Usefulness of Interest Income Sensitivity Disclosures

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ABSTRACT

We examine the usefulness of banks' disclosures of interest income sensitivity to interest rate changes. We find that firm-specific IISD have predictive ability for future realized changes in net interest income. We also find that these sensitivity disclosures are positively associated with analysts' forecasts of net interest income and investor reactions to interest rate shocks. Specifically, conditional on analysts' forecasts of future interest rate changes, analysts forecast higher (lower) changes in net interest income when disclosures indicate firms are more (less) sensitive to interest rates changes. Similarly, given interest rate shocks, investors react more (less) when disclosures indicate firms are more (less) sensitive to interest rates changes. In cross-sectional tests, we find that analyst forecast accuracy is increasing in the predictive ability of managements' IISD, as is the timeliness of price discovery. Taken together, our findings suggest that the disclosures have predictive value, and that the predictive ability of the disclosures has implications for analyst forecast accuracy and price efficiency.

Keywords: *IISD; interest rate risk; disclosure usefulness*
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Usefulness of IISD

I. INTRODUCTION

Although some level of interest rate risk is natural in the banking sector, aggregate interest rate risk has risen sharply following the credit crisis. Financial firms appear to substitute interest rate risk for credit risk in an effort to increase yields (Bednar and Elamin 2014). Interest rate risk is important because high levels can lead to losses when rates change sharply, threatening firm solvency. Moreover, negative consequences of bank interest rate risk extend beyond the banking sector as this exposure can affect the transmission of monetary policy and banks' capacity to lend (Gomez, Landier, Sraer, and Thesmar 2016). For these and other reasons, regulators, including the Securities and Exchange Commission, the Bank for International Settlements, and the Federal Reserve, currently identify interest rate risk as a top priority.[1]

Methods of regulating interest rate risk include enforcement of limits set by regulators and market discipline by capital providers. Each of these requires timely and informative measures of firm-level interest rate risk. To this end, some regulators, including the Enhanced Disclosure Task Force (EDTF), convened in 2012 by operation of the Dodd Frank Act, support mandatory development of quantitative risk models by bank management that can be useful for regulatory oversight, as well as public disclosure of quantitative interest rate risk measures to facilitate market discipline on risk-taking. Similarly, the Securities and Exchange Commission (SEC) and the Financial Accounting Standards Board (FASB) propose that public disclosure of quantitative risk measurements is important to inform and protect investors (FASB 2012; SEC 2016).

[1] Securities and Exchange Commission 2016, Bank for International Settlements, 2015, and Federal Reserve 2010.

Despite regulators' and standard-setters' contention that interest rate risk disclosures theoretically should be useful to market participants, there is significant disagreement about firms' practical ability to convey meaningful information about interest rate risk that is reliable, understandable, and predictive at a sufficiently aggregated level to support investors' decisions. The FASB's proposed standard would require financial institutions to provide sensitivity disclosures at the consolidated entity level that quantify how aggregate net interest income would change in response to hypothetical changes in interest rates. However, preparers describe sensitivity disclosures as burdensome, costly, and inherently uninformative because meaningful aggregation of instrument-level risk is complex and requires numerous assumptions about correlation in the portfolio and exercise of explicit and implicit options that affect aggregate interest rate sensitivity. A majority of the comment letters received by the FASB from preparers reflect the view that sensitivity disclosures will not be useful to investors.[2]

The goal of this study is to conduct a series of empirical tests of the usefulness of interest rate sensitivity disclosures.[3] Although we view interest rate risk and potentially relevant disclosures broadly, we make several design choices to narrow our focus in order to directly inform standard-setters and conduct more powerful tests. First, the object of our analysis is net interest income, rather than the fair values of recognized financial instruments. Our focus on net interest income is motivated both by its economic significance and its importance to risk management strategies. Net interest income represents the largest component of bank earnings and is forecasted by analysts separately from net income. Moreover, prior research finds that

[2] Comment letter texts available at http://www.fasb.org/jsp/FASB/CommentLetter_C/CommentLetterPage&cid=1218220137090.

[3] Although preparers' opposition to the disclosures reflects both perceived costs and a lack of usefulness, we focus on the usefulness of the disclosures. A finding that disclosures are useful does not imply that benefits exceed costs but represents a significant and necessary first step in weighing the costs and benefits of the disclosures.

banks' risk management policies primarily focus on net interest income rather than market values (Ahmed, Beatty, and Takeda 1997).

A second design choice is to limit our analyses of predictive ability to the subset of public financial firms providing investors with net interest income sensitivity disclosures (IISD). IISD are just one type of interest rate risk disclosure that SEC registrants may provide to meet SEC requirements to quantify material market risk exposures in MD&A. Other types include tabular disclosures of asset and liability holdings grouped according to repricing characteristics (TD), and "value at risk" metrics that provide an estimate of maximum losses that would be incurred by investment portfolios under unfavorable rate scenarios (VAR). [4] We focus on IISD for several reasons. First, the FASB's proposed standard would mandate sensitivity disclosures for all firms preparing GAAP financial statements and the mandated disclosures would relate to entity-level risk, similar to the IISD we study. In contrast, tabular disclosures may provide information about subsets of recognized holdings without management-determined aggregation into a summary measure of entity-level risk. Although it is a summary measure, VAR similarly is most frequently presented only for the trading portfolio.

Second, because IISD comprise predictions contingent only on realized interest rate changes they enable assessment of the predictive ability, or accuracy, of managers' ex-ante predictions relative to ex-post outcomes, conditional on actual interest rate changes. This type of analysis is analogous to other accounting research that assesses the accuracy of managements' aggregate earnings forecasts. Third, these disclosures, if useful, directly relate to analyst forecasts of net interest income because accurate analyst forecasts of net interest income require analysts to forecast overall change in yield due to anticipated changes in interest rates, and there

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[4] See Linsmeier et al. (2002) for a comprehensive discussion of acceptable formats that may be used to comply with disclosure requirements for market risks, including interest rate risk.

is evidence that analysts consider these effects. For example, in a random sample of bank analyst reports relevant to our sample, we find that analysts routinely comment on the sensitivity of bank income to anticipated changes in interest rates, and frame the discussion in terms of whether the bank's net interest income will benefit or be harmed. If information in IISD are impounded in analyst forecasts, then we should observe an association between IISD and the forecasts, conditional on analysts' prediction of future rate changes. Moreover, analyst forecasts should be more accurate when IISD have more predictive ability.

IISDs are available for a subset of public firms. In contrast, bank regulatory reports are available for essentially all bank holding companies. Regulatory reports contain summary data about repricing terms of interest rate-sensitive assets and liabilities similar to TD that together with user or researcher-provided assumptions can be used to create predictions of interest income changes conditional on predicted interest rate changes. However, the theoretical weaknesses and practical difficulties of aggregating static repricing data into a summary measure of interest rate sensitivity are well-documented: in the case of repricing data disclosed in financial reports (Ahmed, Beatty, and Takeda, 1997), in the case of SEC TD (Hodder, 2001), in the case of regulatory repricing data (Ahmed, Beatty, and Bettinghaus 2004), and more generally (Ryan 2007). Moreover, unlike disclosed repricing data that may reflect some private information, regulatory repricing data uses standardized categories that by definition cannot incorporate managers' private information about the extent of important factors such as financial and real options, off-balance sheet positions, and the effects of hedging.

Whether IISD have predictive ability and can be useful to market participants is an empirical question that hinges at least partially on the extent to which the summary measures meaningfully aggregate potentially correlated risk exposures and the extent to which managers convey meaningful private information in the process of data collection, aggregation, and simulation. To address this question our study takes a comprehensive four-step approach to assess the usefulness of banks IISD to equity analysts and investors. First, we evaluate whether IISD on average predict future changes in net interest income.[5] Second, consistent with disclosures being useful if they incorporate information used by market participants, we examine whether analyst forecasts of changes in future net interest income reflect information in the IISD. If these disclosures are useful to analysts, we expect to find that for a given expectation of interest rate changes, forecasted changes in net interest income vary with the extent of interest rate sensitivity indicated by the disclosures.

Similarly, we evaluate whether firms' stock price responses to economy-wide interest rate shocks incorporate the firm-specific information content of their IISD. If the disclosures reflect useful information, stock price responses to interest rate shocks should be larger (smaller) when firms disclose higher (lower) sensitivity of interest income to interest rate changes. Finally, we perform cross-sectional tests that link the relative predictive ability of the disclosures to market outcomes. If the disclosures are both useful in predicting future changes in net interest income and used by analysts in their forecasts of changes in net interest income, then more (less) predictive disclosures should be associated with higher (lower) analyst forecast accuracy with respect to net interest income. Further, more predictive disclosures should be associated with faster price discovery following economy-wide interest rate shocks.

Using a comprehensive sample of public banks, we find that managers' predicted changes in net interest income are positively associated with future changes in net interest

[5] These tests are similar in purpose to those conducted by prior research assessing the predictive ability of banks' repricing data derived from bank regulatory reports in the pre-1997 period (Ahmed et al. 2004). As noted by the authors, some regulatory repricing data fields used in that study are not publicly available in subsequent periods.

income for given realized interest rate changes. This evidence is consistent with the intended purpose of the disclosures— to inform users about the effects of interest rate changes on net interest income. Further providing a direct link to the usefulness of the disclosures, we find that analyst forecasts of future net interest income reflect information in the disclosures. Specifically, conditional on analysts' expected interest rate changes, analysts forecast larger changes in net interest income for firms that disclose higher sensitivity to interest rates. Confirming that the information in the disclosures is associated with investors responses, we find that stock returns around interest rate shocks are positively related to the expected changes in interest income inferred from IISD. This evidence suggests that equity investors incorporate the information content of the disclosures into their assessments of firm value when responding to economy-wide interest rate movements.

The preceding results are consistent with the notion that IISD are useful, on average. However, in cross-sectional tests, we find that the relative predictive ability of the disclosures varies across firms and impacts their usefulness. In particular, analyst forecasts of future net interest income are more accurate when management's IISD are more predictive of future changes in net interest income. Finally, using short-window return tests to assess the timeliness of price discovery, we find that bank equity prices adjust more quickly to interest rate shocks when their IISD are more predictive. These results provide a link between the relative predictive ability of the disclosures and price efficiency. Overall, we document consistent empirical evidence supporting the usefulness of IISD.

Our paper provides evidence about an important research question that has implications for regulators, standard setters, and investors, contributes to the literature about interest rate risk, and makes several innovations relative to prior research that provides mixed findings regarding the usefulness of interest rate risk disclosure (e.g. Hodder 2001; Linsmeier, Thornton, Venkatachalam, and Welker 2002; Liu, Ryan, and Tan 2004). First, we focus our tests on the sensitivity of net interest income to changes in interest rates. Net interest income is a significant component of net income, the prediction of which is a primary concern of analysts and other market participants. Second, by focusing our primary tests on the predictive ability of sensitivity disclosures for a single significant component of income, we avoid potential confounding effects of other net income components. Third, our tests establish a link between firm's IISD and analysts' forecasts of net interest income, conditional on predicted economy-wide interest rate changes. This result is new to the literature and is consistent with analysts using interest income sensitivity information to forecast future changes in net interest income. Finally, our cross-sectional tests show that the relative predictability of IISD matters for the accuracy of analyst forecasts and for the efficiency with which market wide interest rate news is impounded into stock prices. These results are also new to the literature and suggest that expanding the set of information relevant for predicting changes in net interest income conditional on changes in market rates can have positive consequences for market efficiency.

The rest of this paper proceeds as follows. Section 2 provides background and hypothesis development. Section 3 describes our empirical design. Section 4 describes the data and findings. Section 5 discusses an additional analysis regarding analyst forecast dispersion. Finally, Section 6 summarizes and concludes.

II. BACKGROUND AND HYPOTHESIS DEVELOPMENT

Interest Rate Risk

Interest rate risk is the potential for changes in the general level of interest rates to reduce earnings and the value of equity. Early research advanced the hypothesis that firms are exposed to interest rate risk mainly because they contract in nominal terms (French, Ruback, and Schwert 1983). Because changes in interest rates primarily reflect changes in inflation expectations, the nominal contracting hypothesis predicts that, other things equal, firms with nominal contractual liabilities will benefit (suffer) from interest rate increases (decreases) because the liabilities will be settled in less (more) expensive nominal dollars. Conversely, firms with nominal contractual assets will benefit (suffer) from interest rate decreases (increases) because the assets will be converted to nominal future dollars that are worth more (less).

Because banks have both nominal assets and nominal liabilities, Flannery and James (1984) predict that banks' firm-specific interest rate risk arises from the mismatch in the amounts of nominal assets relative to nominal liabilities. Consistent with nominal contracting theory, Flannery and James (1984) find that that the amount of net short-term assets (short-term maturity GAP) is negatively related to the sensitivity of bank stock returns to changes in interest rates (interest rate beta).[6]

Nominal contracting theory suggests that bank interest rate risk derives from the effect of changes in general interest rate levels on the fair values of assets and liabilities that are in turn reflected in changes in the market value of equity. A significant body of literature documents this

[6] Explicit in Flannery and James (1984) research design is the assumption that the amount of short-term net assets is a good indicator of the valence and duration of long-term net assets--that is, a higher value of net short-term assets necessarily implies a firm has net longer-term liabilities. The validity of this assumption has not been explicitly tested due to data limitations; however subsequent research demonstrates that the relation documented by Flannery and James (1984) is sensitive to time period, sample composition, and firm effects (for example, see Schrand, 1997).

association between fair values and the market value of equity (see Landsman 2006 for a review). However, Ahmed et al. (2004) note that “banks’ risk-management policies tend to focus on net interest income, rather than market values (page 224).” Bankers historically used short-term repricing or maturity GAP as a measure of net interest income sensitivity to interest rates rather than a measure of market value of equity sensitivity to interest rates. The idea is that if the dollar volume of assets repricing in in the short-term is greater (smaller) than the volume of liabilities repricing, then next period income will be positively (negatively) impacted by increases in interest rates. Consistent with proposition, Ahmed et al. (2004) document an association between a measure similar to the Flannery and James (1984) maturity GAP and future changes in net interest income (NII). Although their study does not present evidence of an association between equity returns and maturity GAP, Ahmed et al. (2004) note that the effect of interest rates on NII is an important risk.

Interest Rate Risk Disclosures

Although one of the primary objectives of external financial reporting is to provide information useful for predicting the amount, timing, and risk of future cash flows, financial statement measurements generally focus on probable, rather than potential, outcomes, and relatively few financial statement disclosures relate directly to risk.[7] To varying extents, standard setters have recognized deficiencies in information useful for assessing firms’ market risk by calling for more forward-looking disclosures. However, providing empirical evidence about the usefulness of proposed financial statement disclosures is difficult, because such disclosures cannot be widely observed unless they are mandated. For this reason, our empirical analysis is inherently limited to disclosures that we can observe. In particular, SEC Financial Reporting

[7] Management Discussion and analysis typically contains qualitative descriptions of risk factors. The financial statements may include risk disclosures for specific positions and critical accounting policies.

