

# Aggregate corporate insider trading and analyst forecast accuracy

## Abstract

We provide consistent evidence that financial analysts employ publicly-available insider-trading information in the six months prior to making their earnings forecasts to enhance the accuracy of their forecasts. Specifically, we document that firms with insider-ownership increases in the six months leading to the forecast issues enjoy significantly better recommendation from analysts compared to firms with unchanged or decreased insider ownership. The results uncover a relevant source of information which complements analysts' independent opinion and increases the value of their forecast. Through this process capital markets become more efficient as insiders' beliefs are disseminated to the public through an additional channel in the form of analysts' guidance; thereby supporting prior work positing that insider-trading enhances market efficiency. The influence of insider trading on forecast accuracy is more robust among non-high-tech sectors, which dissipates during the post-Galleon period (2009-2012).

**JEL Codes:** G14, G17, G18, K22.

**Keywords:** Insider Trading, Analyst Forecast Error, Market Efficiency.

## 1. Introduction

Uninformed investors are at a disadvantage when corporate insiders have private information and trade based on this knowledge, thereby undermining investors' confidence on financial markets.<sup>1</sup> However, besides the conventional perception, corporate insider trading is considered legal<sup>2</sup> when insiders timely report the transactions to the Securities and Exchange Commission (SEC) and such trades are not presumed to violate insiders' fiduciary duty.<sup>3</sup> Whereas

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<sup>1</sup> The SEC considers corporate insiders as the officers, directors, and any beneficial owner of more than ten percent of a class of the company's shares that are registered under section 12 of the Securities Exchange Act of 1934.

<sup>2</sup> The SEC defines illegal insider trading as "buying or selling a security, in breach of a fiduciary duty or other relationship of trust and confidence, while in possession of material, nonpublic information about the security. Insider trading violations may also include 'tipping' such information, securities trading by the person 'tipped,' and securities trading by those who misappropriate such information." <http://www.sec.gov/answers/insider.htm>

<sup>3</sup> Insiders often employ Rule 10b5-1 to reduce insider-trading related liability. This Rule "provides that a person trades on the basis of material nonpublic information if a trader is 'aware' of the material nonpublic information when making the purchase or sale. The rule also sets forth several affirmative defenses or exceptions to liability. The

outsiders trading on private information are occasionally prosecuted, illegal insider trading by corporate executives is rarely an occurrence. Despite efforts by the regulatory authority to rein in illegal insider trading, there is a window of opportunity for illegal trading between the time corporate-insiders trade and report to the SEC.<sup>4</sup> Any information leakage occurring during this lag in time can be exploited by “privileged” traders. Notwithstanding insiders’ disclosure and timely filing, institutional investors and financial analysts may have earlier access to corporate insider-trading disclosures than individual investors who may lack the resources to obtain comparable data, consequently failing to reduce the financial information gap. Information asymmetry between insiders and outsiders plays a paramount role in the financial markets.<sup>5</sup> Therefore, corporate insider trading represent valuable information that, if properly disseminated, can contribute to increased market efficiency by enhancing the price discovery process.

The SEC imposes a substantial level of regulation and constant oversight of informed traders as an attempt to deter unlawful use of private information, particularly following the enactment of the Sarbanes-Oxley Act (SOX).<sup>6</sup> For instance, the SOX accelerates the deadlines for filing most insider reports to the SEC. Yet, despite SEC efforts, existing literature suggests that insiders have special “capabilities” to time the market, hence, to earn abnormal profits from trading

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rule permits persons to trade in certain specified circumstances where it is clear that the information they are aware of is not a factor in the decision to trade, such as pursuant to a pre-existing plan, contract, or instruction that was made in good faith.” <http://www.sec.gov/answers/insider.htm>

<sup>4</sup> According to the SEC, “an insider of an issuer that is registering equity securities for the first time under Section 12 of the Exchange Act must file this Form (3) no later than the effective date of the registration statement.” However, “if the issuer is already registered under Section 12, the insider must file a Form 3 within 10 days of becoming an officer, director, or beneficial owner.” Lastly, changes in ownership must be reported in SEC Form 4 within two business days. <http://www.sec.gov/answers/form345.htm>

<sup>5</sup> *The Wall Street Journal* reported on November 13, 2013 that corporate insiders use their privileged information on their corresponding firm to time their trades and accomplish higher abnormal returns. Additionally, on November 18, 2013 *The WSJ* highlights the information content of corporate insider trading and puts forward some evidence on the outstanding timing of insider transactions.

<sup>6</sup> The U.S. Congress passed the Sarbanes–Oxley Act in July 2002 following a number of high-profile scandals developed during 2001. This Act aims to prevent managerial and accounting misconduct by imposing additional disclosure requirements and corporate governance mandates.

shares of their corresponding firms. This well-documented conclusion implies that there are significant opportunities to improve the current regulatory framework, for instance, by increasing the transparency of corporate insider trading and contributing to a more timely flow of information; thereby making markets more informationally efficient.

We provide consistent evidence that financial analysts enhance the accuracy of their earnings forecast by employing publicly-available insider-trading information up to six months ahead. Specifically, we document that firms with insider-ownership increases during the six months leading to the forecast issues enjoy significantly better recommendation from analysts as compared to firms with unchanged or decreased insider ownership. The results uncover a relevant and important source of information incorporated into analyst forecasts, which complements analysts' independent opinion and increases the value of their forecast. To the extent that corporate insider trading reflects private information, markets become more efficient as insiders' private knowledge is disseminated to the public through an additional channel in the form of analysts' guidance.

We contribute to the literature by putting forward the mechanisms through which financial analysts incorporate publicly-available insider-trading data into their forecasts. We provide evidence that firms with increases in insider-ownership receive significantly more optimistic recommendations from analysts. In addition, we find that firms with increases in insider-ownership exhibit significantly better earnings forecast accuracy, in agreement with the conclusion posited by Lustgarten and Mande (1995, 1998). Consistent with the documented findings by Chira and Madura (2013), the insider-trading effect dissipates following the diffusion of the Galleon insider-

trading case.<sup>7</sup> Lastly, given the higher level of earnings forecast error present in non-high-tech relative to high-tech sectors documented by Kwon (2002), we find that the results are more robust for firms in non-high-tech sectors.

The implications of our paper are twofold. Rather than curbing corporate insider trading preceding earnings announcements, securities regulators, may attempt to increase transparency and enhance the reporting procedures of corporate insiders to ensure a more timely information dissemination. In this way regulators can contribute to an enriched price discovery process that fosters efficiency in capital markets. Additionally, as insider trading patterns are disseminated through venues with broader audiences, the relative information advantages of institutional investors and professional traders relative to individual investors might be mitigated.

This paper is structured as follows. The next section presents a review of the insider trading literature. Section 3 presents our sampling procedure and describes the methodology. Section 4 discusses our results and Section 5 concludes the paper.

## **2. Literature review and hypothesis development**

### *2.1. Insider trading and abnormal returns*

Scholars have long analyzed the trading behavior of corporate insiders and, in particular, the performance of insider trades. Extant research suggests that corporate insiders earn abnormal returns from trading shares of their corresponding firms; for instance, Rozeff and Zaman (1988) find that earnings from corporate insider trading are about three percent before transaction costs.

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<sup>7</sup> “In October 16, 2009, the U.S. government charged Galleon hedge fund founder Raj Rajaratnam and five others with insider trading, in what was described by a key prosecutor overseeing the case as a “wake-up call to Wall Street and to every hedge fund manager” (Chira and Madura, 2013).

Similarly, outsiders can profit from publicly available insider-trading information, yet, the abnormal returns dwindle after controlling for risk factors such as size and earnings/price-ratio. Seyhun (1988) finds that aggregate insider trading has a significant amount of information about the stock market, as net insider trades predict the direction of market movements. Jeng, Metrick, and Zeckhauser (2003) state that insider purchases earn more than six percent annual abnormal returns, whereas insider sales do not earn significant abnormal returns. Betzer and Theissen (2009) shows that corporate insider trading in Germany produces significant abnormal returns and the cross-section of the price reaction strength is contingent on firms' ownership structure and accounting standards.

An additional stream of research analyzes the information content of insider trading around corporate events. Seyhun and Bradley (1997) document clear deviations from the goal of shareholders' wealth maximization as the authors detect significant sales by the insiders of firms filing bankruptcy petitions prior to the filing date.<sup>8</sup> In addition, selling is more intense for top executives and officers at troubled corporations. Agrawal and Nasser (2012) conclude that insiders become net buyers before takeover announcements and the net holdings increase with the level of certainty in the takeover transaction. Bonaimé and Ryngaert (2013) document that insiders become net sellers during share repurchase periods, contrary to the notion that repurchases signal undervaluation. Insiders' knowledge about the "quality" of share repurchase plans becomes visible as share repurchases where insiders are net buyers earn abnormal returns for the following three years, whereas abnormal returns from share repurchase plans where insiders are net sellers dwindle

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<sup>8</sup> *The Wall Street Journal* reported on July 10, 2013 that the trading behavior of corporate insiders shifts from bullish to bearish in the months before filing for bankruptcy. The *WSJ* analyzed nearly 11,000 corporate insider trades of 550 U.S. firms finding that insiders' stock purchases drop by 80% during the three months prior to bankruptcy filing; decreasing value for outside shareholders.

after one year. Similarly, Lakonishok and Lee (2001) identify a contrarian (insider) trading strategy that generates abnormal returns for corporate insiders, particularly when exercising their private knowledge of small firms. However, only insider purchases appear to be informative as selling do not exhibit ability to predict stock returns.

