we expect the coefficient on *LABS_RET* to be negative.

Third, 10-K filings have more pages and more detailed information than 10-Q filings, thereby providing more information to the market (e.g., Griffin, 2003). To control for the larger decrease in the level of uncertainty around 10-K filings than for 10-Q filings, we include an indicator variable of one if the filing is a 10-K filing and zero otherwise (*QTR4*). We expect the coefficient on *QTR4* to be negative since more information released to the market as contained in the 10-K reports relative to the 10-Q reports will lead to less uncertainty after the filing dates. Finally, we also control for analyst following (*NUM_ANALYST*) in our regressions, as more analysts following the same firm should yield a richer information environment (e.g., Riedl and Serafeim, 2011).

[11] In their research setting, Francis et al. (2006) examine the effect of Reg FD on analyst information metrics by comparing firms that are subject to the requirements of Reg FD to a benchmark sample of firms unaffected by Reg FD so as to control for confounding events that affect all firms during the period of their study.

[12] FAS 157 was made effective for financial statements issued for fiscal years beginning after November 15, 2007, and for interim periods within those fiscal years.

As indicated, we also examine whether our results hold for a sample of firms that contain only financial firms.[13] Fair value measurements are particularly important for firms in the financial services industry. As most financial firms carry substantial amounts of fair value assets and liabilities including Level 3 items on their balance sheets, it will not be feasible to match financial firms with Level 3 amounts more than 1% of their total assets to a control group of firms without Level 3 items. Therefore, to perform this analysis, we partition our financial firms' sample based on their median Level 3 assets (scaled by total assets) in the post adoption period. Our treatment firms are firms that hold above the median amount of Level 3 assets to total assets whereas our control firms are firms that hold below the median amount of Level 3 assets to total assets. Within these groups, we again employ the PSM procedure and use the prediction model in Eq. (1) to find homogeneous treatment and control firms. However, instead of using industry fixed effect in the model specification, we control for *BANK* (an indicator variable of one if a firm is in the banking industry, and zero otherwise).

Finally, we employ the following predictability regression model for the test of Hypothesis 2:

$$NI_{i,t+1} = \alpha_0 + \alpha_1\ LEV3\_UGL_{i,t} + \alpha_2\ NIBLEV3_{i,t} + e_{i,t} \tag{3}$$

where $NI_{i,t+1}$ is income before extraordinary items at year $t+1$. $LEV3\_UGL_{i,t}$ is unrealized gains and losses from the fair value changes in Level 3 assets or liabilities. $LEV3\_UGL_{i,t}$ can be included in net income ($LEV3\_UGL\_NI_{i,t}$) or other comprehensive income ($LEV3\_UGL\_OCI_{i,t}$) depending on whether the Level 3 item is a trading or available-for-sales security. $NIBLEV3_{i,t}$ is income before extraordinary items and $LEVEL3\_NI_{i,t}$ at year t. All the variables are scaled by market values at the beginning of the year. Our variable of interest in this regression is $LEV3\_UGL_{i,t}$. We expect to find a significant and positive coefficient for the variable if managers convey useful private information when estimating the fair values of Level 3 instruments. Otherwise, we should not find any significant coefficient on $LEV3\_UGL_{i,t}$. Consistent with the findings in prior literature, we expect to find a positive coefficient on $NIBLEV3_{i,t}$, which indicates that current earnings are positively associated with future earnings. After performing the above test, we also separate $LEV3\_UGL_{i,t}$ into $LEV3\_UGL\_NI_{i,t}$ and $LEV3\_UGL\_OCI_{i,t}$ and examine whether each component has an ability to predict firms' future performance.

In all our regressions, we use two-way cluster robust standard errors to control for within-firm and within-year correlations, and we also control for industry fixed effects for our tests based on the full sample. To minimize the effect of outliers in the regression, we eliminate extreme observations for dependent variables and our income measures at the top and bottom 1%.

3.3. Sample selection

We use accounting data from Compustat, stock returns around filing dates from CRSP, and analysts' one year-ahead annual earnings forecasts from IBES. For the tests of Hypothesis 1, we first collect sample firms that have adopted FAS 157 by examining whether they report fair value hierarchy information (Compustat "AQPL1", "AOL2", "AUL3", "LQPL1", "LOL2", or "LUL3") in their footnote disclosures as a result of FAS 157 adoption. We define the firm-quarter observations for these firms as firms reporting in the post-FAS 157 regime (*POST*_157 = 1). Next, we collect these firms' accounting variables and filing dates from October 2005, until the period before the firms report their fair value hierarchy information in the 10-Q or 10-K reports.[14] We classify the firm-quarter observations for this sample of firms as firms reporting in the pre-FAS 157 regime (*POST*_157 = 0). We confine our sample period after the fiscal year of 2005 to have relatively balanced pre- and post-periods.

We employ several filters in performing our tests. We limit our sample to the firms that file 10-Qs or 10-Ks in both pre- and post-FAS 157 periods. That is, if a firm was newly listed in the post-FAS 157 period or if a firm is delisted in the pre-FAS 157 period, we eliminate those observations. This is

[13] We use the firms classified as Banks (44), Insurance companies (45), and other financial institutions (47) in the Fama and French 48 industry classification as financial firm sample (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)

[14] Since FAS 157 allows early adoption, some firms have already adopted FAS 157 for financial statements issued prior to November 15, 2007, the official effective date for FAS 157. Accordingly, the pre-FAS 157 regime period for early adopters ends earlier for this sample of firms. For the majority of firms in our sample, 2007 marks the last year of the pre-FAS 157 regime.

because we are analyzing the time series difference of $\Delta ANALYST\_INFO_{i,t}$ in firms. Since most of our variables are scaled by stock prices or market value, we eliminate all the observations whose beginning of the quarter stock price is below $1 to limit the undue effect of penny stocks. In computing $\Delta ANALYST\_INFO_{i,t}$, we require two or more analysts to issue annual earnings forecasts within 30 days prior to a 10-Q or 10-K filing date and the same analysts to revise their forecasts within 30 days after the filing dates. Out of these firms, we select firms whose Level 3 amounts are more than 1% of their total assets (treatment firms) and firms without Level 3 items (control firms). We then use the propensity matching procedure to find our final treatment and control firms. Our final sample that meets the selection criteria is 3085 firm-quarter observations from October 2005 to July 2010 (fiscal year 2005–2009). We refer to this sample as our full sample. Likewise, we adopt the same procedure and obtain 560 firm-quarter observations for the financial firms' sample.

