2020

ANALYSTS' EPS FORECAST REVISIONS AFTER REPURCHASE ANNOUNCEMENTS

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Digital Object Identifier: https://doi.org/10.13023/etd.2020.189

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ANALYSTS' EPS FORECAST REVISIONS AFTER REPURCHASE ANNOUNCEMENTS

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Business and Economics
at the University of Kentucky

By

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2020

ABSTRACT OF DISSERTATION

ANALYSTS' EPS FORECAST REVISIONS AFTER REPURCHASE ANNOUNCEMENTS

Analysts' earnings per share (EPS) forecasts are one of the most widely used indicators of firm performance by market participants and firm executives. There are two components in EPS forecasts, but prior literature almost invariably focuses on the net income component (numerator) and ignores the shares outstanding component (denominator). Changes in shares outstanding mechanically alter EPS forecasts due to a changed denominator. These mechanical changes in EPS forecasts, however, do not reflect a firm's real performance. Therefore, it is important to understand analysts' share adjustment behaviors in order to better interpret analysts' EPS revisions after share changing events. This paper uses the setting of open market repurchase (OMR) announcements to explore analysts' share adjustment behaviors. The main findings include that, first, when analysts revise EPS forecasts after repurchase announcements, they adjust the denominator downward based on their estimates of the number of shares to be repurchased by the firms; and the number of days that analysts follow the repurchase firms and the uncertainties of repurchase announcements influence analysts' share adjustment behaviors. Second, the numerator-driven EPS forecast revisions, which remove the mechanical denominator-driven revisions, are more predictive of a firm's future operating performance than the actual EPS forecast revisions as reported by analysts. Lastly, market participants fail to process the implications of the denominator-driven EPS forecast revisions.

KEYWORDS: Open market repurchases, repurchase announcements, analyst forecasts, denominator-driven EPS forecast revisions, operating performance, and market reactions.

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ACKNOWLEDGMENTS

I would like to thank my dissertation Co-chairs Dr. Nicole Thorne Jenkins and Dr. Hong Xie, for their guidance and support. I would also like to thank my committee members Dr. Brian Bratten, Dr. J.S. Butler and my outside examiner Dr. Charles Courtemanche for their insightful feedbacks, and the brownbag and workshop participants at the University of Kentucky for their comments. I acknowledge the financial support from Von Allmen School of Accountancy and the Gatton College of Business and Economics. All errors are my own.

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CHAPTER 1. INTRODUCTION

Market participants and firm executives regard sell-side financial analysts as highly sophisticated professionals and rely on their forecasts to make decisions. Earnings per share (EPS) forecasts are one of the most extensively used forecasts. There are two components in EPS: net income available to shareholders (the numerator) and weighted average number of shares outstanding (the denominator).[1] Therefore, analysts' EPS forecast revisions are driven by both the numerator and denominator forecast changes. However, prior analyst forecast literature almost exclusively focuses on the factors that influence the net income (the numerator) component of EPS forecasts, such as cash flows, accruals, revenues and expenses, but virtually ignores the outstanding shares (the denominator) component of EPS forecasts.[2] This paper takes the first step to examine analysts' EPS forecast behaviors, with a focus on their forecasts of the changes in outstanding shares after a share changing event, thereby shedding light on how and why analyst forecast users should properly interpret analysts' EPS forecast revisions after share changing events.

In this paper, I examine analysts' EPS forecast revisions in the open market repurchase (OMR) announcement setting for the following reasons. First, there is a dramatic increase in share repurchases recently. The money firms recently spent on repurchases reached a historic high – U.S. companies spent $1 trillion in 2018 on buying

[1] Throughout this paper, I label the numerator of EPS as net income. As in most academic papers and media articles, earnings are used interchangeably with EPS.

[2] To my best knowledge, two papers mention the outstanding share component in analysts' EPS forecasts. Hertzel and Jain (1991) examine analysts' EPS revisions after 127 announcements of stock repurchase tender offers during the sample period 1970-1984. They use the change in shares as a control variable and find that Value Line does not mechanically adjust the shares changes in the one-year-ahead EPS forecasts. Green et al. (2016) examine 120 real discounted cash flow (DCF) spreadsheets and document a 15% error rate in analysts' outstanding share inputs in the spreadsheets.

back their own shares (Ivanova 2018; Cox 2019). Second, OMRs are generally treated as positive events as firms conduct OMRs because of undervaluation or to avoid overinvestments. However, OMRs recently attracted intense scrutiny from the public for being responsible for reduced employment and investment and for being used by insiders for personal gains (Almeida et al. 2016; Cox 2019). Therefore, the purpose of announced OMR is difficult for investors to ascertain. Third, the actual number of shares repurchased and the repurchase prices are not available until 10Q/10K release dates or earnings announcement dates. Firms generally do not disclose detailed repurchase plan in their OMR announcements, and they are not legally required to follow their announced OMR plans, which creates a difficulty for market participants to estimate the actual shares to be repurchased. Overall, given the significant economic consequences and high uncertainties associated with OMRs, analysts' interpretations of OMR announcements are especially informative to investors.