Fidrmuc, Goergen, and Renneboog (2006) state that insider trades convey new information to the market, earning abnormal returns, particularly in the U.K. In addition, the abnormal returns are robust even if the insider trades are preceded by important corporate events suggesting that insider trades are informative even after such cases. An exception to this finding is when the event that precedes the insider transaction is a merger or acquisition. Lastly, the information content depends on the market perception of the degree of firms' ownership and control. In firms where outside blockholders exert significant monitoring, insider transactions are *less informative* than in firms with more dispersed ownership that may suffer from higher information asymmetry.

Insider-trading research has also analyzed the cross-section of insider-trading abnormal returns by insider characteristics. Davidson, Dey, and Smith (2013) suggest that the risk-adjusted stock returns varies not only across firms but also across executives based on the level of money-oriented or materialistic behavior identified through their ownership of luxury goods. Furthermore, Ravina and Sapienza (2009) put forward that independent directors benefit the most from access to private information, particularly from stock purchases and from stock sells done in a window before bad news is released to outside investors. On average, independent directors from firms with weak corporate governance have higher abnormal returns.

## 2.2. *Insider trading and efficient markets*

Even though insider trading may have a negative influence on stock market efficiency when there is opacity and a high level of information asymmetry, unbiased insider trading information improves stock price accuracy, whose inherent effect in market efficiency benefits society (Wang and Steinberg, 2010). Nevertheless, some evidence shows little or no effect from corporate insider trading. For instance, Eckbo and Smith (1998) state that corporate insiders of firms listed in the closely-held Oslo Stock Exchange earn zero or negative abnormal stock returns in spite of the limited enforcement of insider-trading regulation during the sample period. Moreover, Aktas, de Bodt, and Van Oppens (2008) point out that the abnormal performance occasionally found in the literature may be due to reverse causality of investors following insiders' strategic behavior as long-term results are tainted by the public release of insider trades, creating endogeneity concerns. The authors conclude that corporate insider trading does not generate abnormal returns, hence supporting the efficient markets hypothesis. In this line, Carlton and Fischel (1983), Meulbroek (1992), and Lustgarten and Mande (1998), among others, argue that insider trading improves share price discovery, thereby making stock markets more efficient, adding to the debate of whether insider trading brings noise into stock prices or incorporates relevant private information. Similarly, insider trades executed by senior officers convey relevant information to predict the accuracy of subsequent earnings forecast as this group of insiders has the ability to manage earnings if needed to meet the analyst forecast (Kraft, Lee, and Lopatta, 2014).

We revisit the issue of aggregate corporate insider trading and examine whether and to what extent financial analysts use publicly-available insider trading information to enhance the forecast accuracy, in particular, earnings forecasts and buy/sell recommendations. We argue that, given the valuable information insiders are able to access and act upon, analysts employ corporate

insider holdings as an essential tool that complements analysts' outlook. For instance, Jiang and Zaman (2010) find that aggregate insider trading involves significant information content. Insider trading comprises relevant news on the direction of unexpected cash flows. Rather than trading on a contrarian strategy, insiders' trades exhibit a blatant use of private information about expected cash flows. Similarly, Ke, Huddart, and Petroni (2003) find that insiders trade upon knowledge of specific and relevant forthcoming accounting disclosures as premature as two years earlier; and significant insider trading occurs between the three quarters and up to nine quarters before the earnings announcement. Yet, corporate insiders avoid trading during the two quarters immediately preceding the earnings announcement. Moreover, Hillier and Marshall (2002) determine that corporate insider trading regulation in the U.K. does not limit insiders from earning abnormal returns when trading on their corresponding firms.<sup>9</sup>

Extant literature consistently finds that corporate insiders earn abnormal profits, which presumably is due to trading on material, private information. Therefore, we posit that, to the extent that corporate insiders trade on private information, capital markets can increase their efficiency as insiders' unique knowledge can be quickly disseminated into the public information through additional channels, such as in the form of financial analysts' guidance. We contemplate that providing objective insider trading data can lead stock prices to more accurately reflect their fundamental value and make investors better off.

### **3. Data and methodology**

#### *3.1. Sample*

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<sup>9</sup> In the U.K., the London Stock Exchange Model Code (1977) imposes a two-month ban on insider trading prior to earnings announcements (Hillier and Marshall, 2002).



From I/B/E/S, we obtain the latest aggregate consensus earnings-per-share (EPS) forecasts and summary recommendations for each firm made in each fiscal year for the subsequent fiscal year (one year ahead).<sup>10</sup><sup>11</sup> We measure changes in the aggregate ownership of eight key insider categories<sup>12</sup> as identified by Fidrmuc, Goergen, and Renneboog (2006), Agrawal and Nasser (2012), Jiang and Zaman (2010), and Tirapat and Visaltanachoti (2013). Ownership information is as reported in SEC Forms 4 and 5 in Thomson One<sup>13</sup> during the 12 months preceding the analyst forecast issue.

Accounting variables and stock price data are from Compustat and CRSP, respectively. We report the sample distribution in Table 1 Panel A and the descriptive statistics in Panel B. Our sample includes 50,731 firm-year observations from 1993-2012. Business equipment (23.16%), health (13.19%), and manufacturing (12.63%) are the three most represented industries in our sample. The sample is proportionally allocated across the 20-year sample period with a median of 4.91% observations per year (mean = 5%). About 44% of the firm/year observations experience changes in insider ownership during the 12 months leading to the forecast issue.

[INSERT TABLE 1 ABOUT HERE]

### 3.2. *Dependent variable*

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<sup>10</sup> We keep only data with forecast period indicator equals 1 in I/B/E/S data.

<sup>11</sup> We use only the latest aggregate forecast summary made in a year for each firm for the next fiscal year so as to avoid overlapping or serial correlation. In addition, since insiders do not trade frequently, using only the latest forecast issues in a year helps avoid missing correspondingly insider trading observations (e.g. forecasts are made monthly while insiders do not trade as frequently). We estimate the aggregate/consensus analysts forecast rather than the individual analyst forecast as there is no reason to expect why some analysts use insider information while others do not.

<sup>12</sup> Relevant insiders are classified in eight categories: CEO, COO, CFO, CB (Chairman of the Board), O (Officers), D (Director), VP, and P (President).

<sup>13</sup> According to the SEC, changes in ownership are reported on Form 4 and must be reported to the SEC within two business days. However, some categories of transactions are not subject to the two-day reporting requirement. Also, insiders must file a Form 5 to report any transactions that should have been reported earlier on a Form 4 or were eligible for deferred reporting. If a Form must be filed, it is due 45 days after the end of the company's fiscal year.

Our main dependent variable is analyst forecast accuracy. Specifically, we measure the degree of *Forecast Error* as the difference between mean (and median, alternatively) forecast EPS generated by analysts following a firm and actual EPS for the firm  $i$  at time  $t$  deflated by stock price as it has been common in previous research (Lang, Lins, and Miller, 2003; Henderson and Marks, 2013; Hilary and Hsu, 2013; Thomas, 2002).

$$Forecast\ Error_{it} = \frac{forecast\ EPS_{it} - actual\ EPS_{it}}{Price_{it}} \quad (1)$$

Moreover, to explore the extent to which changes in insider ownership influence analyst recommendation, we construct *Analyst Recommendation* measures from I/B/E/S details and summary files. We employ a standardized Thomson Reuters Recommendation scale (1 = “Strong buy”, 2 = “Buy”, 3 = “Hold”, 4 = “Underperform”, and 5 = “Sell”) to calculate a mean and a median recommendation score for each firm in each year. To further evaluate the impact of analysts’ rating on a stock, we calculate the following three measures. First, “% of suggested sell” measures the percent of analysts issue with a “SELL” recommendation on the stock. Second, “% of suggested hold” denotes the percent of analysts issuing a “HOLD” rating on the stock. Third, a “% of suggested buy” represents the percent of analysts with a “BUY” recommendation on the stock.

### 3.3. Variable of interest

Insider ownership can be classified as either direct or indirect ownership. Indirect ownership occurs when an insider’s securities are held by a trust or members of an insider’s immediate family who reside in same household and the insider is the beneficial owner (Agrawal and Nasser, 2012). We primarily measure total ownership (direct and indirect holdings) as Berkman, Koch, and Westerholm (2013) find that a high proportion of underaged or children

accounts are likely to be controlled by informed guardians who may profit from indirect holdings, hence, insider trading may be camouflaged through indirect ownership.

