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Corporate Information Environment Dynamics and Equity Valuation

An Analysis of Mandatory disclosures, Voluntary disclosures, and Information Intermediaries

By

Jingran Zhao

Doctor of Philosophy

Business

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An abstract of

A dissertation submitted to the Faculty of the James T. Laney School of Graduate Studies of Emory University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in business

2015

Abstract

Corporate Information Environment Dynamics and Equity Valuation

An Analysis of Mandatory disclosures, Voluntary disclosures, and Information Intermediaries

By Jingran Zhao

This paper examines the dynamics of a firm's information environment and how the components of the firm's information environment affect equity valuation of the firm. I examine the dynamics of a firm's information environment by investigating the relations among mandatory disclosures (*ManDisc*), voluntary disclosures (*VolDisc*), and information generated by information intermediaries (*InfoInt*). I find that firms with superior *ManDisc* also have superior *VolDisc* and superior *InfoInt*. The positive correlations between the three information channels suggest they are complementary in communicating to investors. I then examine the impact of the three information channels on equity valuation. Specifically, I examine the impact of each information channel on the stock price deviation from the firm's fundamental value, as calculated by the residual income valuation model. In the unconditional tests, I find that all three information channels affect equity valuation. However, in the conditional tests, I find that the disclosure effect of *ManDisc* on equity valuation disappears when I control for *VolDisc* and *InfoInt*. This evidence cautions against drawing inferences exclusively from the evidence of relations between equity valuation and one information channel. All three information channels contribute to a firm's overall information environment.

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TABLE OF CONTENTS

CONTENT PAGE

List of Figures

List of Tables

1. Introduction

In their literature review on the corporate information environment, Beyer, Cohen, Lys, and Walther (2010) call for research to examine the interdependencies among the components of the corporate information environment. In this study, I use machine-readable data to measure the three information channels that shape the corporate information environment and examine the relations among the three information channels and their effects on equity valuation. These three information channels are disclosures mandated by regulators (*ManDisc*), voluntary disclosures issued by managers (*VolDisc*), and information generated by information intermediaries (*InfoInt*).

Prior studies focus on the relations between mandatory disclosures and voluntary disclosures (e.g., Verrecchia 1983; Ball, Jayaraman, and Shivakumar 2012; Francis, Nanda, and Olsson 2008). Another important information channel is information generated by information intermediaries, such as analysts and business press. Information intermediaries gather information from different sources, such as mandatory and voluntary disclosures, and then generate and/or disseminate information for investors to use. All three information channels shape a firm's information environment, but little is known about the relations between the three information channels and the impact of each on equity valuation (Beyer et al. 2010). The limited research has been done on the interdependencies between the information channels, and this is because it is almost infeasible to capture the inherent complexity of the corporate information environment and it is challenging to measure the channels with machine readable data. In this study, I aim to capture the average perceived quality of each information channel, examine the correlations between them, and compare their effects on equity valuation.

I select measures from the prior literature or construct new proxies to capture the perceived quality of each information channel. *ManDisc* measures the perceived quality of financial statements in three areas: earnings persistence, which captures the numeric dimension of financial statements; readability, which captures the textual dimension of financial statements; and audit quality, which captures the overall quality and credibility of financial statements. *VolDisc* measures the perceived quality of information that firms voluntarily disclose to the market (e.g., management forecasts). *InfoInt* measures the perceived quality of the information that market intermediaries generate (e.g., analyst forecasts). I use the aggregate score of these three information channels to measure a firm's overall information environment (*InfoEnv*).

Mandatory disclosures and voluntary disclosures can be complementary or substitutive information channels of investor communication. They are complementary when a company commits to an inferior (superior) mandatory disclosure policy and an inferior (superior) voluntary disclosure policy, because when a firm has inferior mandatory disclosures (e.g. earnings quality) investors treat the firm as less (more) credible and the firm has insufficient incentives to voluntarily disclose superior information (e.g., management forecasts) to investors (e.g., Francis et al. 2008). In another related study, Ball, Jayaraman and Shivakumar (2012) show that when a firm commits to a higher level of audit verification to ensure the quality of the financial statements, the more accurate accounting also disciplines the firm to issue more truthful earnings forecasts.

Mandatory disclosures and voluntary disclosures can also be substitutive information channels when a firm communicates to investors. If mandatory disclosure is inferior and information asymmetry between investors and firms is high, investors will demand superior voluntary disclosures. To meet investors' demand, managers may disclose new information, such as earnings forecasts, to adjust investors' expectations about the firm's future earnings (e.g., Verrecchia 1983; Ajinkya and Gift 1984). In this case, mandatory disclosure and voluntary disclosures are substitutive in communicating to investors.

The relations between a firm's information, as generated by information intermediaries, and the firm's mandatory and voluntary disclosure policies can also be complementary or substitutive. When a firm has superior mandatory and voluntary disclosure policies, information acquisition and processing costs are lower for information intermediaries. Superior information comes from information intermediaries, such as analysts (e.g., Lang and Lundholm 1996). Therefore, relations between *ManDisc* and *InfoInt* and between *VolDisc* and *InfoInt* are complementary. *InfoInt* and the firm's disclosure policy can also be substitutive. When a firm is in a competitive industry and the proprietary information costs are high, a firm's incentive to disclose information is low. However, the demand for information from other stakeholders is high. Thus, information intermediaries have incentives to generate information for the stakeholders. For example, when Apple Inc. issues a new product, the firm does not leak information to the public, but analysts and press media issue frequent reports about the new product. In this way, information generated by information intermediaries has substitutive relations with mandatory disclosures and voluntary disclosures.

In this study, I examine the relations among the three information channels in both unconditional and conditional tests. In the unconditional test, I examine the pairwise correlations between the three information channels. In the conditional test, I examine the pairwise correlations between the three information channels and control for firm characteristics. Both tests reveal that the perceived qualities of all three information channels are positively correlated. Following Francis et al. (2008), I define the relations among the three information channels as complementary. I also find that the correlations between *InfoInt* and *ManDisc* and between *InfoInt* and *VolDisc* are higher than the correlation between *ManDisc* and *VolDisc*. This result suggests that information intermediaries gather information from mandatory and voluntary disclosures, so that I*nfoInt* is more closely related to these two information channels. In additional tests, I find that *InfoInt* moves in a similar pattern as that of *ManDisc* and *VolDisc*. When

ManDisc or *VolDisc* improves (deteriorates), *InfoInt* also improves (deteriorates). This result confirms that *InfoInt* relies on *ManDisc* and *VolDisc*.

After examining the relations among the three information channels, I examine the impact of each information channel on equity valuation. It is not clear which information channel has the most impact on equity valuation, because each has advantages and disadvantages. For example, mandatory disclosure is the most regulated but least timely source of information. Voluntary disclosure is timelier and comes directly from the firm's management, but it can be biased by managers' incentives. Information intermediaries generate the most straightforward information (i.e., analysts' reports), but the information does not come directly from the company. Information from information intermediaries can also be more comprehensive than mandatory and voluntary disclosures. In other words, the disclosure effects of mandatory and voluntary disclosures can be subsumed by information disclosed by information intermediaries.

I test the association between a firm's information environment and equity valuation in three ways. First, I test the direct relationship between a firm's information environment and the magnitude of the difference between a firm's market value and its fundamental value, as calculated from the residual income model. Firms with inferior information environments (i.e., inferior *ManDisc*, *VolDisc*, and *InfoInt*) have higher information processing costs for investors. Thus, the difference between a firm's market value and its fundamental value, as calculated from the residual income model, than it is for firms with superior information environments. I use Ohlson's (1995) residual income model to compute a firm's fundamental value. Prior literature has established the existence of mispricing using Ohlson's model (e.g., Frankel and Lee 1998; Dechow, Hutton, and Sloan 1999).

Second, since the market is efficient in the long run, if stock prices temporarily deviate from the fundamental value, they will revert to fundamental values in the long-run. As shown in the first test, prices of firms with inferior information environments deviate more from the firms' fundamental value. I expect that the future stock prices of these firms revert more to their fundamental values than do future stock prices of firms with superior information environments in the future. In other words, I use firms' fundamental values, stock prices, and information environments to predict the firms' future stock returns.

Third, to draw implications for managers who want to price securities correctly and to address endogeneity concerns, I examine the impact of changes in a firm's information environment on changes in the gap between the firm's market value and its fundamental value. I expect improvements (deteriorations) in information environments to be associated with decreases (increases) in the magnitude of the deviation. After examining the impact of a firm's information environment on price deviation from the firm's fundamental value, I repeat each test and compare the impact of each information channel on the price deviation.

In the first test of the information environment's effect on equity valuation, I find that stock prices of the firms with inferior information environments deviate more from their fundamental values than do stock prices of firms with superior information environments. The absolute difference between the market value and the fundamental value from Ohlson's model is 67.4%[1] of market value for firms with the most inferior information environments (i.e., bottom 10% of the sample) and 51.7% of market value for firms with the most superior information environments (i.e., top 10% of the sample). After establishing the baseline of the study with the overall information environment, I repeat the test for each of the three information channels. I find that stock prices of firms with inferior *InfoInt* deviate the most from the firms' fundamental values among all three information channels. The difference of price deviation between firms that

[1] The magnitude of price deviation is sensitive to different discount rates. Because I use the discount rate of 10% for all firms in my sample, the magnitude of price deviation may not reflect the true price deviation magnitude for each firm. More details about this issue are discussed in section 4.2.

have the most superior *InfoInt* (*ManDisc* and *VolDisc)* and most inferior *InfoInt* is 13.4% (4.6% and 8.4%) of the firms' average market value. *InfoInt* has the largest impact on equity valuation, perhaps because information intermediaries cover information that is contained in mandatory and voluntary disclosures.

Because the three information channels are positively correlated, in the conditional tests, I control for firm characteristics and examine whether the impact of one information channel on equity valuation is affected by other information channels. I find that each information channel is associated with a price deviation from the firm's fundamental value. However, the power of *ManDisc* is significantly reduced when I control for *VolDisc*. The disclosure effect of *ManDisc* disappears completely when I control for both *VolDisc* and *InfoInt*. This result cautions against drawing inferences exclusively from the evidence of a relation between equity valuation and one information channel. All three information channels contribute to a firms' overall information environment.

In the second test of the information environment's effect on equity valuation, I examine whether the stock prices revert to fundamental values in future periods. I find that stock prices do indeed revert to fundamental values and that stock prices of firms with inferior information environments revert more to their fundamental values than do the prices of firms with superior information environments. I test the price reversion prediction by building the following trading strategy: I form hedged portfolios by taking a long position in underpriced firms and taking a short position in overpriced firms. I find that hedged portfolios of firms with the most inferior (superior) information environments generate 12-month abnormal returns at a rate of 16% (3.5%) and size-adjusted 12-month returns at a rate of 11% (4.1%).[2] I repeat the test for all three

[2] After matching abnormal returns with price deviation ranges, I find that for every 1% of market value price deviation, prices revert 11.53 basis points in 12 months for firms with the most inferior information environments.

information channels, and I find that the hedged portfolio profit is greatest for firms with inferior *InfoInt* (11.9% of annual abnormal returns). The difference between the most inferior and the most superior *InfoInt* portfolios (8.1% of annual abnormal returns) is larger than those of *ManDisc* (5.8% of annual abnormal return) and *VolDisc* (4.4% of annual abnormal return).

In the third test of the information environment's effect on equity valuation, I examine the impact of changes in the information environment on changes in equity valuation. When the information environment improves, the stock price's deviation from the firm's fundamental value decreases by 1.9% of the firms' average market value; when the information environment deteriorates, the magnitude of the deviation increases by 5.2% of the firms' average market value. When I repeat the test for all three information channels, I find that improvement (worsening) in *InfoInt* reduces (increases) the deviation magnitude the most. When *InfoInt* (*ManDisc* and *VolDisc)* deteriorates, the deviation magnitude increases by 4.3% (3.7% and 3.9%) of the firms' average market value; when *InfoInt* (*ManDisc* and *VolDisc)* improves, the deviation magnitude decreases by 1.3% (1.1% and 0.6%) of the firms' average market value.

I address several concerns with my empirical design in the robustness tests. First, I apply a different model to evaluate firms' fundamental values. Specifically, I use the *FScore*, as applied by Piotroski (2000), which is a financial ratio-based model. Using Piotroski's *FScore*, I find similar results to those found using Ohlson's (1995) model. Second, I test the results to examine the effect of size. In addition to using size-adjusted returns, I sort portfolios by size. I find that the trading strategy works for small-market cap firms, as well as for medium- and large-market cap firms. Third, I find that the trading strategy works for all but one year (i.e., 2008) in the 12-year sample period. This time series of strong positive performance casts doubt on a risk-based explanation for the return differences. Third, I use short window returns to address concerns about the risk-based explanation for the long window return differences. I examine the returns around subsequent earnings announcements and find that the results are consistent with the results of returns using long-term windows. That is, previously underpriced (overpriced) firms generate positive (negative) returns around subsequent earnings announcements. This effect is magnified (abated) for firms with inferior (superior) information environments.

As Beyer et al. (2010) point out in their survey, little has been done to analyze firms' overall information environments and the interdependencies among different aspects of information environments. This may be because the information environment is a vague concept to measure and because no existing dataset has systematically measured the aspects of information environments that are useful for academics. For example, researchers would like to know the differential impacts of mandatory disclosures and voluntary disclosures on capital costs. However, existing data that measure firms' information environments (e.g., analyst rankings of the Association for Investment and Management Research, henceforth AIMR, and Standard & Poor's scores) do not separate mandatory and voluntary disclosures. This study is the first large-scale empirical study to examine both the overall information environments and the interplay among mandatory disclosures, voluntary disclosures, and information intermediaries.