This study first empirically examines whether analysts adjust their estimations of outstanding shares when they revise EPS forecasts after OMR announcements and explores some conditions that influence analysts' share forecasts. While it is difficult for analysts to forecast shares to be repurchased after OMR announcements, they have incentives to make the estimation to generate an accurate EPS forecast. EPS forecasts are sensitive to changes in shares outstanding – a 1% change in the number of shares outstanding can lead to around a 1% change in EPS forecasts assuming no changes in the numerator. In other words, even with perfect net income predictions, analysts may generate significant forecast errors if they ignore the share changes in their EPS forecasts. To facilitate the role of information

intermediaries and to reduce forecast errors, analysts have incentives to incorporate the share changes in their EPS forecast revisions after an event that triggers share changes.

To examine analysts' share adjustment behaviors, I utilize the I/B/E/S detailed forecast file and the SDC database to calculate individual analysts' EPS forecast revisions after repurchase announcements during 2005-2018. EPS forecast revisions after repurchase announcements are measured as the differences between individual analysts' last EPS forecasts before the OMR announcement dates and their first EPS forecasts after the OMR announcement dates. I focus on the one-quarter-ahead EPS forecast because this forecast horizon is relevant to the most recent forecast period and is widely used by market participants. This paper finds that following OMR announcements, analysts indeed adjust their forecasts of shares outstanding downward based on their estimated number of shares to be repurchased when revising EPS forecasts. In addition, this study shows that the number of days analysts following a firm and the uncertainty level of an OMR announcement both influence analysts' share forecast behaviors.

Next, this study tests whether investors should remove the denominator-driven effects from EPS forecast revisions and use only the numerator-driven EPS forecast revisions in evaluating firms' performance. A CNBC report from Pisani (2017) discusses the repurchases by some "buyback monster" companies, and it alerts investors that those companies "have dramatically boosted their earnings, not by selling more stuff, but by buying back stock. The lesson: stock buybacks can boost earnings, but without underlying fundamentals, it's not worth chasing them." The "Earnings" mentioned in this CNBC report is earnings per share. EPS forecast revisions are induced by both numerator and denominator modifications. The denominator-driven EPS revision, however, is induced by

a different outstanding share amount because of repurchases, and this change is mechanical and does not reflect a firm's fundamental changes. As expected, I find that comparing with the actual EPS forecast revisions as reported by analysts, the numerator-driven EPS forecast revisions, which removes the denominator-driven or mechanical EPS revisions from the actual EPS forecast revisions, better predict a firm's future operating performance.[3]

Further, this paper explores whether investors recognize and process the implications of the denominator-drive EPS forecast revisions. Although analyst EPS forecast revisions include the mechanical adjustments induced by denominator changes and only the numerator-driven revisions reflect a firm's future performance, investors may employ the actual EPS forecasts as reported by analysts to make investment decisions. Previous literature provides evidence of market participants' failures of scaled thinking. Cedergren and Marshall (2019) document a market failure to process the denominator-driven changes to EPS released by firms at earnings announcement dates, likely resulting in an economically significant mispricing. Without distinguishing the denominator-driven mechanical and numerator-driven fundamental portions from analysts' reported EPS forecasts, users may reach unreliable conclusions. As anticipated, this paper finds that investors fail to process the denominator-driven EPS forecast revisions when they make investment decisions. If investors take short or long positions based on the portfolio formed by the denominator-driven EPS forecast revisions, they can receive a three to ten percent

[3] The denominator-driven or mechanical EPS revisions = the actual EPS forecast revisions – the numerator-driven EPS forecast revisions.

abnormal return in the three to twelve month periods after analysts report their EPS forecasts.