The fluctuation on the level of firms' insider ownership, implying net buying (bullish signal) or net-selling (bearish signal) of the corresponding shares, conveys insiders' optimism or pessimism about a firm's earnings prospects. We suggest that financial analysts employ publicly-available insider-trading information to enhance forecast accuracy. To address our research question, we construct the variable *Insider Ownership Changes*, which measures the percentage change in total holdings by the key insiders in each firm during the 12, six, and three months preceding the forecast issues. In addition to an unrestricted measure of the variable of interest, we control for asymmetric influence of insider-ownership increases (decreases) by truncating the values to bullish (% change > 0) signals and bearish (% change < 0) signals for each firm in a given month. Moreover, descriptive statistics show that insiders' ownership in our sample is regularly managed through direct insider holdings.<sup>14</sup> Therefore, we additionally consider in our study the effect of the variable *Direct Insider Ownership Change*, which is restricted to direct holdings by the relevant insiders defined above.

#### 3.4. Control variables

To isolate the effect of our variable of interest, fluctuations of insider ownership, we control for the following set of regressors that are commonly employed in the extant literature on analyst forecast and forecast error.<sup>15</sup>

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<sup>14</sup> We find about 66% of the aggregate insider ownership is classified as direct ownership (denoted as 'D' in ownership type) in our dataset.

<sup>15</sup> For instance, Henderson and Marks (2013), Lang, Lins, and Miller (2003), Gu and Wu (2003), Hilary and Hsu (2013), Agrawal and Nasser (2012), Thomas (2002), and So (2013) have put forward relevant models on analyst forecast.

*Lagged absolute EPS forecast error* is the mean realized earnings forecast error in the preceding year (Henderson and Marks, 2013; Lang, Lins, and Miller, 2003). *Number of analysts* is a measure for analyst coverage and represents the log value of the number of analysts following a firm (Gu and Wu, 2003; Hilary and Hsu, 2013; Henderson and Marks, 2013). Higher degree of analyst coverage about a firm can decrease information asymmetry, further improve the forecast accuracy. *Market Capitalization* is a proxy for firm size and is computed as the log value of market capitalization. Larger firms regularly receive coverage from analysts and media in greater extent relative to small firms. The degree of information asymmetry is diminishing as the result of increase in firm size (Agrawal and Nasser, 2012; Hilary and Hsu, 2013; Fidrmuc, Korczak, and Korczak, 2013). *Return and earnings correlation* is the bivariate correlation between returns and earnings per-share in the previous 10 years. A minimum of five observations are required to estimate this variable as suggested by Henderson and Marks (2013), and Lang, Lins, and Miller (2003). *Earnings Volatility* is the standard deviation of the EPS in the previous ten years but with a minimum of five observations (Henderson and Marks, 2013). *Earnings Volatility* is deemed to have a significant association with analyst forecast error and historical earnings variance (Kross, Ro, and Schroeder, 1990). A higher degree of earnings volatility indicates more analyst disagreement, thus, firms with higher earnings volatility are expected to have larger forecast errors.

*Industry diversification* is the product of the number of segments and the ratio of sales from unrelated segments to total sales. Each industry segment is classified as "unrelated" if its 2-digit SIC code is different from that of the firm's primary SIC code (Henderson and Marks, 2013). Based on the transparency hypothesis, greater industry diversification increases the complexity of analysis; therefore, forecasts on highly diversified firms are expected to have a higher forecast error (Thomas, 2002). *Geographic diversification* is the ratio of revenue from foreign segments to

total sales (Henderson and Marks, 2013). Analysts' forecast accuracy tends to suffer a setback given an increased dispersion of revenues overseas due to the exposure to a higher number of risk factors. Moreover, Gu and Wu (2003) find positive relationship between earning *skewness* and analyst forecast error. *Forecast Skewness* is estimated as:

$$Forecast\ Skewness_{it} = \frac{mean(EPS_{it}) - median(EPS_{it})}{Price_{it-1}} \times 100 \quad (2)$$

*Forecast Skewness* is the difference between the mean and median values of the earnings distribution deflated by the stock price and it is expressed as a percentage (Gu and Wu, 2003; Henderson and Marks, 2013).<sup>16</sup>

*Losses* is a dummy indicator that equals one if the median forecast for a given firm during the corresponding quarter is a loss (Henderson and Marks, 2013; So, 2013). *ROA* is computed as the ratio of net income to the book value of total assets. *Market-to-book ratio* is a proxy for firm valuation and equals to the ratio of market value of equity to book value of equity at the end of the previous quarter (Hilary and Hsu, 2013; Fidrmuc, Korczak, and Korczak, 2013). *Debt-to-asset ratio* is a proxy for financial leverage and is defined as the book value of total debt to the book value of total assets. Financial leverage boosts the variance of profits and therefore increases the dispersion of earnings forecast and forecast error (Thomas, 2002).

### 3.5. Multivariate analyses

We examine our main hypothesis regressing the dependent variable *Forecast Error* on the variable of interest *Insider Ownership Change* and a vector of  $m$  firm characteristics. We fit equation (3) using pooled OLS regressions. Our model control for year fixed effects, sector fixed effects, and clustered standard errors as suggested by Petersen (2009).

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<sup>16</sup> Refer to Gu and Wu (2003) page 11 for details on the main measure of skewness and for an alternative measure of this control variable.

$$|Forecast Error_{it}| = \alpha + \beta_1 |Insider Ownership Change_{it-n}| + \beta_m Z_{it}^m + u_i + \epsilon_{it} \quad (3)$$

The dependent variable in equation (3) is the *Absolute Mean Forecast Error*.  $Z_{it}^m$  is a vector of  $m$  firm-specific regressors described in the control variables section.  $u_i$  denotes a set of fixed effects and clustered standard errors and  $\epsilon_{it}$  is an error term.

Further, we examine the extent to which insider ownership change influences *Analyst Recommendation*, we re-estimate our base model specification above using the *Quartiles of % Insider Change* as our variable of interest as shown in equation (4).

$$Analysts Recommendation_{it} = \alpha + \beta_1 Quartiles\ of\ \% Insider\ Change_{it-n} + \beta_m Z_{it}^m + u_i + \epsilon_{it} \quad (4)$$

Where the dependent variable is the mean value of *Analyst Recommendation* and the vector  $Z_{it}^m$  and variables  $u_i$ , and  $\epsilon_{it}$  are as described above.

## 4. Results and Discussion

### 4.1. Insider-ownership changes and earnings forecast accuracy

In Table 2, we compare and contrast the absolute EPS forecast error between three groups of firms: firms with increases in insider ownership, firms with decreases in insider ownership, and firms with unchanged insider ownership in the three-, six-, and 12-month windows leading up to the forecast issues. While the absolute mean/median EPS forecast errors are quite similar for both firms with increases in insider ownership and firms with decreases in insider ownership, they are significantly larger for firms with unchanged insider ownership in the three, six, and 12 months.

Thus, the preliminary result in this table is in accordance to our hypothesis that insider trading is helpful in improving forecast accuracy. Tests in mean and median differences are the Satterthwaite method and Wilcoxon signed-rank method assuming variances are unequal.

[INSERT TABLE 2 ABOUT HERE]

In Panel A of Table 3, we compare and contrast the absolute EPS forecast error by quartiles of the absolute changes in insider ownership prior to the forecast for the whole sample. While higher absolute changes in insider ownership in the six and three months prior to the forecast are associated with lower absolute EPS forecast errors, absolute changes in insider ownership in the 12 months prior to the forecast do not. To shed further light on the impact of insider ownership changes, we exclude firms without insider ownership changes in our analyses in Panel B and Panel C of Table 3. We compare and contrast the absolute EPS forecast error by quartiles of the increases (in Panel B) and decreases (in Panel C) in insider ownership prior to the forecast. Consistent with our prior results, changes in insider ownership (e.g. increases and decreases) in the six and three months prior to the forecast are strongly related to lower absolute forecast errors.

[INSERT TABLE 3 ABOUT HERE]

In this stream of research, reverse causality may be present as the disclosure of new information might be determined by whether insiders are looking to make a trade. Cheng and Lo (2006) find that insiders strategically choose disclosure policies and the timing of their equity trades to maximize trading profits. When managers plan to purchase shares, they increase the number of bad news forecasts to reduce the purchase price. Executives successfully time their

trades around bad news forecasts, buying fewer shares beforehand and more afterwards.<sup>17</sup> We address the potential feedback effect from stock returns to insider-trading estimations by employing a dependent variable that is correlated with stock returns but is exogenous to insider trading. Analyst forecast accuracy serves as an instrument to dissipate this endogeneity concern.

In Table 4, we perform the multivariate analyses of the absolute EPS forecast errors using OLS regressions in which we control for year-fixed effects, sector-fixed effects and clustered standard errors as suggested by Petersen (2009). The variables of interest are the absolute changes in insider ownership in the 12, six, and three months prior to the forecast. Consistent with the univariate results in Tables 2 and 3, the coefficients on the absolute changes in insider ownership in the six and three months prior to the forecast are negative and significant at the 1% level in models 1 and 2, confirming the value added of aggregate insider ownership changes in enhancing forecast accuracy. The coefficient on the absolute changes in insider ownership in the 12 months prior to the forecasts is insignificant in Model 3. We repeat Models 1 through 3 and include the lagged value of the forecast errors in Models 4 through 6 to control for potential serial correlations of the forecast error as suggested by Henderson and Marks (2013). While the number of observations reduce in these models, the results on our variables of interest hold.