The evidence of this study also has implication for academics who study the effect of disclosure on equity valuation. Numerous accounting studies examine the impact of accounting information on equity valuation, but most focus on only one information channel. This study includes three information channels and compares the impact of each information channel on equity valuation. The evidence shows that three information channels have differential effects on equity valuation and that the disclosure impact of mandatory disclosures can be subsumed by voluntary disclosures and information intermediaries. This evidence cautions against drawing inferences exclusively from market reactions to one information channel. All three information channels contribute to a firm's overall information environment.

The rest of the paper is organized as follows. First, I develop the hypotheses. Second, I describe the sample selection and construct the measure for information environment. Third, I present the results of the empirical tests and robustness tests. Last, I conclude and suggest future research opportunities.

2 Hypothesis Development

2.1 Relations Between Information Channels

Mandatory disclosures, voluntary disclosures, and information intermediaries can be complementary or substitutive when communicating information to investors. First, for the relations between mandatory disclosures and voluntary disclosures, prior studies find that mandatory and voluntary disclosures can be complementary or substitutive information channels for communicating with investors. For instance, when a company commits to an inferior (superior) mandatory disclosures policy, the company also has an inferior (superior) voluntary disclosures policy, because investors treat the firm's voluntarily disclosed information as less (more) credible and managers have insufficient incentives to voluntarily disclose superior information to investors (e.g., Francis et al. 2008). In this case, the relation between mandatory disclosures and voluntary disclosures is complementary. Mandatory disclosures and voluntary disclosures can also be substitutive information channels when a firm communicates to investors. If the mandatory disclosures is inferior and information asymmetry between investors and firms is high, then investors will demand superior voluntary disclosures. Thus, managers have incentives to voluntarily disclose information to the market. Managers may also issue earnings forecasts that contain new information to adjust investors' expectations about the firm's future earnings (e.g., Verrecchia 1983; Ajinkya and Gift 1984).

Second, the relations between a firm's information generated by information intermediaries and the firm's mandatory and voluntary disclosures policies can also be complementary or substitutive in communicating information to investors. When a firm has superior mandatory and voluntary disclosure policies, information acquisition costs are lower for information intermediaries. The firm has superior information, as generated by information intermediaries, such as analysts (e.g., Lang and Lundholm 1996). In this case, the relation between mandatory and voluntary disclosures and information generated by information intermediaries is complementary. Information generated by information intermediaries and the firm's disclosure policy can also be substitutive. When a firm is in a highly competitive industry and information proprietary costs are high, the firm does not have strong incentives to disclose information to outsiders. However, there is strong demand from the market and other stakeholders. The market and the press thus generate information to meet this demand.

H1a: *ManDisc*, *VolDisc*, and *InfoInt* are complementary in communicating information to investors.

H1b: *ManDisc*, *VolDisc*, and *InfoInt* are substitutive in communicating information to investors.

2.2 Information Environment and Equity Valuation

Investors evaluate securities with information that they obtain from various sources. The measure in this study captures the information environment from investors' perspectives. If a firm has an inferior information environment, then investors do not have access to superior quality information about the firm. In other words, when information processing and trading costs are high, stock prices of the firm are more likely to deviate from the firm's fundamental value than are stock prices for firms with superior information environments.

The fundamental values are calculated from accounting models. Compared to stock prices, accounting models should reflect a firm's fundamental value and are less affected by a firm's information environment. In this study, I use Ohlson's (1995) residual income model to compute a firm's fundamental value. The implementation of Ohlson's model is described in detail in Appendix A.

When a firm has an inferior information environment, investors have inferior quality information to evaluate the firm's intrinsic value. The information asymmetry between the firm and the investors is high, and the firm is likely to be mispriced. On the other hand, when a firm has a superior information environment, investors have access to straightforward information to evaluate its securities (i.e., information processing costs for investors are low). The stock price is more likely to be aligned with the fundamental value, as calculated from accounting models.

H2: Stock prices of firms with inferior information environments deviate more from the firms' fundamental values than do stock prices of firms with superior information environments.

I further look into each of the information channels in the measure of information environments and investigate their impacts on equity valuation. It is difficult to predict which of the three information channels has the most impact on valuation, because each has advantages and disadvantages. For example, *ManDisc* is the most reliable information source among the three, because it is strictly monitored by auditors and regulatory bodies, such as the SEC. *VolDisc* comes from managers, who have more information about the firm than do information intermediaries. Managers also have more flexibility when communicating with investors through *VolDisc* than through *ManDisc*. Information from information intermediaries is less costly for investors to obtain and consume than information from mandatory disclosures or voluntary disclosures. For example, analysts' forecast estimates or recommendations may be easier to understand than management guidance or 10-K filings. Information from information intermediaries can also be more comprehensive than mandatory and voluntary disclosures. In other words, the disclosure effect of mandatory and voluntary disclosures can be subsumed by information disclosed by information intermediaries. Therefore, given the same quality of information from the three information channels, *InfoInt* is likely to have the most impact on valuation. Because it is not clear which information channel would most affect valuation, I state hypothesis 3 in the null form.

H3: *ManDisc*, *VolDisc*, or *InfoInt* have the same impact on price deviation from fundamental values as calculated by the residual income valuation model.

3 Sample Description

3.1 Sample Selection

I construct the sample by identifying firms with sufficient stock price and financial statement data on CRSP and Compustat. The sample period is from 2000 to 2013. The sample period starts at 2000 because firms' information environments were substantially different prior to 2000. For example, the number of corporate news releases related to earnings increased dramatically after the adoption of Regulation Fair Disclosure (Reg FD) in 2000 (Bailey, Li, Mao, and Zhong 2003), and this greatly influenced the *VolDisc* variable.

To be included in the sample, a firm must trade on a U.S. exchange and must have nonmissing data to compute the information environment variables (more details in Section 3.2). I deleted any firm-year observation lacking sufficient data to compute 12- and 24-month returns from the sample.[3] After trimming on PForeErr [4] at 1% and 99%, I have 39,607 firm-year observations and 6,357 firms.

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[3] I follow (Beaver, McNichols, and Price 2007) to compute returns when a firm delists during the sample period.

3.2 Information Environment Measures

I follow Bushman, Piotroski, and Smith (2004) to build the measure of the information environment. Bushman et al. (2004) define corporate transparency as the widespread availability of firm-specific information concerning publicly listed firms in the economy to those outside the firm. They categorize corporate transparency into three types: corporate reporting, private information acquisition, and information dissemination. They operationalize these concepts with measures at the country level. In this study, I directly measure the perceived quality of information channels that investors use to evaluate a firm's fundamental value at a firm level.[5] Most of the variables used to construct a firm's information environment are based on investors' perspectives and are commonly used in the prior literature.

The overall information environment is a self-constructed summary score (*InfoEnv*) of each of the three measures (*ManDisc*, *VolDisc* and *InfoInt*). I choose a self-constructed measure over externally generated scores (e.g., AIMR scores and Standard & Poor's scores) for the following reasons. First, externally generated scores face severe selection bias. For example, AIMR scores tend to cover large firms (Botosan and Plumlee 2002; Lang and Lundholm 1993). Second, all existing scores from prior research are outdated for the current study. For example, the Financial Analysts Federation discontinued AIMR ratings in 1995. Third, a self-constructed score can be customized to capture what the scholar intends to measure. Researchers can use data

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[4] PForeErr is the forecast error, which is the difference between market value of the firm and the fundamental value of the firm calculated from Ohlson's (1995) residual income model, scaled by market value of the firm.
Forecast Error $=\left(P_t-(b_t+\frac{\omega}{1+r-\omega}x_t^a)\right)/P_t$.

[5] Another concept closely related to information environment is information uncertainty. Zhang (2006) operationalizes information uncertainty as the variance of a signal(s): *var(s) = var(v) + var(e)*, where *var(v)* is a firm's underlying fundamental volatility and *var(e)* reflects the quality of information. Zhang (2006b) does not distinguish a firm's underlying fundamental volatility from information quality, because both effects contribute to the uncertainty of a firm's value and because it is hard to separate them empirically. My unique research design can disentangle these concepts. I hold the firm's fundamental value constant and investigate the quality of the information environment, which is similar to the concept of *var(e)*.

collection and coding schemes to customize the self-constructed score. Last but not least, this measure is computed using machine-readable data. This approach can reduce the replication cost for future empirical research.

3.2.1 Mandatory disclosures Variables

The first information channel is mandatory disclosures. Mandatory disclosures is a hard construct to measure because it contains a large amount of information and there is little consensus in the literature on how to measure the quality of mandatory disclosures. I choose the investors' perspective and measure the perceived quality of mandatory disclosures in the following three dimensions. First, I capture the numeric aspect of financial statements. I treat earnings quality as the primary component of mandatory financial reporting. It is the most important outcome indicator of the financial reporting process (e.g., Lev 1989). There are many proxies for earnings quality. Dechow, Ge, and Schrand (2010) summarize the proxies in three categories: properties of earnings (e.g. persistence), investor responsiveness to earnings (e.g., earnings response coefficients), and external indicators of earnings misstatements (e.g. Accounting and Auditing Enforcement Releases). Of these three categories, I choose earnings persistence to represent earnings quality, because this measure is easy for investors to evaluate and does not require a long time-series of data to compute.[6] It is the slope coefficient estimated from an autoregressive model of order one for ROA: $ROA_{i,q} = \alpha + \beta ROA_{i,q-1} + \delta Seasonal\ Dummies + u_{i,q}$. I estimate the equation using OLS and rolling 20-quarter windows. All firms have to have at least 8 quarters of data (Please refer to table 1 for details of the computation of the variables.)

[6] Many proxies for earnings quality require a long time-series of data (e.g., eight to ten years). This can bias the sample to large surviving firms. In this study, I use a large sample to represent the population of firms and to increase external validity.

In addition to accounting numbers, I also measure the quality of nonfinancial information in financial statements. Financial statements can contain hundreds of pages with information in the text. In recent years, empirical researchers have developed several measures to capture the quality of nonfinancial information in financial statements. One popular measure is readability. I use readability as a measure for mandatory disclosures, because financial statements are difficult for investors to understand. The legal jargon and lengthy sentences can increase the cost for investors to consume the information in financial statements. Following Li (2008), I use a Fog Index as a proxy for readability.[7] The Fog Index indicates the number of years of formal education an average reader needs to understand the content of the text.

Another measure for mandatory disclosures is audit quality. Audit quality measures the overall quality and the credibility of financial statements. Prior literature shows that audit quality is positively associated with the quality of financial statements (e.g., Watts and Zimmerman 1986). I use auditors' independence from their clients as a crude proxy for audit quality. Frankel, Johnson, and Nelson (2002) show that the lack of auditors' economic independence is associated with lower earnings quality. Following Frankel et al. (2002), I measure the independence of auditors as the ratio of audit fees to total fees paid to the auditor firm. I collect audit fees and total fee paid to auditors from AuditAnalytics. By conducting a principal component analysis of the three proxies of mandatory disclosures, I obtain the first principal component to capture the underlying attribute of mandatory disclosures (*ManDisc*). Table 3 summarizes the results of the principal component analysis. The first principal component from the analysis captures 38% of the total variance of the three variables, and it is strongly related to readability and audit quality.

[7] Another proxy for readability is the file size of 10-K. Loughran and McDonald (2011) find that the 10-K document file size is better than the Fog Index as a proxy for readability. They find that the Fog Index is poorly specified in financial applications, and file size outperforms the Fog Index as a proxy for readability. I repeat the principal component analysis with file size. The results of the principal component analysis and the main tests in this study remain similar.

3.2.2 Voluntary disclosures Variables

The second information channel is voluntary disclosures. Besides mandatory disclosures, managers use other mechanisms to disseminate information to outside investors, such as management forecasts, earnings conference calls, conference presentations, and analyst conferences. Similar to mandatory disclosures, I develop several proxies to measure different aspects of a firm's voluntary disclosures and conduct a principal component analysis to calculate a common factor to measure voluntary disclosures (*VolDisc*).

First, I measure the quality of management forecasts (*MF*). I collect management forecast data from the FirstCall database. For each firm *i*, I construct a management forecast score. Following prior literature (e.g. Ball, Jayaraman, and Shivakumar 2012), I use the number (*FREQ*), timeliness (*HORIZON*), and specificity (*SPECIFICITY*) of firm *i*'s forecasts in year *t* to construct the management forecast score (*MF*). *FREQ* is the number of annual and quarterly EPS forecasts firm *i* made during year *t*. Firms that do not make any forecasts in year *t* are assigned a value of 0 for that firm-year. I measure *HORIZON* as the average horizon of firm *i*'s forecasts released in year *t*. The average horizon of firm *i*'s forecasts released in year *t* is computed as one plus the log of the difference in days between the fiscal period end and the forecast date. Larger values of *HORIZON* indicate timelier, and hence more informative, forecasts. *SPECIFICITY* is the average over year *t* of firm *i*'s forecast specificity or precision. If firm *i* provides no forecast guidance in the testing period, then *SPECIFICITY* = 0. For each of firm *i*'s forecasts, if the forecast is purely qualitative, then *SPECIFICITY* = 1 for that forecast. If the forecast is an open-ended estimate (where one end of the range is provided but not the other), then *SPECIFICITY* = 2 for that forecast. If a range estimate is given, then *SPECIFICITY* = 3. If a point estimate is given, then *SPECIFICITY* = 4. Consistent with prior studies, such as Francis, Nanda, and Olsson (2008), I interpret more specific forecasts as being more informative. I rank *FREQ*, *HORIZON*, and

SPECIFICITY and use the sum of the rankings with equal weights as the measure for firm *i*'s year *t* management forecasts (*MF*).