For the test of Hypothesis 2, we hand-collect information on the unrealized gains and losses from the fair value changes in the Level 3 measurements from the 10-K footnotes. Appendix B shows an example of the unrealized gains and losses from fair value changes in the Level 3 measurements which is either included in earnings or other comprehensive income.[15] Since this is based on annual data, our sample size is relatively smaller. The sample for the test of Hypothesis 2 is 498 firm-year observations from the fiscal year of 2007 to 2009 for the full sample, and 181 firm-year observations for the financial firms' sample. The sample period for the Hypothesis 2 test starts from 2007 fiscal year since some early adopters report Level 3 gains and losses in their 10-K filings from the 2007 fiscal year onwards.

4. Empirical results

4.1. Descriptive statistics and propensity score matching procedure

Tables 1 and 2 report the descriptive statistics for our full sample and our financial firms' sample respectively. We also report the descriptive statistics for these firms separately for the treatment firms and control firms. As expected, the mean of the change in the BKLS uncertainty variable around the filing dates is negative across all samples and sub-samples, which indicates reduced informational uncertainty about the firms' future earnings after the 10-Q and 10-K filing dates. Similarly, we find a reduction in forecast dispersion and an improvement in forecast accuracy (i.e., smaller forecast errors) across these samples. Among all samples, financial firms for the treatment sample report the largest mean decrease in information uncertainty and reduction in forecast errors. Specifically, the mean differences for *UNCERTAINTY* and *ACCURACY* are −0.142 and −0.011 respectively for the treatment sample of the financial firms (Panel B, Table 2).

For our full sample, 45.6% of the firm-quarters are in the post-FAS 157 regime. The mean *LNMV* for our sample firms is 8.161. Converting the log value to raw value, it is $13,323 million, which is the average size of our sample firms in our full sample. Our sample firms are relatively large because of our data requirement that there must be two or more analysts issuing annual earnings forecasts before the filing dates and that the same analysts revise their forecasts after the filing dates.

Panel A of Table 3 reports the results of the first stage prediction model (1) for the propensity score matching procedure. In the full sample analysis, the area under ROC curve (AUC) is 0.776. A prediction model without any ability to discriminate will produce 0.5 AUC. Thus, 0.776 AUC in the full sample analysis is well above 0.5 and are on par with the AUCs documented in the prior accounting literature. For example, Kim and Skinner (2012) attempt to predict class action lawsuits of their sample firms based on their prediction model. The AUCs of their main prediction model and expanded prediction model are 0.756 and 0.759 respectively. We find significant coefficients for the firm's debt ratio (*DEBT*) and pre-adoption period return skewness (*SKEW*). In our financial firms' analysis, the AUC is 0.813, and the most important predictor of the treatment firms are firm size (*LNAT*), debt ratio (*DEBT*), and whether a financial firm is a bank or not (*BANK*). Panel B reports the *t*-statistics and *p*-values of the difference between the treatment and control groups. None of the variables are significantly different across the treatment and control groups at conventional levels.

[15] An example of the unrealized Level 3 fair value gains included in earnings is in the bottom row of the table whereas the second row of the footnote disclosure provides the total realized/unrealized gains/(losses) relating to Level 3 items.

Table 1
Descriptive statistics – All firms.

	N	Mean	Std. dev.	Lower quartile	Median	Upper quartile
Panel A: Full sample						
ΔUNCERTAINTY	3085	−0.011	0.062	−0.003	0.000	0.000
ΔDISPERSION	3085	−0.001	0.014	−0.002	0.000	0.001
ΔACCURACY	3085	−0.004	0.017	−0.004	−0.001	0.001
POST_157	3085	0.456	0.498	0.000	0.000	1.000
LNMV	3085	8.161	1.533	7.094	8.073	9.157
ABS_RET	3085	0.053	0.063	0.014	0.034	0.070
LABS_RET	3085	−3.552	1.280	−4.267	−3.388	−2.660
NUM_ANALYST	3085	18.672	9.212	12.000	17.000	24.000
QTR4	3085	0.225	0.418	0.000	0.000	0.000
Panel B: Treatment sample						
ΔUNCERTAINTY	1557	−0.014	0.074	−0.004	0.000	0.000
ΔDISPERSION	1557	−0.001	0.016	−0.002	0.000	0.001
ΔACCURACY	1557	−0.004	0.019	−0.005	−0.001	0.001
POST_157	1557	0.484	0.500	0.000	0.000	1.000
LNMV	1557	8.156	1.524	7.086	8.135	9.225
LABS_RET	1557	−3.546	1.316	−4.242	−3.390	−2.643
NUM_ANALYST	1557	19.048	9.121	12.000	17.000	25.000
QTR4	1557	0.220	0.414	0.000	0.000	0.000
Panel C: Control sample						
ΔUNCERTAINTY	1528	−0.008	0.045	−0.002	0.000	0.000
ΔDISPERSION	1528	−0.001	0.013	−0.001	0.000	0.001
ΔACCURACY	1528	−0.003	0.015	−0.003	−0.001	0.001
POST_157	1528	0.428	0.495	0.000	0.000	1.000
LNMV	1528	8.168	1.542	7.105	8.027	9.108
LABS_RET	1528	−3.559	1.243	−4.283	−3.387	−2.669
NUM_ANALYST	1528	18.289	9.293	11.000	17.000	24.000
QTR4	1528	0.230	0.421	0.000	0.000	0.000