[INSERT TABLE 4 ABOUT HERE]

## ***4.2 Robustness tests of earnings forecast accuracy***

### ***4.2.1. The impact of corporate events***

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<sup>17</sup> Yet, there is an asymmetric effect as managers do not seem to adjust their forecasting activity when selling shares, consistent with higher litigation concerns associated with insider sales.



Related literature presumes that corporate insiders adjust their ownership on the corresponding firm based on their, often accurate, perception of the firm's future cash flows. Hence, corporate insider trading conveys unique firm information that can be used to anticipate firm performance, however, the outcome of major corporate events may be more challenging to predict. For instance, Fidrmuc, Goergen, and Renneboog (2006) find that merger and acquisitions brings a unique firm outcome that cannot be fully anticipated by insiders; consequently, analysts may opt not to incorporate insider-ownership changes in their prediction around these events. Yet, lacking better material, analysts may still incorporate insiders' signals. To ensure our results are not influenced by corporate events, we re-test Models 1-3 of Table 4 using two subsamples based on acquisitions and share repurchases events as reported in Compustat.

We employ "*Purchase of common stock & preferred stock*" and "*Acquisition*" variables and create two dummy variables which are equal to one if the corresponding variable is not missing and is non-zero. Then, we rerun our analyses removing observations where the dummy for repurchase = 1 or the dummy for acquisition = 1 in Panel A and Panel B of Table 5.<sup>18</sup> Our results are not significantly altered in the subsample models.

[INSERT TABLE 5 ABOUT HERE]

#### 4.2.2. *The impacts of hi-tech characteristics*

During the past several decades, the high-tech industry has received remarkable attention from financial analysts due to its superior growth prospects. A higher degree of press and analyst coverage is expected to reduce information asymmetry thereby decreasing information-induced

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<sup>18</sup> We remove 5,530 and 6,026 observations in the "repurchase" and "acquisition" subsamples, respectively.

forecast error. For instance, Kwon (2002) finds that analysts' EPS forecasts are more accurate and consistent among hi-tech companies. Based on these arguments, we recognize that the impact of insider-ownership on forecast accuracy may differ between firms with and without hi-tech characteristics. To investigate this possibility, we proceed as follows. We classify a hi-tech firm as a firm with the following 3-digit SIC codes: 357, 367, 369, 382, 384, 737, based on Field and Hanka (2001). Then in Panel A of Table 6, we simultaneously regress our base model in hi-tech and non-hi-tech subsamples employing seemingly unrelated regressions (SUR) as the error terms across both groups may be correlated. We find that the influence of *Insider Ownership Change* on *Forecast Error* remains robust only in the non-hi-tech subsample and as expected, the coefficient means significantly differ across groups.

[INSERT TABLE 6 ABOUT HERE]

#### 4.2.3. *Impact of the Galleon insider-trading case*

In October 2000, the SEC adopted Regulation Fair Disclosure (FD) to prevent information leakage of material non-public information to select subjects and to clarify and improve insider-trading guidelines.<sup>19</sup> However, the effectiveness of this regulation is questionable as researchers find evidence of insider-trading involving private information still after the passage of Regulation FD (Chira and Madura, 2013). Due to its magnitude and media coverage, the Galleon insider-trading case is one of largest hedge-fund insider-trading cases ever charged by the U.S. Government (Chira and Madura, 2013). We suspect that the “wake-up call” delivered by the

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<sup>19</sup> Specifically, Regulation FD attempts to address three main issues. “The selective disclosure by issuers of material nonpublic information; when insider trading liability arises in connection with a trader's ‘use’ or ‘knowing possession’ of material nonpublic information; and when the breach of a family or other non-business relationship may give rise to liability under the misappropriation theory of insider trading.” <http://www.sec.gov/rules/final/33-7881.htm>

Galleon case has discouraged illegal insider trades, reducing information asymmetry, and therefore reducing the impact of insider-trading on analysts' forecast error. We then re-estimate the specification model shown in equation (3) with two sub-sample periods, pre- and post-Galleon, using SUR technique. The results in Panel B of Table 6 show that the predictive power of *Insider Ownership Change* dissipates and becomes insignificant during the post-Galleon subsample. In contrast, the pre-Galleon period shows a significant and negative relationship, consistent with our previous results. This finding confirms that after the Galleon event analysts rely less on insider-ownership changes as a signal of firms' financial prospects, by this means highlighting the impact of the Galleon case in deterring insider trading.

#### *4.3. Insider ownership changes and direction of analyst recommendation*

Now that we confirm that insider ownership changes are associated with lower analyst forecast errors, we explore further if the direction of insider ownership changes is consistent with the direction of analyst recommendation. More specifically, we expect analysts to give more favorable recommendation for firms with recent increases in insider ownership since insider ownership increases might suggest that insiders are confident of their firm prospect. In Table 7, we compare and contrast analyst recommendation between quartiles of insider ownership increases. Consistent with our prediction, firms in the largest quartile of insider ownership increases in the preceding six and three months, alternatively, enjoy better recommendation (e.g. lower mean and median recommendation scores), lower percentage of "SELL" and "HOLD" recommendation, and higher percentage of "BUY" recommendations among analysts. Similarly, in Table 8, we compare and contrast analyst recommendation between quartiles of insider ownership decreases. Firms with largest decreases in insider ownership receive less favorable recommendation (e.g. larger mean and median recommendation scores) and higher percentage of

“SELL” and “HOLD” recommendation, and lower percentage of “BUY” recommendations among analysts. Thus, the results in Table 7 and Table 8 suggest that the direction of analyst recommendation is consistent with the direction of insider ownership changes in the preceding six and three months.

[INSERT TABLE 7 ABOUT HERE]

[INSERT TABLE 8 ABOUT HERE]

In Table 9, we regress the analyst recommendations (in Panel A) and percentage of “BUY” recommendation (in Panel B) on the variable that indicates the quartile of the insider ownership increases among other control variables. In Table 10, we regress the analyst recommendations (in Panel A) and percentage of “SELL” recommendation (in Panel B) on the variable that indicates the quartile of the insider ownership decreases among other control variables. We control for year-fixed effects, industry-fixed effects, and correct the standard errors for firm clustering effects as suggested by Petersen (2009). Consistent with our documented univariate results in Table 7, we find that larger increases in insider ownership in the preceding six and three months are associated with more favorable recommendation (e.g. lower recommendation score) and higher percentages of “BUY” recommendation. Decreases in insider ownership, on the other hand, are not associated with analyst recommendation (see Table 10).

[INSERT TABLE 9 ABOUT HERE]

[INSERT TABLE 10 ABOUT HERE]

#### *4.4. Robustness tests of analyst recommendation*

The changes in direct ownership of the firm shares might be more informative of the firm prospect as compared to the trading of indirect ownership. In Table 11, we examine the relationship between analyst recommendations and the increases/decreases in direct ownership of the firm. Larger insider ownership increases in the preceding three months are significantly associated with more favorable recommendation (e.g. lower mean recommendation score) and higher percentages of “BUY” rating. Consistent with our previous results, decreases in direct insider ownership of the firm are not associated with a significant effect in analysts’ recommendations.

[INSERT TABLE 11 ABOUT HERE]

## **5. Conclusions**

We provide consistent evidence that financial analysts enhance forecast accuracy employing publicly-available insider-trading information up to six months ahead of the earnings forecast. Specifically, we document that firms with insider-ownership increases during the six months leading to the forecast issues enjoy significantly better recommendation from analysts as compared to firms with unchanged or decreased insider ownership. Our findings uncover a relevant source of information incorporated into analyst forecast which complements the independent opinion and increases the value of analysts’ guidance. In addition, to the extent that corporate insider trading reflects private information, markets become more efficient as insiders’ private knowledge is disseminated to the public through an additional channel in the form of analysts’ guidance; hence supporting prior work positing that insider-trading contributes to market efficiency. The influence of insider-trading on forecast accuracy is stronger in firms outside high-tech sectors, yet the effect dissipates after the Galleon insider-trading case was disclosed by authorities in 2009.

The implications of our paper are twofold. Securities regulators, rather than curbing corporate insider trading preceding earnings announcements, may attempt to increase transparency and enhance the reporting procedures of corporate insiders to ensure a more timely information dissemination. In this way regulators can contribute to an enriched price discovery process that foster efficiency in capital markets. Additionally, as insider trading patterns are disseminated through venues with broader audiences, individual investors can gain access to objective data thereby reducing the information disparity relative to institutional investors and professional traders.