The second proxy for voluntary disclosures is information release (*Info*), and it includes most information release events, such as earnings conference calls, press releases, and conference presentations. I collect this information from Bloomberg. Using this database increases the external validity of this study, because it directly measures the information environment that practitioners face in their day-to-day work. Bloomberg collects the information from a variety of sources, such as companies' websites, news releases, investor relation departments, as well as Bloomberg news staff and analysts. I count the number of information release events per year and use it as the measure for *Info*.

The last *VolDisc* proxy is insider trading. Unlike management forecasts and information events, insider trading might have a positive or a negative relationship with the quality of voluntary disclosures. Investors can retrieve information from insider sales (e.g., Karamanou, Pownall and Prakash 2014), and more insider trades means more information for investors. Managers also have incentives to hold information or strategically disclose information for their personal gain. Baiman and Verrecchia (1996) model the relationship between disclosure, market liquidity, cost of capital, and profits of insider trading. They show a negative relationship between the level of disclosures and the managers' insider trading profits. Cheng and Lo (2006) find empirical evidence that shows managers do exploit voluntary disclosures opportunities for their personal gains. I use net insider trades in firm *i*'s shares in year *t*, scaled by total common shares outstanding as the profit of insider trades (*Insider*). I obtain data on insider transactions from Thomson Reuters Insiders Database. The first principal component of the three variables is the final measure for *VolDisc*. Table 3 summarizes the results of the principal component analysis. The first principal component from the analysis captures 45% of the total variance of the three variables, and it is strongly related to all three variables. *Insider* is negatively correlated with the overall perceived quality of voluntary disclosures.

3.2.3 Information Intermediaries Variables

The third information channel I measure is information intermediaries (*InfoInt*). Information intermediaries in the stock market, such as analysts, help disseminate firm information to investors. They either sell the processed information to the market or trade on the information themselves. Compared with the mandatory and voluntary disclosures channels, information generated by intermediaries is less influenced by managers and easier to understand by investors.

Similar to measuring the voluntary disclosures channel, I perform a principal component analysis on several proxies for information intermediaries (*InfoInt*). These proxies include analysts following (*AFollow*), proportion of institutional investors' ownership (*Inst*), and number of shareholders (*NoShr*). Analysts specialize in processing and interpreting financial information reported by firms, and they collect additional information through discussions with firms' managers, suppliers, customers, and others. Following prior research (Lang and Lundholm 1993; Healy, Hutton, and Palepu 1999; Lang, Lins, and Miller 2003), I use the number of analyst forecasts issued for firm *i* in year *t* from FirstCall to measure *AFollow*.

Institutional investors (*Inst*) influence a firm's information environment and price formation (Utama and Cready 1997; El-Gazzar 1998; Healy, Hutton, and Palepu 1999; Jiambalvo, Rajgopal, and Venkatachalam 2002; Bushee and Noe 2000). Significant levels of institutional ownership should be associated with greater monitoring and increased access to firm-specific information. I use the proportion of firm *i*'s shares held by institutional investors at the end of year *t* as a proxy for *Inst*. I collected data of institutional ownership from the WRDS Thomson Reuters Institutional (13f) Holdings database. [8]

Lastly I measure a firm's investor recognition with a firm's shareholder base. The number of shareholders of common stock equity (*NoShr*) is positively associated with firms' investor recognition (Grullon, Kanatas, and Weston 2004). When a firm is more recognizable by investors, there is more information about the firm in public than a firm that is less recognizable. I measure *NoShr* as the natural log of total number of shareholders of common stock. I conduct principal component analysis of *AFollow*, *Inst*, and *NoShr* to measure *InfoInt*. Table 3 summarizes the results of the principal component analysis. The first principal component captures 56% of the total variance of the three variables, and it is strongly related to *AFollow* and *Inst*.

To capture all aspects of the firm's information environment, I compute firm *i*'s information environment in year *t* (*InfoEnv*) as the sum of the three measures of information channels (*ManDisc*, *VolDisc* and *InfoInt*).

4 Results

4.1 Descriptive Statistics and Relations Between the Information Channels

To better understand the sample, I partition the sample into firms with different information environments and present the characteristics of firms in different information environments. Table 4 panel A shows the descriptive statistics for the sample. *InfoEnv*, *ManDisc*, *VolDisc*, and *InfoInt* are scores from the PCA analyses. The sample is partitioned by *InfoEnv*. Superior *InfoEnv* firms have more persistent earnings, more readable financial statements, and

[8] This database provides institutional common stock holding and transactions, as reported on Form 13f filed with the U.S. Securities and Exchange Commission. This database is formerly known as the CDA/Spectrum 34 database, and it contains ownership information by institutional managers with $100 million or more in assets under management.

have more independent auditors than those with inferior *InfoEnv*. They also have better management forecasts (forecasts are more frequent, timelier, and more specific), they hold more information events for investors, and they have less insider trading. More analysts follow firms with superior *InfoEnv*, institutional investors invest more in these firms, and more investors hold shares in such firms. Firms with superior *InfoEnv* also tend to be larger. The differences of these variables between superior and inferior *InfoEnv* portfolios are statistically significant. I also check these descriptive statistics for *ManDisc*, *VolDisc*, and *InfoInt.* I find the results have the same pattern of *InfoEnv*. This implies that *ManDisc*, *VolDisc*, and *InfoInt* are positively correlated.

Panel B of table 4 shows the industry composition of the sample. Observations are evenly distributed across different information environment portfolios. This ensures that the findings in this study are not driven by industry effects. Panel C of table 4 presents the comparison of market value of equity of the sample with the average market value of equity of the NYSE firms from 2000 to 2012. The sample includes more small firms than NYSE firms because many of the firms are from NASDAQ and AMEX.

Panel D of table 4 shows the correlations among the information channels and information sources that I use to construct the three information channels. All three information channels are positively correlated. This suggests that the three information channels are complementary. Among all three information channels, *InfoInt* is most correlated with the overall *InfoEnv* variable. This means most of the variation of *InfoEnv* comes from *InfoInt*. Another result worth noting is that the correlation between *InfoInt* and *ManDisc* and the correlation between *InfoInt* and *VolDisc* are higher than the correlation between *ManDisc* and *VolDisc*. This means the information from information intermediaries is highly affected by mandatory disclosures and voluntary disclosures. Size (i.e., market cap and total asset) is positively correlated with the information environment variables, and Book-to-Market is negatively correlated with information environment variables. This is not surprising because firms that have superior *InfoEnv* tend to be larger because they have more resources for investor relations. High Book-to-Market firms are often neglected firms and they tend to have inferior *InfoEnv*.

To control for firm characteristics and time series fixed effects, I run OLS regressions to further examine the relations between the information channels. The results in table 4 panel E confirms with the results in table 4 panel D. In the OLS regression, I control for the firm size, Book-to-Market ratio, and leverage ratio. I also include firm and year fixed effects. The standard errors are clustered by firm and by year. All three information channels are positively correlated with each other, and the correlation between *InfoInt* and *ManDisc*, and the correlation between *InfoInt* and *VolDisc* are stronger than the correlation between *ManDisc* and *VolDisc*. This result suggests that information from information intermediaries is highly affected by mandatory disclosures and voluntary disclosures. To further examine this hypothesis, I test the relations between the changes of each information channels. Table 4 panel F shows the OLS regression results. In the OLS regression, I control for changes of firm sizes, changes of Book-to-Market ratios, and changes of leverage ratios. I also include firm and year fixed effects. The standard errors are clustered by firm and by year. I find that the changes of *ManDisc* and *VolDisc* are associated with the changes of *InfoInt*, but the changes of *ManDisc* are not associated with changes of *VolDisc*. This result suggests that the perceived quality of information generated by information intermediaries rely on the perceived quality of mandatory disclosures and voluntary disclosures, and the perceived quality of information generated by information intermediaries co-moves with *ManDisc* and *VolDisc*.

4.2 Information Environment & Equity Valuation

First, I examine the relationship between information environment and equity valuation using a portfolio approach. Table 5 panel A reports the results of the Ohlson model's ability to explain contemporaneous stock prices for firms with different information environments. Observations are sorted into deciles based on their information environment scores (*InfoEnv*). Forecast error is the scaled difference between a firm's market value and its fundamental value calculated by Ohlson's residual income model. I use Ohlson's residual income model without modeling other information; in other words, eq. (4) in Appendix A without the third term.

$$P_t = b_t + \frac{\omega}{1+r-\omega} x_t^a \tag{5}$$

P_t denotes the market value of the firm measured at the end of the month following the earnings announcement of year t. b_t denotes the book value of equity at the end of year t. x_t^a denotes abnormal earnings for year t and is defined as $x_t^a = x_t - rb_{t-1}$. Following Dechow, Hutton, and Sloan (1999), I use a first-order, auto-regressive process to estimate ω. r is the discount rate. Theoretically r should be firm-specific, reflecting the compensation that equity investors demand for the risk they take to invest in the stock. However, it is difficult to determine the value of r in practice. Because r enters the model in a similar fashion, variations of r do not affect the model materially in empirical tests (Dechow et al. 1999). I use 10% as the approximation of the long-run average realized return on U.S. equities.[9]

As predicted by H2, firms that have the most superior information environments (i.e., firms in the bottom decile) have the smallest mean absolute forecast error (0.517). This means that the average of the absolute differences between the market value and the value predicted by Ohlson's model is about 51.7% of the average firms' market value. Firms that have the most inferior information environments (i.e., firms in the top decile) have a mean absolute forecast error of 0.674. The difference in forecast errors between firms with the most inferior information environments and firms with the most superior information environments is 0.157, which is 15.7%

[9] I also tested the results using the range from 8% to 15%. The inferences remain unchanged. In addition to the constant discount rates, I also calculate the discount rates based on Fama-French three-factor model. Again, the inferences of the main results remain unchanged.

of the average firms' market value. This difference is both statistically and economically significant.

The pattern of the mean forecast error is the opposite of the mean absolute forecast error and mean square forecast error. This is because inferior *InfoEnv* portfolios have more firms with negative forecast errors than superior *InfoEnv* portfolios do. Negative mean forecast errors mean that the stock prices are lower than the fundamental values computed from Ohlson's model. In other words, the stock is underpriced. The results in table 5 panel A indicate that firms with inferior information environments are underpriced more than firms with superior information environments.

Table 5 panel B shows range of the forecast errors or price deviation for each decile portfolio. The range of price deviation is bigger for firms with inferior information environments than for firms with superior information environments. In other words, firms with inferior information environments are underpriced or overpriced to a greater extent than firms with superior information environments. Figure 1 illustrates this pattern. An interesting fact is that most of the price deviation comes from underpricing, not overpricing.

Information about the firm disseminates through different channels. H3 examines and compares the impact of each information channel on equity valuation. Table 5 panel C shows the results of Ohlson's model explaining contemporaneous stock prices for firms in different *ManDisc*, *VolDisc*, and *InfoInt* portfolios. The results for all three information channels are similar to those in Table 5 panel A and B. Among the three information channels, firms with different *InfoInt* have the largest difference in mean absolute forecast errors. I sort firms into terciles[10] based on *ManDisc*/*VolDisc*/*InfoInt*. The difference between mean absolute forecast error of firms that have the most superior *InfoInt* (top tercile) and of firms that have the most inferior *InfoInt* (bottom tercile) is 13.4% of the firms' average market value (t-statistics is 24.91). The difference between mean absolute forecast errors of firms with the most superior and firms with the most inferior *ManDisc* and *VolDisc* are 4.6% and 8.4% of the firms' average market value, respectively (t-statistics are 8.50 and 15.73, respectively). This means that when a firm has superior *InfoInt*, investors have access to superior information generated by information intermediaries. The stock price of the firm deviate the least from the firm's fundamental value.

The previous tests are unconditional tests. In conditional tests, I control for firm characteristics and examine whether the impact of one information channel on equity valuation would be affected by other information channels. Table 5 panel D shows the OLS regression results of information channels and equity valuation. The dependent variable is the price deviation ratio, and I control for the firm size, Book-to-Market ratio, and leverage ratio. I also include firm and year fixed effects in the regressions. The standard errors are clustered by firm and by year. I find that each information channel is statistically significantly associated with the price deviation from the firm's fundamental value. However, the power of mandatory disclosures is significantly reduced when I control for voluntary disclosures (t-statistics is reduced from -2.34 to -1.88). The disclosure effect of mandatory disclosures is completely taken away when I control for both voluntary disclosures and information intermediaries. This result cautions against drawing inferences exclusively from equity valuation of one information channel. All three information channels contribute to a firms' overall information environment.

[10] I sort firms into terciles instead of deciles because the single information channel is noisier than the overall information environment measure, *InfoEnv*. The general inferences remain unchanged when firms are sorted into deciles.

Among the three information channels, *InfoInt* has the most impact on equity valuation in both the unconditional tests and the conditional tests. In the conditional tests, *InfoInt* has the largest estimates among the three information channels, and is the least affected when other information channels are included in the regression analyses. As shown in the earlier test for H1, *InfoInt* is highly associated with *ManDisc* and *VolDisc*. Information from information intermediaries can also be more comprehensive than mandatory and voluntary disclosures. In other words, the disclosure effect of mandatory and voluntary disclosures can be subsumed by information disclosed by information intermediates.

4.3 Information Environment & Future Stock Returns

One concern for the results in table 5 is whether the computed forecast errors is due to the deviation of the stock price from the firm's fundamental value or the error in calculating the firm's fundamental value from Olson's residual income valuation model. One way to address this concern is investigating future stock returns to see whether investors correct their priors and the stock prices will revert toward the fundamental or intrinsic values implied by Ohlson's model. The deviation of stock prices from the fundamental value will be reduced.