This study provides some additional findings. First, although the numerator-driven EPS revisions better predict a firm's future performance, analysts rely more on their actual EPS forecast revisions than the numerator-driven EPS revisions in their price target forecasts, which is associated with an over-estimation of stock prices. Second, comparing with the numerator-driven EPS forecast revisions, I find that the actual forecast revisions as reported by analysts are relatively more informative in predicting actual EPS. Third, I examine whether analysts estimate share changes based on repurchases when the actual number of shares repurchased are released in earnings announcements. I find evidence that analysts routinely update their shares outstanding estimations and impound their expectations of repurchases into their forecasts after they receive new information about the actual shares repurchased. This paper is the first to provide initial evidence that analysts on average do consider the effects of shares repurchased on EPS forecasts. Finally, I utilize a sample of individual analysts providing multiple forecasts that enable me to back out the number of shares they use in their forecasts to validate the method used in this paper to proxy analysts' estimates of outstanding share changes.

Overall, these findings are consistent with my main conjecture that, on average, analysts adjust the denominator of their EPS forecasts downward based on the estimated number of shares to be repurchased following an OMR announcement. To better predict future operation performance, analyst EPS forecast users should exclude the denominator-driven forecasts. Also, investors fail to incorporate the denominator-driven revisions into their investment decision making process.

This paper makes both academic and practical contributions. It expands our understanding of whether and how analysts revise their estimated number of shares outstanding after a significant corporate event – OMR announcement. Using the OMR announcement setting, I document that analysts use forecasted repurchases to adjust both the net income and the shares outstanding components in their EPS forecasts. This paper highlights the necessity to use the numerator-driven EPS forecast number, instead of the actual EPS forecast number as reported by analysts, in evaluating and predicting a firm's operating performance after a share changing event. Moreover, since this paper studies the one-quarter-ahead analyst forecast revisions, where the period for firms to repurchase shares and thus the estimated number of shares to be repurchased is relatively small comparing with longer period forecasts, the results in this study have smaller power. Therefore, analysts' share adjustment behaviors identified in this paper are generalizable to other forecast periods.

Also, unlike typical disclosures which result in increased transparency, repurchase announcements lead to increased information asymmetry as evidenced by the conflicting opinions regarding their legitimacy. The results documented in this paper shed light on how the market, as broadly defined, may use analysts' revision behaviors to better interpret OMR announcements. For example, market participants should use analysts' actual EPS forecasts to predict firms' actual EPS, but they should use the numerator-driven EPS forecasts to evaluate firms' real performance to make long-term investment decisions. It is also informative to market participants to provide further evidence of the consequences of failing to process the denominator-drive EPS forecast revisions.

Finally, when public media provide analyst forecasts and when firms compare their earnings with analyst forecasts, most of them only provide the EPS number, instead of the numerator and denominator components of the EPS forecasts.[4] In response to the call for academia to provide strong implications in our research, this paper suggests that when analysts, firms and the general public media report or use the EPS forecast number, they should look through both the EPS number and its net income and shares components used to derive the number, especially for the events with information changing both net income and shares, such as the repurchase announcement event. It would be more informative if they can disclose the EPS effects because of the denominator changes.

The remainder of the dissertation is organized as follows: Chapter 2 provides literature review and develop hypotheses. Chapter 3 illustrates sample construction and key variable definition. Chapter 4 demonstrates research methods, summary statistics and empirical results. Chapter 5 provides some additional analysis results. Finally, Chapter 6 concludes this study and provides implications for practice and future research.

[4] For example, Yahoo Finance provides rich analyst earnings forecast information, including the high, low and average forecast and the number of analysts with upward or downward EPS revisions. However, the website users cannot figure out how much of the EPS forecasts and revision directions are driven by numerator versus denominator forecast changes.

CHAPTER 2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Analyst Forecasts

Market participants and management regard sell-side financial analysts as highly sophisticated professionals and rely on their forecasts to make decisions. Executives rate analysts' recommendations and forecasts as one of the strongest forces influencing stock prices (Graham et al. 2005). There are many events that can trigger analysts' forecasts, including (1) firm-level events such as earnings announcements, mergers and acquisitions, divestitures, new products announcements, restructurings, dividend declarations, and repurchase announcements; (2) macro-level events, such as exchange rate changes; and (3) regulations, such as Reg FD passage and tax law changes (Ramnath et al. 2008; Brauer and Wiersema 2018). There is a large body of literature examining the outputs provided by analysts, including forecasts for short-term and long-term earnings, long-term growth rates, target prices, stock recommendations, and cost of equity capital (Brav and Lehavy 2003; Hong and Kubik 2003; Bradshaw 2004; Balakrishnan et al. 2018). Among all those outputs, EPS forecasts are the most extensively examined outputs in the literature. For example, EPS forecasts have been used to understand analysts' decision-making processes, to evaluate analysts' abilities, to proxy for firms' information environments, to measure earnings pressures, and to provide information to market participants (Ramnath et al. 2008; Zhang and Gimeno 2016).