Release 48 (FRR48) requires registrants to present estimates of three categories of market risk, including interest rate risk, commodity risk, and exchange rate risk in one of three alternative formats (i.e., tabular, sensitivity and value-at-risk), using a number of different bases of measurement (e.g. equity value, net income, and net interest income). Refer to Linsmeier et al. (2002) for a detailed discussion and examples of alternative formats of market risk disclosures permitted under FRR48.

In this paper, we focus only on IISD that provide estimated changes in NII for various assumed changes in market interest rates. For example, a typical sensitivity disclosure for interest rate risk reports the expected dollar or percentage change in NII that would result from a certain basis point change in interest rates. We provide two examples in Appendix A to illustrate how banks disclose the interest income sensitivity information, and how we estimate the expected changes in NII for purposes of our analyses. The IISD permitted by the SEC and illustrated in Appendix A are similar to those proposed by the FASB (FASB 2012). However, the SEC disclosures are notable in several respects. First, because they are presented outside of the financial statements, the SEC disclosures are unaudited. Second, because they are forward-looking, they are covered by a "safe harbor" regulation that limits managers' liability for inaccuracy. Third, although firms are encouraged to provide results from internal models used to manage interest rate risk, management has significant discretion over the content of the disclosures. Each of these factors potentially limits the disclosures' predictive ability and usefulness.

Bank regulatory filings are another source of information about maturity and repricing. The most detailed filings are available at the subsidiary level prior to 1996, and prior research finds that subsidiary-level repricing and maturity data from this time period are associated with future changes in net interest income (Ahmed et al. 2004). The use of regulatory data to predict future changes in net interest income requires user-generated assumptions about the sensitivity of assets and liabilities to interest rate changes. Thus, the user must provide the sensitivity parameters we wish to evaluate rendering tests of predictive ability joint tests of the usefulness of regulatory data and the validity of particular user-generated sensitivity parameters.[8] In contrast, our aim is to test the joint usefulness of financial reporting data and manager-generated sensitivity parameters.

Prior Research on SEC Interest Rate Risk Disclosures

Relatively little existing literature examines both the usefulness of interest rate risk disclosures mandated by the SEC for public companies and market participants' use of these disclosures. Linsmeier et al. (2002) hypothesize that information contained in firms FRR48 disclosures reduces investors' uncertainty and diversity of opinions about the implications of market rate or price changes for firm value. The study posits that more precise public information reduces returns to private information acquisition and decreases the number of analysts and investors willing to search for and trade on private information. Documenting a decline in abnormal trading volume subsequent to the enactment of FRR48, Linsmeier et al. (2002) conclude that the regulation resulted in preparer dissemination of more precise information about firms' market risk exposures. However, whether there are cross-sectional differences in the precision of firm disclosures or whether more precise preparer information results in a net increase or decrease in analyst forecast accuracy or the efficiency with which market wide interest rate shocks are impounded in stock prices remain unanswered questions.

[8] For example, regulatory filings report the total amount of non-term deposits. Given this input, to predict future changes in net interest income the user of the data must assume that managers will choose to adjust the rate on these deposits either immediately or on a lagged basis when interest rates change. If the user's assumption is incorrect, the disclosures will have less predictive ability.

Collecting individual FRR48 interest rate risk disclosures, Hodder (2001) examines their predictive ability and risk relevance, and fails to find that the disclosures are either predictive of future net income or associated with market measures of interest rate risk. Because the study's sample period extends only to the first three years after adoption, the inability to document predictive ability of the disclosures leaves open the question of whether the apparent lack of FRR48 disclosure usefulness derives from attributes of the disclosures (low average predictive ability) or insufficiently powerful tests given the small sample size and relative interest rate stability during the 1997-1999 sample period. Moreover, lack of experience with modeling may bias against finding results and may result in cross-sectional differences not explored in prior research (Liu et al. 2004).

The few other studies focusing on firms' interest rate risk disclosures primarily examine value-at-risk disclosures associated with only one component of large bank operations: the trading portfolio. This line of research relies on relatively small samples of specialized banking firms and provides mixed evidence about the usefulness of such disclosures (Jorian 2002; Liu et al. 2004; Perignon and Smith 2010). Mixed results in these studies may be due to the exclusion of certain items from the scope of the risk disclosures that do not reflect entity-level risk well (Sribunnak and Wong 2004). Their findings suggest that in the context of interest rate risk, entity-level disclosures, such as the overall IISD we study, are likely to provide more generalizable results than disclosures that are limited only to derivatives or trading activities.

In summary, prior research provides only indirect and equivocal evidence about the usefulness of existing public-firm interest rate risk disclosures similar to those contemplated by the FASB and other regulators. The failure to demonstrate usefulness in certain studies plausibly may be attributable to low power tests specific to sample periods and sample sizes, including potentially low quality disclosures in the years immediately following mandatory adoption of the SEC's reporting requirements. Studies that provide support for FRR48 disclosure usefulness generally focus on other types of market risk (e.g. commodity price risk and foreign exchange rate risk) rather than interest rate risk, include very large firms in which risk exposures are very concentrated, or assess structural shifts in average levels of risk or information asymmetry following adoption of FRR48. In contrast, this study focuses on the usefulness of firm-specific interest income sensitivity disclosure content.

Usefulness of IISD for Predicting Future Changes in Net Interest Income

FRR48 IISD present a summary measure that quantifies the impact on NII of a potential hypothetical change in interest rates. Appendix A presents two examples. Using rate/volume decomposition, represented by equation (1) below, we compare the predicted change in NII per the income sensitivity disclosure to realized changes in NII to assess the predictive ability of the disclosure.

$$\Delta NII_{it} = \Delta r_t \boldsymbol{\gamma}_{\mathbf{it}} (A_{it-l} - L_{it-l}) + (\Delta A_{it} - \Delta L_{it}) r_{t-1} + \Delta r_t \boldsymbol{\gamma}_{\mathbf{it}} (\Delta A_{it} - \Delta L_{it}) \quad (1)$$

In equation (1) for firm i in year t, ΔNII is the realized change in NII; A is the amount of average interest-earning assets; L is the amount of interest-bearing liabilities; r is the average rate earned (paid) on interest-earnings assets (interest-bearing liabilities); and $\boldsymbol{\gamma}$ is the effective sensitivity of net interest-earning assets to changes in interest rates.[9] Refer to Appendix B for a derivation of equation (1).

Equation (1) shows that an observed change in NII can be decomposed into rate and volume variances. Specifically, the rate variance (first term), represents the change in NII

[9] Making the assumption that interest rate changes equally affect assets and liabilities, we apply the same interest rate to both interest-earnings assets and interest-bearing liabilities,

attributable solely to the change in interest rates between the two periods. In contrast, the volume variance (second term), represents the change in NII attributable to the change in the volume of net interest-earning assets between the two periods. The remaining (third) term reflects the change in NII arising from both the change in rates and the change in volume over the same period. This decomposition of the change in NII demonstrates that a static prediction of the effect of interest rates on balance sheet positions at a point in time will result in a prediction error that is a function of the change in net interest-earning assets. We use this as a motivation to control for the change in net earning assets in our tests.

It is also important to note that bank assets and liabilities generally do not reprice immediately—the sensitivity of NII to changes in interest rates is a complex function of asset and liability terms, including repricing frequency and embedded options. To reflect differences in asset and liability re-pricing across bank holdings, we define $\boldsymbol{\gamma}$ generically, as the effective sensitivity of net interest earning assets to changes in interest rates, expressed as a percentage change in NII for a 100-basis point change in interest rates.[10] Including $\boldsymbol{\gamma_{it}}$ in equation (1) yields a firm-specific model of changes in NII, reflecting cross-sectional differences in effective interest rate sensitivity.

The SEC encourages banks to incorporate private information about contract details and optionality in estimating and disclosing their interest income sensitivity to changes in interest rates. Thus, IISD can be used to infer bank managers' estimates of $\boldsymbol{\gamma_{it}}$. Bank managers have incentives to truthfully disclose risk-relevant information to investors because the disclosures may help to reduce costly information asymmetry between banks and investors (Healy and

[10] In terms of informative disclosure of interest income sensitivity to changes in interest rates, γ can represent otherwise private information about the composition and terms of financial instruments as well as discretionary actions. In our specification, the term does not reflect expected changes in net assets.

Palepu 2001; Linsmeier et al. 2002).[11] If managements' disclosed interest income sensitivity to changes in interest rates is indeed informative, then conditional on actual volume and interest rate changes, the predicted change in NII per the disclosure should be positively correlated with future realized changes in NII. This leads to our first hypothesis, stated in alternative form:

H1: On average, banks' future realized net interest income changes are positively associated with disclosed interest income sensitivity conditional on actual interest rate changes.

Holding other factors constant, we posit that prediction error will increase to the extent that a bank's modeling does not capture the underlying interest rate sensitivity of net interest income. We do not infer manipulative intent when prediction errors are high. Some managers may not invest in disclosures because they do believe that investors actually use the disclosures (FASB, 2012). Others, due to complexity, may feel constructing meaningful and predictive summary risk measures is impossible or too costly. In either event, because the disclosures are unaudited and covered by a safe harbor regulation, management is less accountable for intentional or unintentional inaccuracy. These possibilities add tension to H1 and suggest that cross-sectional variations in prediction errors can be used to test the link between relative interest income sensitivity disclosure predictive ability and both analyst forecast accuracy and the efficiency of price discovery.

Usefulness of IISD for Analysts

We next examine whether IISD are useful to analysts. The analyst forecast literature generally documents that value and risk-relevant information can reduce analyst forecast errors (e.g. Lang and Lundholm 1996; Hope 2003; Behn, Choi, and Kang 2008; Dhaliwal,

[11] Unlike earnings and capital, there are no clear incentives to over- or understate income sensitivity because the effect of sensitivity depends on exogenous rate changes. For example, high earnings sensitivity could increase (decrease) net income and capital if rates move in a favorable (unfavorable) direction.

Radhakrishnan, Tsang, and Yang 2012). The empirical literature is consistent with the view that informative disclosure is an important determinant of analyst forecast characteristics.

Financial analysts consider the effect of interest rate changes as well as the effect of asset changes, when making forecasts about banks' future NII.[12] If, as predicted by H1, disclosed interest income sensitivity information is predictive of future NII, then analysts seeking to improve their NII forecast accuracy have incentives to incorporate management-provided information about the sensitivity of NII to changes in interest rates into their forecasts. Therefore, if analysts do in fact use this information, then analysts' forecasts of NII should be correlated with managers' disclosed interest income sensitivity, conditional on analysts' expectation of rate changes. Our second hypothesis reflects this reasoning:

H2: Financial analysts' forecasts of net interest income are positively associated with banks' disclosed interest income sensitivity conditional on analysts' expectation of rate changes.

Moreover, whether banks' sensitivity disclosures increase analyst forecast accuracy depends on the quality of the disclosures. In particular, if management-provided predictions of changes in NII per the IISD are useful in forecasting future NII, then forecast accuracy should vary in the cross-section with disclosure predictive ability. Therefore, we posit that disclosures with higher predictive ability will result in more accurate analyst forecasts of NII. This leads our third hypothesis:

*H3: Financial analysts' forecast errors of net interest income are lower for banks whose IISD have greater predictive ability***.**

Usefulness of IISD for Equity Investors

[12] This is supported by our ability to collect contemporaneous forecasts of asset growth and NII for the same firm made by the same analyst.

We next examine whether IISD are useful to equity investors. Flannery and James (1984) posit that bank stock returns are on average negatively related to interest rate changes, and that maturity mismatch (short-term maturity GAP) moderates this relation. Their reasoning is that firms with more short-term net assets have less long-term net assets subject to fair value risk (i.e. the decline in the fair value of assets due to an increase in interest rates). Thus, the more positive the short-term maturity GAP, the less the market value of equity decreases (increases) when interest rates increase (decrease).

Separately, Ahmed et al. (2004) propose that short-term maturity GAP should be positively related to future changes in NII because the more positive the positive maturity GAP, the more beneficial (detrimental) increases (decreases) in interest rates are to NII. Extending the reasoning of Flannery and James (1984) and Ahmed et al. (2004) to the interest income setting, and adapting it to our disclosure context, we posit that firms' disclosed interest income sensitivity to interest rate changes is positively related to the stock price response to interest rate shocks. For example, a firm disclosing a more positive hypothetical change in NII for a hypothetical increase in interest rates should experience a more positive (less negative) change in stock price when rate shocks are positive, because their higher income sensitivity means there is a lower relative volume of long-term net assets subject to fair value declines. Consistent with Flannery and James (1984), we assume that if investors consider the IISD in their assessment of firm value following a shock to interest rates, then they can infer the expected changes in NII and in fair value of net assets given the change in rates, both of which should be reflected through the aggregated market returns. These arguments lead to our fourth hypothesis:

H4: Equity investors' reactions to interest rate shocks are positively associated with banks' disclosed interest income sensitivity conditional on realized interest rate shocks.

In our assessment of the association between disclosure predictive ability and the timeliness of price discovery, we define price discovery consistent with prior literature as "the process whereby information becomes impounded in publicly observable market price (p 931)" (Bushman, Smith, and Wittenberg-Moerman 2010). We define the timeliness of price discovery as the speed with which an information-related price reaction is impounded into price over a specific period of time (Butler, Kraft, and Weiss 2007; Bushman et al. 2010, McMullin, Miller, and Twedt 2015; Twedt 2016). Price discovery is more timely as firms' information environments improve, including earlier dissemination of private information (Bushman et al. 2010), the frequency of both voluntary and mandatory disclosure (Butler et al. 2007; McMullin et al. 2015), and more extensive newswire dissemination (Twedt 2016).

If IISD help investors understand the effect of interest rate changes on NII, and if the effect of interest rate changes on NII are reflected in stock prices consistent with the theory provided by Ahmed et al. (2004), then the rate of equity price adjustment to interest rate changes should be faster for firms with more predictive IISD. This leads to our last hypothesis:

H5: The rate of price discovery is higher for banks with more predictive IISD.