In this study, I expect the stock prices of firms with inferior information environments to revert more to fundamental values than do the stock prices of firms with superior information environments. If stock prices of firms with inferior information environments deviate more from the firms' fundamental values than firms with superior information environments, then investors should correct their valuations more for firms with inferior information environments than they do for firms with superior information environments in future periods.

I construct portfolios by information environment scores (*InfoEnv*) and deviation ratios. Deviation ratio is the ratio of values predicted by Ohlson's model to firms' contemporaneous market values. Deciles are formed by double sorting firm-years on *InfoEnv* and the price deviation ratio. Specifically, I first sort firm-years on *InfoEnv* into deciles, and I form terciles by sorting observations within each decile on deviation ratios. The low deviation ratio portfolio consists of firms that are overpriced by the market. The high deviation ratio portfolio consists of firms that are undervalued. These firms should generate positive future returns. The hedged portfolio takes a long position on firms that are undervalued and takes a short position on firms that are overvalued.

Table 6 panel A shows the results of future returns of the hedged portfolios. All hedged portfolios based on deviation ratios generate positive returns (i.e., high-ratio tercile – low-ratio tercile within each decile portfolios). This means that previously undervalued firms generate higher returns than do previously overvalued firms for all information environment deciles. Moreover, I show that the hedged portfolios of firms that have the most inferior information environments earn the highest profit. These firms were mispriced the most, so their stock prices revert the most to the fundamentals valued by Ohlson's model. One (two)- year abnormal return for the hedged portfolio of firms with the most inferior information environments is 16% (26.4%) while the one (two)- year abnormal return for the hedged portfolio of firms with the most superior information environments is only 3.5% (8.2%). The difference in the hedged profits between the most superior and the most inferior information environments is 12.6% (18.2%) for one (two)- year abnormal return. After matching abnormal returns with deviation ranges, I find that for every 1% of market value deviation, prices revert 11.53 basis points in 12 months for firms with the most inferior information environments.

Size-adjusted returns show similar results. One (two)- year size-adjusted return for the hedged portfolio of firms with inferior information environments is 11% (17.1%) while the one (two)- year abnormal return for the hedged portfolio of firms with superior information environments is only 4.1% (9.9%). The difference in the hedged profits between the most superior and inferior information environments is 6.9% (7.2%) for one (two)- year abnormal return. It is both economically and statistically significant.

After establishing the baseline, I then form the hedged portfolios based on each information channels. I double sort firms on *ManDisc*/*VolDisc*/*InfoInt* and deviation ratios. The low-ratio portfolio consists of firms that are overpriced by the market. The high-ratio portfolio consists of firms that are undervalued and that generate positive future returns. The hedged portfolio takes a long position on firms that are undervalued and takes a short position on firms that are overvalued. I examine which portfolio reverts the most to fundamental values.

Table 6 panel B presents the results for the hedged portfolios. Similar to the results shown in Table 6 panel A, the hedged profit of firms with inferior information environments is higher than the hedged profit of firms with superior information environments for all three information channels. This means that firms that have inferior *ManDisc, VolDisc,* or *InfoInt* are mispriced more, and stock prices revert more to fundamental values in the future. Among the three information channels, the hedged profit is greatest for firms with inferior *InfoInt* (12-month abnormal return is 11.9%). This means that firms with inferior *InfoInt* are mispriced the most among the three information channels, and their stock prices revert the most to fundamental values in the future. The difference between the most inferior and the most superior *InfoInt* (8.1% annual abnormal return and 4.0% annual size-adjusted return) is larger than that of *ManDisc* (5.8% annual abnormal return and 3.0% annual size-adjusted return) and *VolDisc* (4.4% annual abnormal return and 2.3% annual size-adjusted return). I also match the abnormal returns with the deviation range for each of the information channels, I find that for every 1% deviation of the market value, prices reverts 8.56 basis points in 12 month for firms with the most inferior *InfoInt*, 6.61 basis points for firms with the most inferior *VolDisc*, and 8.19 basis points for firms with the most inferior *ManDisc*. The differences among the three are statistically significant. Again, these results show that *InfoInt* has the most impact on valuation.

4.4 Changes of Information Environment & Changes of Price Deviation

To draw implications for managers and to address endogeneity concerns in this study, I investigate whether changes in information environment have any impact on equity valuation. Specifically, I examine whether changes in information environments (*InfoEnv*) are associated with changes in price deviation (i.e., the difference between the stock price and the fundamental value from Ohlson's model). If a firm's information environment improves, the price deviation should decrease, and *vice versa*.

Table 7 presents the results. I sort firms into three portfolios based on the changes in information environments from the previous year to the current year. Portfolio 0 (2) consists of firms whose information environments get worse (better). Consistent with my prediction, price deviation increases for firms whose information environments get worse, and decreases for firms whose information environments get better. Among the three information channels, changes in *InfoInt* are associated with the biggest change in price deviation. When *InfoInt* (*ManDisc* and *VolDisc)* deteriorates, price deviation increases by 4.3% (3.7% and 3.9%) of market value; when *InfoInt* improves, magnitude of price deviation decrease by 1.3% (1.1% and 0.6%) of market value. The price deviation is measured as the scaled difference between a firm's market value and its fundamental value. The result is robust without the scaling effect.

4.5 Robustness Tests

4.5.1 Financial Multiple: *FScore*

In addition to Ohlson's residual income model, another stream of fundamental value literature uses multiple financial ratios to value securities. I test my theory using the *FScore* from

Piotroski (2000). *FScore* is an aggregate measure developed by Lev and Thiagarajan (1993) and modified by Piotroski (2000) using nine financial values. Lev and Thiagarajan (1993) identify 12 fundamental financial variables from financial analysts' reports and financial statement analysis texts. Of these 12, they find nine value-relevant variables. Studies also use the summary index of the nine fundamental variables (*FScore*) to predict earnings and future stock returns (Abarbanell and Bushee 1997, 1998). Based on these studies, Piotroski (2000) develops nine fundamental variables and categorizes them into three dimensions of a firm's financial condition: profitability (e.g., ROA and CFO), change in financial leverage and liquidity, and change in operational efficiency (e.g. gross margin and asset turnover ratio). Appendix B describes the detailed calculation of the *FScore*.[11]

Similar to my tests based on Ohlson's model, I form portfolios based on a firm's fundamental value (i.e., *FScore*) and its information environment. I then test whether the profit from the value-investing strategy for firms with inferior information environments is higher than the profit from the value-investing strategy for firms with superior information environments. I rank the firms by *FScore* and form 10 deciles. I group the top 3 deciles into the High *FScore* group and bottom 3 deciles into the Low *FScore* group and compute the difference between the two groups. I then use the information environment proxy (*InfoEnv* or *ManDisc* or *VolDisc* or *InfoInt*) to split each decile into three groups (Superior, Medium, and Inferior). Portfolios are formed one month after earnings announcements for year *t*.

Similar to the main test in table 6, I predict that hedged portfolios that have superior information environments (high *InfoEnv*) generate lower returns than do hedged portfolios that have inferior information environments (low *InfoEnv*). Table 8 presents the results of future return prediction using the *FScore*. Consistent with the results from Ohlson's model, firms with

[11] Appendix B can be found at https://sites.google.com/site/jingranzhaous/research

inferior information environments generate the highest hedged profits. The difference in 12-month abnormal returns between the most inferior and the most superior *InfoEnv* portfolio is 9.6% and 12.3% for 12-month size-adjusted returns. Consistent with the results in table 6, the hedged portfolio formed with *InfoInt* generates the highest profit. The difference between the most inferior and the most superior *InfoInt* (5.3% annual abnormal return and 5.5% annual size-adjusted return) is larger than that of *ManDisc* (4.1% annual abnormal return and 4.7% annual size-adjusted return) and *VolDisc* (3.9% annual abnormal return and 4.6% annual size-adjusted return).

4.5.2 Effect of Size

Some might argue that the effect I capture in the return results is mainly due to the size effect that prior literature has identified. To address this concern in addition to the size-adjusted returns that I used in the main tests, I control for the size effect by testing the trading strategy conditioning on size in addition to information environments. I first group observations into three groups based on size. I then form deciles based on information environments. Within each decile I assign observations into terciles based on mispricing ratios. The hedged portfolio takes a long position on firms that have high mispricing ratios and takes a short position on firms that have low price deviation ratios. Portfolios are formed after earnings announcements for year t. Table 9 reports the results. The trading strategy generates material profits not only for small-size firms, but also for large-size (15.3% annual abnormal return) and medium-size firms (10.4% annual abnormal return).

4.5.3 Time-Series of the Trading Strategy

To mitigate the concern that the return differences I find in this study are due to risk, I test the trading strategy across the times-series of my sample period. Figure 2 shows that over the

11-year sample period of this study, the average 12-month abnormal return is 11.3% and the strategy is successful for all 10 out of the 11 years.[12] This time series of strong positive performance casts doubt on a risk-based explanation.

4.5.4 Subsequent Earnings Announcement Reactions

Another way to address the concern with risk-based explanation for my findings is to examine price reactions in a short window. I use earnings announcement windows because earnings are another measure of firm performance, and it is one of the most important disclosure events. If stock prices are not aligned with the fundamental values from Ohlson's model, investors should correct their priors about the intrinsic value of the firm around the subsequent earnings announcements. For firms that were previously underpriced (overpriced), their stock prices should increase (decrease) around subsequent earnings announcements. This reaction should be magnified for firms that have inferior information environments.

Table 10 presents the results of subsequent earnings announcement reactions conditional on fundamental values from Ohlson's model and information environments. Consistent with Table 6, firms that were previously underpriced (overpriced) generate positive (negative) returns, and this effect is magnified (abated) for firms that have inferior (superior) information environments.[13] In other words, the high-low portfolio return is higher for firms with inferior information environments than for firms with superior information environments. The 12-month buy-and-hold portfolio return for firms with inferior information environments is 4.27%, and the sum of returns around the first four quarters earnings announcements is 3.79%. This means that almost all of the 12-month buy-and-hold returns are earned over just 28 trading days. This result is not surprising because the firms with inferior information environments are thinly traded, and

[12] I omitted 2013 from the figure, because the sample for 2013 is too small to draw any meaningful inference.

[13] The first quarter result is an exception. High-ratio (i.e., underpriced) firms do not generate returns that are higher than low-ratio (i.e., overpriced) firms. This could imply that it takes longer than a quarter for investors to update their priors about the firms.

most trading activities happen around earnings announcements. This result is robust when tested using abnormal returns.

5 Conclusion

This paper examines the dynamics of a firm's information environment and how the information environment affects equity valuation of the firm. I use machine readable data to measure the perceived quality of a firm's information environment, which is composed of mandatory disclosures (*ManDisc*), voluntary disclosures (*VolDisc*), and information generated by information intermediaries (*InfoInt*). I examine the dynamics of a firm's information environment by investigating the relations among *ManDisc*, *VolDisc*, and *InfoInt*. I find that firms' *ManDisc*, *VolDisc*, and *InfoInt* are positively correlated. Firms with superior *ManDisc* also have superior *VolDisc* and superior *VolDisc*. This result suggests that the three information channels are complementary in communicating with investors. The correlation between *ManDisc* and *InfoInt* and the correlation between *VolDisc* and *InfoInt* are higher than the correlation between *ManDisc* and *VolDisc*. This suggests that information generated by information intermediaries is highly affected by the quality of information contained in mandatory disclosures and voluntary disclosures. I further investigate this hypothesis by examining the changes of the three information channels. I find that changes of *InfoInt* are associated of changes of *ManDisc* and *VolDisc*, but the changes of *ManDisc* are not associated with changes of *VolDisc*.

I then examine the impact of the three information channels on equity valuation. Specifically, I examine the impact of each of the information channels on the difference between a firm's market value and its fundamental value calculated from the residual income valuation model. In the unconditional tests, I find that all three information channels have impacts on equity valuation. However, in conditional tests, I find that the disclosure effect of *ManDisc* on equity valuation disappears once I control for *VolDisc* and *InfoInt*, and *InfoInt* has the largest impact on equity valuation. This evidence cautions against drawing inferences exclusively from market reactions of one information channel. All three information channels contribute to a firm's overall information environment.

Information environment has been a difficult measure to construct. This study took the first step to structure the comprehensive information environment with machine-readable data. This study facilitates replication and future research that needs to directly measure a firm's information environment. In addition, the evidence of this study also cautions against researchers drawing inferences exclusively from market reactions of one information channel. All three information channels contribute to a firm's overall information environment.

There are limitations of this study. The measure of information environment lacks theoretical guidance. Future theoretical work in this area is needed. The advantage of the comprehensiveness of the information environment measure comes with the limitation of precision. Some proxies for information environments are correlated with other factors. For example, earnings persistence could be correlated with business operating cycles. In addition, *ManDisc* PCA could be improved by incorporating other dimensions of mandatory disclosures. For example, the accessibility of a firm's financial statements could be measured by the use of extended tags in their eXtensible Business Reporting Language (XBRL) fillings with the SEC. Filing with these extended tags could decrease information processing costs for investors and improve the firm's information environment by standardizing financial statements.

There are also multiple implications for future research. For example, this study could be extended to international markets, in which the information environment is measured at a country level. In countries with inferior information environments, such as China, fundamental analysis trading strategies should generate higher profits than in countries with superior information environments, such as the U.S. Similar logic applies to studies that examine cross-listing companies. Lang, Lins, and Miller (2003) show that when firms cross list in the U.S., their information environments improve and their market values increase. Future research can examine whether cross-listing reduces price deviation. The market valuation in this study focuses on the equity market. Future research can examine debt market valuation, and test how a firm's information environment affects debt contracting, and how creditors value mandatory disclosures, voluntary disclosures, and information intermediation.