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**Table 1 – Sample Distribution and Descriptive**  
**Panel A - Sample Distribution**

Fama-French 12 - sector classification	N	Percent	Year	N	Percent
NoDur	2,896	5.71	1993	1,731	3.41
Durbl	1,526	3.01	1994	2,284	4.50
Manuf	6,406	12.63	1995	2,485	4.90
Enrgy	2,597	5.12	1996	2,839	5.60
Chems	1,424	2.81	1997	2,973	5.86
BusEq	11,748	23.16	1998	2,986	5.89
Telcm	1,692	3.34	1999	2,875	5.67
Utils	1,938	3.82	2000	2,796	5.51
Shops	6,393	12.60	2001	2,487	4.90
Hlth	6,692	13.19	2002	2,386	4.70
Other	7,419	14.62	2003	2,307	4.55
			2004	2,449	4.83
			2005	2,535	5.00
Firms with changes in insider ownership prior to forecast	22,337	44.03	2006	2,594	5.11
Firms without changes in insider ownership prior to forecast	28,394	55.97	2007	2,596	5.12
Total	50,731	100	2008	2,486	4.90
			2009	2,408	4.75
			2010	2,451	4.83
			2011	2,493	4.91
			2012	2,570	5.07

**Panel B - Sample Descriptive Statistics (N=50,731)**

Variable	N	Mean	Median	25 <sup>th</sup> Percentile	75 <sup>th</sup> Percentile
Absolute mean forecast error	48,386	0.085	0.030	0.010	0.090
Absolute median forecast error	48,386	0.084	0.030	0.010	0.090
Mean recommendation	50,731	2.146	2.130	1.750	2.600
Median recommendation	50,731	2.179	2.000	2.000	3.000
% suggested sell	50,731	3.206	0.000	0.000	0.000
% suggested hold	50,731	36.205	33.330	0.000	56.670
% suggested buy	50,731	59.467	61.540	33.330	100.000
Number of analysts	50,731	7.208	5.000	2.000	10.000
Market capitalization	50,731	3,354.184	436.535	135.130	1,551.488
Return and earnings correlation	45,724	0.329	0.442	0.048	0.710
Earnings volatility	50,397	1.353	0.632	0.331	1.195
Industrial diversification	50,731	0.067	0.000	0.000	0.000
Geographic diversification	50,731	0.173	0.000	0.000	0.301
Forecast skewness	46,370	1.318	0.000	0.000	0.000
ROA	50,218	-0.003	0.011	-0.003	0.022
Market-to-book ratio	50,187	4.626	2.115	1.322	3.603
Debt-to-asset ratio	50,222	0.484	0.478	0.285	0.643
% direct insider ownership 3 months prior	50,731	1.477	0.043	0.000	0.799
% direct insider ownership 6 months prior	50,731	3.079	0.118	0.000	2.073
% direct insider ownership 12 months prior	50,731	6.118	0.281	0.000	4.850
% total insider ownership 3 months prior	50,731	2.112	0.035	0.000	0.583
% total insider ownership 6 months prior	50,731	3.874	0.091	0.000	1.409
% total insider ownership 12 months prior	50,731	7.062	0.219	0.000	3.125

We track the changes in aggregate insider ownership of the firm for the preceding 12 months as reported in SEC Forms 4 and 5 in Thomson One. We consider only insider ownership by the eight key insiders: CEO, COO, CFO, CB (Chairman of the Board), O (Officers), D (Director), VP and P (President). We remove the financial sector. We obtain accounting data for the firms in the preceding fiscal year from Compustat and stock prices from CRSP. Our sample includes 50,731 firm-year observations from 1993-2012. We obtain the latest aggregate consensus earnings-per-share (EPS) forecasts and summary recommendations for each firm made in each fiscal year for the subsequent fiscal year from I/B/E/S. Analyst forecast accuracy is measured by the absolute mean/median EPS forecast

errors deflated by stock price. *Mean (Median) recommendation* is calculated by assigning to each contributing analyst recommendation an integer based on a 5 standardized Thomson Reuters Recommendation scale and calculating a real number average (median). Lower the recommendation scores suggest better recommendation of the firm prospect. *% suggested sell* is percent of analysts issue a “SELL” rating on the stock. *% suggested hold* is percent of analysts issue a “HOLD” rating on the stock. *% suggested buy* is percent of analysts issue a “BUY” rating on the stock. *Number of analysts* represents the log of the number of analysts following the firm. *Market Capitalization* is a proxy for firm size and defines as log of Market capitalization. *Return and earnings correlation* is the bivariate correlation between earnings and returns in the previous ten years; a minimum of five observations are required. *Earnings Volatility* is defined as the standard deviation of the EPS in the previous ten years; a minimum of five observations are required. *Industry diversification* is the product of the number of segments and the ratio of unrelated sales to total sales. Each industry segment is classified as "unrelated" if its 2-digit SIC code is different from that of the firm's primary SIC code. *Geographic diversification* is the ratio of revenue from foreign segments to total sales. *Forecast Skewness* is measured by the difference in the mean-median of the earnings distribution deflated by stock price, expressed as a percentage. *ROA* is net income to total assets. *Market-to-book ratio*, a proxy for firm valuation, is computed as market value to book value at the end of the previous quarter. *Debt-to-asset ratio* is total debt to total assets.

**Table 2 – Comparison of Absolute EPS Forecast Errors by Whether Insider Ownership Changes**

Variables	Windows	Decrease (N=12,645)	Increase (N=14,618)	No change (N=23,468)	Decrease - No change t-stat	Wilcoxon- stat	Increase - No change t-stat	Wilcoxon- stat		
Absolute mean forecast error	3 months prior	0.075	0.075	0.096	-0.021	-15.15***	-13.81***	-0.021	-15.53***	-13.72***
Absolute median forecast error		0.074	0.075	0.095	-0.021	-15.04***	-13.84***	-0.021	-15.21***	-13.67***
Absolute mean forecast error	6 months prior	0.074	0.074	0.096	-0.022	-15.72***	-14.14***	-0.022	-16.54***	-14.6***
Absolute median forecast error		0.073	0.073	0.095	-0.022	-15.36***	-14.23***	-0.022	-16.33***	-14.33***
Absolute mean forecast error	12 months	0.072	0.074	0.095	-0.002	-16.19***	-13.56***	-0.021	-15.52***	-13.22***
Absolute median forecast error	prior	0.071	0.073	0.094	-0.002	-15.96***	-13.70***	-0.021	-15.35***	-12.74***

We track the changes in aggregate insider ownership of the firm up to the preceding 12 months as reported in SEC Forms 4 and 5 in Thomson One. We differentiate among decrease, increase, and no change in insider ownership. We obtain the latest aggregate consensus EPS forecasts and summary recommendations for each firm made in each fiscal year for the one upcoming fiscal year from I/B/E/S. Analyst forecast accuracy is measured by the absolute mean/median EPS forecast errors deflated by stock price. Tests in mean and median differences are the Satterthwaite method and Wilcoxon signed-rank method assuming variances are unequal. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 3 – Comparison of Absolute EPS Forecast Error by Quartiles of Insider Ownership Changes****Panel A - Quartiles of absolute insider ownership changes (N = 50,731)**

	Windows	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Q4 - Q1	t-stat	Wilcoxon-stat
Absolute mean forecast error	3 months prior	0.077	0.077	0.077	0.071	-0.006	-2.61***	-3.07***
Absolute median forecast error		0.076	0.076	0.076	0.070	-0.006	-2.34**	-3.33***
Absolute mean forecast error	6 months prior	0.077	0.076	0.074	0.070	-0.007	-2.53***	-3.22***
Absolute median forecast error		0.076	0.075	0.072	0.069	-0.007	-2.47**	-3.17***
Absolute mean forecast error	12 months prior	0.071	0.076	0.074	0.075	0.004	1.61	0.02
Absolute median forecast error		0.070	0.075	0.073	0.074	0.004	1.42	0.15

**Panel B - Quartiles of insider ownership increase (N = 14,618)**

Variables	Windows	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Q4 - Q1	t-stat	Wilcoxon-stat
Absolute mean forecast error	3 months prior	0.077	0.078	0.077	0.071	-0.005	-1.96**	-2.98***
Absolute median forecast error		0.076	0.077	0.076	0.070	-0.006	-2.15**	-3.3***
Absolute mean forecast error	6 months prior	0.077	0.076	0.075	0.070	-0.007	-2.53**	-3.42***
Absolute median forecast error		0.076	0.075	0.074	0.069	-0.007	-2.46**	-3.38***
Absolute mean forecast error	12 months prior	0.071	0.076	0.074	0.075	0.004	1.46	0.15
Absolute median forecast error		0.070	0.075	0.073	0.074	0.004	1.26	0.29

**Panel C - Quartiles of insider ownership decrease (N = 12,645)**

	Windows	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Q4 - Q1	t-stat	Wilcoxon-stat
Absolute mean forecast error	3 months prior	0.076	0.077	0.078	0.069	-0.007	-2.51**	-0.53
Absolute median forecast error		0.075	0.075	0.077	0.068	-0.007	-2.42**	-0.15
Absolute mean forecast error	6 months prior	0.073	0.077	0.077	0.070	-0.003	-1.14	-0.21
Absolute median forecast error		0.072	0.076	0.076	0.069	-0.004	-1.26	-0.08
Absolute mean forecast error	12 months prior	0.073	0.071	0.079	0.067	-0.006	-2.01**	-1.53
Absolute median forecast error		0.071	0.070	0.078	0.066	-0.006	-1.89*	-0.74