III. EMPIRICAL RESEARCH DESIGN

Usefulness of IISD for Predicting Future Changes in Net Interest Income

If IISD on average are predictive of future realized NII, we should observe a significant relation between actual change in NII from year t-1 to year t and the predicted change in NII from the interest income sensitivity disclosure, conditional on the actual change in rates from year t-1 to year t. We test for this relation using the empirical specification in equation (2).

$$\Delta NII_{it} = \alpha + \beta_1 E[\Delta NII_{it}|\Delta r_t] + \beta_2 \Delta TA_{it} + \beta_3 E[\Delta NII_{it}|\Delta r_t] \times \Delta TA_{it} + \varepsilon_{it} \tag{2}$$

Appendix C presents detailed variable definitions and calculations. ΔNII_{it} represents the realized change in NII from year t-1 to year t. $E[\Delta NII_{it}|\Delta r_t]$ is our primary variable of interest and represents the expected change in NII inferred from the firm's interest income sensitivity disclosure conditional on the actual change in interest rates. Thus, $E[\Delta NII_{it}|\Delta r_t]$ is the empirical approximation of $\Delta r_t\ \gamma_{it}$ from equation (1). A numerical example of the calculation of $E[\Delta NII_{it}|\Delta r_t]$ is included in Appendix A. ΔTA_{it} is the realized change in total assets, and serves as the empirical approximation of the volume variance (i.e. $(\Delta A_{it} - \Delta L_{it})r_{t-1}$ from equation (1))[13]. Lastly, we include the interaction of $E[\Delta NII_{it}|\Delta r_t]\times\Delta TA_{it}$, which represents the third term in equation (1) (i.e. $\Delta r_t\ \gamma_{it}\ (\Delta A_{it} - \Delta L_{it})$).

We estimate equation (2) using OLS regression, clustering standard errors by firm.[14] Consistent with H1, we expect β_1 to be positive, suggesting IISD are predictive of future changes in NII. We control for period-specific factors affecting the relation between interest rate changes and changes in NII by including year fixed effects. Our use of NII as a dependent variable, rather than net income, excludes other operating and non-operating income and expenses and ensures that prediction errors are not a function of differences that may exist across banks in the scope or efficiency of operations. Additionally, our use of observable realized interest rate changes, observable realized asset volume changes, and exclusion of other firm effects allows us to

[13] We use the change in total assets as our proxy for the change in net interest-earning assets to be consistent with the volume variable (i.e. total assets) used in the analyst forecast analyses. As discussed later, the data provider reports analyst forecasts of total assets, but not net interest earning assets. Untabulated analyses reveal 0.97(0.94) Pearson(Spearman) correlations between total assets and net interest earning assets for the SNL population over the period 2000-2013, leading us to conclude that total assets is a reasonable proxy for net interest-earning assets.

[14] Our results are robust to clustering standard errors by firm and year. Because we do not have a large enough sample in each cluster following this two-way cluster, we present our main results using firm clustering.

attribute the residual from the regression to firm-specific interest income sensitivity prediction errors.[15]

Usefulness of IISD for Analysts

As described earlier, we similarly posit that analysts predict future changes in NII using expectations of the terms in equation (1). Thus, analysts' forecasts of NII changes involve the prediction of three components—1) future changes in net earning assets (ΔA_{it}- ΔL_{it}), 2) future changes in interest rates (Δr_t,), and 3) the sensitivity of net earning assets to forecasted changes in interest rates ($\boldsymbol{\gamma_{it}}$). If analysts use IISD when forecasting NII, there should exist a positive association between analysts' forecasts of future changes in NII and the expected change in NII based on the firm's interest income sensitivity disclosure and analysts' expected change in interest rates. We test for such an association using the empirical specification represented by equation (3) below. The theoretical derivation of equation (3) is discussed in Appendix B.

$$\begin{aligned} CONFOR\_\Delta NII_{it} = {} & \alpha + \beta_1 E[\Delta NII_{it}|\Delta\hat{r}_t] + \beta_2 CONFOR\_\Delta TA_{it} \\ & + \beta_3 E[\Delta NII_{it}|\Delta\hat{r}_t] \times CONFOR\_\Delta TA_{it} + \beta_4 NII\_Beta_{it} + \varepsilon_{it} \qquad (3) \end{aligned}$$

Appendix C presents detailed variable definitions and calculations. $CONFOR\_\Delta NII_{it}$ represents the median consensus forecast for change in NII. $E[\Delta NII_{it}|\Delta\hat{r}_t]$ is our primary variable of interest and represents the expected change in NII based on the firm's interest income sensitivity disclosure and the expected change in interest rates.[16] $CONFOR\_\Delta TA_{it}$ represents the

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[15] Our specification of residual error implicitly assumes that the quality of firms' estimation technology is increasing in the complexity of balance sheet holdings that contribute to net interest income. That is, our tests are not designed to disentangle whether disclosures are less predictive because firm attributes make prediction more difficult, holding disclosure quality constant. Answering that question requires a measure of disclosure quality that is independent of predictive ability, the development of which we leave to future research.

[16] In estimating Equation (2), we calculate the predicted change in NII ($E[\Delta NII_{it}|\Delta r_t]$) using the actual changes in interest rates over year t-1 to year t, represented by Δr_t. However, for this test, we calculate the predicted change in NII ($E[\Delta NII_{it}|\Delta\hat{r}_t]$) using the forecasted rate change over year t-1 to year t, represented by $\Delta\hat{r}_t$. We make this design choice because Equation (2) aims to estimate sensitivity disclosure prediction errors assuming perfect knowledge of changes in rates and net asset volumes, while this test aims to assess whether the information reflected in the interest rate risk disclosures is used by analysts based on information observable at the date of the forecast.

consensus analyst forecast of change in total assets and serves as a proxy for analysts' forecasts of future changes in net interest earning assets.[17] We also include the interaction of $E[\Delta NII_{it}|\Delta\hat{r}_t]\times CONFOR\_\Delta TA_{it}$, as an estimate of analysts' forecast of the interaction term in equation (1) (i.e. $\Delta r_t\ \gamma_{it}\ (\Delta A_{it} - \Delta L_{it})$). Finally, we control for the observable, historical sensitivity of NII to changes in interest rates (NII_Beta_{it}) to assess whether analysts use the information reflected in IISD incrementally to other information about NII sensitivity to interest rates observable at the forecast date. We estimate equation (3) using OLS regression and cluster standard errors by firm. Consistent with H2, if analysts use the information reflected in the IISD, we expect β_1 to be positive.

Assuming perfect foresight of interest rate changes, analyst forecast error can be decomposed into components reflecting the differences between expected and actual changes in interest-earning assets and liabilities and the sensitivity of net earning assets to changes in interest rates. Thus, if analysts rely on a firm's interest income sensitivity disclosure when forecasting NII, it is plausible that forecast error may in part be attributable to the low predictive ability the disclosure. We test for an association between the predictive ability of income sensitivity disclosures and analyst forecast error using the empirical model specified by equation (4). The theoretical derivation of equation (4) is discussed in Appendix B.

$$\begin{aligned} NII\_FError_{it} = {} & \alpha + \beta_1 LowAccuracy_{it} + \beta_2 TA\_FError_{it} + \beta_3 STDNII_{it-1} \\ & + \beta_4 DERIV_{it-1} + \beta_5 NANALY_{it-1} + \beta_6 SIZE_{it-1} + YEAR + \varepsilon_{it} \qquad (4) \end{aligned}$$

Appendix C presents detailed variable definitions and calculations. NII_FError_{it} represents the consensus forecast error of NII. We compute the median forecast of NII using the

[17] We use analyst forecasts of total assets as opposed to forecasts of average earning assets because these forecasts are available for the majority of our sample for which analyst forecasts of NII are available (i.e. 85 percent of the firm-years), while forecasts of average earning assets are available only for fiscal years beginning in 2015, after our sample period ends.

same detailed forecasts used to compute the median forecast of change in NII in equation (3) above. $LowAccuracy_{it}$ is our primary variable of interest and is a dummy variable equal to one (zero) if the absolute value of the residual for the same firm-year observation from the estimation of equation (2) is above (below) the sample median. As discussed above, we attribute differences between the actual value and predicted value of change in NII per equation (2) to low predictive ability of firms' sensitivity disclosures. Consistent with H3, if less predictive IISD are less useful to analysts for predicting future NII, we expect β_1 to be positive. That is, we predict a positive relation between disclosure prediction errors and analyst forecast errors. TA_FError_{it} represents analyst consensus forecast error of total assets and proxies for forecast error arising from the difference between expected and actual future interest-earning assets and liabilities. We compute median forecasts of total assets using the same detailed forecasts used to compute the median forecast of change in total assets in equation (3) above.

We control for several variables that may affect the difficulty of forecasting NII. We control for the volatility of NII ($STDNII_{it-1}$), as forecasting NII is more difficult for firms with more variable NII. Because derivatives may affect NII in complex ways, we control for the use of derivatives use in year t-1 ($DERIV_{it-1}$). We also control for the information environment of the firm using the number of analysts issuing NII forecasts ($NANALY_{it-1}$) and expect forecasts to be more accurate when more analysts cover the firm. We include $SIZE_{it-1}$, as another measure of complexity beyond the volatility of NII and expect a positive relation with forecast errors. Finally, we include YEAR fixed effects to control for period-specific factors contributing to forecast accuracy, including errors of analysts' expectations of rate changes.[18] We note that with respect to the controls in equation (4), we are only interested in including the characteristics that

[18] Because we use the same expectation of and actual realization of interest rates for all observations from the same year, including year fixed effects controls for errors in analysts' consensus expectations of rate changes.

may affect NII but not net income. We estimate equation (4) using OLS regression and cluster standard errors by firm.

Usefulness of IISD for Equity Investors

Next, we assess whether IISD are useful for equity investors by examining whether equity investors' reactions to large interest rate shocks are positively associated with managements' disclosed interest income sensitivity. An affirmative finding suggests that equity investors use firm-specific information reflected in these disclosures when responding to economy-wide rate shifts. We define information event dates as those on which a significant change in interest rates occurs and define significance as rate changes in the seventy-fifth percentile of the annual distribution of the absolute value of daily change in interest rates for three respective interest rate benchmarks, including LIBOR, the six-month Treasury Bill Secondary rate, and the ten-year constant maturity Treasury. We restrict this sample of events to those that are persistent by excluding rate changes that reverse in the event window. We do this by requiring that the absolute value of the sum of the daily changes in rates over the (0, +4) day window for the benchmark interest rate also be above the same seventy-fifth percentile of daily rate changes. We then match each event-date to the firm-year sensitivity disclosure observations that were disclosed in the prior-year 10-K. To minimize potential confounding information in the narrow event window, we exclude firm-year-event-dates that occur within (-4, +4) days of a firm's quarterly earnings announcement.[19]

In order to test the usefulness of income sensitivity disclosures for equity investors, we measure the association between the market reaction to a shock to interest rates and the expected

[19] As part of our matching process, we require that the event date occur on or after the 10-K filing deadline to ensure that the annual interest income sensitivity disclosure is available at the time of the shock to interest rates.

change in NII based on the firm's interest income sensitivity disclosure and the daily change in interest rates using equation (5).

$$BAHR_{ite} = \alpha + \beta_1 E[\Delta NII_{it}|\Delta r_e] + (\beta_2 \Delta r_e \text{ or EVENT\_DATE}) + \varepsilon_{it} \quad (5)$$

$BAHR_{ite}$ represents the excess five-day buy-and-hold returns over the return to a benchmark portfolio formed based on size, measured over the (0, +4) day window, where day zero is the event-date. $E[\Delta NII_{it}|\Delta r_e]$ is our primary variable of interest and represents the expected change in NII based on the shock to interest rates on event-date e and the firm's disclosed interest income sensitivity to potential interest rate shocks. The calculation of $E[\Delta NII_{it}|\Delta r_e]$ is discussed in detail in Appendix C. Finally, we control for either the daily change in interest rates (Δr_e) or use event-date fixed effects in alternative specifications. The daily change in interest rates is equal to the average of the daily change in LIBOR, the six-month Treasury Bill Secondary rate, and the ten-year constant maturity Treasury occurring on event-date e. We estimate equation (5) using OLS and cluster standard errors by firm and alternatively by firm and event-date. Consistent with H4, if equity investors use the information reflected in the interest rate risk disclosures, we expect β_1 to be positive and significant, suggesting that investors respond more strongly to interest rate shocks for banks that disclose more sensitive NII.

We use the same sample of firm-year-event date observations from the preceding test to assess how the predictive ability of interest rate risk disclosures influences the speed of price discovery following these interest rate-related events. The intuition for our price discovery test is that the relative usefulness of the year t-1 interest rate risk disclosures for determining the impact of a shock to interest rates on equity value is increasing in the disclosures' predictive ability.

To measure the speed with which rate shock information is impounded into price over the event window, we use an intraperiod timeliness (IPT) metric common to the accounting literature, i.e. area-under-the-curve analysis (e.g. Butler et al. 2007; Bushman et al. 2010; McMullin et al. 2015; Twedt 2016). To measure IPT, we first construct a curve that plots the percentage of the cumulative abnormal buy-and-hold return for each day during the five-day period from the day of a significant interest rate change to four days after. A larger area under the curve reflects faster impounding of information into price and, therefore, a more efficient price discovery process. The formula for the area under the curve for firm i, year t, and event-date e, is:

$$\begin{aligned} \mathrm{IPT}_{ite}(0,+4) &= \frac{1}{2}\sum_{\mathrm{t=0}}^{4}\left(\mathrm{Abn}_{\mathrm{Return}_{t-1}} + \mathrm{Abn}_{\mathrm{Return}_{t}}\right) / \mathrm{Abn}_{\mathrm{Return}_{4}} \\ &= \textstyle\sum_{\mathrm{t=0}}^{3}\left(\mathrm{Abn}_{\mathrm{Return}_{t}} / \mathrm{Abn}_{\mathrm{Return}_{4}}\right) + 0.5 \end{aligned} \tag{6}$$

where day zero is the day of a significant change in interest rates. Because IPT holds the magnitude of the price response and information content constant, these analyses are less susceptible to concerns that differences in the price reaction or information content are influencing the results (McMullin et al. 2015; Twedt 2016).

After calculating the IPT metric for each firm-year-event-date observation, we compare the mean IPT for a high predictive ability disclosure portfolio to that of a low predictive ability disclosure portfolio. The high (low) predictive ability portfolio represents the subsample of observations where the absolute value of the residual from the estimation of equation (2) over the entire sample is below (above) the sample median. The significance of the difference in IPT between the high and low predictive ability portfolios is determined using a traditional t-test and a bootstrapping approach.[20]

[20] The bootstrap technique: 1) randomly selects observations from the complete sample and assigns them to a pseudo high or low predictive ability portfolio. The assignment continues until each pseudo portfolio has the same number of observations as the actual high and low predictive ability portfolios; 2) calculates the difference between

We also examine IPT using multivariate regression analysis, as represented by equation (7) below. Specifically, we examine the relation between IPT for firm i in year t in response to event e (IPT_{ite}) and an indicator variable equal to one (zero) if the absolute value of the residual from the estimation of equation (2) over the entire sample of firm-year-event-dates is above (below) the sample median ($LowAccuracy_{it-1}$). In this regression, we control for volatility of NII over the prior five years ($STDNII_{it-1}$), whether the firm uses derivatives ($DERIV_{it-1}$), size ($SIZE_{it-1}$), profitability (ROA_{it-1}), analyst following ($FOLLOW_{it-1}$), and either the daily change in interest rates (Δr_e) or event-date fixed effects. The detailed variable definitions are presented in Appendix C. We estimate equation (7) using OLS regression and cluster standard errors by firm and alternatively by firm and event-date.

$$IPT_{ite} = \alpha + \beta_1 LowAccuracy_{it-1} + \beta_2 STDNII_{it-1} + \beta_3 DERIV_{it-1} + \beta_4 SIZE_{it-1} + \beta_5 ROA_{it-1} + \beta_6 FOLLOW_{it-1} + (\beta_7 \Delta r_e \text{ or EVENT DATE}) + \varepsilon_{it} \qquad (7)$$

Consistent with H5, we expect the IPT of the high predictive ability portfolio to be significantly greater than the IPT of the low predictive ability portfolio and β_1 in equation (7) to be negative and significant, suggesting that firms with more predictive IISD will exhibit more efficient price discovery following future interest rate shocks relative to firms with less predictive disclosures.