Given the inherent complexity of corporate information environment, it is almost impossible to capture all of the interdependencies in one setting. Future research can implement the measures I develop in this study in other settings to examine the relations between the three information channels. For example, researchers can use even study designs and examine the effect of a regulation about one information channel (e.g., Regulation Fair Disclosure) on the other two information channels. When managers are prohibited from disclosing information to groups of individual, such as analysts, do managers increase or decrease earnings qualities? How does the regulation affect the quality of analyst forecasts?

Appendix A: Implementation of Ohlson's Model (1995)

In Ohlson's (1995) influential residual income model, stock prices are linked with accounting variables in a linear fashion.

$$P_t = b_t + \sum_{\tau=1}^{\infty} \frac{E_t[x_{t+\tau}^a]}{(1+r)^\tau} \quad (1)$$

($P_t = b_t$ + Present Value of Expected Future Abnormal Earnings)

where $P_t =$ is the equity value at *t*, b_t is the book value of equity at *t*, and abnormal earnings is $x_t^a = x_t - rb_{t-1}$, with *r* being the discount rate. To measure the present value of expected future abnormal earnings, Ohlson (1995) models the autoregressive process of abnormal earnings and other information about future abnormal earnings that is not reflected in current abnormal earnings:

$$x_{t+1}^a = \omega x_t^a + v_t + \varepsilon_{1,t+1} \quad (2)$$

$$v_{t+1} = \gamma v_t + \varepsilon_{2,t+1} \quad (3)$$

where v_t is information about future abnormal earnings not in the current abnormal earnings $\varepsilon_{1,t+1}$, $\varepsilon_{2,t+1}$ are unpredictable, mean-zero disturbance terms, and ω and γ are fixed persistence parameters.

Combining the residual income model in eq.(1) with the information dynamics in eqs.(2) and (3) results in the following valuation function:

$$P_t = b_t + \alpha_1 x_t^a + \alpha_2 v_t \quad (4)$$

where $\alpha_1 = \omega/(1 + r - \omega)$ and $\alpha_2 = (1 + r)/[(1 + r - \omega)(1 + r - \gamma)]$.

In this study, I do not directly measure *v*. I acknowledge the fact that the omission of *v* might limit the ability of the model to evaluate a firm's fundamental value, but I choose to omit *v* because modeling *v* could remove a significant portion of the sample in this study. *v* measures information not from abnormal earnings that is relevant for valuation. The empirical literature finds that using analyst forecasts is by far the best implementation of *v* (e.g., Dechow, Hutton, and Sloan 1999). Unfortunately, modeling *v* with analyst forecast data would remove most firms with inferior information environments in this study as most firms with inferior information environments do not have analysts following. To maintain the external validity, I choose not to model *v* for the main tests.[14]

[14] I repeated the main tests with *v* modeled with analyst forecasts. The inferences supported by table 5 - 7 are unchanged. The economic magnitudes of returns increase when calculating the fundamental value with analyst forecasts. I find that for every 1% of market value price deviation, prices will revert 14.15 (1.09) basis points in 12 month for firms with the most inferior (superior) information environments.

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Figure 1:

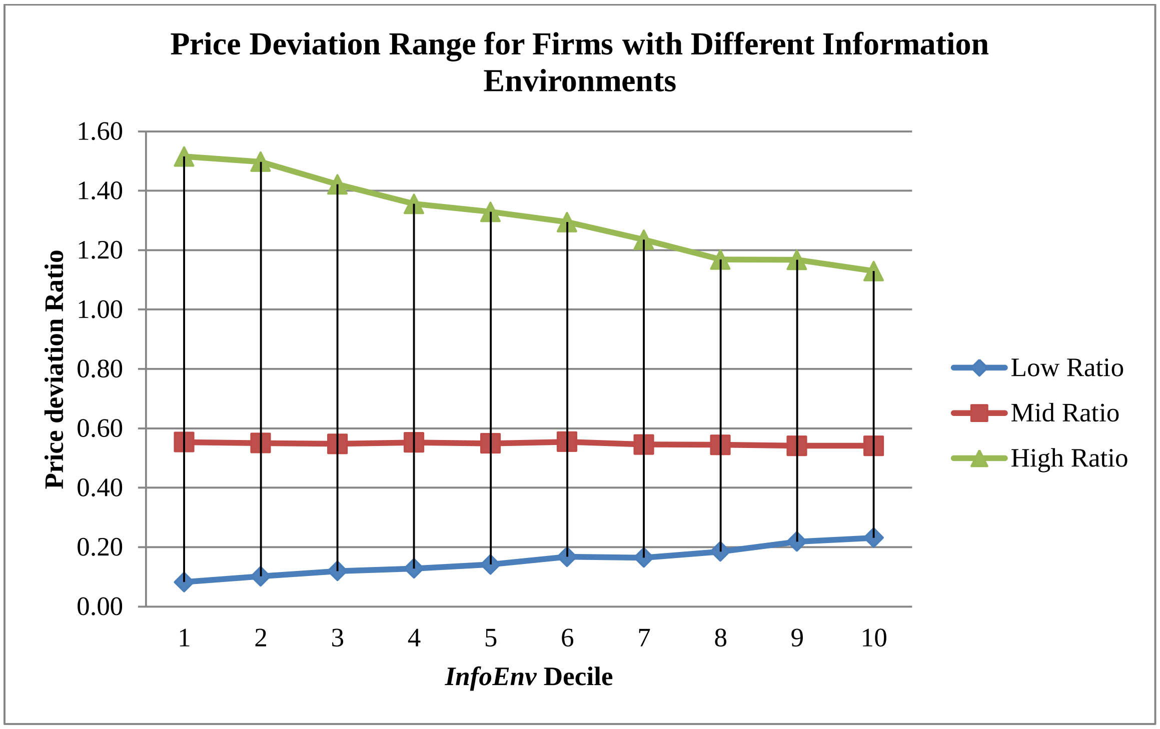

Figure 1 shows the price deviation ranges for firms with different information environments. The detailed numeric numbers represented in this figure are documented in table 5 panel B. I first sort firm-years on *InfoEnv* into deciles, and I form terciles by sorting observations within each decile on price deviation ratios. The price deviation ratio is calculated as the ratio of the firm's fundamental value, as predicted by Ohlson's (1995) model to contemporaneous market value of the equity. The low price deviation ratio portfolio consists of firms that are overpriced by the market.

Figure 2:

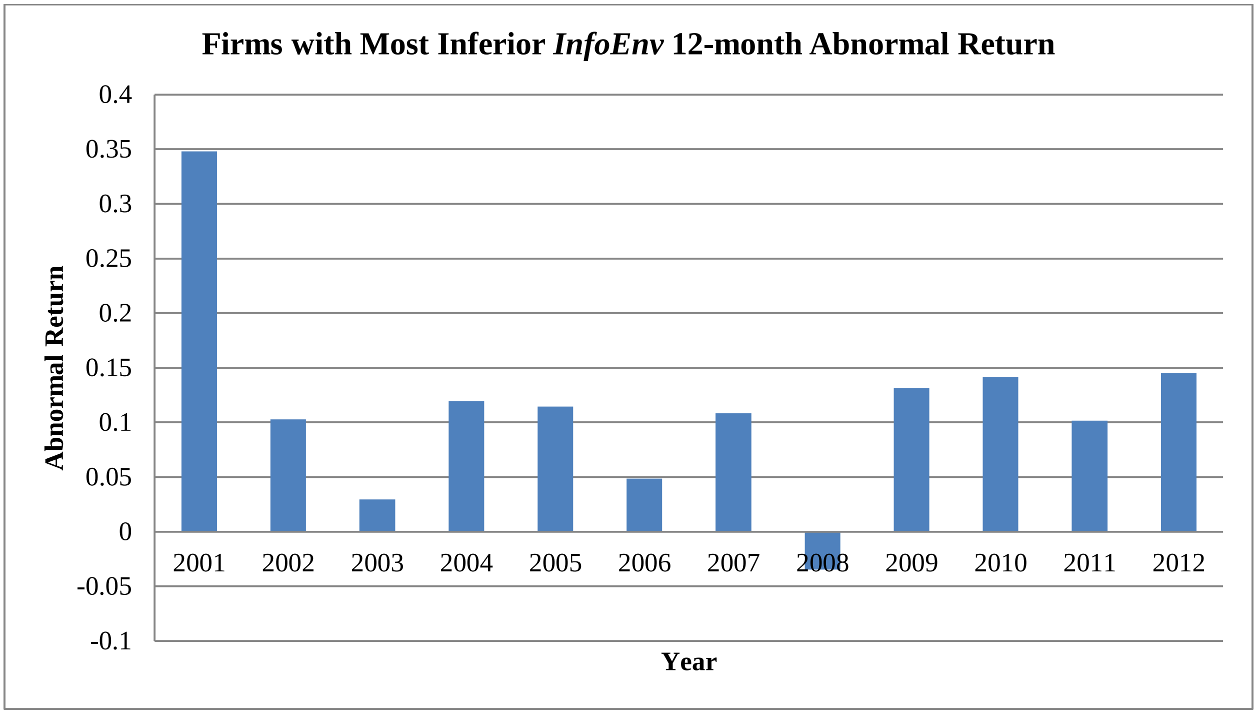

Figure 2 shows the time-series of abnormal returns earned by the hedged portfolio of the most inferior *InfoEnv*. I first sort observations on *InfoEnv* into deciles, and then I form terciles by sorting within each decile on price deviation ratios. The low price deviation ratio portfolio consists of firms that are overpriced by the market, and the high price deviation ratio portfolio consists of firms that are undervalued by the market. The hedged portfolio takes a long position on firms that are undervalued and takes a short position on firms that are overvalued. Portfolios are formed after earnings announcement each year.

Table 1: Main variable description and data source

Category	Variable	Description	Source
Mandatory disclosures (*ManDisc*)	Earnings Persistence (*EarnPer*)	The slope coefficient estimate from an autoregressive model of order one for ROA: $ROA_{i,q} = \alpha + \beta\, ROA_{i,q-1} + \delta$ Seasonal Dummies $+ u_{i,q}$. I estimate the equation using OLS and rolling 20-quarter windows*.	Compustat
	Fog Index (*Read*)	The fog index score of a firm's 10-K report.	10-Ks
	Audit Fees Ratio (*Audit*)	Audit Fees/Total Fees paid to the auditor. Audit fees include fees for audit or review services in accordance with the standards of the Public Company Accounting Oversight Board. Audit fees also include fees for services that are normally incurred in connection with statutory and regulatory filings or engagements. Total Fees is the sum of audit fees and total non-audit fees.	Audit Analytics
Voluntary disclosures (*VolDisc*)	Frequency of Management Forecast (*FREQ*)	*FREQ* is the number of annual and quarterly EPS forecasts firm *i* made during year *t*. Firms not making any forecasts in year *t* are assigned a value of 0 for that firm-year.	FirstCall
	Horizon of Management Forecast (*HORIZON)*	*HORIZON* is the average horizon of firm *i*'s forecasts released in year *t*. The average horizon of firm *i*'s forecasts released in year *t* is computed as one plus the log of the difference in days between the fiscal period end and the forecast date. Larger values of *HORIZON* indicate timelier, and hence more informative, forecasts.	FirstCall
	Specificity of Management Forecast (*SPECIFICITY*)	*SPECIFICITY* is the average over year *t* of firm *i*'s forecast specificity or precision. If firm *i* provides no forecast guidance in the testing period, then *SPECIFICITY* =0. For each of firm *i*'s forecasts, if the forecast is purely qualitative, then *SPECIFICITY* =1 for that forecast. If the forecast is an open-ended estimate (where one end of the range is provided but not the other), then *SPECIFICITY* =2 for that forecast. If a range estimate is given, then *SPECIFICITY* =3, and if a point estimate is given, then *SPECIFICITY* =4. Consistent with prior studies, I interpret more specific forecasts as being more informative.	FirstCall
	Management Forecast (*MF*)	I use the number (*FREQ*), timeliness (*HORIZON*), and specificity (*SPECIFICITY*) of firm *i*'s forecasts in year *t* to construct the management forecast score (*MF*). To sum up *FREQ*, *HORIZON* and *SPECIFICITY* with equal weights for each firm *i* in year *t*, I rank each of the measures and use the sum of the rankings as the measure for firm *i*'s year *t* management forecasts (*MF*).	FirstCall

Voluntary disclosures (*VolDisc*)	Information Release (*Info*)	The number of information release events held by firm *i* in year *t*. Events include earnings conference calls, conference presentations, shareholder meetings, and other investor and analyst conferences.	Bloomberg
	Insider Trading (*Insider*)	The natural log of total number of shares that direct and indirect insiders of firm *i* trade in year *t* deflated by the total number of outstanding common stock shares. Direct insider trades include equity securities held in the insider's name or in the name of a broker, bank, or nominee on behalf of the insider. Indirect ownership occurs when an insider's position creates a reportable pecuniary interest and/or when securities are held by members of the insider's immediate family. It is measured in millions of shares.	Thomson Reuters Insiders Database
Information Intermediaries (*InfoInt*)	Analyst Forecast (*AFollow*)	The number of analysts forecasts issued for firm *i* in year *t*.	FirstCall
	Institutional Investors (*Inst*)	The proportion of firm *i*'s shares held by institutional investors at the end of year *t*. It is measured as the number of shares held by institutional investors divided by number of outstanding common shares.	Thomson Reuters Institutional (13f) Holdings
	Shareholders (*NoShr*)	The natural log of total number of shareholders of common capital as reported by firm *i* in fiscal year *t*.	Compustat
	Information Environment (*InfoEnv)*	The sum of the three measures of information channels (*ManDisc*, *VolDisc and InfoInt*).	
FScore	F_ROA	Net income before extraordinary items for year *t* scaled by average total assets during the fiscal year. If ROA is positive, then the indicator variable F_ROA equals one.	Compustat
	F_CFO	Cash flow from operations for year *t* scaled by average total assets during the fiscal year. If CFO is positive, then the indicator variable F_CFO equals one; otherwise, it equals zero.	
	F_ΔROA	The current year ROA less the prior year's ROA. If ΔROA is positive then F_ΔROA equals one; otherwise, it equals zero.	