We compare and contrast the absolute mean/median EPS forecast error by quartiles of the absolute changes in insider ownership prior to the forecasts for the whole sample (in Panel A). We exclude firms without insider ownership changes in our analyses and compare the absolute mean/median EPS forecast error by quartiles of the increases (in Panel B) and decreases (in Panel C) in insider ownership prior to the forecasts. Tests in mean and median differences are the Satterthwaite method and Wilcoxon signed-rank method assuming variances are unequal. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 4 - Regressions of Absolute Mean Forecast Error on Insider Ownership Changes**

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>	<i>Model 6</i>
Constant	0.058 (5.524***)	0.058 (5.501***)	0.059 (5.546***)	0.046 (5.559***)	0.046 (5.527***)	0.046 (5.578***)
Absolute insider ownership % change in 3 months prior	-0.013 (-3.097***)			-0.010 (-2.298**)		
Absolute insider ownership % change in 6 months prior		-0.014 (-3.274***)			-0.010 (-2.298**)	
Absolute insider ownership % change in 12 months prior			-0.001 (-0.149 )			0.002 (0.488 )
Lagged absolute EPS forecast error				0.285 (30.364***)	0.285 (30.348***)	0.285 (30.369***)
Number of analysts	-0.155 (-13.157***)	-0.155 (-13.158***)	-0.156 (-13.154***)	-0.107 (-10.865***)	-0.107 (-10.865***)	-0.106 (-10.852***)
Market capitalization	-0.005 (-0.392 )	-0.005 (-0.377 )	-0.006 (-0.478 )	-0.005 (-0.480 )	-0.005 (-0.469 )	-0.006 (-0.581 )
Return and earnings correlation	0.046 (7.546***)	0.046 (7.540***)	0.046 (7.561***)	0.042 (8.262***)	0.042 (8.258***)	0.043 (8.286***)
Earnings volatility	0.044 (3.375***)	0.044 (3.374***)	0.044 (3.377***)	0.028 (3.354***)	0.028 (3.353***)	0.029 (3.358***)
Industrial diversification	-0.001 (-0.105 )	-0.001 (-0.105 )	-0.001 (-0.127 )	0.001 (0.276 )	0.002 (0.276 )	0.001 (0.252 )
Geographical diversification	0.016 (1.971**)	0.016 (1.962**)	0.017 (1.994**)	0.015 (2.201**)	0.015 (2.196**)	0.015 (2.229**)
Forecast skewness	0.016 (77.895***)	0.016 (77.863***)	0.016 (78.038***)	0.012 (47.709***)	0.012 (47.770***)	0.012 (47.838***)
Losses	0.245 (33.081***)	0.245 (33.095***)	0.245 (33.108***)	0.190 (27.649***)	0.190 (27.656***)	0.190 (27.678***)
ROA	0.023 (2.649***)	0.023 (2.650***)	0.023 (2.648***)	0.016 (2.533**)	0.016 (2.535**)	0.016 (2.537**)
Market-to-book ratio	0.004 (1.602 )	0.004 (1.601 )	0.004 (1.608 )	0.004 (1.977**)	0.004 (1.964**)	0.004 (1.987**)
Debt-to-asset ratio	0.135 (12.553***)	0.135 (12.563***)	0.135 (12.569***)	0.095 (10.021***)	0.095 (10.029***)	0.095 (10.045***)
F-statistics	99.38***	99.38***	99.13***	187.48***	187.84***	187.40***
Adj. R-squared	0.138	0.138	0.138	0.207	0.207	0.207
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firms clustered std err.	Yes	Yes	Yes	Yes	Yes	Yes
N	43,508	43,508	43,508	38,083	38,083	38,083

We perform the multivariate analyses of the absolute EPS forecast errors using OLS regressions in which we control for year fixed effects, sector fixed effects and clustered standard errors as suggested by Petersen (2009). Dependent variable is *Absolute mean forecast error*. The variables of interest are the absolute changes in insider ownership in the 12, 6 and 3 months prior to the forecasts. The control variables are included in the models as the following. *Lagged absolute EPS forecast error* is mean realized earnings forecast error in the preceding year. *Losses* is a dummy indicator that equals one if the median forecast for a given firm during the corresponding quarter is a loss. The remainder variables are as explained in Table 1. Numbers presented in parentheses are t-statistics. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 5-Robustness Tests Controlling for Corporate Events**

	<i>Panel A-Firms w/o Share Repurchases</i>			<i>Panel B-Firms w/o Acquisitions</i>		
	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
Constant	0.072 (6.744 ***)	0.072 (6.726 ***)	0.072 (6.778 ***)	0.064 (5.805 ***)	0.064 (5.777 ***)	0.065 (5.837 ***)
Absolute insider ownership % Change in 3 months prior	-0.000 (-3.355 ***)			-0.000 (-3.110 ***)		
Absolute insider ownership % Change in 6 months prior		-0.000 (-3.478 ***)			-0.000 (-3.412 ***)	
Absolute insider ownership % Change in 12 months prior			-0.000 (-0.280 )			0.000 (0.224 )
Number of analysts	-0.019 (-12.846 ***)	-0.019 (-12.844 ***)	-0.019 (-12.843 ***)	-0.020 (-12.507 ***)	-0.020 (-12.505 ***)	-0.020 (-12.501 ***)
Market capitalization	-0.001 (-1.406 )	-0.001 (-1.400 )	-0.001 (-1.507 )	-0.001 (-0.920 )	-0.001 (-0.899 )	-0.001 (-1.024 )
Return and earnings correlation	0.011 (7.242 ***)	0.011 (7.220 ***)	0.012 (7.251 ***)	0.012 (7.458 ***)	0.012 (7.448 ***)	0.012 (7.467 ***)
Earnings volatility	0.000 (2.879 ***)	0.000 (2.879 ***)	0.000 (2.881 ***)	0.001 (2.009 **)	0.001 (2.009 **)	0.001 (2.009 **)
Industrial diversification	0.005 (0.801 )	0.005 (0.803 )	0.004 (0.795 )	0.009 (1.441 )	0.009 (1.438 )	0.009 (1.426 )
Geographic diversification	0.008 (1.989 **)	0.008 (1.979 **)	0.008 (2.012 **)	0.005 (1.090 )	0.004 (1.076 )	0.005 (1.119 )
Forecast skewness	0.000 (72.772 ***)	0.000 (72.745 ***)	0.000 (72.884 ***)	0.000 (70.614 ***)	0.000 (70.554 ***)	0.000 (70.722 ***)
Losses	0.068 (32.297 ***)	0.068 (32.309 ***)	0.069 (32.331 ***)	0.067 (30.817 ***)	0.067 (30.832 ***)	0.067 (30.854 ***)
ROA	0.018 (2.928 ***)	0.018 (2.927 ***)	0.018 (2.925 ***)	0.018 (2.796 ***)	0.018 (2.798 ***)	0.018 (2.795 ***)
Market-to-book ratio	0.000 (1.705 *)	0.000 (1.702 *)	0.000 (1.712 *)	0.000 (1.725 *)	0.000 (1.721 *)	0.000 (1.735 *)
Debt-to-asset ratio	0.058 (12.104 ***)	0.058 (12.109 ***)	0.058 (12.115 ***)	0.057 (11.810 ***)	0.057 (11.818 ***)	0.057 (11.827 ***)
F-statistics	9649***	9637***	9612***	9306***	9298***	9277***
Adj. R-squared	0.142	0.142	0.142	0.141	0.141	0.141
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm clustered std err.	Yes	Yes	Yes	Yes	Yes	Yes
N	38,268	38,268	38,268	37,880	37,880	37,880

We control for corporate events and conduct a series of robustness test of the absolute EPS forecast errors using OLS regressions in which we control for year fixed effects, sector fixed effects and clustered standard errors as suggested by Petersen (2009). We remove the observations with share repurchases event (in Panel A) and acquisitions event (in Panel B). Dependent variable is *Absolute mean forecast error*. The variables of interest are the absolute changes in insider ownership in the 12, 6 and 3 months prior to the forecasts. The control variables are as explained in Tables 1 and 4. Numbers presented in parentheses are t-statistics. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 6-Seemingly Unrelated Regression Analyses of Absolute Mean Forecast Error**

VARIABLES	<i>Panel A- Non-HiTech vs. HiTech</i>		<i>Panel B- Pre-Galleon vs. Post-Galleon</i>	
	<i>Model 1</i>	<i>Model 2</i>	<i>Model 1</i>	<i>Model 2</i>
Absolute insider ownership %	-0.014	-0.010	-0.013	-0.010
Change in 3 months prior	(-2.728)***	(-1.032)	(-2.535)**	(-0.961)
Number of analysts	-0.137	-0.112	-0.126	-0.188
	(-17.239)***	(-7.318)***	(-16.358)***	(-11.553)***
Market capitalization	0.002	-0.095	-0.038	0.098
	(0.249)	(-5.753)***	(-4.551)***	(5.516)***
Return and earnings correlation	0.054	0.043	0.048	0.036
	(10.419)***	(4.601)***	(9.372)***	(3.518)***
Earnings volatility	0.050	0.116	0.067	0.062
	(9.606)***	(12.001)***	(13.335)***	(5.657)***
Industrial diversification	0.003	0.005	0.009	0.012
	(0.579)	(0.554)	(1.705)*	(1.161)
Geographic diversification	0.020	0.022	-0.008	0.004
	(3.752)***	(2.268)**	(-1.477)	(0.409)
Forecast skewness	0.018	0.042	0.018	0.020
	(3.547)***	(4.541)***	(3.634)***	(1.866)*
Losses	0.265	0.146	0.259	0.143
	(47.295)***	(13.549)***	(45.285)***	(12.543)***
ROA	0.051	-0.040	0.015	0.058
	(8.939)***	(-3.867)***	(2.689)***	(4.622)***
Market-to-book ratio	0.002	0.001	0.008	0.006
	(0.438)	(0.060)	(1.648)*	(0.555)
Debt-to-asset ratio	0.167	0.084	0.168	0.162
	(29.419)***	(8.786)***	(32.778)***	(12.730)***
F-statistics	386.5***	107.5***	468.7***	49.99***
Adj. R-squared	0.123	0.109	0.140	0.061
Chi-squared	158.21***		170.69***	
N	33029	10479	34439	9069