IV. DATA AND FINDINGS

the mean IPT for the two pseudo portfolios, which represents an observation under the null hypothesis of no difference in IPT; 3) repeats this process 1,000 times to generate 1,000 IPT differences under the null hypothesis of no difference in IPT; and 4) uses the empirical distribution of these null differences to test the statistical significance of the actual observed difference in IPT between the high and low predictive ability subsamples.

We obtain all financial statement variables from SNL Financial. We obtain our analyst variables, including actuals, from Factset.[21,22] Interest rate data are obtained from the Federal Reserve Bank of Saint Louis (i.e. FRED Economic Data) and interest rate forecasts are obtained from the Survey of Professional Forecasters, provided by the Federal Reserve Bank of Philadelphia. Finally, we obtain returns data from CRSP and quarterly earnings announcement dates from Compustat.

Table 1 provides the details of our sample selection. Our sample begins with firms in the banking industry that report income sensitivity disclosures to comply with FRR48 between 2000 and 2013. We begin our sample in 2000 as it is the first year for which sensitivity disclosure data are available electronically. We limit our sample to firm-year disclosures of "Net Interest Income" or "Net Interest Margin" sensitivity to interest rate changes.[23] We also exclude observations that do not have the necessary data to calculate regression variables, resulting in a final sample of 3,444 firm years for our test of disclosure predictive ability.

Our analyst forecast tests require firms to have market capitalization available from SNL as of the end of fiscal year t-1 and the first quarter of fiscal year t to determine the respective 10-K and 10-Q filing deadlines.[24] We require firm-years to have at least one forecast for NII issued by an analyst between the year t-1 10-K filing deadline and the subsequent 10-Q filing deadline. NII forecast data is available only for fiscal years 2008 and later, resulting in exclusion of 2,452

[21] Factset provides industry specific analyst forecasts, including forecasts of Net Interest Income for the Banking Industry. The data set is incrementally useful to I/B/E/S data, as it provides forecasts for a wide variety of specific line items in firms' financial statements, including net interest income and total assets.

[22] For our price discovery tests we control for the number of analysts issuing an annual EPS forecast per I/B/E/S in the year preceding the 10-K filing deadline as a proxy for the firm's information environment. We use I/B/E/S to determine analyst following for our price discovery test because coverage is available for our entire sample period and is available for majority of our firm-years. In contrast, Factset is only available for the latter half of our sample.

[23] Net Interest Margin (NIM) is the ratio of net interest income scaled by net interest earning assets and is expressed as a percentage. Our results are essentially identical if we exclude 27 firm-years reporting NIM from our tests.

[24] If the market capitalization is missing for the first quarter of fiscal year t but is available as of the end of fiscal year t-1, we use the market capitalization available at the end of fiscal year t-1 to determine the 10-Q filing deadline.

firm-years from our sample. We further require each analyst contributing to the NII consensus forecast to also provide a forecast of total assets over the same window. We exclude any observations missing data to compute our control variables. This results in a final sample of 666 firm-years for our analyst forecast analyses.

Tests of the market reaction to shocks to interest rates and the speed of price discovery begin with the same sample of firm years used for the test of predictive ability. Observations missing market capitalization necessary to determine the 10-K filing deadlines are excluded and each firm-year observation is matched to any significant rate change events occurring in the subsequent year, resulting in a sample of 12,246 firm-year-event-date observations. Observations missing data to compute returns and our control variables are also excluded, as are firm-year-event-date observations occurring within (-4, +4) days of the firm's quarterly earnings announcement date. These filters yield a final sample of 7,544 firm-year-event-date observations for our equity return and price discovery tests.

Descriptive Statistics

Table 2, Panel A presents summary descriptive statistics of our disclosure predictive ability sample. The mean (median) annual change in NII (ΔNII_{it}) is 0.26 (0.18) percent of lagged total assets, while the mean (median) predicted change in NII based on the firm's sensitivity disclosure and the actual change in interest rates ($E[\Delta NII_{it}|]\Delta r_t$) is -0.01 (0.00) percent of lagged total assets. The mean (median) annual change in total assets (ΔTA_{it}) is 8.95 (5.79) percent. Asset size is skewed; the mean (median) total assets for firms in our disclosure predictive ability sample is \$8.1 billion (\$1.2 billion). For this reason, we use log of total assets ($SIZE_{it}$) in our regressions. Finally, the mean (median) actual change in interest rates is -0.31 (-0.14) percent.

Table 2, Panel B presents summary descriptive statistics for analyst forecast sample. The mean (median) consensus forecast of change in NII as a percentage of lagged total assets ($CONFOR\_\Delta NII_{it}$) of our analyst forecast sample is 0.27 (0.17) percent. The mean (median) predicted change in NII as a percentage of lagged total assets given the sensitivity disclosure and forecasted changes in rates ($E[\Delta NII_{it}|\Delta\hat{r}_t]$) is -0.01 (0.00) percent. The mean (median) NII forecast error (NII_FError_{it}) is 0.151 (0.094), while the mean (median) total assets forecast error (TA_FError_{it}) is 0.059 (0.033). The mean (median) total assets for firms in our analyst forecast and forecast accuracy samples is $20.4 billion ($4.7 billion), respectively, suggesting that firms with analyst coverage for NII are larger than the average firm in our disclosure predictive ability sample. Finally, the mean (median) number of analysts issuing NII forecasts for our analyst forecast accuracy sample is 5.24 (5) analysts (i.e. the exponential of $NANLY_{it-1}$ minus 1).

Table 2, Panel C presents summary statistics of the key variables used in our market reaction and price discovery tests. These observations represent firm-years that are slightly larger than those in the predictive ability test (mean total assets of about $14.0 billion versus $8.1 billion). The mean (median) abnormal buy-and-hold return in the (0, +4) day window following a shock to interest rates is 0.80 (0.35) percent, while the inter-quartile range is -1.72 to 2.79 percent, consistent with investors responding both negatively and positively to interest rate shocks. Finally, the mean (median) IPT for our price discovery test is 2.71 (2.72), which is comparable to that found in other research (e.g. Twedt 2016).

Table 3 presents both Pearson and Spearman correlations among the key variables for our three samples of interest. Complete correlation tables are available as supplemental tables. Panel A reveals a positive and significant correlation (Pearson=0.1637, Spearman=0.1879) between change in NII (ΔNII_{it}) and predicted change in NII based on the firm's interest income sensitivity disclosure and the actual change in interest rates from year ($E[\Delta NII_{it}|\Delta r_t]$), lending univariate support to H1. Partially supporting H2, Panel B reveals a positive and significant (insignificant) Pearson (Spearman) correlation coefficient between analysts' forecast of change in NII ($CONFOR\_\Delta NII_{it}$) and the predicted change in NII based on the firm's interest income sensitivity disclosure and the forecasted change in interest rates ($E[\Delta NII_{it}|\Delta \hat{r}_t]$) (Pearson=0.1038, Spearman=0.0282). Supporting H3, Panel B presents a positive and significant correlation (Pearson=0.1782, Spearman=0.2049) between analyst forecast error (NII_FError_{it}) and the lower degree of predictive ability of the firm's year t-1 interest rate risk disclosure ($LowAccuracy_{it}$). Partially supporting H4, in Panel C we observe a positive and significant correlation between the five-day buy-and-hold abnormal return following a shock to interest rates ($BAHR_{ite}$) and the predicted change in NII based on the firm's sensitivity disclosure and the shock to interest rates ($E[\Delta NII_{it}|\Delta r_e]$) for the Pearson correlation coefficient but an insignificant correlation between these two measures for the Spearman correlation coefficient (Pearson=0.0283, Spearman=0.0137). Finally, supporting H5, we observe a negative and significant correlation between the lower degree of predictive ability of the firm's year t-1 interest rate risk disclosure ($LowAccuracy_{it-1}$) and five-day IPT following a significant change in interests (IPT_{ite}) (Pearson=-0.0293, Spearman=-0.0238).

Primary Findings

Usefulness of IISD for Predicting Future Changes in Net Interest Income

Table 4 presents our estimation of equation (2), which examines the association between realized changes in NII (ΔNII_{it}) and predicted change in NII based on the firm's interest income sensitivity disclosure and the actual change in interest rates ($E[\Delta NII_{it}|\Delta r_t]$). If these disclosures are predictive of future changes in NII, we expect $E[\Delta NII_{it}|\Delta r_t]$ to be significantly positively associated with ΔNII_{it}. In Column (1) of Table 4, we estimate the relation between ΔNII_{it} and $E[\Delta NII_{it}|\Delta r_t]$ without controlling for the volume variance (ΔTA_{it}) component of change in NII. The estimated coefficient on $E[\Delta NII_{it}|\Delta r_t]$ is positive and significant, supporting H1, suggesting that IISD are, on-average, predictive of future changes in NII. In Column (2), we estimate the relation between ΔNII_{it} and $E[\Delta NII_{it}|\Delta r_t]$ controlling for ΔTA_{it} and find that even after controlling for the volume variance, which is also positively and significantly related to ΔNII_{it}, there is still a significant relation between ΔNII_{it} and $E[\Delta NII_{it}|\Delta r_t]$. We do note, however, that a larger portion of the change in NII is driven by the volume variance than by the rate variance and the firm's sensitivity to changes in interest rates, as the adjusted R-square increases from 0.0723 for the specification with just $E[\Delta NII_{it}|\Delta r_t]$ to 0.4753 when we control for both $E[\Delta NII_{it}|\Delta r_t]$ and ΔTA_{it}. Finally, in Column (3) we control for both the volume variance and the interaction term (i.e. $E[\Delta NII_{it}|\Delta r_t]\times \Delta TA_{it}$) and find that both $E[\Delta NII_{it}|\Delta r_t]$and ΔTA_{it} are positively and significantly associated with ΔNII_{it}, while the interaction of these two terms is not. Additionally, the coefficient of determination does not improve after including the interaction term, suggesting that the interaction term does not provide incremental explanatory power over the predicted change in NII given the firm's disclosed sensitivity to change in rates and actual change in rates and the volume variance.

In addition to being statistically significant, the relation between ΔNII_{it} and $E[\Delta NII_{it}|\Delta r_t]$ is also economically significant. Using the fully specified model in Column (3), a one standard deviation increase in $E[\Delta NII_{it}|\Delta r_t]$ (0.0013) is associated with in an increase ΔNII_{it} of 0.0007 (i.e. 0.0013×0.4872), which is equal to about 25 percent of mean ΔNII_{it} (i.e. 0.0007/0.0026=25.0%) and when grossed up by the mean of lagged total assets ($8.1 billion) is equivalent to a dollar change in NII of \$5.258 million. Results in Table 4 support H1 and suggest that IISD are, on-average, predictive of future changes in NII.

Usefulness of IISD for Analyst Forecasts

Table 5 presents our analyses of the association between analyst forecasts of changes in future NII and the information reflected in IISD. Panel A uses the three-month Treasury Bill as the interest rate benchmark for forecasted and actual changes in interest rates, while Panel B uses the ten-year Treasury Bond. For the full model that includes proxies for the predicted change in NII per the sensitivity disclosure and forecasted changes in interest rates, analysts' expectations of changes in total assets, the interaction term, and historical sensitivity of NII to changes in interest rates, results in Panel A show a positive and significant relation between the analyst consensus forecast of change in NII ($CONFOR\_\Delta NII_{it}$) and predicted change in NII per the interest income sensitivity disclosure and forecasted changes in interest rates ($E[\Delta NII_{it}|\Delta \hat{r}_t]$). Moreover, results in Panel B show that the relation between $CONFOR\_\Delta NII_{it}$ and $E[\Delta NII_{it}|\Delta \hat{r}_t]$ is positive and significant when the ten-year Treasury Bond is used as the interest rate benchmark. The relations between $CONFOR\_\Delta NII_{it}$ and $E[\Delta NII_{it}|\Delta \hat{r}_t]$ are economically significant as well. Using the three-month Treasury Bill as the interest rate benchmark in the fully specified model, a one standard deviation increase in $E[\Delta NII_{it}|\Delta \hat{r}_t]$ (0.0005) is associated with an increase $CONFOR\_\Delta NII_{it}$ of 0.0005 (i.e. 0.0005×0.9828), which is equal to about 19.2 percent of mean $CONFOR\_\Delta NII_{it}$ (i.e. 0.0005/0.0027=19.2%) and when grossed up by the mean of lagged total assets (\$20.4 billion), is equivalent to a dollar change in NII of \$10.367 million. Similarly, using the ten-year Treasury Bond as the interest rate benchmark, a one standard deviation increase in $E[\Delta NII_{it}|\Delta \hat{r}_t]$ (0.0006 untabulated) results in an increase in $CONFOR\_\Delta NII_{it}$ of 0.0003 (i.e. 0.0006×0.4987), which when grossed up by the mean of lagged total assets ($20.4 billion) is equivalent to a dollar change in NII of $6.282 million. Overall, test results support H2, and suggest that not only are IISD useful in predicting changes in NII but are also useful to analysts when forecasting changes in NII.

Analyst Forecast Accuracy Conditional on Interest Income Sensitivity Disclosure Predictive Ability

We next estimate equation (4), which examines the association between analyst forecast error for future NII (NII_FError_{it}) and the degree of predictive ability of the firm's year t-1 interest income sensitivity disclosure ($LowAccuracy_{it}$). If analysts use the disclosures and low disclosure predictive ability contributes to analyst error in forecasting NII, we expect $LowAccuracy_{it}$ to be positively and significantly associated with NII_FError_{it}. Table 6 presents our results. In Column (1) of Table 6, we estimate the relation between NII_FError_{it} and $LowAccuracy_{it}$ with no controls. The estimated coefficient on $LowAccuracy_{it}$ is positive and significant, supporting H3. In Column (2), we control for total asset forecast error (TA_FError_{it}), consistent with volume variance being an important factor in explaining changes in NII as demonstrated by Table 4. We find that even after controlling for the error in forecasting total assets, which is also positively and significantly related to NII_FError_{it}, there is still a significant relation between NII_FError_{it} and $LowAccuracy_{it}$.