	F_ACCRUAL	Current year's net income before extraordinary items less cash flow from operations, scaled by average total assets. F_ACCRUAL equals one if ACCRUAL is less than zero; otherwise, it equals zero.	

FScore	F_ΔLEVER	The change in the ratio of long-term debt to average total assets during the fiscal year. F_ΔLEVER equals one if the firm's leverage fell in the year preceding portfolio formation or if the firm has no-long term debt at both the beginning and the end of the fiscal year; otherwise, I equals zero.	Compustat
	F_ΔLIQUID	ΔLIQUID measures the change in the firm's current ratio between the current and prior year, in which the current ratio is the ratio of current assets to current liabilities at fiscal year-end. F_ΔLIQUID equals one if the firm's liquid improved; otherwise it equals zero.	
	ISSUANCE	Equals one if the firm did not issue common equity in the fiscal year preceding portfolio formation and zero otherwise.	
	F_ΔMARGIN	ΔMARGIN is a firm's current gross margin ratio less the prior year's gross margin ratio. The indicator variable F_ΔMARGIN equals one if ΔMARGIN is positive; otherwise, it equals zero.	
	F_ΔTURN	ΔTURN is the difference between a firm's current and the previous year's asset turnover ratio, in which the asset turnover ratio is measured as total sales scaled by average total assets during the fiscal year. The indicator variable F_ΔTURN equals one of ΔTURN is positive; otherwise, it equals zero.	
	Market Cap	Total shares outstanding*Stock price at the fiscal year end. It is measured in $ millions.	Compustat & CRSP
	Total Assets	Total asset at the fiscal year end. It is measured in $ millions.	
	BTM	Book value scaled by market cap at the fiscal year end.	

* To reduce sample selection bias and to reduce noise, I retain firms with two or more years of data.

Table 2 Sample selection procedure

Sample Selection Procedure	# Firm-year	# Firm
Compustat and CRSP merged sample from 2000 to 2013 without missing fundamental value variables	63,943	9,427
Sample without missing *ManDisc* variables	49,195	7,700
Sample without missing *VolDisc* and *InfoInt* variables	44,580	6,879
Sample without missing market variables	41,575	6,501
After trimming on *PForeErr* and *SqrForeErr* at 1% and 99%.	39,607	6,357

Table 2 presents the sample selection process. *ManDisc* variables include *EarnPer*, *Read*, and *Audit*. *VolDisc* variables include *MF*, *Info*, and *Insider*. *InfoInt* variables include *AFollow*, *NoShr*, and *Inst*. Market variables include stock price, 12(24)- month buy-and-hold abnormal return, and 12(24)-month size-adjusted return. 12(24)-month buy-and-hold abnormal returns are calculated with equal-weighted market returns. PForeErr is Forecast Error, which is the difference between stock price and the value calculated from Ohlson's (1995) residual income model, scaled by market value of equity. Forecast Error = $((P_t - (b_t + \frac{\omega}{1+r-\omega} x_t^a))$/Market Value.

Table 3: Principal component analysis to obtain information environment measures.

		Mandatory Disclosure					Voluntary Disclosure					Information Intermediary		
Panel A: Simple Statistics														
		EarnPer	Read	Audit			MF	Info	Insider			AFollow	NoShr	Inst
Mean		0.50	17.75	0.75	Mean		15151	7.83	-0.01	Mean		55.98	0.20	0.52
StD		0.34	2.63	0.77	StD		22011	6.52	0.07	StD		74.36	2.06	0.41
Panel B: Univariate Correlation														
		EarnPer	Read	Audit			MF	Info	Insider			AFollow	Short	Inst
EarnPer		1.00			MF		1.00			AFollow		1.00		
Read		-0.04	1.00		Info		0.23	1.00		NoShr		0.30	1.00	
Audit		0.01	-0.14	1.00	InsiderTrade		-0.17	-0.13	1.00	Inst		0.56	0.10	1.00
Panel C: Eigenvalues														
	Eigenvalue	Difference	Proportion	Cummulation		Eigenvalue	Difference	Proportion	Cummulation		Eigenvalue	Difference	Proportion	Cummulation
Factor 1	1.14	0.15	0.38	0.38	Factor 1	1.36	0.48	0.45	0.45	Factor 1	1.68	0.76	0.56	0.56
Factor 2	0.99	0.13	0.33	0.71	Factor 2	0.88	0.12	0.29	0.75	Factor 2	0.92	0.51	0.31	0.87
Factor 3	0.86		0.27	1.00	Factor 3	0.76		0.25	1.00	Factor 3	0.40		0.13	1.00
Panel D: Principal Component Analysis Loadings														
		Factor 1	Factor 2	Factor 3			Factor 1	Factor 2	Factor 3			Factor 1	Factor 2	Factor 3
EarnPer		0.22	0.97	0.13	MF		0.62	0.21	0.75	AFollow		0.68	-0.09	-0.73
Read		-0.69	0.07	0.71	Info		0.59	0.50	-0.63	NoShr		0.39	0.88	0.27
Audit		0.68	0.25	-0.69	InsiderTrade		-0.51	0.84	0.19	Inst		0.62	-0.47	0.63

Table 3 presents the principal component analysis for information environment measures. *EarnPer* is earnings persistence. It is measured as the slope coefficient estimate from an autoregressive model of order one for ROA: $ROA_{i,q} = \alpha + \beta\ ROA_{i,q-1} + \delta$ Seasonal Dummies $+ u_{i,q}$. I estimate the equation using OLS and rolling 20-quarter windows. *Read* is readability of 10-K documents. It is measured with the Fog Index. *Audit* is ratio of audit fees to total fees paid to the auditor. *MF* is management forecast. It is measured as the sum of the ranking of *FREQ*, *HORIZON* and *SPECIFICITY* (see Table 1 for details). *Info* is the number of information release events held by firm *i* in year *t*. These events include earnings conference calls, conference presentations, shareholder meetings, and other investor and analyst conferences. *Insider* is net insider trades in firm *i*'s shares in year *t*. *AFollow* is the number of analyst forecasts issued for firm *i* in year *t*. *NoShr* is the number of shareholders. It is measured as the natural log of total shareholders of firm *i* in year *t*. *Inst* is the proportion of firm *i*'s shares held by institutional investors at the end of year *t*.

Table 4: Descriptive statistics

Panel A: Sample Description

	Inferior InfoEnv		Medium InfoEnv		Superior InfoEnv		T Test
Variable	**Mean**	**Med**	**Mean**	**Med**	**Mean**	**Med**	**p-value**
InfoEnv	-0.91	-0.85	-0.08	-0.08	1.00	0.89	<.0001
ManDisc	-0.66	-0.56	0.01	0.07	0.63	0.55	<.0001
VolDisc	-0.98	-0.94	-0.06	-0.10	1.06	1.10	<.0001
InfoInt	-1.10	-1.19	-0.18	-0.25	1.29	1.21	<.0001
EarnPer	0.40	0.43	0.51	0.58	0.59	0.66	<.0001
Fog Index	18.98	19.02	17.92	18.34	16.38	17.23	<.0001
AuditFee	0.66	0.70	0.76	0.82	0.82	0.86	<.0001
Frequency	0.53	0.00	1.13	1.10	1.63	1.61	<.0001
Horizon	4.74	4.99	5.55	5.77	5.87	6.01	<.0001
Specificity	2.47	3.00	2.94	3.00	3.09	3.00	<.0001
Info	3.82	4.00	7.24	7.00	12.68	12.00	<.0001
Insider Trade	-3.28	-3.69	-5.11	-5.37	-5.74	-5.85	<.0001
Afollow	9	0	39	26	122	105	0.0892
InstHd	0.18	0.08	0.53	0.54	0.86	0.89	<.0001
NoShr	-0.43	-0.49	0.05	0.01	1.04	1.13	<.0001
Market Cap	741	81	1,295	320	7,942	1,666	<.0001
Total Assets	2,060	90	3,261	342	15,173	1,774	<.0001
BTM	0.84	0.62	0.73	0.57	0.61	0.49	<.0001

Table 4: Descriptive statistics (Continued)

Panel A: Sample Description

	Full Sample					
Variable	**Mean**	**1%**	**25%**	**Med**	**75%**	**99%**
InfoEnv	0.01	-1.61	-0.65	-0.08	0.60	2.15
ManDisc	0.00	-2.49	-0.65	0.03	0.61	2.84
VolDisc	0.02	-2.03	-0.79	-0.12	0.81	2.80
InfoInt	0.01	-1.90	-1.07	-0.21	0.88	3.40
EarnPer	0.50	-0.27	0.26	0.56	0.77	1.04
Fog Index	17.75	8.07	16.92	18.35	19.31	22.07
AuditFee	0.75	0.00	0.07	0.20	0.38	0.94
Frequency	1.44	0.00	1.10	1.39	1.95	2.89
Horizon	5.73	2.61	5.30	5.96	6.28	7.02
Specificity	3.02	1.00	3.00	3.00	3.06	4.00
Info	7.94	0.00	4.00	7.00	11.00	27.00
Insider Trade	-4.72	0.00	0.00	0.00	0.01	0.22
Afollow	57	0.00	0.00	28.00	85.00	316.00
InstHd	0.53	0.00	0.13	0.54	0.86	1.34
NoShr	0.23	0.02	0.29	1.10	4.90	214.00
Market Cap	3,349	5	91	380	1520	55139
Total Assets	6,873	7	93	395	1,839	104,808
BTM	0.73	0.02	0.31	0.55	0.92	3.51

Table 4 Panel A presents descriptive statistics of the sample. The sample period is from 2000 to 2013. The sample consists of 39,607 firms-years and 6,357 firms. The portfolio of firms with superior *InfoEnv* has 13,053 observations, the portfolio of firms with medium *InfoEnv* has 13,229 observations, and the portfolio of firms with inferior *InfoEnv* has 13,325 observations. T-test and p-values for portfolio means are computed from two-sample t-tests of Superior *InfoEnv* and Inferior *InfoEnv* portfolios.

Panel B: Industry Composition of the Sample

	Information Environment			
SIC Industry	Inferior	Medium	Superior	Total
Agriculture, Forestry, and Fishing	65	39	26	130
Mining and Construction	656	688	906	2,250
Manufacturing	5,542	5,910	5,900	17,352
Utility	952	1,113	1,287	3,352
Wholesale and Retail Trade	1,051	984	1,103	3,138
Finance, Insurance, and Real Estate	1,885	1,963	1,773	5,621
Services	2,827	2,446	2,262	7,535
Public Administration	24	25	27	76
Total	13,002	13,168	13,284	39,454

153 observations do not have SIC code.

Table 4 Panel B presents the industry composition of the sample.

Panel C: Comparison with NYSE ME Breakpoints

	5%	25%	50%	75%	95%	100%
Sample	14	91	380	1,520	12,664	511,887
NYSE	131	593	1,665	4,840	29,731	398,105

Table 4 Panel C presents the comparison of the average market equity of the sample and all NYSE firms from 2000 to 2010. NYSE ME breakpoints data are obtained from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Panel D: Correlation among Information Environment Channels