ΔUNCERTAINTY = change in the empirical proxy for uncertainty proposed by Barron et al. (1998) scaled by the quarter *t* beginning stock price, estimated using analysts' annual earnings forecasts issued within the 30-day window prior to the period *t* 10-Q (or 10-K) filing date, and revised within a 30-day window following the period *t* filing date.
ΔDISPERSION = change in the dispersion in analysts' one-year ahead earnings forecasts, which is calculated as the sample variance of individual analysts' forecasts around the mean forecasts for period *t*, scaled by the quarter *t* beginning stock price.
ΔACCURACY = change in squared error in the mean forecast, which is calculated as the mean of the squared differences between individual analysts' forecasts and firm's reported earnings for period *t*, scaled by the quarter *t* beginning stock price.
POST_157 = indicator variable of one if a firm adopts FAS 157 during the quarter, zero otherwise.
LNMV = the natural log of the market value at the end of the quarter.
ABS_RET = the absolute value of the sum of firms' daily returns in the three-day event window around the filing date.
LABS_RET = the natural log of *ABS_RET*.
NUM_ANALYST = the number of analysts following the firm for the fiscal quarter.
QTR4 = indicator variable of one if the filing is a 10-K report, zero otherwise.
Panel A provides descriptive statistics of the variables that are used in the analyses of the changes in analysts' information environments between pre- and post-FAS 157 periods. This sample consists of 3085 firm-quarter observations from October 2005 to February 2010. Panel A presents the descriptive statistics for the full sample. To be included in the sample, we require firms to have at least two analysts' forecasts of annual earnings issued within 30 days before the filing date of their 10-Q (or 10-K) reports, with the same analysts updating their forecasts within 30 days after the filing date for the 10-Q (or 10-K) reports. Panel B and C present the descriptive statistics for the treatment and control firms respectively. The treatment firms are firms that hold Level 3 assets or liabilities amounting to more than 1% of the firms' total assets. The control firms are firms that do not have Level 3 assets or liabilities in the post adoption period. We use propensity score matching (PSM) to match treatment and control firms. The first stage PSM prediction model is specified in Table 3.

4.2. Univariate analyses

Table 4 reports the univariate analysis of the changes in our variables of interest for our treatment and control firms. We compare the mean differences between the post-FAS 157 regime against the pre-FAS 157 regime. The univariate analysis provides some preliminary evidence suggesting that firms

Table 2
Descriptive statistics – financial firms.

	N	Mean	Std. dev.	Lower quartile	Median	Upper quartile
Panel A: Full sample						
ΔUNCERTAINTY	560	−0.081	0.618	−0.004	0.000	0.000
ΔDISPERSION	560	−0.001	0.028	−0.001	0.000	0.001
ΔACCURACY	560	−0.007	0.038	−0.004	−0.001	0.001
POST_157	560	0.536	0.499	0.000	1.000	1.000
LNMV	560	8.410	1.422	7.443	8.371	9.415
LABS_RET	560	−3.672	1.286	−4.376	−3.554	−2.800
NUM_ANALYST	560	15.859	6.482	11.000	16.000	20.000
QTR4	560	0.145	0.352	0.000	0.000	0.000
Panel B: Treatment sample						
ΔUNCERTAINTY	281	−0.142	0.842	−0.012	−0.001	0.000
ΔDISPERSION	281	0.000	0.039	−0.001	0.000	0.001
ΔACCURACY	281	−0.011	0.051	−0.007	−0.002	0.000
POST_157	281	0.569	0.496	0.000	1.000	1.000
LNMV	281	8.285	1.559	7.322	8.279	9.206
LABS_RET	281	−3.582	1.311	−4.301	−3.454	−2.734
NUM_ANALYST	281	15.989	7.080	11.000	15.000	21.000
QTR4	281	0.128	0.335	0.000	0.000	0.000
Panel C: Control sample						
ΔUNCERTAINTY	279	−0.020	0.215	−0.002	0.000	0.000
ΔDISPERSION	279	−0.001	0.010	−0.001	0.000	0.001
ΔACCURACY	279	−0.002	0.015	−0.002	0.000	0.001
POST_157	279	0.502	0.501	0.000	1.000	1.000
LNMV	279	8.535	1.259	7.640	8.604	9.530
ABS_RET	279	0.043	0.051	0.011	0.026	0.056
LABS_RET	279	−3.762	1.257	−4.493	−3.634	−2.886
NUM_ANALYST	279	15.728	5.827	11.000	16.000	20.000
QTR4	279	0.161	0.368	0.000	0.000	0.000

Panel A provides descriptive statistics of the variables in the financial firm sample. This sample consists of 560 firm-quarter observations from October 2005 to February 2010. Panel A presents the descriptive statistics of the entire sample of financial firms. To be included in the sample, we require firms to have at least two analysts' forecasts of annual earnings issued within 30 days before the filing date of their 10-Q (or 10-K) reports, with the same analysts updating their forecasts within 30 days after the filing date for the 10-Q (or 10-K) reports. Panel B and C present the descriptive statistics for the treatment and control firms respectively. For treatment and control firms, we use the full sample of financial firms and compute the firms' average ratio of Level 3 assets and liabilities to the total assets in the post adoption period. We classify our sample into treatment and control groups by dividing the firms into above and below median based on their average ratio of Level 3 assets and liabilities. We use propensity score matching (PSM) to match treatment and control firms. The first stage PSM prediction model is specified in Table 3.

in the post-FAS 157 regime experience a decline in information uncertainty compared with the pre-FAS 157 regime. For the full sample, we find a significant reduction in Δ*UNCERTAINTY*, Δ*DISPERSION* and Δ*ACCURACY* (i.e., lower forecast error) for the treatment firms and a corresponding smaller reduction in these variables for the control firms. Specifically, the mean decreases for *UNCERTAINTY*, *DISPERSION* and *ACCURACY* are −0.0154, −0.0018 and −0.0039 for the treatment firms respectively, and −0.0068, −0.0011 and −0.0025 for the control firms respectively. All the differences are statistically significant at the 0.01 level except for Δ*DISPERSION*.