However, prior literature almost invariably focuses on the factors that impact the numerator of EPS forecasts (net income) such as cash flows, accruals, revenues, and expenses (Ertimur et al. 2003; Melendrez et al. 2008). Although the denominator of EPS forecasts (the number of shares outstanding) is another component of EPS forecasts, the

investigation of the denominator's impact on analysts' EPS forecasts is scarce at best. Hertzel and Jain (1991) examine analysts' forecasts after tender offer announcements and find that Value Line does not mechanically adjust outstanding share changes in short-term EPS forecasts after tender offer announcements. Green et al. (2016) examine 120 real discounted cash flow (DCF) spreadsheets used by analysts and find that there is a 15% error rate related to the number of outstanding shares used in forecasts. The error here is defined as a more than 3% difference from the outstanding common shares per Compustat. If their samples were limited to firms with changes in common share or used a smaller deviation rate to define error, I argue that the error rate related to outstanding shares used in EPS forecasts would have been larger.

In summary, analyst's EPS forecast is a widely used indicator by management and the general market. Although there are two components in the EPS calculation, prior literature focuses on the numerator component (net income), ignoring the denominator component (the number of shares outstanding). Examining whether and how analysts update the number of shares outstanding in their forecasts can enrich our understandings of analysts' EPS forecast behaviors.

2.2 Repurchase Announcements and Analysts' EPS Revisions

Stock repurchases have become increasingly popular and attracted extensive attention from both practice and academia. There is a debate about whether repurchases are positive or negative events. Skeptics of repurchases believe that firms use repurchases to benefit executives or large shareholders at the expense of other stakeholders. For instance, the SEC commissioner Robert Jackson and senator Chris Van Hollen both

criticized corporate insiders' opportunistic trading behaviors around repurchase announcements and called for restrictions on such behaviors. Hribar et al. (2006) find that firms use repurchases opportunistically to meet or beat analyst EPS forecasts, and that the market discounts the repurchase-induced earnings surprises. Kim and Ng (2017) further find that firms' opportunistic repurchase behaviors are more likely when firms offer executives EPS-based bonuses. Chen and Wang (2012) discover that even financially constrained firms conduct share repurchases and that these firms display poor post-buyback returns and performances. Almeida et al. (2016) use a fuzzy regression discontinuity design and find that firms that conduct EPS-driven repurchases reduce employment and investment after repurchases. Senators Chuck Schumer and Bernie Sanders proposed to restrict corporate share buybacks unless firms meet certain employment requirements. On the other hand, supporters of repurchases believe that firms have legitimate reasons to conduct repurchases and the negative consequences are not because of repurchases. Firms generally announce repurchases to send positive signals. The reasons for repurchases include signaling firm undervaluation, showing managements' confidence in their firms' future performances, returning excess cash to investors to avoid overinvestments, and improving financial ratios. Also, some researchers do not see evidence of a drop in the overall investment in the economy when there are extensive repurchases (Fried and Wang 2018). Overall, the market generally interprets repurchase announcements as positive signals (Lie 2005), but the documented opportunistic repurchase behaviors and the public scrutiny of repurchases create a sense of uncertainty related to repurchase announcement activities. That is, it is hard for the market to ascertain whether a repurchase announcement is a positive or negative event.

When there is high uncertainty, the market relies more on analysts' forecasts (Loh and Stulz 2018), which makes the understanding of how analysts interpret repurchase announcements an important topic. Hertzel and Jain (1991) find that analysts revise their EPS forecasts upward after tender offer announcements, and Bartov (1991) find the same upward EPS revisions after OMR announcements. On the contrary, Grullon and Michaely (2004) document negative EPS revisions after OMR announcements, and O'Brien (2014) finds no post-OMR announcement EPS revisions after correcting for performance related biases. Peyer and Vermaelen (2009) discover that analyst forecasts are pessimistic before repurchases and are not revised after repurchase announcements. Kurt (2018) uses the accelerated share repurchases (ASR) setting and find that analysts first revise EPS forecasts upward after ASR announcements and then revise forecasts downward when approaching firms' earnings announcement dates. In general, prior literature presents mixed findings regarding whether analysts interpret repurchase announcements as positive or negative events.