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	InforEnv		0.6558*	0.7262*	0.7711*	0.1823*	-0.4788*	-0.4454*	0.3447*	0.2131*	0.1418*	0.3752*	0.6296*	-0.3072*	0.6944*	0.5605*	0.3137*	0.5768*	0.5155*	-0.1381*
2	ManDisc	0.5647*		0.3063*	0.1880*	0.2151*	-0.6794*	-0.7461*	0.0790*	0.0853*	0.0125	0.0880*	0.4241*	0.0061	0.1668*	0.2417*	-0.0105	0.1390*	0.1235*	-0.0098
3	VolDisc	0.7999*	0.1598*		0.4239*	0.0461*	-0.1880*	-0.2496*	0.4469*	0.3365*	0.2567*	0.5561*	0.7492*	-0.4714*	0.3883*	0.3127*	0.1744*	0.4114*	0.3758*	-0.0932*
4	InfoInt	0.8237*	0.1636*	0.5778*		0.1359*	-0.1884*	-0.0505*	0.2745*	0.0979*	0.0799*	0.2500*	0.3091*	-0.2549*	0.8960*	0.6428*	0.4729*	0.6698*	0.5903*	-0.1816*
5	EarnPer	0.2466*	0.2372*	0.1296*	0.1828*		-0.0381*	0.0102	0.0473*	-0.1247*	-0.0023	-0.0465*	0.0601*	-0.0498*	0.1222*	0.1438*	0.0075	0.0795*	0.0313*	-0.0793*
6	Fog Index	-0.4640*	-0.7482*	-0.1379*	-0.1893*	-0.0362*		0.1551*	-0.0666*	-0.0817*	-0.0134	-0.0851*	-0.2120*	0.0445*	-0.1708*	-0.1376*	-0.0879*	-0.2087*	-0.2077*	0.0137
7	Audit Ratio	0.3304*	0.7262*	0.0672*	-0.0028	0.0087*	-0.1362*		0.0463*	0.0625*	0.0157*	0.0573*	0.3947*	0.0693*	0.0440*	0.1834*	-0.1071*	-0.0311*	-0.0400*	0.0235*
8	Frequency	0.3502*	0.0865*	0.4352*	0.2668*	0.0483*	-0.0540*	-0.0660*		0.1175*	0.1084*	0.6866*	0.2155*	-0.0505*	0.2376*	0.2126*	0.1232*	0.2895*	0.2563*	-0.1037*
9	Horizon	0.2489*	0.0992*	0.3588*	0.1195*	-0.1016*	-0.0852*	-0.1021*	0.2597*		0.0220*	0.6071*	0.1196*	-0.0234*	0.0523*	0.0503*	0.1336*	0.1998*	0.2243*	-0.0473*
10	Specificity	0.1907*	0.0632*	0.2736*	0.1036*	0.0008	-0.0443*	-0.0542*	0.1560*	0.0869*		0.5196*	0.0487*	-0.0211*	0.0735*	0.0749*	0.0121	0.0695*	0.0489*	-0.0402*
11	MF	0.5308*	-0.0006	0.7236*	0.4178*	0.0812*	-0.0451*	0.0739*	0.6882*	0.6666*	0.5236*		0.2028*	-0.0592*	0.1998*	0.1789*	0.1594*	0.3133*	0.2994*	-0.1027*
12	Info	0.6488*	0.3030*	0.6888*	0.4348*	0.1015*	-0.1980*	-0.2398*	0.2002*	0.1319*	0.0827*	0.2215*		-0.0052	0.3002*	0.3274*	-0.0005	0.2342*	0.1754*	-0.0902*
13	Insider Trade	-0.4099*	-0.0098*	-0.5823*	-0.2932*	-0.0766*	0.0266*	-0.0370*	-0.0552*	-0.0117	-0.0225*	-0.1540*	-0.1249*		-0.2337*	-0.0104	-0.2855*	-0.3170*	-0.3530*	-0.0360*
14	Afollow	0.7277*	0.1423*	0.5095*	0.8861*	0.1471*	-0.1770*	0.0065	0.2065*	0.0658*	0.0734*	0.3392*	0.4224*	-0.2490*		0.4740*	0.2435*	0.6221*	0.5115*	-0.2043*
15	InstHd	0.6979*	0.1859*	0.5051*	0.7943*	0.1720*	-0.1553*	-0.0765*	0.2252*	0.0981*	0.1265*	0.3841*	0.3915*	-0.2192*	0.5521*		-0.0720*	0.2441*	0.1804*	-0.1116*
16	NoShr	0.3465*	-0.0021	0.2200*	0.4998*	0.0752*	-0.0704*	0.1004*	0.1196*	0.1061*	0.0061	0.1812*	0.0783*	-0.1875*	0.3025*	0.0811*		0.4787*	0.5264*	-0.0015
17	Market Cap	0.2725*	0.0298*	0.2158*	0.3288*	0.0541*	-0.0728*	0.0457*	0.1099*	0.0645*	-0.0098	0.1101*	0.1839*	-0.1414*	0.3841*	0.0607*	0.3177*		0.8727*	-0.3148*
18	Total Assets	0.1288*	0.0167*	0.0997*	0.1553*	0.0230*	-0.0360*	0.0182*	0.0135	0.0327*	-0.0047	0.0181*	0.1118*	-0.0745*	0.1681*	0.0142*	0.1968*	0.4845*		0.0614*
19	BTM	-0.1463*	-0.0055	-0.1446*	-0.1595*	-0.0250*	0.0076	-0.0073	-0.0968*	-0.0926*	-0.0244*	-0.1207*	-0.1183*	0.0419*	-0.1599*	-0.1353*	-0.0331*	-0.0783*	0.0226*	

Table 4 Panel D presents Pearson correlations on the left bottom corner and Spearman correlations on the right top corner. * denotes significance level equal or smaller than 0.1 level.

Panel E: Regression Analyses of Relations between Information Channels

	ManDisc	*ManDisc*	*VolDisc*
VolDisc	0.057***		
	(3.06)		
InfoInt		0.300***	0.149***
		(9.21)	(6.36)
Size	-0.087	0.322***	-0.127*
	(-1.22)	(7.15)	(-1.83)
BTM	0.013	0.120***	0.007
	(0.91)	(9.02)	(0.53)
Leverage	0.006	0.031**	0.004
	(0.67)	(2.23)	(0.53)
Intercept	-1.188***	-0.408***	-1.178***
	(-78.69)	(-21.00)	(-83.42)
Firm Fixed-effect	Yes	Yes	Yes
Year Fixed-effect	Yes	Yes	Yes
N	30,242	30,242	30,242
Adj R-square	0.583	0.674	0.585

Table 4 Panel E reports the coefficient estimates and t-statistics from ordinary least squares regressions of information channels (*ManDisc*, *VolDisc*, and *InfoInt*) and other firm characteristics (Size, BTM, and Leverage). Size is log value of a firm's market value. BTM is the log value of a firm's book value scaled by a firm's market value. Leverage is the log value of a firm's long term debt scaled by total assets. *ManDisc*, *VolDisc*, and *InfoInt* are standardized in this regression. The OLS regressions contain both firm and year fixed effects, and standard errors are clustered by firm and year.

Panel F: Regression Analyses of Relations between Changes of Information Channels

	ΔManDisc	*ΔManDisc*	*ΔVolDisc*
ΔVolDisc	0.011		
	(1.63)		
ΔInfoInt		0.018**	0.081***
		(2.52)	(8.19)
ΔSize	-0.001	-0.001	-0.007
	(-0.08)	(-0.16)	(-0.63)
ΔBTM	-0.001	-0.001	0.011
	(-0.24)	(-0.25)	-1.54
ΔLeverage	-0.010**	-0.010**	-0.002
	(-2.01)	(-2.03)	(-0.43)
Intercept	0.210***	0.214***	0.294***
	(14.64)	(15.64)	(15.42)
Firm Fixed-effect	Yes	Yes	Yes
Year Fixed-effect	Yes	Yes	Yes
N	35,030	35,030	35,030
Adj R-square	-0.067	-0.067	-0.021

Table 4 Panel F reports the coefficient estimates and t-statistics from ordinary least squares regressions of changes of information channels (*ManDisc*, *VolDisc*, and *InfoInt*) and other changes of firm characteristics (Size, BTM, and Leverage). ΔSize is change of log value of firm *i*'s market value of year *t-1* to year *t*. ΔBTM is the change of the log value of firm *i*'s book value scaled by a firm *i*'s market value of year *t-1* to year *t*. ΔLeverage is the change of the log value of a firm *i*'s long term debt scaled by total assets of year *t-1* to year *t*. *ΔManDisc*, *ΔVolDisc*, and *ΔInfoInt* are standardized in this regression. The OLS regressions contain both firm and year fixed effects, and standard errors are clustered by firm and year.

Table 5: Information environment & equity valuation

Panel A: Forecast Error

InfoEnv Portfolios	Mean Forecast Error	Mean Absolute Forecast Error	Mean Square Forecast Error
1 (Most Inferior)	0.232	0.674	0.750
2	0.231	0.656	0.714
3	0.263	0.627	0.627
4	0.301	0.596	0.554
5	0.300	0.578	0.529
6	0.337	0.563	0.482
7	0.358	0.551	0.460
8	0.396	0.535	0.415
9	0.395	0.526	0.391
10 (Most Superior)	0.414	0.517	0.358
Superior - Inferior	-0.182***	0.157***	0.392***
(t-stat)	(12.29)	(15.96)	(15.96)

Panel B: Price deviation Range

InfoEnv Portfolios	Low Ratio	Mid Ratio	High Ratio	High - Low
1 (Most Inferior)	0.08	0.55	1.52	1.43
2	0.10	0.55	1.50	1.40
3	0.12	0.55	1.42	1.30
4	0.13	0.55	1.36	1.23
5	0.14	0.55	1.33	1.19
6	0.17	0.55	1.29	1.13
7	0.16	0.55	1.24	1.07
8	0.19	0.54	1.17	0.98
9	0.22	0.54	1.17	0.95
10 (Most Superior)	0.23	0.54	1.13	0.90

Panel C: Comparison of ManDisc, VolDisc, and InfoInt in Portfolios

ManDisc Portfolio	Mean Forecast Error	Mean Absolute Forecast Error	Mean Square Forecast Error	Price Deviation Range
1 (Most Inferior)	0.309	0.603	0.568	1.231
2	0.345	0.584	0.524	1.160
3 (Most Superior)	0.316	0.558	0.487	1.133
Inferior - Superior	-0.007	0.046***	0.081***	0.098***
(t-stat)	(-0.84)	(8.50)	(6.24)	(6.17)
VolDisc Portfolio				
1 (Most Inferior)	0.253	0.627	0.646	1.322
2	0.315	0.577	0.521	1.175
3 (Most Superior)	0.400	0.543	0.417	0.994
Inferior - Superior	-0.147***	0.084***	0.229***	0.328***
(t-stat)	(-18.51)	(15.73)	(17.64)	(20.90)
InfoInt Portfolio				
1 (Most Inferior)	0.254	0.659	0.708	1.387
2	0.310	0.562	0.491	1.146
3 (Most Superior)	0.404	0.526	0.384	0.939
Inferior - Superior	-0.150***	0.134***	0.324***	0.448***
(t-stat)	(-18.51)	(24.91)	(24.44)	(28.71)

Table 5 Panel A presents the results of the Ohlson (1995) model's ability to explain contemporaneous stock prices for firms with different information environments. Deciles are formed on *InfoEnv*. Ohlson's model is computed as $b_t + \frac{\omega}{1+r-\omega} x_t^a$. The forecast error is the difference between stock price and the value computed from Ohlson's model scaled by market value at the end of year *t*. Forecast Error = $\left(P_t - (b_t + \frac{\omega}{1+r-\omega} x_t^a)\right)/P_t$. P_t denotes the market value measured at the end of the month following the earnings announcement of year *t*. b_t denotes the book value of equity at the end of year *t*. x_t^a denotes abnormal earnings for year *t* and is defined as $x_t^a = x_t - rb_{t-1}$. r denotes the discount rate (assumed to be 10%).

Table 5 Panel B presents the results of the Ohlson (1995) model's ability to explain price deviation ranges for firms with different information environments. I first sort firm-years on *InfoEnv* into deciles, and I form terciles by sorting observations within each decile on price deviation ratios. The price deviation ratio is calculated as the ratio of the firm's fundamental value, as predicted by Ohlson's (1995) model to contemporaneous market value of the equity. The price deviation range is the difference in price deviation ratios of firms with high and firms with low price deviation ratios. The high (low) price deviation ratio firms are in the top (bottom) price deviation ratio tercile. These firms are underpriced (overpriced) by the market and should generate positive (negative) future returns.

Table 5 Panel C presents the results of the Ohlson (1995) model's ability to explain contemporaneous stock prices and price deviation ranges for firms with different information channels (*ManDisc*, *VolDisc*, and *InfoInt*). t-statistics for portfolio means are from two-sample t-tests. Significance test are from bootstrapping procedures based on 1,000 iterations. *, **, *** denote the statistical significance level at 10%, 5%, and 1% level, respectively.

Panel D: Regression Analyses of Information Channels and Equity Valuation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
ManDisc	-0.016**			-0.012*	-0.010*		-0.008
	(-2.34)			(-1.88)	(-1.66)		(-1.42)
VolDisc		-0.024***		-0.020***		-0.016***	-0.015***
		(-3.54)		(-3.31)		(-2.83)	(-2.68)
InfoInt			-0.044***		-0.038***	-0.036***	-0.031***
			(-3.78)		(-3.77)	(-3.31)	(-3.34)
Size	0.045***	0.044***	0.048***	0.046***	0.049***	0.048***	0.049***
	(4.45)	(4.12)	(4.57)	(4.48)	(4.73)	(4.56)	(4.71)
BTM	0.182***	0.182***	0.182***	0.182***	0.182***	0.182***	0.182***
	(9.67)	(9.60)	(9.54)	(9.61)	(9.56)	(9.51)	(9.53)
Leverage	0.049***	0.050***	0.049***	0.049***	0.049***	0.049***	0.049***
	(7.83)	(7.91)	(7.93)	(7.82)	(7.86)	(7.90)	(7.84)
N	39,607	39,607	39,607	39,607	39,607	39,607	39,607
Adj R-square	0.455	0.456	0.456	0.456	0.457	0.457	0.457

Table 5 Panel D reports the coefficient estimates and t-statistics from ordinary least squares regressions of price deviation magnitude (Mean Absolute Forecast Error) on information channels (*ManDisc*, *VolDisc*, and *InfoInt*) and other firm characteristics (Size, BTM, and Leverage). Size is log value of a firm's market value. BTM is the log value of a firm's book value scaled by a firm's market value. Leverage is the log value of a firm's long term debt scaled by total assets. *ManDisc*, *VolDisc*, and *InfoInt* are standardized in this regression. The OLS regressions contain both firm and year fixed effects, and standard errors are clustered by firm and year.