Panel B of Table 4 reports the univariate analysis for the financial firms. We find consistent results for the financial firms. The treatment firms in the financial firm sample report the largest improvements for Δ*UNCERTAINTY* and Δ*ACCURACY* in the post-157 period compared with the pre-FAS 157 period. The mean decreases for *UNCERTAINTY* and *ACCURACY* are −0.2439 and −0.0174 for the treatment firms respectively, and −0.0154 and −0.0034 for the control firms respectively. The mean differences for Δ*UNCERTAINTY* and Δ*ACCURACY* are not statistically significant for the control firms whereas they are statistically significant for the treatment firms at the 0.05 level.

Table 3
Prediction model for propensity score matching procedure.

	Dep. Var. = *TREATMENT*	
	Full sample	Financial firms
Panel A: Selection model		
SIZE	0.035	0.762***
	(0.49)	(5.16)
BIG4	0.181	0.526
	(0.45)	(0.45)
DEBT	−1.661***	−2.499***
	(−3.53)	(−2.65)
STD_MRET	6.026*	3.208
	(1.79)	(0.26)
MRET	0.035	−0.797
	(0.40)	(−1.63)
SKEW	−0.329**	−0.318
	(−2.13)	(−1.06)
SALE_GROW	−0.725	−0.605
	(−0.87)	(−0.30)
TURN	0.080	0.388
	(1.11)	(1.01)
BANK		−1.234**
		(−2.42)
Intercept	−0.686	−7.735***
	(−0.42)	(−4.25)
Pseudo R-square	0.176	0.236
Area under ROC curve	**0.776**	**0.813**

	Full sample		Financial firms	
	t-statistics	*p*-value	*t*-statistics	*p*-value
Panel B: t-statistics of the difference between the treatment and control groups				
LNAT	−0.07	0.943	0.08	0.935
BIG4	0.03	0.978	0.46	0.650
DEBT	1.30	0.196	0.91	0.367
STD_MRET	−0.49	0.623	−0.43	0.670
MRET	−0.21	0.832	1.3	0.197
SKEW	0.58	0.560	−0.54	0.588
SALE_GROW	0.45	0.655	1.15	0.252
TURN	0.32	0.751	−0.61	0.543

Panel A reports the results of the prediction model employed for the propensity score matching procedure to find treatment and control firms. *SIZE* is the natural log of total asset. *BIG4* is an indicator variable of one if a firm hire big 4 auditor and zero otherwise. *DEBT* is total debt over total assets. *STD_MRET* is the standard deviation of the market-adjusted returns. *MRET* is market-adjusted returns. *SKEW* is the monthly return skewness. *SALE_GROW* is the average sales growth. *TURN* is the average stock trading volume scaled by the number of shares outstanding. All these variables are measured in the pre-adoption period to avoid look-ahead bias. Other than the variables included in the table, we control for industry fixed effect in the full sample analysis. In the financial firm analysis, we control for *BANK*, which is an indicator variable of one if a firm is in the banking industry, and zero otherwise. Panel B shows *t*-statistics of the difference between the treatment and control groups selected.

4.3. Main results

Table 5 reports the test results of Hypothesis 1 for our full sample (Panel A) and financial firms' samples (Panel B), respectively. As described earlier, we adopt the difference-in-difference approach so as to control for unobserved changes to analysts' information environment using a benchmark sample that is relatively unaffected by the treatment effect (e.g., Francis et al., 2006). For the tests based on

Table 4
Univariate analyses.

	Post-adoption period	Pre-adoption period	Difference	*t*-statistics
Panel A: Full sample				
Treatment firms				
Δ*UNCERTAINTY*	−0.0215	−0.0062	−0.0154***	−4.14
Δ*DISPERSION*	−0.0022	−0.0004	−0.0018**	−2.26
Δ*ACCURACY*	−0.0064	−0.0025	−0.0039***	−4.06
Control firms				
Δ*UNCERTAINTY*	−0.0119	−0.0051	−0.0068***	−2.91
Δ*DISPERSION*	−0.0015	−0.0004	−0.0011	−1.58
Δ*ACCURACY*	−0.0046	−0.0021	−0.0025***	−3.23
Panel B: Financial firms				
Treatment firms				
Δ*UNCERTAINTY*	−0.2439	−0.0079	−0.2359**	−2.34
Δ*DISPERSION*	−0.0009	0.0007	−0.0016	−0.35
Δ*ACCURACY*	−0.0174	−0.0024	−0.0150**	−2.45
Control firms				
Δ*UNCERTAINTY*	−0.0154	−0.0253	0.0010	−0.38
Δ*DISPERSION*	−0.0020	−0.0005	−0.0016	−1.32
Δ*ACCURACY*	−0.0034	−0.0013	−0.0022	−1.18

These tables provide the univariate analyses of the mean changes in analysts' information environment regarding future earnings measured based on the BKLS information uncertainty measure, analyst forecast accuracy and analyst forecast dispersion measured around the firms' 10-Q and 10-K filing dates for each quarter. The variables are defined in Table 1
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

our full sample, we are assessing whether there is a greater informational benefit to be derived from FAS 157 adoption for firms with Level 3 disclosures compared with other control firms that do not have Level 3 disclosures.

We find evidence that our treatment firms in the post-FAS 157 period experience an incremental decrease in analysts' overall uncertainty compared with their matched control firms. The results are consistent with analysts benefiting from more comprehensive fair value disclosures as a result of FAS 157 adoption. Specifically, the coefficient of *POST*_157 × *TREAT* is negative and statistically significant for Δ*UNCERTAINTY* (−0.009, *t*-stat: −1.85) and Δ*ACCURACY* (−0.002, *t*-stat: −2.73) as reported in the column (1) and (3) of Panel A, respectively. However, we do not find significant results for Δ*DISPERSION* in column (2). The regression coefficient for Δ*DISPERSION* is −0.001 (*t*-stat: −0.83).