We perform seemingly unrelated regression analyses of the absolute mean forecast errors. We divide the full sample into two groups based on the hi-tech industry characteristics (in Panel A) and the presence of Galleon event in 2009 (in Panel B). HiTech firms are classified in Model 2 of Panel A if its 3-digit SIC code is 357, 367, 369, 382, 384, or 737. The variables of interest are the absolute changes in insider ownership in the 3 months prior to the forecasts. The control variables are as explained in Tables 1 and 4. Numbers presented in parentheses are t-statistics. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.



**Table 7 – Analyst Recommendation by Quartiles of Firms with Increases in Insider Ownership**

<i>Panel A - Quartiles of insider ownership percent increase in 3 months prior</i>							
	Q1 (N=5166)	Q2 (N=5161)	Q3 (N=5169)	Q4 (N=5162)	Q4 - Q1	t-stat	Wilcoxon-stat
Mean recommendation	2.231	2.170	2.155	2.156	-0.074	-5.76***	-5.93***
Median recommendation	2.289	2.219	2.203	2.199	-0.090	-5.61***	-5.62***
% suggested sell	3.915	3.259	3.102	3.125	-0.789	-4.72***	-5.63***
% suggested hold	40.299	38.013	37.392	37.210	-3.088	-4.51***	-5.08***
% suggested buy	54.674	57.860	58.696	58.880	4.207	5.72***	5.91***
<i>Panel B - Quartiles of insider ownership percent increase in 6 months prior</i>							
	Q1 (N=4,900)	Q2 (N=4,895)	Q3 (N=4,892)	Q4 (N=4,903)	Q4 - Q1	t-stat	Wilcoxon-stat
Mean recommendation	2.237	2.188	2.182	2.167	-0.070	-5.29***	-5.51***
Median recommendation	2.299	2.239	2.229	2.218	-0.081	-4.94***	-5.04***
% suggested sell	3.898	3.456	3.525	3.158	-0.740	-4.36***	-4.88***
% suggested hold	40.996	39.054	38.207	37.344	-3.653	-5.20***	-5.52***
% suggested buy	54.118	56.595	57.307	58.518	4.400	5.84***	5.96***
<i>Panel C - Quartiles of insider ownership percent increase in 12 months prior</i>							
	Q1 (N=4,420)	Q2 (N=4,435)	Q3 (N=4,422)	Q4 (N=4,422)	Q4 - Q1	t-stat	Wilcoxon-stat
Mean recommendation	2.256	2.205	2.201	2.211	-0.045	-3.35***	-3.12***
Median recommendation	2.317	2.264	2.250	2.270	-0.048	-2.82***	-2.73***
% suggested sell	3.930	3.872	3.430	3.512	-0.417	-2.27**	-2.87***
% suggested hold	41.826	39.045	39.983	39.638	-2.187	-3.00***	-3.46***
% suggested buy	53.144	56.185	55.896	55.963	2.819	3.62***	3.72***

We compare and contrast analyst recommendation between quartiles of insider ownership increases in 3 month prior (in Panel A), 6 months prior (in Panel B), and 12 months prior (in Panel C). *Mean (Median) recommendation* is calculated by assigning to each contributing analyst recommendation an integer based on a 5 standardized Thomson Reuters Recommendation scale and calculating a real number average (median). Lower the recommendation scores suggest better recommendation of the firm prospect. *% suggested sell* is percent of analysts issue a “SELL” rating on the stock. *% suggested hold* is percent of analysts issue a “HOLD” rating on the stock. *% suggested buy* is percent of analysts issue a “BUY” rating on the stock. Tests in mean and median differences are the Satterthwaite method and Wilcoxon signed-rank method assuming variances are unequal. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 8 – Analyst Recommendation by Quartiles of Firms with Decreases in Insider Ownership**

<b>Panel A - Quartiles of insider ownership percent decrease in 3 months prior</b>							
	Q1 (N=4,484)	Q2 (N=4,424)	Q3 (N=4,431)	Q4 (N=4,257)	Q4 - Q1	t-stat	Wilcoxon-stat
Mean recommendation	2.128	2.167	2.157	2.162	0.034	2.50**	2.79***
Median recommendation	2.163	2.203	2.196	2.198	0.035	2.03**	1.98**
% suggested sell	2.985	3.323	3.603	3.462	0.477	2.78***	3.91***
% suggested hold	35.536	37.685	36.661	37.052	1.516	2.11**	2.37**
% suggested buy	60.604	58.205	58.607	58.752	-1.852	-2.40**	-2.58***
<b>Panel B - Quartiles of insider ownership percent decrease in 6 months prior</b>							
	Q1 (N=4,152)	Q2 (N=4,276)	Q3 (N=4,213)	Q4 (N=3,983)	Q4 - Q1	t-stat	Wilcoxon-stat
Mean recommendation	2.155	2.156	2.167	2.176	0.021	1.50	1.53
Median recommendation	2.186	2.196	2.205	2.223	0.037	2.06**	1.93*
% suggested sell	3.202	3.382	3.309	3.674	0.472	2.57***	3.45***
% suggested hold	37.038	37.190	37.636	37.807	0.768	1.03	1.62
% suggested buy	58.819	58.611	58.275	57.724	-1.094	-1.37	-1.79*
<b>Panel C - Quartiles of insider ownership percent decrease in 12 months prior</b>							
	Q1 (N=4,260)	Q2 (N=4,273)	Q3 (N=4,265)	Q4 (N=4,260)	Q4 - Q1	t-stat	Wilcoxon-stat
Mean recommendation	2.164	2.167	2.190	2.177	0.013	0.89	1.20
Median recommendation	2.212	2.204	2.230	2.231	0.019	1.00	1.10
% suggested sell	3.316	3.565	3.534	3.786	0.470	2.39**	3.19***
% suggested hold	37.633	37.705	38.660	37.923	0.290	0.38	1.04
% suggested buy	58.246	57.897	56.887	57.392	-0.854	-1.02	-1.34

We compare and contrast analyst recommendation between quartiles of insider ownership decreases in 3 month prior (in Panel A), 6 months prior (in Panel B), and 12 months prior windows (in Panel C). *Mean (Median) recommendation* is calculated by assigning to each contributing analyst recommendation an integer based on a 5 standardized Thomson Reuters Recommendation scale and calculating a real number average (median). Lower the recommendation scores suggest better recommendation of the firm prospect. *% suggested sell* is percent of analysts issue a “SELL” rating on the stock. *% suggested hold* is percent of analysts issue a “HOLD” rating on the stock. *% suggested buy* is percent of analysts issue a “BUY” rating on the stock. Tests in mean and median differences are the Satterthwaite method and Wilcoxon signed-rank method assuming variances are unequal. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 9 – Regressions of Analyst Recommendations on Insider Ownership Increases**