Table 6: Information environment and future stock returns

Panel A: InfoEnv & Future Stock Returns

	12-month Abnormal Return					12-month Size-adjusted Return				
InfoEnv Portfolios	Low Ratio	Mid Ratio	High Ratio	High - Low	(t-stat)	Low Ratio	Mid Ratio	High Ratio	High - Low	(t-stat)
1 (Most Inferior)	-0.086	-0.007	0.074	0.160***	(7.20)	-0.11	-0.03	0.00	0.110***	(5.39)
5	-0.027	0.032	0.058	0.085***	(4.73)	-0.02	0.03	0.05	0.069***	(4.00)
10 (Most Superior)	-0.003	0.011	0.031	0.035***	(2.82)	0.01	0.02	0.05	0.041**	(3.35)
Inferior - Superior				0.126***	(4.62)				0.069**	(2.73)

	24-month Abnormal Return					24-month Size-adjusted Return				
InfoEnv Portfolios	Low Ratio	Mid Ratio	High Ratio	High - Low	(t-stat)	Low Ratio	Mid Ratio	High Ratio	High - Low	(t-stat)
1 (Most Inferior)	-0.112	-0.010	0.143	0.264***	(7.81)	-0.154	-0.058	0.017	0.171***	(6.11)
5	-0.036	0.069	0.117	0.151***	(5.94)	-0.034	0.067	0.100	0.134**	(5.46)
10 (Most Superior)	-0.008	0.020	0.089	0.082***	(5.03)	0.018	0.045	0.117	0.099***	(5.35)
Inferior - Superior				0.182***	(3.95)				0.072**	(2.03)

Table 6 Panel A presents one-year and two-year –ahead annual abnormal returns and size-adjusted returns to a trading strategy, conditional upon a firm's information environment and its price deviation ratio. I first sort observations on *InfoEnv* into deciles, and I then form terciles by sorting observations within each decile on price deviation ratios. The low (high) price deviation ratio portfolio consists of firms are overpriced (underpriced) by the market. The hedged portfolio takes a long position on firms that are undervalued and takes a short position on firms that are overvalued. Buy and hold returns are computed a month after the earnings announcement of year *t*. I follow (Beaver, McNichols, and Price 2007) to compute returns when a firm delists during the sample period. t-statistics for portfolio means are from two-sample t-tests. Significance test are from bootstrapping procedures based on 1,000 iterations. *, **, *** denote the statistical significance level at 10%, 5%, and 1% level, respectively.

Panel B: ManDisc, VolDisc, InfoInt & Future Stock Returns

	High - Low			
ManDisc Portfolio	12-month Abnormal Return	12-month Size-adjusted Return	24-month Abnormal Return	24-month Size-adjusted Return
1 (Most Inferior)	0.101***	0.059***	0.145***	0.100***
	(9.22)	(6.42)	(9.85)	(7.05)
2	0.064***	0.044*	0.124***	0.096*
	(5.58)	(3.93)	(7.02)	(6.00)
3 (Most Superior)	0.043	0.035	0.068**	0.056**
	(4.27)	(3.61)	(4.98)	(4.30)
Inferior - Superior	0.058***	0.030**	0.084***	0.040**
(t-statistics)	(3.85)	(2.11)	(4.07)	(2.12)

VolDisc Portfolio	12-month Abnormal Return	12-month Size-adjusted Return	24-month Abnormal Return	24-month Size-adjusted Return
1 (Most Inferior)	0.087***	0.059***	0.145***	0.100***
	(5.32)	(3.88)	(6.61)	(5.01)
2	0.078***	0.061***	0.120***	0.097***
	(4.35)	(3.32)	(4.44)	(3.90)
3 (Most Superior)	0.044**	0.036**	0.080***	0.069***
	(2.83)	(2.92)	(4.78)	(4.87)
Inferior - Superior	0.044**	0.023	0.065***	0.031
(t-statistics)	(2.86)	(1.59)	(2.83)	(1.49)

InfoInt Portfolio	12-month Abnormal Return	12-month Size-adjusted Return	24-month Abnormal Return	24-month Size-adjusted Return
1 (Most Inferior)	0.119***	0.076***	0.201***	0.133***
	(6.34)	(4.89)	(7.75)	(6.35)
2	0.046***	0.035***	0.055***	0.048***
	(2.82)	(2.69)	(2.57)	(2.73)
3 (Most Superior)	0.037*	0.037*	0.079***	0.075***
	(1.88)	(2.58)	(4.63)	(5.14)
Inferior - Superior	0.081***	0.040***	0.122***	0.058**
(t-statistics)	(5.10)	(2.62)	(5.23)	(2.79)

Table 6 Panel B presents results of future returns, as predicted by portfolios constructed with the ratio of values predicted by Ohlson's (1995) model to contemporaneous stock prices and information channels (*ManDisc*, *VolDisc*, and *InfoInt*). I first sort observations on *ManDisc/VolDisc/InfoInt*, and I form terciles by sorting observations within each decile on price deviation ratios. The low (high) price deviation ratio portfolio consists of firms are overpriced (underpriced) by the market. The hedged portfolio takes a long position on firms that are undervalued and takes a short position on firms that are overvalued. Portfolios are formed a month after earnings announcement of year *t*. Buy and hold returns are computed a month after the earnings announcement of year *t*. I follow (Beaver, McNichols, and Price 2007) to compute returns when a firm delists during the sample period. t-statistics for portfolio means are from two-sample t-tests. Significance test are from bootstrapping procedures based on 1,000 iterations. *, **, *** denote the statistical significance level at 10%, 5%, and 1% level, respectively.

Table 7: Changes in information environments and changes in equity valuation

Changes of Information Environments Portfolios	Changes in Price deviation			
	InfoEnv	*ManDisc*	*VolDisc*	*InfoInt*
0 (get worse)	0.052	0.037	0.039	0.043
1	0.014	0.021	0.014	0.016
2 (get better)	-0.019	-0.011	-0.006	-0.013
0-2	0.072***	0.048***	0.046***	0.056***
(t-statistics)	(6.76)	(4.55)	(4.27)	(5.31)

Table 7 presents the relationship of changes in *InfoEnv*, *ManDisc*, *VolDisc*, *InfoInt* from the previous year to the current year and changes in price deviation for each portfolio. Price deviation (i.e., forecast error) is measured as the difference between stock price and the value computed from Ohlson's model scaled by market value at the end of year *t*. Price deviation/Forecast Error = = $\left(P_t - (b_t + \frac{\omega}{1+r-\omega} x_t^a)\right) / P_t$. P_t denotes the market value measured at the end of the month following the earnings announcement of year t. b_t denotes the book value of equity at the end of year t. x_t^a denotes abnormal earnings for year *t* and is defined as $x_t^a = x_t - r b_{t-1}$. r denotes discount rate (assumed to be 10%). t-statistics for portfolio means are from two-sample t-tests. Significance test are from bootstrapping procedures based on 1,000 iterations. *, **, *** denote the statistical significance level at 10%, 5%, and 1% level, respectively.

Table 8: Future returns to a trading strategy based on Fscore

Panel A: InfoEnv

InfoEnv Portfolio	12-month Abnormal Return	12-month Size-adjusted Return
1 (Most Inferior)	0.066	0.102**
	(1.28)	(2.52)
5	0.064**	0.087***
	(2.92)	(3.96)
10 (Most Superior)	-0.030**	-0.021**
	(2.28)	(2.05)
Inferior - Superior	0.096**	0.123**
(t-statistics)	(2.10)	(2.92)

Panel B: ManDisc, VolDisc, and InfoInt

	ManDisc		*VolDisc*		*InfoInt*	
Portfolio	12-month Abnormal Return	12-month Size-adj Return	12-month Abnormal Return	12-month Size-adj Return	12-month Abnormal Return	12-month Size-adj Return
1 (Most Inferior)	0.023	0.051*	0.030	0.065**	0.043	0.068**
	(0.08)	(1.99)	(1.14)	(2.75)	(1.47)	(2.60)
2	0.029	0.055*	0.009	0.031	-0.018	0.012
	(1.21)	(2.56)	(0.37)	(1.39)	(-0.79)	(0.58)
3 (Most Superior)	-0.018	0.004	-0.009	0.019	-0.010	0.013
	(-0.82)	(0.22)	(-0.38)	(0.88)	(-0.47)	(0.68)
Inferior - Superior	0.041	0.047*	0.039	0.046*	0.053*	0.055*
(t-statistics)	(1.36)	(1.73)	(1.29)	(1.67)	(1.75)	(1.98)

Table 8 Panel A presents results of future returns, as predicted by portfolios constructed with *FScore* and overall information environment (*InfoEnv*). Panel B presents results of future returns as predicted by portfolios constructed with *FScore* and each information channels (*ManDisc*, *VolDisc*, *InfoInt*). The *FScore* reflects the strength of a firm's financial performance. I first sort observations on *InfoEnv* or the information channel; I then form the hedged portfolio by taking a long position on firms that have high *FScore* and a short position on firms that have low *FScore*. Buy and hold returns are computed after the earnings announcement of year *t*. I follow (Beaver, McNichols, and Price 2007) to compute returns when a firm delists during the sample period. t-statistics for portfolio means are from two-sample t-tests. Significance test are from bootstrapping procedures based on 1,000 iterations. *, **, *** denote the statistical significance level at 10%, 5%, and 1% level, respectively.

Table 9: Future 12-month abnormal returns to a trading strategy based on Ohlson (1995) by size partition

	InfoEnv		
	Inferior	Medium	Superior
Small Firms	0.144***	0.113**	-0.058
	(6.77)	(2.55)	(2.56)
Medium Firms	0.104***	0.090***	0.119
	(3.20)	(2.96)	(1.50)
Large Firms	0.153***	0.033***	0.014
	(2.90)	(2.68)	(0.79)

Table 9 presents result of 12-month ahead abnormal returns to a trading strategy conditional upon fundamental values as calculated by Ohlson's (1995) model and firm size. I sort observations on size and form terciles. I then form decile portfolios within each size portfolio based on *InfoEnv*. Within each deciles I sort on price deviation ratios and assign observations into terciles. The hedged portfolio takes a long position on firms that have high price deviation ratios and takes a short position on firms that have low price deviation ratios. Portfolios are formed after earnings announcement of year *t*. Buy and hold returns are computed a month after the earnings announcement of year t. I follow (Beaver, McNichols, and Price 2007) to compute returns when a firm delists during the sample period. t-statistics for portfolio means are from two-sample t-tests. Significance test are from bootstrapping procedures based on 1,000 iterations. *, **, *** denote the statistical significance level at 10%, 5%, and 1% level, respectively.

Table 10: Subsequent earnings announcement reactions

		Raw Return				
Quarter	*InfoEnv* Portfolios	Low Ratio	Mid Ratio	High Ratio	High - Low	(t-statistics)
	1 (Most Inferior)	-0.0010	-0.0024	-0.0151	-0.0140	(-4.02)
1st Qtr	2	0.0034	-0.0032	-0.0108	-0.0142	(-4.31)
	3 (Most Superior)	0.0122	0.0036	-0.0062	-0.0184	(-5.99)
	1 (Most Inferior)	-0.0049	-0.0028	0.0088	0.0137	(3.16)
2nd Qtr	2	-0.0036	-0.0002	0.0039	0.0075	(2.34)
	3 (Most Superior)	0.0014	0.0030	-0.0043	-0.0056	(-2.1)
	1 (Most Inferior)	-0.0127	-0.0044	0.0092	0.0219	(5.59)
3rd Qtr	2	-0.0014	0.0072	0.0047	0.0061	(2.08)
	3 (Most Superior)	0.0062	0.0108	0.0091	0.0029	(1.17)
	1 (Most Inferior)	-0.0125	-0.0053	0.0039	0.0164	(3.81)
4th Qtr	2	-0.0044	-0.0001	-0.0003	0.0041	(1.37)
	3 (Most Superior)	0.0060	0.0044	0.0013	-0.0047	(-1.78)
	1 (Most Inferior)	-0.0067	-0.0069	0.0096	0.0163	(2.11)
5th Qtr	2	-0.0103	-0.0063	-0.0058	0.0045	(0.66)
	3 (Most Superior)	0.0007	0.0063	0.0020	0.0012	(0.24)
	1 (Most Inferior)	-0.0065	0.0042	0.0020	0.0085	(1.07)
6th Qtr	2	0.0047	0.0011	0.0000	-0.0046	(-0.68)
	3 (Most Superior)	0.0029	0.0041	0.0063	0.0034	(0.63)
	1 (Most Inferior)	0.0013	0.0069	0.0180	0.0167	(2.10)
7th Qtr	2	-0.0001	0.0032	0.0096	0.0097	(1.30)
	3 (Most Superior)	0.0089	0.0067	-0.0004	-0.0093	(-1.9)
	1 (Most Inferior)	0.0092	0.0027	0.0131	0.0040	(0.41)
8th Qtr	2	0.0127	0.0130	0.0124	-0.0003	(-0.05)
	3 (Most Superior)	0.0137	0.0101	0.0073	-0.0064	(-1.36)
First 4 Qtrs	1 (Most Inferior)	-0.0311	-0.0150	0.0068	0.0379	(4.46)
	2	-0.0059	0.0037	-0.0025	0.0035	(0.40)
	3 (Most Superior)	0.0258	0.0218	-0.0001	-0.0259	(-4.75)
Total Qtrs	1 (Most Inferior)	-0.0338	-0.0080	0.0496	0.0834	(5.22)
	2	0.0011	0.0148	0.0138	0.0127	(0.61)
	3 (Most Superior)	0.0520	0.0490	0.0150	-0.0369	(-4.68)

Table 10 presents mean stock returns over the subsequent eight quarterly earnings announcement periods following portfolio formation. Announcement returns are measured as the buy-and-hold returns earned over the seven-day window (-3, +3) surrounding each earnings announcement. Mean return for a specific quarter represents the average return for the firms with returns for that quarter. The total returns (4 Qtrs) are the sum of all (4) quarters' returns. t-statistics for portfolio means are from two-sample t-tests.