With regard to the control variables, we find that the regression coefficients for firm size (*LNMV*) are positive and statistically significant for all three regression specifications. Specifically, the regression coefficient for *LNMV* is significantly positive when the dependent variable is Δ*ACCURACY* (0.001; *t*-stat 3.56). Because the information environment for smaller firms tend to be lower than that for larger firms, a positive coefficient denotes that the information content from corporate disclosures have a greater impact in resolving information uncertainty for smaller firms than for larger firms. Likewise, we find consistent signs for *LABS_RET* as well. *LABS_RET* is measured as the absolute values of the sum of the three-day returns around the firms' 10-K or 10-Q filing dates. It is a proxy for value relevant, market-based information that is available around its filing date (e.g., Barron et al., 2005), Consistent with our expectations, we find a negative coefficient for this variable. This is because a firm's uncertainty level should reflect a greater decrease if there is more value relevant, market-based information available around its filing date. We also find a negative regression coefficient for *NUM_ANALYST* as the presence of more analysts to read and interpret these filings is associated with a greater decrease in informational uncertainty. Finally, we find a negative regression coefficient for *QTR*4 which indicates that 10-K disclosures have a greater impact in alleviating information uncertainty than 10-Q disclosures. However, we note that the predicted signs of the regression coefficients for *NUM_ANALYST* and *QTR*4 are not statistically significant at conventional levels.

Table 5
Regression analyses of changes in the analysts' information environment for all firms between the pre- and post-FAS 157 periods.

	Dependent variables		
	$\Delta UNCERTAINTY$ (1)	$\Delta DISPERSION$ (2)	$\Delta ACCURACY$ (3)
Panel A: Full sample			
POST_157	−0.004***	−0.000	−0.002***
	(−9.08)	(−0.88)	(−3.64)
LNMV	0.002	0.000	0.001***
	(1.17)	(1.22)	(3.56)
QTR4	−0.004	−0.000	−0.001
	(−1.61)	(−0.87)	(−1.35)
LABS_RET	−0.003***	0.000	−0.001***
	(−4.92)	(0.07)	(−3.04)
NUM_ANALYST	−0.000	−0.000	−0.000*
	(−0.03)	(−0.95)	(−1.89)
TREAT	−0.001	−0.000	0.000
	(−0.37)	(−0.94)	(0.02)
POST_157 × *TREAT*	−0.009*	−0.000	−0.002***
	(−1.85)	(−0.64)	(−2.73)
Intercept	−0.013	−0.001	−0.016***
	(−0.92)	(−0.83)	(−4.23)
Observations	3085	3085	3085
Adj. R^2	0.033	0.007	0.054
Panel B: Financial firms			
POST_157	−0.013	−0.000	−0.003*
	(−0.27)	(−0.11)	(−1.79)
LNMV	−0.055	0.000	−0.002
	(−0.77)	(0.66)	(−0.74)
QTR4	0.077***	−0.000	0.007**
	(4.86)	(−0.55)	(2.59)
LABS_RET	−0.025***	−0.000	−0.001**
	(−2.69)	(−0.34)	(−2.22)
NUM_ANALYST	0.009	−0.000	0.000
	(0.92)	(−0.52)	(0.98)
TREAT	0.006	0.001	−0.001
	(0.16)	(1.26)	(−1.06)
POST_157 × *TREAT*	−0.240***	0.001	−0.008**
	(−2.76)	(0.26)	(−2.41)
Intercept	0.207	−0.004	0.006
	(0.46)	(−0.91)	(0.34)
Observations	560	560	560
Adj. R^2	0.028	−0.007	0.052

This table compares changes in information uncertainty, forecast dispersion and forecast accuracy regarding one-year ahead earnings among analysts around firms' 10-Q and 10-K filing dates for firms with and without Level 3 fair value assets and liabilities between the pre- and post-FAS 157 periods. The first, second, and third column shows the main regression results when the dependent variables are $\Delta UNCERTAINTY$, $\Delta DISPERSION$, and $\Delta ACCURACY$, respectively. *TREAT* is one if the firm is in the treatment sample, and zero if it is in the control sample. The treatment firms are firms that hold Level 3 assets or liabilities amounting to more than 1% of the firms' total assets. The control firms are firms that do not have Level 3 assets or liabilities in the post adoption period. We use propensity score matching (PSM) to match treatment and control firms. The first stage PSM prediction model is specified in Table 3. All other variables are defined in Table 1. In the full sample analyses, we also control for industry fixed effect. Standard errors are clustered by firm and year. The *t*-statistics are reported in parentheses.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Panel B of Table 5 reports the regression results for the impact of information uncertainty for financial firms as a result of the FAS 157 adoption. Consistent with our intuition, we obtain stronger results for our tests when we examine only the sample of financial firms. We expect this is because the impact from FAS 157 disclosures is greater for financial firms than for non-financial firms. Specifically, the coefficients of *POST*_157 × *TREAT* are negative and statistically significant for Δ*UNCERTAINTY* (−0.240, *t*-stat: −2.76) and Δ*ACCURACY* (−0.008, *t*-stat: −2.41), respectively. However, we do not find a significant coefficient on *POST*_157 × *TREAT* when the dependent variable is Δ*DISPERSION*.

With respect to the control variables, the regression coefficients for *LNMV* are positive whereas the regression coefficients for *LABS_RET* are negative, consistent with the test results in the full sample. In contrast, the regression coefficients for *QTR*4 and *NUM_ANALYST* are positive, opposite to our expectations. Finally, we note that several control variables are not statistically significant, possibly due to low power from a smaller sample size for these regression specifications.