Finally, in Column (3) we control for additional common sources of NII forecast errors, including the volatility of NII ($STDNII_{it-1}$), use of derivative instruments ($DERIV_{it-1}$), the number of analysts issuing NII forecasts ($NANALY_{it-1}$), and firm size ($SIZE_{it-1}$). We find that the relation between NII_FError_{it} and $LowAccuracy_{it}$ is robust to the inclusion of these additional control variables. Consistent with expectations, we also find that the analyst forecast error is positively associated with volatility of NII. Using the fully specified model in Column (3), we find that the forecast error for low accuracy firms increases on average by 0.0474, which is equivalent to 31.5

percent of the mean of NII_FError_{it} (i.e. 0.0474/0.1505). This suggests the relation between NII_FError_{it} and $LowAccuracy_{it}$ is economically significant. Overall, we find that IISD that are less predictive of future changes in NII, and therefore less accurate, are positively and significantly associated with analyst forecast error, supporting H3.

Usefulness of IISD for Equity Investors

Table 7 presents our analyses of whether equity investors' reactions to shocks to interest rates vary with the extent of interest income sensitivity reported in managements' disclosures. Table 7 reveals that abnormal returns for the five-day window following a shock to interest rates ($BAHR_{ite}$) are significantly and positively associated with disclosed interest income sensitivity, based on the predicted change in NII given the firm's interest income sensitivity disclosure and the change in interest rates on event-date e ($E[\Delta NII_{it}|\Delta r_e]$). These results are robust to event-date fixed effects, controlling for change in interest rates for event-date e, and to clustering standard errors by firm and by firm and event-date. Moreover, the relation between $BAHR_{ite}$ and $E[\Delta NII_{it}|\Delta r_e]$ is economically significant. Using the model in Column (3) of Table 7, a one standard deviation in $E[\Delta NII_{it}|\Delta r_e]$ (0.0001) is associated with an increase in $BAHR_{ite}$ of 0.19 percent (i.e. 0.0001×24.0708), which is equivalent to 23.8 percent of the mean $BAHR_{ite}$ (i.e. 0.0019/0.0080) and 4.2 percent of the interquartile range in $BAHR_{ite}$ (i.e. 0.0019/(0.0279+0.0172)). Results in Table 7 support H4 and suggest that IISD are useful in the sense that equity investors' responses to interest rate shocks are stronger for firms that disclose greater sensitivity of NII to changes in interest rates.

Efficiency of Price Discovery Conditional on Interest Income Sensitivity Disclosure Predictive Ability

Figure 1 graphs the IPT curves for both the high and low predictive ability portfolios and shows that the area under the high predictive ability portfolio curve is greater than that under the low predictive ability portfolio curve. [25] Additionally, Table 8 presents our analyses of IPT for the portfolio of firm-year-event-date observations with more predictive IISD relative to that of the portfolio of firms with less predictive disclosures. Results in Table 8 show that the calculated IPT of the high predictive ability portfolio is significantly greater than that of the low predictive ability portfolio, using both standard and boot-strapped t-statistics. Moreover, regression results in Table 9 show that IPT is negatively and significantly associated with an indicator variable equal to one (zero) for firm-years with low (high) disclosure predictive ability ($LowAccuracy_{it-1}$), even after controlling for a number of other firm characteristics, including volatility of NII ($STDNII_{it-1}$), the use of derivatives ($DERIV_{it-1}$), firm size ($SIZE_{it-1}$), firm profitability (ROA_{it-1}), and analyst following ($FOLLOW_{it-1}$). These results are robust to including or excluding event-date fixed effects, controlling for change in interest rates for event-date e, and clustering standard errors by firm and by firm and event-date. Using the model in Column (3) of Table 9, IPT for low predictive disclosure firms is on average reduced by 0.5138, which is about 19 percent of the sample mean IPT (i.e. -0.5138/2.7084), suggesting that the relation between disclosure predictive ability and the speed of price discovery is economically significant. Overall, results in Tables 8 and 9 are consistent with H5 and suggest that IISD are useful in the sense that when disclosures are more predictive, information about interest rate shocks is impounded into stock prices more quickly.[26]

V. ADDITIONAL ANALYSIS

[25] We use the firm-year-event-date observations to estimate equation (2) to determine the absolute value of the residual which is used to partition firms into high and low accuracy portfolios. However, results are robust to using firm-year level analysis.

[26] We also examine the relation between ranked IPT and interest rate risk disclosure accuracy. Univariate results reveal that ranked IPT is significantly greater for the high predictive ability subsample than the low predictability subsample at the 0.05 level using IPT rankings of 100, 50, 20 or 10. However, using multivariate regression, ranked IPT is negatively and significantly associated with an indicator variable set equal to 1 for firm-years with low disclosure predictive ability only at the 0.10 level.

In an untabulated analysis, we examine the relation between dispersion of analyst forecasts of NII and the degree of predictive ability of the firm's year t-1 interest income sensitivity disclosure ($LowAccuracy_{it}$). Consistent with prior literature (Lang and Lundholm 1996), we do not have clear signed predictions ex-ante. If more predictive disclosure reduces analysts' uncertainty about private information, forecast dispersion may decrease. On the other hand, if analysts differ in the weights they place on public information, including the disclosures, then disclosure of new information, even if it is more predictive of future outcomes, can increase dispersion. We examine the relation between predictive ability and forecast dispersion using the same model used to assess the relation between analyst forecast accuracy and disclosure predictive ability (equation (4)) with dispersion of analysts' forecasts of NII as the dependent variable and an additional control variable for the dispersion of the analyst consensus forecast of total assets. Untabulated results reveal that the association between analyst forecast dispersion and $LowAccuracy_{it}$ is positive and significant at the 0.01 level. Moreover, forecast dispersion for low accuracy firms is, on average 31.8 percent higher relative to the sample mean. These results suggest that disclosures that are less predictive result not only in greater analyst forecast error but also in greater forecast dispersion.

VI. SUMMARY AND CONCLUSIONS

We examine whether banks' IISD that provide the estimated change in net interest income for a hypothetical change in economy-wide interest rates, are useful. We define usefulness of the disclosures in terms of their ability to predict future changes in net interest income conditional on actual realized changes in interest rates. Using a comprehensive sample of commercial banks, we conduct a series of tests that provide consistent empirical evidence supporting the usefulness of IISD, for which prior literature has mixed findings. We first find that forward-looking bank IISD are positively associated with future changes in net interest income for given magnitudes of realized interest rate changes. This evidence is consistent with the notion that these disclosures serve their purpose of informing users about the potential impact of interest rate changes on net interest income.

In additional tests, we find that analyst forecasts of future net interest income reflect information in the disclosures. Specifically, analysts' forecasts of net interest income are positively associated with predicted changes in net interest income given the sensitivity disclosure and analysts' expectations of rate changes. In cross-sectional tests, we find that analyst forecasts of future net interest income are more accurate when management's sensitivity disclosures have greater predictive ability for future changes in net interest income. Because we use disaggregated analyst forecasts of net interest income (rather than net income), our results are not confounded by other factors that drive net profits, including the extent of ancillary banking activities that generate fee income or result in other gains and losses. In addition, because we control for analyst forecasts of changes in the volume of invested assets, we have greater confidence that our results are driven by the sensitivity of invested assets to changes in interest rates, rather than growth in earning assets.

In our final tests, we evaluate whether the disclosures can be useful to equity investors as they impound market wide shocks into individual firm stock prices, and whether the relative predictive ability of the disclosures influences the speed of price discovery. Using short-window returns tests, we find that, given interest rate shocks, equity market responses to interest rate changes are larger for banks with greater disclosed sensitivity of net interest income to interest rate changes. For given levels of price adjustment to macroeconomic news, we also find that bank prices adjust more quickly when their ex-ante IISD are more predictive. These findings further support the view that more predictive IISD are more useful and can be associated with greater price efficiency.

Our paper provides evidence about an important research question that has implications for standard setters and contributes to the literature about interest rate risk disclosures. Effective disclosure regulation requires a deeper understanding of the usefulness of these disclosures informed by empirical research. Early research on mandated IISD was unable to consistently demonstrate their predictive ability. We document that the lack of predictive ability is limited to the period immediately following adoption of the mandatory disclosure when interest rates were relatively stable and firms were newly adopting the disclosures.[27]

We make several innovations relative to prior research. First, we refine the concept of usefulness to focus more specifically on the predictive ability of the disclosures for future earnings, and our study is among the first to document how this predictive ability affects market participants' forecast accuracy and price discovery following shocks to market rates. Thus, our study provides a direct link between the content of the disclosures and subsequent market outcomes. Second, our sample includes banks of diverse sizes and interest rate risk exposure levels. Although we focus on financial institutions, our focus on interest rate risk reflects a generalizable question. In contrast to commodity risk or exchange rate risk, potential exposure to interest rate risk is common to all firms of all sizes in the economy.

[27] In untabulated results we find evidence that learning may play a role. Specifically, we find evidence that experience with the disclosure (number of years disclosing), is associated with greater predictive ability.

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APPENDIX A
Examples of Interest Rate Sensitivity Disclosures

Example 1 VALLEY NATIONAL BANCORP 2008 10-K

Interest Rate Sensitivity

We use a simulation model to analyze net interest income sensitivity to movements in interest rates. The simulation model projects net interest income based on various interest rate scenarios over a twelve and twenty-four month period. The model is based on the actual maturity and re-pricing characteristics of rate sensitive assets and liabilities. The model incorporates certain assumptions which management believes to be reasonable regarding the impact of changing interest rates and the prepayment assumptions of certain assets and liabilities as of December 31, 2008. The model assumes changes in interest rates without any proactive change in the composition of the balance sheet by management. In the model, the forecasted shape of the yield curve remains static as of December 31, 2008. The impact of interest rate derivatives, such as interest rate swaps and caps, is also included in the model.

Our simulation model is based on market interest rates and prepayment speeds prevalent in the market as of December 31, 2008. New interest earning assets and interest bearing liability originations and rate spreads are estimated utilizing our actual originations during the fourth quarter of 2008. The model utilizes an immediate parallel shift in the market interest rates at December 31, 2008.

The following table reflects management's expectations of the change in our net interest income over a one-year period in light of the aforementioned assumptions:

Immediate Changes in Levels of Interest Rates	Change in Net Interest Income Over One Year Horizon At December 31, 2008	
	Dollar Change	Percentage Change
	($ in thousands)	
+3.00%	$ 23,795	5.33%
+2.00	17,324	3.88
+1.00	7,070	1.58
(1.00)	(10,884)	(2.44)

Example 2 SUNTRUST BANKS, INC 2009 10-K

The sensitivity analysis included below is measured as a percentage change in net interest income due to an instantaneous 100 basis point move in benchmark interest rates. Estimated changes set forth below are dependent upon material assumptions such as those previously discussed. The net interest income profile reflects a fairly neutral interest rate sensitivity position with respect to an instantaneous 100 basis point change in rates.

Financial Reporting Perspective

Rate Change (Basis Points)	Estimated % Change in Net Interest Income Over 12 Months	
	December 31, 2009	December 31, 2008
+100	**0.5%**	4.2%
-100	**(0.3%)**	(1.3%)

This Appendix shows two examples of banks' interest rate sensitivity disclosures. Banks can disclose the predicted increase (decrease) in net interest income amount as well as the percentage. To calculate expected changes in NII, we first obtain the actual change in interest rates from the Federal Reserve Bank of Saint Louis (i.e. FRED Economic Data). We then calculate the predicted change in NII amount, given the actual rate changes, following the sensitivity disclosure. If the actual rate change increases (decreases), we follow the rate increase (decrease) sensitivity disclosures. When there are multiple hypothesized interest rate increase (decrease) sensitivity disclosures, we follow the smallest hypothetical interest rate increase (decrease) disclosure. Finally, we scale the predicted change in NII by lagged total assets. For example, in VALLEY NATIONAL BANKCORP's case, if the actual interest rate goes up by 25 basis points, we follow the smallest hypothetical disclosure of a 100 basis-point increase to calculate the increase in net interest income to be 7,070*25/100=1,767.5. If the actual interest rate goes down by 25 basis points, we would calculate the decrease in net interest income to be 10,884*25/100=2,721.

APPENDIX B
Theoretical Model Development

Derivation of Equation (1)

Realized NII in any period is a function of the volume of interest-earning assets (net of interest-bearing liabilities) and average prevailing interest rates over the measurement period:

$$NII_t = A_t r_{A,t} - L_t r_{L,t} \tag{A1}$$

In equation (A1), A_t is average interest-earning assets; L_t is average interest-bearing liabilities; $r_{A,t}$ is the average rate on interest bearing assets; and $r_{L,t}$ is the average rate paid on liabilities, all measured over period t.

Differencing equation (A1) between period t and t-1 gives the change in NII over the interval. Taking this difference and rearranging terms results in:

$$\Delta NII_t = \Delta r_{A,t,}A_{t-l} + \Delta A_t r_{A,t-1} + \Delta r_{A,t}\Delta A_t - \Delta r_{Lt}\ L_{t-l} - \Delta L_t r_{L,t-1} - \Delta r_{L,t}\Delta L_t \tag{A2}$$

where delta (Δ) represents the change over the interval t-1 to t.

If interest rate changes equally affect assets and liabilities, equation (A2) can be rearranged as follows:

$$\Delta NII_{t,} = \Delta r_t(A_{t-l} - L_{t-l}) + (\Delta A_t - \Delta L_t)\ r_{t-1} + \Delta r_t(\Delta A_t - \Delta L_t) \tag{A3}$$

Equation (A3) shows that an observed change in NII can be decomposed into rate and volume variances. The rate variance (first term), represents the change in NII attributable solely to the change in interest rates between the two periods. In contrast, the volume variance (second term), represents the change in NII attributable to the change in the volume of net interest-earning assets between the two periods. The remaining (third) term reflects the change in NII arising from the change in rates during the period on the change in volume over the same period. This decomposition of the change in NII demonstrates that a static prediction of the effect of interest rates on balance sheet positions at a point in time will result in a prediction error that is a function of the change in net interest earning assets. We use this as a motivation to control for the change in net earning assets in our tests.