VARIABLES	<i>Panel A - Dep. Var. = Mean Recommendation</i>			<i>Panel B - Dep. Var. = % Suggested Buy</i>		
	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
Constant	2.414 (29.962 ***)	2.461 (30.418 ***)	2.482 (27.922 ***)	40.085 (8.753 ***)	36.750 (8.024 ***)	36.192 (7.251 ***)
Quartiles of % insider increases in 3 months prior	-0.021 (-2.426 **)			0.018 (2.092 **)		
Quartiles of % insider increases in 6 months prior		-0.020 (-2.297 **)			0.023 (2.605 ***)	
Quartiles of % insider increases in 12 months prior			-0.010 (-1.121 )			0.008 (0.873 )
Number of analysts	0.210 (10.393 ***)	0.222 (11.081 ***)	0.217 (10.279 ***)	-0.165 (-8.009 ***)	-0.176 (-8.546 ***)	-0.182 (-8.455 ***)
Market capitalization	-0.090 (-4.611 ***)	-0.108 (-5.588 ***)	-0.099 (-4.851 ***)	0.091 (4.525 ***)	0.111 (5.571 ***)	0.109 (5.160 ***)
Return and earnings correlation	-0.003 (-0.312 )	-0.002 (-0.196 )	-0.013 (-1.164 )	-0.009 (-0.887 )	-0.010 (-0.922 )	-0.006 (-0.507 )
Earnings volatility	0.004 (0.300 )	0.003 (0.287 )	-0.006 (-1.024 )	-0.008 (-0.880 )	-0.003 (-0.373 )	0.001 (0.310 )
Industrial diversification	-0.016 (-1.470 )	-0.005 (-0.404 )	-0.018 (-1.509 )	0.019 (1.813 *)	0.006 (0.490 )	0.015 (1.229 )
Geographical diversification	0.042 (3.362 ***)	0.036 (2.934 ***)	0.033 (2.483 **)	-0.034 (-2.770 ***)	-0.034 (-2.772 ***)	-0.026 (-2.054 **)
Forecast skewness	0.010 (1.857 *)	0.008 (1.674 *)	0.014 (3.205 ***)	-0.014 (-2.393 **)	-0.011 (-3.005 ***)	-0.018 (-3.675 ***)
Losses	0.102 (8.923 ***)	0.104 (8.937 ***)	0.108 (9.039 ***)	-0.100 (-8.531 ***)	-0.094 (-7.711 ***)	-0.101 (-8.118 ***)
ROA	-0.040 (-3.809 ***)	-0.038 (-3.523 ***)	-0.042 (-4.009 ***)	0.028 (2.481 **)	0.034 (2.839 ***)	0.033 (2.778 ***)
Market-to-book ratio	0.009 (4.106 ***)	-0.011 (-1.729 *)	-0.006 (-0.938 )	-0.011 (-4.866 ***)	0.011 (1.599 )	0.010 (1.166 )
Debt-to-asset ratio	0.058 (4.950 ***)	0.057 (5.084 ***)	0.041 (3.068 ***)	-0.043 (-3.509 ***)	-0.047 (-4.036 ***)	-0.033 (-2.548 **)
F-statistics	25.04***	24.55***	23.39***	25.56***	24.30***	23.64***
Adj. R-squared	0.0999	0.0983	0.101	0.0996	0.0972	0.103
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firms clustered std err.	Yes	Yes	Yes	Yes	Yes	Yes
N	13,601	13,208	12,100	13,601	13,208	12,100

We regress the analyst mean recommendations (in Panel A) and percentage of “BUY” recommendation (in Panel B) on the variable that indicates the quartile of the insider ownership increases in 3,6,and 12 months prior windows among other control variables as defined in Tables 1 and 4. We use OLS regressions with control for year fixed effects, sector fixed effects and clustered standard errors as suggested by Petersen (2009). Numbers presented in parentheses are t-statistics. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 10 – Regressions of Analyst Recommendations on Insider Ownership Decreases**

VARIABLES	Dep. Var. = Mean Recommendation			Dep. Var. = % Suggested Sell		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	2.408 (29.044 ***)	2.397 (26.938 ***)	2.389 (24.237 ***)	6.619 (6.198 ***)	6.304 (5.597 ***)	6.060 (4.716 ***)
Quartiles of % insider decreases in 3 months prior	-0.001 (-0.128 )			-0.001 (-0.103 )		
Quartiles of % insider decreases in 6 months prior		0.001 (0.099 )			-0.002 (-0.180 )	
Quartiles of % insider decreases in 12 months prior			-0.004 (-0.370 )			0.004 (0.408 )
Number of analysts	0.218 (10.812 ***)	0.197 (9.638 ***)	0.203 (9.267 ***)	0.251 (15.551 ***)	0.231 (14.456 ***)	0.227 (13.206 ***)
Market capitalization	-0.105 (-5.495 ***)	-0.085 (-4.422 ***)	-0.092 (-4.610 ***)	-0.119 (-6.529 ***)	-0.101 (-5.605 ***)	-0.098 (-5.215 ***)
Return and earnings correlation	-0.014 (-1.351 )	-0.014 (-1.325 )	-0.006 (-0.497 )	-0.005 (-0.455 )	-0.015 (-1.449 )	-0.000 (-0.037 )
Earnings volatility	0.009 (1.814 *)	0.009 (1.259 )	0.007 (0.524 )	0.020 (3.843 ***)	0.016 (2.283 **)	0.006 (0.487 )
Industrial diversification	0.001 (0.050 )	-0.018 (-1.474 )	-0.013 (-1.100 )	0.004 (0.383 )	0.005 (0.408 )	0.002 (0.156 )
Geographic diversification	0.032 (2.692 ***)	0.035 (2.821 ***)	0.038 (2.870 ***)	0.017 (1.389 )	0.024 (1.953 *)	0.018 (1.467 )
Forecast skewness	0.007 (0.752 )	0.008 (0.874 )	-0.003 (-0.320 )	-0.001 (-0.091 )	-0.007 (-1.164 )	-0.016 (-1.322 )
Losses	0.113 (9.232 ***)	0.107 (8.656 ***)	0.095 (7.358 ***)	0.084 (6.714 ***)	0.081 (6.461 ***)	0.083 (6.293 ***)
ROA	-0.034 (-3.162 ***)	-0.040 (-3.698 ***)	-0.034 (-3.090 ***)	0.001 (0.143 )	-0.012 (-1.134 )	-0.002 (-0.155 )
Market-to-book ratio	-0.015 (-1.639 )	0.010 (3.398 ***)	0.008 (1.459 )	0.003 (0.612 )	0.013 (5.548 ***)	0.013 (5.252 ***)
Debt-to-asset ratio	0.070 (5.500 ***)	0.067 (5.117 ***)	0.070 (5.684 ***)	0.044 (3.534 ***)	0.055 (4.361 ***)	0.049 (3.554 ***)
F-statistics	25.54***	24.52***	20.42***	24.58***	27.63***	27.00***
Adj. R-squared	0.109	0.107	0.0986	0.103	0.107	0.103
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firms clustered std err.	Yes	Yes	Yes	Yes	Yes	Yes
N	11,760	11,402	10,394	11,760	11,402	10,394

We regress the analyst mean recommendations (in Panel A) and percentage of “SELL” recommendation (in Panel B) on the variable that indicates the quartile of the insider ownership increases in 3,6,and 12 months prior windows among other control variables as defined in Tables 1 and 4. We use OLS regressions with control for year fixed effects, sector fixed effects and clustered standard errors as suggested by Petersen (2009). Numbers presented in parentheses are t-statistics. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

**Table 11 – Regressions of Analyst Recommendations on Direct Insider Ownership Increases/Decreases**

	Dep. Var. = Mean Recommendation		Dep. Var. = % Suggested Buy/Sell	
	Firms with ownership increases	Firms with ownership decreases	Firms with ownership increases	Firms with ownership decreases
Constant	2.432 (29.866 ***)	2.384 (28.647 ***)	39.074 (8.441 ***)	6.609 (6.192 ***)
Quartiles of % direct insider increases in 3 months prior	-0.012 (-2.772 ***)		0.604 (2.425 **)	
Quartiles of % direct insider decreases in 3 months prior		0.002 (0.539 )		0.027 (0.469 )
Number of analysts	0.123 (10.303 ***)	0.129 (10.801 ***)	-5.530 (-7.957 ***)	1.936 (15.598 ***)
Market capitalization	-0.027 (-4.534 ***)	-0.032 (-5.458 ***)	1.508 (4.368 ***)	-0.467 (-6.469 ***)
Return and earnings correlation	-0.005 (-0.393 )	-0.015 (-1.208 )	-0.648 (-0.974 )	-0.082 (-0.543 )
Earnings volatility	0.000 (0.149 )	0.001 (1.727 *)	-0.029 (-0.719 )	0.024 (3.938 ***)
Industrial diversification	-0.035 (-1.211 )	-0.011 (-0.328 )	2.797 (1.645 )	-0.134 (-0.330 )
Geographic diversification	0.097 (3.596 ***)	0.068 (2.494 **)	-4.634 (-3.020 ***)	0.354 (0.980 )
Forecast skewness	0.552 (1.593 )	0.662 (0.966 )	-42.136 (-1.968 **)	-1.497 (-0.126 )
Losses	0.138 (8.991 ***)	0.147 (9.166 ***)	-7.843 (-8.677 ***)	1.452 (6.915 ***)
ROA	-0.439 (-3.851 ***)	-0.292 (-3.236 ***)	18.254 (2.658 ***)	-0.035 (-0.035 )
Market-to-book ratio	0.000 (3.669 ***)	-0.000 (-1.674 *)	-0.002 (-4.495 ***)	0.001 (0.746 )
Debt-to-asset ratio	0.122 (4.776 ***)	0.156 (5.628 ***)	-4.904 (-3.183 ***)	1.459 (3.952 ***)
F-statistics	25.46***	25.51***	26.17***	25.82***
Adj. R-squared	0.0999	0.110	0.100	0.105
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Firms clustered std err.	Yes	Yes	Yes	Yes
N	13,502	11,850	13,502	11,850

We examine the relationship between analyst recommendations and the increases/decreases in direct ownership of the firms by using OLS regressions in which we control for year fixed effects, sector fixed effects and clustered standard errors as suggested by Petersen (2009). We measure aggregate direct insider ownership changes in each firm in the (-12,-1), (-6,-1) and (-3,-1) months windows prior to the forecast issues. The control variables as defined in Tables 1 and 4. Numbers presented in parentheses are t-statistics. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.