Tables 6 and 7 report the results relating to our second hypothesis. Table 6 provides the descriptive statistics for the variables used in our predictability tests. For the full sample, the mean value for NI_{t+1} (earnings before extraordinary items at year $t + 1$, scaled by the beginning of the year market value) is 13.494 whereas the mean values for $LEV3\_UGL_t$, $LEV3\_UGL\_NI_t$, $LEV3\_UGL\_OCI_t$, and $NIBLEV3_t$ (i.e., NI_t minus $LEV3\_UGL\_NI_t$) are −8.828, −11.763, 2.936, and −3.592, respectively. We also tabulate the relative impact of these unrealized fair value gains and losses on firms' earnings. The unrealized Level 3 fair value gains and losses recognized as net income as a proportion of earnings before extraordinary items, on average, is 16.8%. The sample distribution for this variable shows that it ranges from −4.6% at the 25th percentile to 9.7% at the 75th percentile for our sample firms.

For the sample of financial firms, the mean values for NI_{t+1} are 43.522 whereas the mean values for $LEV3\_UGL_t$, $LEV3\_UGL\_NI_t$, $LEV3\_UGL\_OCI_t$, and $NIBLEV3_t$ are −18.628, −33.076, 14.448, and 34.204, respectively. Hence, financial firms report greater magnitudes of fair value gains and losses on average than non-financial firms. The unrealized Level 3 fair value gains and losses recognized as net income as a proportion of earnings before extraordinary items, on average, is 10.9%. Not surprisingly, the ranges of the magnitude of the unrealized Level 3 fair value gains and losses are wider for financial firms than for non-financial firms. The sample distribution of the unrealized Level 3 fair value gains and losses included in earnings as a proportion of earnings before extraordinary items ranges from −22.8% at the 25th percentile to 32.1% at the 75th percentile for our sample firms.

Table 6
Descriptive statistics – predictability tests.

	N	Mean	Std. dev.	Lower quartile	Median	Upper quartile
Full sample						
NI_{t+1}	498	13.494	205.991	−13.646	53.254	97.593
$LEV3\_UGL_t$	498	−8.828	71.646	−6.937	0.000	2.611
$LEV3\_UGL\_NI_t$	498	−11.763	62.038	−3.759	0.000	0.017
$LEV3\_UGL\_OCI_t$	498	2.936	35.633	−0.426	0.000	0.170
NIBLEV3t	498	−3.592	212.123	−39.582	38.907	81.733
$LEV3\_UGL\_NI_t/NI_t$	498	0.168	4.271	−0.046	0.000	0.097
Financial firms						
NI_{t+1}	181	43.522	303.075	27.286	87.702	140.952
$LEV3\_UGL_t$	181	−18.628	181.494	−44.421	−2.760	14.763
$LEV3\_UGL\_NI_t$	181	−33.076	156.096	−48.995	−1.290	0.771
$LEV3\_UGL\_OCI_t$	181	14.448	112.798	−0.130	0.000	1.295
NIBLEV3t	181	34.204	248.266	−2.398	58.364	109.129
$LEV3\_UGL\_NI_t/NI_t$	181	0.109	5.016	−0.228	0.000	0.321

This table presents the descriptive statistics of the variables used in our predictability tests in Table 7. NI_{t+1} is earnings before extraordinary items at year $t + 1$. $LEV3\_UGL_t$ is unrealized gains and losses from the fair value changes in Level 3 assets or liabilities. $LEV3\_UGL\_NI_t$ is unrealized gains and losses from the fair value changes in Level 3 assets or liabilities included in net income. $LEV3\_UGL\_OCI_t$ is unrealized gains and losses from the fair value changes in Level 3 assets or liabilities included in other comprehensive income. All these income variables are scaled by market value at the beginning of the year. $NIBLEV3_t$ is NI_t minus $LEV3\_UGL\_NI_t$. $LEV3\_UGL\_NI_t/NI_t$ is $LEV3\_UGL\_NI_t$ scaled by NI_t.

Table 7
Regression of unrealized Level 3 fair value gains and losses on firms' future earnings in the post-FAS 157 period.

	Dependent variable: NI_{t+1}			
	(1)	(2)	(3)	(4)
Panel A: Full sample				
$NIBLEV3_t$	0.139	0.217***	0.137	0.183***
	(1.62)	(3.51)	(1.54)	(4.82)
$LEV3\_UGL_t$	0.268	0.133***		
	(0.80)	(6.87)		
$LEV3\_UGL\_NI_t$			0.184	−0.009
			(0.40)	(−0.09)
$LEV3\_UGL\_OCI_t$			0.494***	0.295***
			(18.82)	(2.70)
$NEGATIVE\_NI_t$		−91.985***		−94.453***
		(−6.65)		(−7.55)
$NEGATIVE\_NI \times NIBLEV3_t$		−0.263***		−0.223***
		(−3.61)		(−4.11)
$NEGATIVE\_NI \times LEV3\_UGL_t$		0.008		
		(0.02)		
$NEGATIVE\_NI \times LEV3\_UGL\_NI_t$				0.082
				(0.12)
$NEGATIVE\_NI \times LEV3\_UGL\_OCI_t$				0.302
				(0.66)
Intercept	77.678***	74.552***	77.618***	75.796***
	(21.52)	(29.52)	(22.26)	(46.53)
Observations	498	498	498	498
Adjusted *R*-squared	0.075	0.108	0.076	0.107
Panel B: Financial firms				
$NIBLEV3_t$	0.311***	0.372***	0.319***	0.375***
	(4.47)	(4.83)	(4.50)	(6.21)
$LEV3\_UGL_t$	0.125**	0.276***		
	(2.53)	(4.32)		
$LEV3\_UGL\_NI_t$			0.159**	0.280***
			(1.98)	(5.18)
$LEV3\_UGL\_OCI_t$			0.064	0.265**
			(1.62)	(2.11)
$NEGATIVE\_NI_t$		−56.737		−59.127
		(−1.53)		(−1.23)
$NEGATIVE\_NI \times NIBLEV3_t$		−0.182		−0.189
		(−0.98)		(−1.06)
$NEGATIVE\_NI \times LEV3\_UGL_t$		−0.337		
		(−1.03)		
$NEGATIVE\_NI \times LEV3\_UGL\_NI_t$				−0.361
				(−0.66)
$NEGATIVE\_NI \times LEV3\_UGL\_OCI_t$				−0.310**
				(−2.36)
Intercept	35.192	38.892	36.925	38.801
	(1.33)	(1.07)	(1.33)	(1.08)
Observations	181	181	181	181
Adjusted *R*-squared	0.048	0.045	0.044	0.034