Equation (A3) is derived using the assumption that all assets and liabilities reprice immediately in the presence of universally applicable interest rate changes. However, bank assets and liabilities do not reprice immediately—the sensitivity of NII to changes in interest rates is a complex function of asset and liability terms, including repricing frequency and embedded options. As well, different financial assets and liabilities are sensitive to different rate indexes that may not move in tandem. To reflect differences in asset and liability re-pricing across bank holdings, we define $\boldsymbol{\gamma}$ generically, as the effective, ex post sensitivity of net interest earning assets to changes in interest rates. For example, given perfect, instantaneous repricing, a 100 basis point increase in interest rates should result in the sum of 1) a dollar change in NII equal to 1% of beginning net earning assets 2) a dollar change in NII equal to the dollar change in net assets times the rate earned on net assets, and 3) a dollar change in NII equal to 1% of each dollar change in net assets. Adding $\boldsymbol{\gamma_{it}}$ to equation (A3) allows effective sensitivity to deviate from perfect sensitivity at the firm-level. This is shown by equation (1), which is introduced in Section 2.

$$\Delta NII_{it} = \Delta r_t \, \boldsymbol{\gamma_{it}} \, (A_{it-l} - L_{it-l}) + (\Delta A_{it} - \Delta L_{it}) \, r_{t-1} + \Delta r_t \, \boldsymbol{\gamma_{it}} \, (\Delta A_{it} - \Delta L_{it}) \qquad (1)$$

Derivation of Equation (3)

We posit that analysts predict future changes in net interest income using expectations of the terms in equation (1). Thus, analysts' forecasts of NII changes involve the prediction of three components—1) future changes in net earning assets (ΔA_{it}- ΔL_{it}), 2) future changes in interest rates (Δr_t,), and 3) the sensitivity of net earning assets to forecasted changes in interest rates ($\boldsymbol{\gamma_{it}}$.) This can be represented by the following equation where E represents expectations:

$$E(\Delta NII_{it,}) = E[\Delta r_t\, \boldsymbol{\gamma}_{it}\, (A_{it-l} - L_{it-l})] + E[(\Delta A_{it} - \Delta L_{it})\, r_{t-1}] + E[\Delta r_t\, \boldsymbol{\gamma}_{it}\, (\Delta A_{it} - \Delta L_{it})] \quad (A4)$$

Our empirical specification of equation (A4), models analysts' prediction of future changes in net interest income and is represented by equation (3), discussed in Section 3.

$$\begin{aligned} CONFOR\_\Delta NII_{it} = {} & \alpha + \beta_1\, E[\Delta NII_{it}|\Delta \hat{r}_t] + \beta_2 CONFOR\_\Delta TA_{it} \\ & + \beta_3\, E[\Delta NII_{it}|\Delta \hat{r}_t] \times CONFOR\_\Delta TA_{it} + \beta_4 NII\_Beta_{it} + \varepsilon_{it} \end{aligned} \quad (3)$$

Derivation of Equation (4)

By extension of equation (A4), analyst forecast error is given by the following where E again represents expectations and $A_{it-l} - L_{it-l}$ and r_{t-1} are observable:

$$\begin{aligned} \Delta NII_{it,} - E(\Delta NII_{it,}) = {} & \Delta r_t\, \boldsymbol{\gamma}_{it}\, (A_{it-l} - L_{it-l}) - E[\Delta r_t\, \boldsymbol{\gamma}_{it}\, (A_{it-l} - L_{it-l})] + (\Delta A_{it} - \Delta L_{it})\, r_{t-1} \\ & - E[(\Delta A_{it} - \Delta L_{it})\, r_{t-1}] + \Delta r_t\, \boldsymbol{\gamma}_{it}\, (\Delta A_t - \Delta L_t) - E[\Delta r_t\, \boldsymbol{\gamma}_{it}\, (\Delta A_t - \Delta L_t)] \end{aligned} \quad (A5)$$

As shown in equation (A5), and assuming perfect foresight of interest rate changes, analyst forecast error can be decomposed into components reflecting the differences between expected and actual changes in interest rates, expected and actual changes in interest-earning assets and liabilities, and the expected and actual changes in the interactions of rates and assets and liabilities. Thus, for a known change in rates, analyst forecast error arising from the first two terms in equation (A5) is attributable to the low predictive ability of firm i's sensitivity disclosure, while forecast error arising from the middle two terms in equation (A5) is attributable to the analyst's forecast errors of the change in net interest earning assets. Forecast errors from the last two terms reflect the interaction of errors in forecasting volume changes and low predictive ability of firms' sensitivity disclosures.

Our empirical specification of equation (A5), models analyst forecast error, and is represented by equation (4), discussed in Section 3.

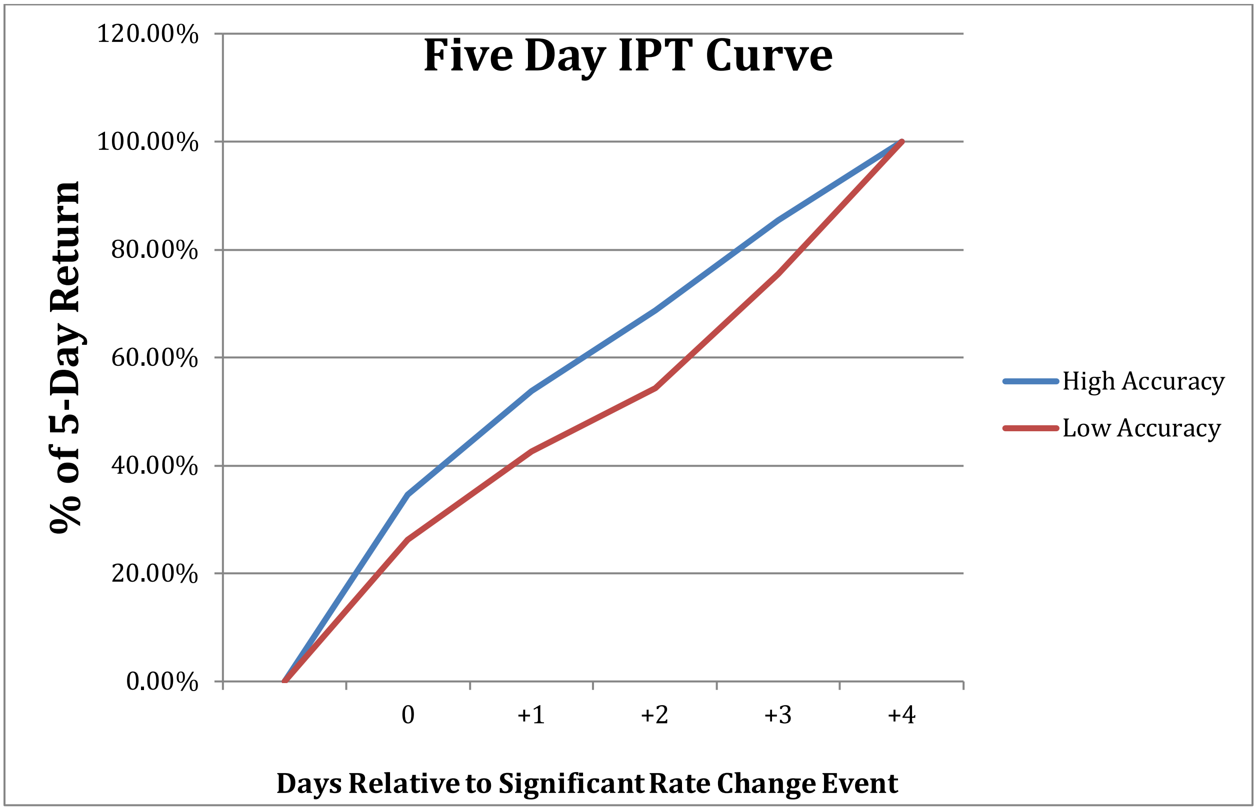
$$\begin{aligned} NII\_FError_{it} = {} & \alpha + \beta_1 LowAccuracy_{it} + \beta_2 TA\_FError_{it} + \beta_3 STDNII_{it-1} \\ & + \beta_4 DERIV_{it-1} + \beta_5 NANALY_{it-1} + \beta_6 SIZE_{it-1} + YEAR + \varepsilon_{it} \end{aligned} \quad (4)$$

APPENDIX C
Variable Definitions

Unless otherwise specified, all variables are scaled by lagged total assets, all changes are measured from year t-1 to year t, realized interest rate series are obtained from the Federal Reserve Bank of St. Louis, and financial statement data are obtained from SNL Financial.	
Variable	***Definition of Variable***
$BAHR_{ite}$	Buy-and-hold abnormal return equal to raw return minus the size matched benchmark over (0, +4) day window around significant interest rate change.
$CONFOR\_\Delta NII_{it}$	Consensus forecast for change in NII equal to the difference between the analyst consensus forecast of NII_t and actual NII_{t-1}, obtained from Factset. The consensus is the median forecast of all the first analyst forecasts issued after the year t-1 10-K filing deadline but prior to the first quarter of year t 10-Q filing deadline.
$CONFOR\_\Delta TA_{it}$	The consensus forecast for change in Total Assets equal to the difference between the analyst consensus forecast of Total $Assets_t$ and actual Total $Assetst_{-1}$ obtained from Factset. Consensus is the median forecast of all the total assets analyst forecasts issued after the year t-1 10-K filing deadline but prior to the first quarter of year t 10-Q filing deadline, retaining the Total Assets forecast per analyst that is issued closest to corresponding analyst's NII forecast.
$DERIV_{it-1}$	An indicator variable equal to one if the notional value of interest rate swaps in year t-1 is not equal to zero and is equal to zero otherwise. The notional value of interest rate swaps is obtained from SNL Financial.
ΔNII_{it}	Change in annual net interest income.
Δr_e	Actual change in interest rates on rate change event dates equal to the average of the daily change in LIBOR, the six-month Treasury Bill secondary rate, and the ten-year constant maturity Treasury.
ΔTA_{it}	Actual change in total assets.
$FOLLOW_{it-1}$	The natural log of one plus the number of unique analysts issuing annual EPS forecasts for firm i in the year leading up to the 10-K filing deadline of fiscal year t, obtained from I/B/E/S.
High Accuracy/Low Accuracy	The high (low) accuracy dummy/subsample that takes the value of one if the absolute value of the residual from the estimation of equation (2) over the entire sample is below (above) the sample median, and zero otherwise.
IPT_{ite}	Intraperiod timeliness, is the area under the curve of the cumulative return ratio (i.e. the ratio of the cumulative buy-and-hold abnormal return to the cumulative buy-and-hold abnormal return) for the (0,+4) day window. Day 0 is the date of a significant change in interest rates and abnormal returns are measured as raw buy-and-hold returns minus the return to a benchmark portfolio formed based on size.

$NANALY_{it-1}$	Natural log of 1 plus the number of unique analysts issuing NII forecasts for firm i in the one year leading up to the 10-Q filing deadline for the first quarter of fiscal year t. obtained from Factset.
NII_Beta_{it}	Coefficient estimated from rolling regression of change in NII on change in interest rates over the eight year period ending in year t. Change in interest rates is the average daily three-month (ten-year) Treasury Constant Maturity rate.
NII_FError_{it}	Forecast error of the consensus NII forecast equal to absolute value of the difference between the analyst consensus forecast of NII for year t and actual NII for year t and multiplied by 100. Forecasts as well as the actual value of NII are obtained from Factset. The consensus forecast is the median forecast of all the first analyst forecasts issued after the year t-1 10-K filing deadline but prior to the first quarter of year t 10-Q filing deadline.
ROA_{it-1}	The ratio of net income before extraordinary items to average total assets.
$SIZE_{it-1}$	Natural log of total assets as of the end of year t-1.
$STDNII_{it-1}$	Standard deviation of annual NII over years t-5 to t-1.
TA_FError_{it}	Total assets forecast error, equal to the absolute value of the difference between the analyst consensus forecast of total assets and actual total assets for year t both derived from Factset. The consensus forecast is the median of all total assets forecasts issued after the year t-1 10-K filing deadline but prior to the first quarter of year t 10-Q filing deadline, retaining the forecast per analyst issued closest to corresponding analyst's NII forecast.
$E[\Delta NII_{it}\|\Delta r_t]$ $E[\Delta NII_{it}\|\Delta r_e]$ $E[\Delta NII_{it}\|\Delta \hat{r}_t]$	Predicted dollar change in NII based on the firm’s 10-K sensitivity disclosure and the actual change in interest rates for the year, or for significant rate change event dates, or forecasted rate changes, respectively, scaled by lagged total assets. For realized or predicted rate increases (decreases), amount is equal to managements’ predicted percentage change in NII per basis point of hypothetical rate increase (decrease), multiplied by lagged NII and by the actual realized rate changes for the subsequent year for $E[\Delta NII_{it}\|\Delta r_t]$ or by the realized rate change on significant rate change events for $E[\Delta NII_{it}\|\Delta r_e]$, or by the forecasted rate change for $E[\Delta NII_{it}\|\Delta \hat{r}_t]$. When management discloses predicted amounts for multiple rate change scenarios, we use the smallest hypothetical rate change. For $E[\Delta NII_{it}\|\Delta r_t]$, actual change in interest rates is the daily average one-year Treasury Constant Maturity rate over year t less that over year t-1. For $E[\Delta NII_{it}\|\Delta r_t]$, actual change in rates is the average of the daily change in LIBOR, the six-month Treasury Bill secondary rate, and the ten-year constant maturity Treasury. Forecasted rate changes are the average of the six-month and twelve-month horizon interest rate forecasts on the three-month Treasury Bill (ten-year Treasury Bond), forecasted during Q1 of year t, less the average daily rate on the three-month (ten-year) constant maturity Treasury over calendar year t-1. For $E[\Delta NII_{it}\|\Delta \hat{r}_t]$, median forecasted rates are obtained from the Survey of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia.

FIGURE 1
Intraperiod Timeliness Curves



This figure plots the percentage of the cumulative five-day abnormal buy and hold return for each day during the five-day period from the day of a significant interest rate change to four days after the rate change. A significant interest rate change event is defined as a day in which the magnitude of change in LIBOR, the six-month Treasury Bill secondary rate, and the ten-year constant maturity Treasury all are greater than or equal to the specific rate of interest's annual seventy-fifth percentile cutoff of daily changes in interest rates. IPT is measured as the area under the curve over the (0,+4) day window, where day zero is the date of a significant change in interest rates, and is calculated as:

$$\mathrm{IPT}(0,+4) = \frac{1}{2}\sum_{t=0}^{4}\left(\mathrm{Abn}_{\mathrm{Return}_{t-1}} + \mathrm{Abn}_{\mathrm{Return}_{t}}\right)/\mathrm{Abn}_{\mathrm{Return}_{4}} = \sum_{t=0}^{3}\left(\mathrm{Abn}_{\mathrm{Return}_{t}}/\mathrm{Abn}_{\mathrm{Return}_{4}}\right) + 0.5 \tag{6}$$

The high (low) accuracy portfolio represents the subsample of observations where the absolute value of the residual from the estimation of equation (2) over the entire sample is below (above) the sample median.