This table reports regression results to examine Level 3 measurements' unrealized fair values gains and losses on firms' future earnings. Panel A reports the full sample analyses. Panel B reports the analyses on the financial firm samples. $NEGATIVE\_NI_t$ is an indicator variable of one if earnings before extraordinary items is negative and zero otherwise. All other variables are defined in Table 6. In the full sample analyses, we also control for industry fixed effect. Standard errors are clustered by firm and year. The *t*-statistics are reported in parentheses.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Table 7 reports the regression results for our predictability tests. Panel A reports the full sample analyses. In column (1), we do not find significant coefficients on both *LEV*3_*UGL* and *NIBLEV*3. However, different earnings components can have differential predictive ability depending on whether net income is positive or negative. Therefore, we create an indicator variable of one if NI_t is negative and zero otherwise (*NEGATIVE_NI*), and interact *NEGATIVE_NI* with each earnings component. As shown in column (2), we find significantly positive coefficients on both *LEV*3_*UGL* and *NIBLEV*3. The evidence suggests that *LEV*3_*UGL* and *NIBLEV*3 are positively associated with firms' future earnings when they are positive. Then, in column (3), we split *LEV*3_*UGL* into *LEV*3_*UGL_NI* and *LEV*3_*UGL_OCI* to investigate the differential predictive ability of the unrealized fair value gains and losses included in earnings and other comprehensive income. Surprisingly, we only find the coefficient on *LEV*3_*UGL_OCI* to be significantly positive. When we interact each component with *NEGATIVE_NI* in column (4), we get significantly positive coefficients on *LEV*3_*UGL_OCI* and *NIBLEV*3. Thus, it appears that, in the full sample analyses, only the fair value gains and losses included in other comprehensive income provide information about our sample firms' future performance.

Panel B reports the test results with financial firms. We find stronger evidence of the predictive ability of Level 3 items with the financial firms. Specifically, all four income components ($NIBLEV3_t$, $LEV3\_UGL_t$, $LEV3\_UGL\_NI_t$ and $LEV3\_UGL\_OCI_t$) have significantly positive coefficients except for $LEV3\_UGL\_OCI_t$ in column (3).

Overall, our results provide some evidence that the unrealized Level 3 fair value gains and losses are informative about firms' future earnings. While Level 3 estimates are viewed as less reliable and verifiable than Level 1 and 2 measurements, it appears that disclosures about Level 3 fair value gains and losses are able to perform an informational role about firms' future earnings.

4.4. Additional analyses

We perform several tests to determine the robustness of our main results. First, we consider whether the financial crisis of 2008 affects our results. There was tremendous uncertainty during the financial crisis. Hence, inferences made during the crisis period might not be applicable to conditions prevailing in non-crisis periods. As 2008 marks the height of the financial crisis, we rerun our tests without firm-quarter observations in the 2008 period. Untabulated results indicate that our test results are weaker for H1 tests in the full sample. The *p*-values for *POST*_157 × *TREAT* are slightly above 10% when the dependent variables are Δ*UNCERTAINTY* and Δ*ACCURACY*. Interestingly, the coefficient on *POST*_157 × *TREAT* becomes significant (*t*-value: −2.06) when the dependent variable is Δ*DISPERSION* after deleting 2008 observations. The test results are essentially unchanged for the financial firm sample even after the deletion of the year 2008 observations. Our test results are slightly weaker for H2 tests. In many cases, the coefficient on the income components becomes significant at the 0.10 level. The main reason for the weaker results appears to be due to the significant decrease in our sample size. If we delete year 2008 observations, the sample size in the H2 tests reduces substantially.

Second, the level of information uncertainty may be different in the post-FAS 157 period than in the pre-FAS 157 period. While we use a change regression specification for our all dependent variables, as robustness check, we include the BKLS uncertainty before the filing dates as a level variable to control for differences in the uncertainty level in the pre- and post-FAS 157 period. Including the uncertainty level variable before the filing dates does not change the results much in the full sample analyses. We obtain almost the same *t*-statistics and *p*-value. With respect to the financial firms' sample, untabulated results show that *POST*_157 × *TREAT* (−0.043; *t*-stat: −12.97) is still statistically significant at the 0.01 level after the inclusion of this control variable.

Finally, we perform placebo tests by using year 2005 and 2006 as pseudo-adoption year to ensure that our results are not driven by differences due to time trends. Since our current sample period starts from 2005, our current sample period is not appropriate for the placebo test. Therefore, to perform this test, we start our pre-adoption sample period after 2002. When we use year 2005 and 2006 as a pseudo-adoption year, we do not find any significant result in the test of H1, which leads to the conclusion that our results are not spuriously due to time trends.

5. Conclusion

This study examines whether analysts' information environment is affected when additional fair value information is disclosed as a result of FAS 157 adoption. While prior research tends to focus on cross-sectional settings, the innovation in our study is that we examine whether expanded disclosure as required under FAS 157 reduces uncertainty about future earnings in the post-adoption period as compared with the period when this information was not available to analysts. Specifically, we examine whether there is an incremental informational benefit arising from FAS 157 adoption for firms that hold significant amounts of Level 3 assets.

Overall, our findings suggest that more comprehensive fair value disclosures as a result of FAS 157 adoption reduce information uncertainty among analysts. We thus provide evidence to suggest that FAS 157 disclosures pertaining to Level 3 estimates are informative to analysts. We also find that gains and losses from fair value changes in Level 3 measurements convey useful information about a firm's future earnings. Our study thus makes a contribution to existing fair value research by examining the usefulness of these fair value footnote disclosures to analysts. We believe that our paper is likely to be of interest to standard setters and regulators concerned about the informational benefits of FAS 157 adoption to financial statement users. Notwithstanding our findings that show analysts have benefitted from the initial FAS 157 adoption, we do not purport to imply that FAS 157-related disclosures are sufficient and complete.

One caveat of our study is that we do not know the amount of the Level 3 items that our sample firms have in the pre-adoption period, and therefore, we cannot control for the change in the amount of Level 3 items after the adoption of FAS 157. We currently assume that firms hold similar amounts of Level 3 items in both pre- and post-adoption period, and examine whether disclosures on the Level 3 items reduce the informational uncertainty in the post adoption period. However, firms may reduce their holdings of Level 3 items when they have to disclose this item. Hence, the degree of firms' informational uncertainty may decrease after the adoption of FAS 157 because of the reduction in firms' holdings of Level 3 items.

Appendix A

1. The following are extracts from FAS 157 footnote disclosures in the 2008 Bank of America 10-K filing to illustrate how these disclosures may convey useful information to analysts.

(i) Fair value information provides forward-looking information.

Consumer MSRs are also included in Level 3 assets as valuing these MSRs requires significant management judgment and estimation. The Corporation uses an option-adjusted spread (OAS) valuation approach to determine the fair value of MSRs which factors in prepayment risk. This approach consists of *projecting servicing cash flows* under multiple interest rate scenarios and discounting these cash flows using risk-adjusted discount rates. The key economic assumptions used in valuations of MSRs include weighted average lives of the MSRs and the OAS levels.

The key economic assumptions used in valuations of MSRs include weighted average lives of the MSRs and the OAS levels were disclosed (e.g. 1.71% weighted average option adjusted spread and 3.26 weighted average life for these instruments). A sensitivity table was also provided that is useful to analysts (e.g. the impact of 100 basis point increase in OAS will cause a $428 million decrease in fair value).

(ii) Fair value information provides detailed information about gains/losses across classes of assets.

The Level 3 reconciliation table presents a reconciliation for all Level 3 assets and liabilities measured at fair value on a recurring basis, that shows a breakdown of various classes of Level 3 assets and liabilities' realized and unrealized gains (losses) included in earnings and OCI. For BOA, Level 3 assets, before the impact of counterparty netting related to our derivative positions, were $59.4 billion as of December 31, 2008 and represented approximately 10% of assets measured at fair value (or three percent of total assets).

See also the detailed breakdown of total realized and unrealized gains (losses) included in earnings (Card income, equity investment income, trading accounting profit/losses, mortgage banking income/

loss) across various classes of Level 3 assets (net derivatives, trading account assets, available for sale debt securities, loans and leases, mortgage servicing rights).

(iii) Fair value information provides greater explanation of economic drivers to the fair value changes.

During 2008, we recognized losses of $12.1 billion on Level 3 assets and liabilities which were primarily related to losses on consumer MSRs, trading account assets and AFS debt securities partially offset by gains on net derivatives. The losses on consumer MSRs were due to declines in mortgage rates which resulted in a significant increase in expected prepayments causing large decreases in the value of our consumer MSRs. These consumer MSR losses were more than offset by economic hedge gains of which approximately $750 million were classified as Level 3. The losses in our trading account assets were *due to widening credit spreads on our trading account positions and losses related to CDOs and ARS*.

2. The following are excerpts from analyst reports that have directly use information from FAS 157 footnote disclosures in their reports.

(i) "Lowering 3Q08 estimates to reflect new ABS-CDO write-downs."
– July 30, 2008 report on Citigroup by David Trone.

Revisions to the quarterly earnings estimates were made after assessing the Level 3 estimates of Citigroup's ABS-CDO valuations. The earnings revision might not have been possible without the expanded fair value information in Citigroup's FAS 157 notes to the accounts in their quarterly filing.

(ii) "*BAC 3Q09: Earnings recovery near?*"
– October 16, 2009 report on Bank of America by Todd Hagerman.

Adjusting for fair value marks on certain counter-party derivatives ($714 mil) and write-ups of certain legacy assets ($218 mil), trading revenue fell about $1 billion to approximately $5.1 billion. Net exposures and write-downs of various CDOs, MBS, CDS were prominently displayed in the analyst report as a separate exhibit, and fair value changes in mortgage servicing rights were factored into their earnings model in generating future earnings estimates in arriving at the bank's total mortgage banking income.

(iii) "*Unusual Quarter but not a hard one to understand*"
– January 22, 2010 report on Goldman Sachs by Chris Kotowski.

Level 3 asset estimates are prominently reported as a separate line item in the analyst report.

(iv) "*Quantifying mortgage repurchase risks*"
– October 20, 2010 report on Bank of America by David Hilder.

The analyst quantified the earnings and valuation impact to Bank of America (BAC) at around $400 million as a result of a potential development to replace BAC as the mortgage servicer for a tranche of MBS issues. Information used in computing the loss assumptions was obtained in part from the expanded fair value information in BAC's filings.

Appendix B

B.1. Sun trust

The following table shows a reconciliation of the beginning and ending balances for fair valued assets measured using significant unobservable inputs:

(Dollars in thousands)	Fair value measurements using significant unobservable inputs			
	Trading assets	Securities available for sale	Mortgage loans held for sale	Loans, net
Beginning balance January 1, 2007	$24,393	$734,633	$-	$-
Total gains/(losses) (realized/unrealized)				
Included in earnings	(518,242)	–	(15,528)	(60)
Included in other comprehensive income	–	416	–	–
Purchases and issuances	2,586,901	90,605	2,786	–
Settlements	(11,149)	(27,604)	–	–
Sales	(49,550)	–	–	–
Paydowns and maturities	(66,361)	(34,152)	(2,498)	–
Transfers from loans held for sale to loans held in portfolio	–	–	(219,461)	219,461
Transfers into Level 3	984,153	105,809	716,028	1383
Ending balance December 31, 2007	**$2,950,145**	**$869,707**	**$481,327**	**$220,784**
The amount of total gains/(losses) for the period included in earnings attributable to the change in unrealized gains or losses relating to assets and liabilities still held at December 31, 2007	**($518,242)**	**$-**	**($15,528)**	**($60)**

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