TABLE 1
Sample Selection

Panel A: Predictive Ability Sample

	Sample Reductions (Firm-Years)	Cumulative Sample Total (Firm-Years)	Sample Reductions (Unique Firms)	Cumulative Sample Total (Unique Firms)
Observations Per SNL Financial 2000-2013		4,098		477
Require non-missing data from SNL Financial	(442)	3,656	(12)	465
Removal of non 12/31 fiscal year-end firms	(212)	3,444	(38)	427
Total Sample for Disclosure Predictive Ability Test		**3,444**		**427**

Panel B: Analyst Forecast Sample

	Sample Reductions (Firm-Years)	Cumulative Sample Total (Firm-Years)	Sample Reductions (Unique Firms)	Cumulative Sample Total (Unique Firms)
Total Sample for Predictive Ability Test		3,444		427
Require market capitalization from SNL Financial	(160)	3,284	(10)	417
Require at least one analyst forecast for Net Interest Income for year t	(2,452)	832	(224)	193
Require at least one forecast for Total Assets for year t	(127)	705	(19)	174
Require non-missing data from Factset/SNL Financial for control variables	(39)	666	(13)	161
Total Sample for Analyst Forecast Tests		**666**		**161**

Panel C: Market Reaction and Price Discovery Sample

	Sample Reductions (Firm-Year Events)	Cumulative Sample Total (Firm-Year Events)	Sample Reductions (Firm-Years)	Cumulative Sample Total (Firm-Years)	Sample Reductions (Unique Firms)	Cumulative Sample Total (Unique Firms)
Require market capitalization from SNL Financial		12,246		3,110		418
Require CRSP Permno	(2,296)	9,950	(583)	2,527	(104)	314
Require Raw Returns Over the Five-Day Return Window	(711)	9,239	(173)	2,354	(3)	311
Require Size-Matched Portfolio Returns Over the Five-Day Return Window	(2)	9,237	(1)	2,353	-	311
Require IBES ticker	(48)	9,189	(12)	2,341	(5)	306
Removal of Firm-Year Event Dates Occurring within (-4,+4) days of a Firm's Quarterly Earnings Announcement	(1,484)	7,705	(15)	2,338	(5)	306
Require non-missing data from SNL Financial for control variables	(161)	7,544	(43)	2,295	(5)	301
Total Sample for Market Reaction and Price Discovery Tests		**7,544**		**2,295**		**301**

TABLE 2
Descriptive Statistics

Panel A: Predictive Ability Sample

Variable	N	Mean	Std Dev	Q1	Median	Q3
ΔNII_{it}	3,444	0.0026	0.0046	-0.0002	0.0018	0.0044
$E[\Delta NII_{it} \vert \Delta r_t]$	3,444	-0.0001	0.0013	-0.0003	0.0000	0.0001
ΔTA_{it}	3,444	0.0895	0.1405	0.0112	0.0579	0.1318
$E[\Delta NII_{it} \vert \Delta r_t] \times \Delta TA_{it}$	3,444	-0.6695	745.5042	-22.7927	-0.2524	13.4184
Total Assets	3,444	8,088,735	25,909,764	572,544	1,166,123	3,211,865
Δr_t	3,444	-0.3125	1.2193	-0.7605	-0.1368	-0.0060

Panel B: Analyst Use and Accuracy Sample

Variable	N	Mean	Std Dev	Q1	Median	Q3
ΔNII_{it}	666	0.0024	0.0051	-0.0004	0.0012	0.0038
$CONFOR\_\Delta NII_{it}$	666	0.0027	0.0048	0.0000	0.0017	0.0038
$E[\Delta NII_{it} \vert \Delta r_t]$	666	-0.0001	0.0007	-0.0001	0.0000	0.0000
$E[\Delta NII_{it} \vert \Delta \hat{r}_t]$	666	-0.0001	0.0005	0.0000	0.0000	0.0000
ΔTA_{it}	666	0.0892	0.1701	0.0028	0.0476	0.1244
$CONFOR\_\Delta TA_{it}$	666	0.0668	0.1525	0.0050	0.0308	0.0655
NII_Beta_{it}	666	0.0003	0.0018	-0.0008	0.0002	0.0013
NII_FError_{it}	666	0.1505	0.1867	0.0433	0.0944	0.1829
$LowAccuracy_{it}$	666	0.5000	0.5004	0.0000	0.5000	1.0000
TA_FError_{it}	666	0.0594	0.0854	0.0158	0.0325	0.0631
$STDNII_{it-1}$	666	0.0044	0.0028	0.0023	0.0037	0.0058
$DERIV_{it-1}$	666	0.5766	0.4945	0.0000	1.0000	1.0000
$NANALY_{it-1}$	666	1.8311	0.5575	1.3863	1.7918	2.1972
$SIZE_{it-1}$	666	15.6104	1.3608	14.6374	15.3677	16.2724
Total Assets	666	20,382,409	48,236,278	2,274,878	4,721,861	11,668,710
Δr_t	666	-0.4307	0.8121	-0.1559	-0.0437	-0.0100
$\Delta \hat{r}_{t,3\ Month\ TBill}$	666	-0.1463	0.6466	0.0204	0.0211	0.1344
$\Delta \hat{r}_{t,10\ Year\ TBond}$	666	0.3860	0.5668	-0.2990	0.5481	0.9632

Panel C: Market Reaction and Price Discovery Sample

Variable	N	Mean	Std Dev	Q1	Median	Q3
$BAHR_{ite}$	7,544	0.0080	0.0491	-0.0172	0.0035	0.0279
ΔNII_{it}	7,544	0.0024	0.0044	-0.0003	0.0016	0.0043
$E[\Delta NII_{it} \mid \Delta r_e]$	7,544	0.0000	0.0001	0.0000	0.0000	0.0000
ΔTA_{it}	7,544	0.0967	0.1487	0.0138	0.0648	0.1392
Δr_e	7,544	0.0044	0.0933	-0.0567	-0.0013	0.0355
$LowAccuracy_{it-1}$	7,544	0.4999	0.5000	0.0000	0.0000	1.0000
IPT_{ite}	7,544	2.7084	8.5155	1.0680	2.7243	4.3005
$RANK\_IPT_{ite}$	7,544	0.5000	0.3191	0.2222	0.5000	0.7778
$STDNII_{it-1}$	7,544	0.0051	0.0037	0.0023	0.0041	0.0069
$SIZE_{it-1}$	7,544	14.7226	1.4759	13.6872	14.4443	15.4426
ROA_{it-1}	7,544	0.0088	0.0075	0.0064	0.0096	0.0126
$DERIV_{it-1}$	7,544	0.2613	0.4394	0.0000	0.0000	1.0000
Total Assets	7,544	14,033,930	70,705,522	879,551	1,875,255	5,088,954

This table presents descriptive statistics for our key variables, winsorized at the first and ninety-ninth percentiles. Total Assets represents raw lagged total assets in thousands. Δr_t in Panels A and B represents the actual change in interest rates and is measured as the average one year constant maturity Treasury rate over year t less that over year t-1, where the average rate is calculated as the arithmetic mean of the rate measured on a daily basis from January 1 to December 31. $\Delta\hat{r}_{t,3\ month\ TBill}$ ($\Delta\hat{r}_{t,10\ year\ TBond}$) in Panel B represents the forecasted change in interest rates for the three-month Treasury Bill (ten-year Treasury Bond) and is measured as the average of the six-month and twelve-month horizon forecasts of interest rates on the three-month Treasury Bill (ten-year Treasury Bond), forecasted during Q1 of year t, less the average rate on the three-month (ten year) constant maturity Treasury over year t-1. The year t-1 average rate is calculated as the arithmetic mean of the rate measured daily from January 1 to December 31. We obtain the median forecasted rates from the Survey of Professional Forecasters, conducted by the Federal Reserve Bank of Philadelphia and the actual three-month (ten-year) constant maturity Treasury rates from the Federal Reserve Bank of Saint Louis (i.e. FRED Economic Data). All other variables are defined in Appendix C.

TABLE 3
Correlations

Panel A: Predictive Ability Sample

	Variable	1	2	3	4
1	ΔNII_{it}	1.0000	0.1637***	0.6546***	0.0441***
2	$E[\Delta NII_{it} \mid \Delta r_t]$	0.1879***	1.0000	0.0145	0.3408***
3	ΔTA_{it}	0.5895***	0.0404**	1.0000	-0.0500***
4	$E[\Delta NII_{it} \mid \Delta r_t]\times\Delta TA_{it}$	0.0391**	0.6662***	-0.1367***	1.0000

Panel B: Analyst Use and Accuracy Sample

	Variable	1	2	3	4	5	6	7	8	9	10
1	ΔNII_{it}	1.0000	0.8831***	0.0864**	0.1034***	0.6572***	0.6084***	-0.0276	0.1034***	0.0997**	0.1790***
2	$CONFOR\_\Delta NII_{it}$	0.8517***	1.0000	0.0871**	0.1038***	0.5775***	0.6203***	0.0497	0.0862**	0.0553	0.2066***
3	$E[\Delta NII_{it} \mid \Delta r_t]$	0.0782**	0.0653*	1.0000	0.9186***	-0.0162	0.0068	0.3247***	0.2754***	-0.0728*	-0.0088
4	$E[\Delta NII_{it} \mid \Delta \hat{r}_t]$	0.0510	0.0282	0.2500***	1.0000	0.0071	0.0181	0.3011***	0.3080***	-0.0670*	-0.0422
5	ΔTA_{it}	0.5139***	0.4270***	0.0318	0.0035	1.0000	0.7874***	-0.1694***	0.0804**	0.1345***	0.1845***
6	$CONFOR\_\Delta TA_{it}$	0.4471***	0.4687***	0.0222	-0.0919**	0.7185***	1.0000	-0.0617	0.0905**	0.0648*	0.1546***
7	$E[\Delta NII_{it} \mid \Delta r_t]\times\Delta TA_{it}$	-0.1557***	-0.1389***	0.4305***	0.1788***	-0.3834***	-0.2815***	1.0000	0.5592***	-0.0634*	0.0623
8	$E[\Delta NII_{it} \mid \Delta \hat{r}_t]\times CONFOR\_\Delta TA_{it}$	0.1000***	0.0872**	0.2368***	0.5009***	0.1525***	0.1333***	0.0653*	1.0000	-0.0222	0.0314
9	NII_Beta_{it}	0.0703*	0.0015	-0.0278	0.0766**	0.0564	-0.0106	-0.0505	0.1187***	1.0000	0.0997***
10	NII_FError_{it}	0.0227	0.0872**	0.0162	-0.0143	0.0975**	0.0665*	-0.0106	0.0203	0.1103***	1.0000
11	$LowAccuracy_{it}$	0.0641*	0.0982**	-0.0376	0.0440	0.1431***	0.0369	-0.0184	-0.0153	0.0611	0.2049***
12	TA_FError_{it}	0.2168***	0.2025***	-0.0315	0.0229	0.3220***	0.1221***	-0.1376***	0.0207	0.0946**	0.1702***
13	$STDNII_{it-1}$	0.1020***	0.0570	0.0215	-0.0322	0.1620***	0.1368***	-0.0201	-0.0545	0.1271***	0.1732***
14	$DERIV_{it-1}$	-0.0096	0.0065	-0.0798**	0.1149***	-0.0502	-0.0317	-0.0584	0.0784**	-0.0297	-0.0363
15	$FOLLOW_{it-1}$	-0.0261	-0.0191	-0.0829**	0.0936**	0.0218	0.0271	-0.1978***	0.1403***	0.0996**	-0.0024
16	$SIZE_{it-1}$	-0.0388	-0.0350	-0.1501***	0.0655*	-0.0670*	-0.0357	-0.1691***	0.0473	-0.1149***	-0.0292

	Variable	11	12	13	14	15	16
1	ΔNII_{it}	0.1777***	0.1899***	0.0861**	0.0216	0.0040	-0.0205
2	$CONFOR\_\Delta NII_{it}$	0.1803***	0.1676***	0.0603	0.0393	0.0129	0.0251
3	$E[\Delta NII_{it} \mid \Delta r_t]$	-0.0407	-0.0678*	-0.0711*	0.0269	0.0068	-0.0039
4	$E[\Delta NII_{it} \mid \Delta \hat{r}_t]$	-0.0216	-0.0339	-0.0758*	0.0849**	0.0432	0.0375
5	ΔTA_{it}	0.1971***	0.4164***	0.1488***	-0.0222	0.0376	-0.0512
6	$CONFOR\_\Delta TA_{it}$	0.1068***	0.12283***	0.0780**	-0.0140	0.0289	-0.0259
7	$E[\Delta NII_{it} \mid \Delta r_t]\times\Delta TA_{it}$	-0.0461	-0.0972**	-0.0535	0.0608	-0.0340	0.0990**
8	$E[\Delta NII_{it} \mid \Delta \hat{r}_t]\times CONFOR\_\Delta TA_{it}$	-0.0054	-0.0262	-0.1228***	0.0545	0.0374	0.0653*
9	NII_Beta_{it}	0.0854**	0.1105***	0.1726***	-0.0228	0.0896**	-0.1031***

10	NII_FError$_{it}$	0.1782***	0.2426***	0.1903***	-0.0510	-0.0599	-0.0268
11	LowAccuracy$_{it}$	1.0000	0.1428***	0.0843**	-0.0304	-0.0361	-0.0368
12	TA_FError$_{it}$	0.2222***	1.0000	0.1301***	-0.0511	0.0176	-0.0028
13	STDNII$_{it-1}$	0.0969**	0.1052***	1.0000	-0.0588	0.0424	0.0116
14	DERIV$_{it-1}$	-0.0304	-0.0657*	-0.1037***	1.0000	0.3832***	0.4148***
15	FOLLOW$_{it-1}$	-0.0352	-0.0021	0.0138	0.3749***	1.0000	0.7207***
16	SIZE$_{it-1}$	-0.0466	-0.0130	-0.0463	0.4293***	0.7419***	1.0000

Panel C: Market Reaction and Price Discovery Sample

	Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	BAHR$_{ite}$	1.0000	-0.0050	0.0283**	0.0226**	0.0110	-0.0565***	0.0059	0.0113	0.0041	0.0377***
2	ΔNII$_{it}$	0.0144	1.0000	-0.0596***	0.6251***	-0.0402***	0.0203**	0.1428***	0.0005	0.2728***	0.0355***
3	E[ΔNII$_{it}$|Δr$_e$]	0.0137	-0.0641***	1.0000	-0.0092	0.3584***	0.1651***	-0.0233**	0.0044	-0.0016	0.0490***
4	ΔTA$_{it}$	0.0307***	0.5770***	-0.0199*	1.0000	-0.0382***	0.0118	0.1691***	-0.0010	0.2306***	0.0371***
5	E[ΔNII$_{it}$|Δr$_e$]×ΔTA$_{it}$	0.0049	-0.1229***	0.6311***	-0.1249***	1.0000	0.0243**	0.0042	-0.0006	0.0012	-0.0107
6	Δr$_e$	-0.0652***	0.0368***	0.2681***	-0.0143	0.1589***	1.0000	0.0086	0.0191*	-0.0251**	0.0124
7	LowAccuracy$_{it-1}$	-0.0004	0.0653***	-0.0223*	0.1414***	-0.0271**	-0.0093	1.0000	-0.0293**	0.1152***	-0.0153
8	IPT$_{ite}$	0.0376***	0.0009	0.0026	-0.0081	0.0062	0.0198*	-0.0238**	1.0000	-0.0033	0.0023
9	STDNII$_{it-1}$	0.0077	0.2116***	-0.0199*	0.2390***	-0.0348***	-0.0224*	0.0920***	-0.0213*	1.0000	-0.0024
10	SIZE$_{it-1}$	0.0519***	0.0078	0.0360***	0.0228**	-0.0732***	0.0171	-0.0315***	0.0322***	-0.0250**	1.0000
11	ROA$_{it-1}$	0.0255**	0.1657***	-0.0817***	0.2886***	-0.0806***	-0.1108***	-0.0356***	-0.0025	0.1358***	0.1758***
12	DERIV$_{it-1}$	0.0368***	-0.0633***	0.0620***	-0.0625***	-0.0137	0.0303***	-0.0183	0.0495***	-0.0743***	0.4080***
13	NANALY$_{it-1}$	0.0508***	0.0284**	0.0235**	0.0702***	-0.0713***	-0.0014	0.0013	0.0342***	0.0756***	0.8360***

	Variable	**11**	**12**	**13**
1	BAHR$_{ite}$	0.0064	0.0361***	0.0420***
2	ΔNII$_{it}$	0.2029***	-0.0241**	0.0562***
3	E[ΔNII$_{it}$|Δr$_e$]	-0.0397***	0.0565***	0.0345***
4	ΔTA$_{it}$	0.2365***	-0.0099	0.0777***
5	E[ΔNII$_{it}$|Δr$_e$]×ΔTA$_{it}$	-0.0159	0.0261**	-0.0124
6	Δr$_e$	-0.0595**	0.0178	-0.0062
7	LowAccuracy$_{it-1}$	-0.0400***	-0.0183	0.0032
8	IPT$_{ite}$	-0.0080	0.0021	0.0096
9	STDNII$_{it-1}$	0.0894***	-0.0470***	0.0863***
10	SIZE$_{it-1}$	0.1490***	0.4133***	0.8608***
11	ROA$_{it-1}$	1.0000	-0.0836***	-0.1608***
12	DERIV$_{it-1}$	-0.1008***	1.0000	0.3845***
13	NANALY$_{it-1}$	0.2111***	0.3710***	1.0000

This table presents correlation statistics for our key variables. All variables are winsorized at the first and ninety-ninth percentiles. Pearson (Spearman) correlation coefficients are presented in the upper-right (bottom-left) portion of the table. *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test. All variables are defined in Appendix C.

TABLE 4
Interest Income Sensitivity Disclosure Predictive Ability

	Column (1)	Column (2)	Column (3)
$E[\Delta NII_{it} \mid \Delta r_t]$	0.5534***	0.5156***	0.4872***
	(6.59)	(7.57)	(8.09)
ΔTA_{it}		0.0214***	0.0214***
		(27.66)	(27.72)
$E[\Delta NII_{it} \mid \Delta r_t] \times \Delta TA_{it}$			0.0000
			(1.16)
Observations	3,444	3,444	3,444
Adj R-Squared	0.0723	0.4753	0.4757
Year FE	YES	YES	YES
Clustered SE	FIRM	FIRM	FIRM

This table estimates an association between change in NII from year t-1 to year t, scaled by lagged total assets, (ΔNII_{it}) and predicted change in NII from year t-1 to year t, scaled by lagged total assets, based on the firm's interest income sensitivity disclosure and the actual change in interest rates ($E[\Delta NII_{it} \mid \Delta r_t]$).

$$\Delta NII_{it} = \alpha + \beta_1 E[\Delta NII_{it} \mid \Delta r_t] + \beta_2 \Delta TA_{it} + \beta_3 E[\Delta NII_{it} \mid \Delta r_t] \times \Delta TA_{it} + \varepsilon_{it} \qquad (2)$$

All variables are defined in Appendix C and are winsorized at the first and ninety-ninth percentiles. All models include year fixed effects, and standard errors are clustered by firm. T-statistics are presented in parentheses, and *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

TABLE 5
Analysts Use of Information Reflected in IISD

Panel A: 3-Month Treasury Bill as Benchmark Interest Rate

	Column (1)	Column (2)	Column (3)	Column (4)
$E[\Delta NII_{it} \mid \Delta\hat{r}_t]$	1.0681^{**}	0.9689^{***}	0.9558^{**}	0.9828^{**}
	(2.26)	(2.93)	(2.29)	(2.29)
$CONFOR\_\Delta TA_{it}$		0.0194^{***}	0.0194^{***}	0.0193^{***}
		(10.12)	(9.96)	(9.94)
$E[\Delta NII_{it} \mid \Delta\hat{r}_t] \times CONFOR\_\Delta TA_{it}$			0.0000	0.0000
			(0.09)	(0.09)
NII_Beta_{it}				0.0813
				(0.85)
Observations	666	666	666	666
Adj R-Squared	0.0474	0.4196	0.4187	0.4188
Year FE	YES	YES	YES	YES
Clustered SE	FIRM	FIRM	FIRM	FIRM

Panel B: 10-Year Treasury Bond as Benchmark Interest Rate

	Column (1)	Column (2)	Column (3)	Column (4)
$E[\Delta NII_{it} \mid \Delta\hat{r}_t]$	0.4204	0.3730^{*}	0.5056^{**}	0.4987^{**}
	(1.03)	(1.67)	(2.08)	(2.11)
$CONFOR\_\Delta TA_{it}$		0.0195^{***}	0.0198^{***}	0.0198^{***}
		(10.06)	(9.20)	(9.44)
$E[\Delta NII_{it} \mid \Delta\hat{r}_t] \times CONFOR\_\Delta TA_{it}$			-0.0000	-0.0000
			(-0.95)	(-0.97)
NII_Beta_{it}				0.0399
				(0.87)
Observations	666	666	666	666
Adj R-Squared	0.0374	0.4113	0.4124	0.4132
Year FE	YES	YES	YES	YES
Clustered SE	FIRM	FIRM	FIRM	FIRM

This table estimates an association between the analyst consensus forecast of growth in NII from year t-1 to year t (CONFOR_ΔNIIit) and predicted percentage growth in NII from year t-1 to year t based on the firm's interest income sensitivity disclosure and the forecasted change in interest rates $E[\Delta NII_{it}|\Delta\hat{r}_t]$.

$$\begin{aligned}CONFOR\_\Delta NII_{it} = {} & \alpha + \beta_1 E[\Delta NII_{it}|\Delta\hat{r}_t] + \beta_2 CONFOR\_\Delta TA_{it} \\ & + \beta_3 E[\Delta NII_{it}|\Delta\hat{r}_t] \times CONFOR\_\Delta TA_{it} + \beta_4 NII\_Beta_{it} + \varepsilon_{it} \qquad (3)\end{aligned}$$

All variables are defined in Appendix C and are winsorized at the first and ninety-ninth percentiles. All models include year fixed effects, and standard errors are clustered by firm. T-statistics are presented in parentheses, and *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

TABLE 6
Analyst Forecast Accuracy Conditional on
Interest Income Sensitivity Disclosure Predictive Ability

	Column (1)	Column (2)	Column (3)
$LowAccuracy_{it}$	0.0617***	0.0512***	0.0474***
	(3.96)	(3.15)	(2.85)
TA_FError_{it}		0.4822***	0.4470***
		(3.46)	(3.38)
$STDNII_{it-1}$			10.1694***
			(2.63)
$DERIV_{it-1}$			-0.0027
			(-0.16)
$NANALY_{it-1}$			-0.0282
			(-1.07)
$SIZE_{it-1}$			0.0052
			(0.51)
Observations	666	666	666
Adj R-Squared	0.0338	0.0798	0.0991
Year FE	YES	YES	YES
Clustered SE	FIRM	FIRM	FIRM

This table estimates an association between forecast error of the analyst consensus forecast of NII (NII_FError_{it}) and the degree of inaccuracy of the firm's year t-1 interest income sensitivity disclosure ($LowAccuracy_{it}$).

$$NII\_FError_{it} = \alpha + \beta_1 LowAccuracy_{it} + \beta_2 TA\_FError_{it} + \beta_3 STDNII_{it-1} + \beta_4 DERIV_{it-1} + \beta_5 NANALY_{it-1} + \beta_6 SIZE_{it-1} + YEAR + \varepsilon_{it} \quad (4)$$

All variables are defined in Appendix C and are winsorized at the first and ninety-ninth percentiles. All models include year fixed effects, and standard errors are clustered by firm. T-statistics are presented in parentheses, and *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

TABLE 7
Equity Investors Use of Information Reflected in the Interest Income Sensitivity Disclosure

	Column (1)	Column (2)	Column (3)
$E[\Delta NII_{it}\|\Delta r_e]$	18.4971**	24.0708***	24.0708**
	(2.22)	(3.02)	(2.80)
Δr_e		-0.0331***	(0.0331)
		(-4.34)	(-0.68)
Observations	7,544	7,544	7,544
Adj R-Squared	0.1740	0.0046	0.0046
Event Date FE	YES	NO	NO
Clustered SE	FIRM	FIRM	FIRM/ EVENT DATE

This table estimates an association between the five-day abnormal buy-and-hold return measured over the (0, +4) day event window, where day zero is the date of the interest rate shock, ($BAHR_{ite}$) and predicted percentage growth in NII from year t-1 to year t based on the firm's interest income sensitivity disclosure and the change in interest rates on date e ($E[\Delta NII_{it}|\Delta r_e]$).

$$BAHR_{ite} = \alpha + \beta_1 E[\Delta NII_{it}|\Delta r_e] + (\beta_2 \Delta r_e \text{ or } EVENT\_DATE) + \varepsilon_{it} \qquad (5)$$

All variables are defined in Appendix C and are winsorized at the first and ninety-ninth percentiles. T-statistics are presented in parentheses, and *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

TABLE 8
Price Discovery
Conditional on Interest Income Sensitivity
Disclosure Predictive Ability

	Cumulative Returns Ratio	
Day	**High Accuracy**	**Low Accuracy**
0	0.3531	0.2585
+1	0.5403	0.4202
+2	0.7002	0.5348
+3	0.8639	0.7458
+4	1.0000	1.0000
IPT	**2.9574**	**2.4593**
N	**3,773**	**3,771**
Difference	**0.4981**	
T-Stat	**2.54 [2.55]**	
P-Value	**0.011 [0.011]**	

This table compares intraperiod timeliness (IPT) across high and low predictive ability portfolios based on a median split of the residual from equation (2). Information events are defined as days in which the magnitude of change in LIBOR, the six-month Treasury Bill secondary rate, and the ten-year constant maturity Treasury each are greater than or equal to the seventy-fifth percentile benchmark's annual distribution of the absolute value of daily change in interest rate. IPT is measured as the area under the curve over the (0,+4) day event window, where day zero is the date of the interest rate shock IPT is calculated as:

$$\mathrm{IPT}(0,+4) = \frac{1}{2}\sum_{t=0}^{4}\left(\mathrm{Abn}_{\mathrm{Return}_{t-1}} + \mathrm{Abn}_{\mathrm{Return}_{t}}\right)/\mathrm{Abn}_{\mathrm{Return}_{4}} = \sum_{t=0}^{3}\left(\mathrm{Abn}_{\mathrm{Return}_{t}}/\mathrm{Abn}_{\mathrm{Return}_{4}}\right) + 0.5 \qquad (6)$$

Significance of the difference in IPT between the high and low accuracy portfolios is based on a t-test, shown as unbracketed, as well as a bootstrapping approach, shown in brackets. The bootstrap technique 1) randomly selects observations from the complete sample and assign them either to a pseudo high-accuracy portfolio or a pseudo low-accuracy portfolio. The assignment continues until each pseudo portfolio has the same number of observations as the actual high-accuracy and low-accuracy portfolios; 2) calculates the difference between the mean IPT for the two pseudo portfolios, which represents an observation under the null hypothesis of no difference in IPT; 3) repeats this process 1,000 times to generate 1,000 IPT differences under the null hypothesis of no difference in IPT; 4) uses the empirical distribution of these null differences to test statistical significance of the observed difference in IPT between the high and low accuracy subsamples.

All variables are defined in Appendix C and are winsorized at the first and ninety-ninth percentiles. *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

TABLE 9
Price Discovery Regression Analysis
Conditional on Interest Income Sensitivity Disclosure Predictive Ability

	Column (1)	Column (2)	Column (3)
$LowAccuracy_{it-1}$	-0.5012**	-0.5138**	-0.5138**
	(-2.50)	(-2.56)	(-2.48)
$STDNII_{it-1}$	0.9115	-3.7331	-3.7331
	(0.03)	(-0.13)	(-0.13)
$DERIV_{it-1}$	-0.2975	-0.0466	-0.0466
	(-1.06)	(-0.18)	(-0.16)
$SIZE_{it-1}$	-0.1576	-0.1472	-0.1472
	(-1.16)	(-1.10)	(-0.99)
ROA_{it-1}	-8.7734	-11.1259	-11.1259
	(-0.70)	(-0.92)	(-0.85)
$NANALY_{it-1}$	0.4050*	0.3478	0.3478
	(1.70)	(1.48)	(1.33)
Δr_e		1.7659	1.7659**
		(1.64)	(2.06)
Observations	7,544	7,544	7,544
Adj R-Squared	0.0004	0.0007	0.0007
Event Date FE	YES	NO	NO
Clustered SE	FIRM	FIRM	FIRM/ EVENT DATE

This table estimates an association between intraperiod timeliness (IPT) of price reaction in response to an information event and the degree of inaccuracy of the firm's year t-1 interest income sensitivity disclosure ($LowAccuracy_{it-1}$). Information events are defined as days in which the magnitude of change in LIBOR, the six-month Treasury Bill secondary rate, and the ten-year constant maturity Treasury each are greater than or equal to the seventy-fifth percentile benchmark's annual distribution of the absolute value of daily change in interest rate.

$$IPT_{ite} = \alpha + \beta_1 LowAccuracy_{it-1} + \beta_2 STDNII_{it-1} + \beta_3 DERIV_{it-1} + \beta_4 SIZE_{it-1} + \beta_5 ROA_{it-1} + \beta_6 FOLLOW_{it-1} + (\beta_7 \Delta r_e \text{ or EVENT DATE}) + \varepsilon_{it} \qquad (7)$$

All variables are defined in Appendix C and are winsorized at the first and ninety-ninth percentiles. T-statistics are presented in parentheses, and *, **, *** indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.