A limitation common to all the above literature is that these studies only examine the factors that may affect the net income forecast, the numerator of EPS forecasts. However, repurchase announcements not only provide information related to net income, but also contain non-operating performance information related to repurchase implementations, which reduces the denominator of EPS forecasts. Therefore, the smaller denominator of EPS due to shares repurchased mechanically increases EPS forecasts if analysts incorporate shares repurchased in their forecasts. As information intermediaries that monitor financial information for investors, analysts are supposed to incorporate the information related to both net income (the numerator) and shares outstanding (the

denominator) from repurchase announcements to update their EPS forecasts. In analysts' valuation models, the number of shares outstanding is one input that they use to make EPS forecasts (Green et al. 2016). However, unlike stock split or stock dividend events, it is impossible to know the actual number of shares to be repurchased during analysts' forecast periods.[5] In addition, a unique feature about repurchases is that firms are not required to implement repurchases after announcements or carry through the announced plans. In fact, Bonaimé (2015) documents the existence of false signalers who use repurchase announcements to boost stock prices without actually repurchasing the announced shares. One online analyst forecast training website – Wall Street Prep – shows that forecasting shares to be repurchased is most complex and is a challenge to analysts (WallStreetPrep). Therefore, it is hard for analysts to estimate shares to be repurchased after the repurchase announcements, and it is possible that analysts may ignore shares to be repurchased in their EPS forecasts after the repurchase announcements.

In summary, there is a high uncertainty regarding whether a repurchase announcement is a positive or negative event, and so analysts' interpretations of the repurchase announcement are informative. Prior literature produces mixed findings of whether analysts treat the event as positive or negative, but that literature focuses primarily on the net income component (the numerator) of EPS forecasts. Repurchase announcements also provide information regarding the share component (the denominator) of EPS forecasts. Analysts are expected to update their share estimates after the repurchase announcements as well. Failing to consider the possibility of analysts adjusting the share

[5] The actual number of shares repurchased is released at earnings announcements or in 10K/10Q filings after earnings announcements.

component in their EPS forecasts may produce a misuse of analyst EPS forecasts by investors and other analyst forecast users.

2.3 Hypotheses Developments

A primary explanation for observed positive stock price reactions to stock repurchases is that repurchase announcements convey favorable information about the future prospects of the firm (Hertzel and Jain 1991). This information hypothesis suggests that analysts should revise their forecasts and recommendations after repurchase announcements (Hertzel and Jain 1991). In addition, there may be a higher demand for analysts to synthesize the additional information when firms increase disclosure (Boone and White 2015). Repurchase announcements provide new information about changes in shares outstanding, so analysts should revise their estimates of shares outstanding, based on the expected number of shares to be repurchased after repurchase announcements. Simkovic (2009) tracks repurchases for 20 months after repurchase announcements and finds an 80.3% completion rate in 2004. Huang and Zhang (2015) and Lie (2005) also mention that although announced OMR plans may be executed over a period of one to three years, firms typically start actual repurchasing right after repurchase announcements. Wall Street Prep recommends that analysts forecast the number of shares to be repurchased when making EPS forecasts, especially for regular large repurchase firms (WallStreetPrep). Overall, although it is difficult to estimate the number of shares to be repurchased during the forecast period, given the routine repurchase implementations after announcements in the past for an announcing firm, I expect that analysts are incentivized to estimate the number of shares to be repurchased when making EPS forecasts after the

firm's repurchase announcement. Such adjustments to shares outstanding by analysts can reduce their forecast errors or increase forecast accuracy. My first hypothesis is stated as follows:

H1: *Analysts revise their estimated number of shares outstanding downward based on their estimates of the number of shares to be repurchased when they revise EPS forecasts after repurchase announcements.*

In my second hypothesis, I examine whether analysts' estimated number of shares outstanding after repurchase announcements vary across two dimensions: manager-analyst relationships and repurchase announcement uncertainty. First, I investigate the impact of analyst-manager relationships on the revised number of shares outstanding. On the one hand, prior literature finds that analysts opportunistically forecast smaller EPS so that it is easier for managers to beat the EPS forecast targets. For example, Berger et al. (2018) find that analysts sometimes omit positive information from their EPS forecasts to facilitate beatable forecast targets. Cen et al. (2016) find that analysts with more access to managers are strategically less optimistic in forecasting earnings and more optimistic in stock recommendations. Thus, analysts may ignore the inflation in EPS due to the expected number of shares to be repurchased so that firms can meet or beat analysts' forecasts easily with the help of repurchases. On the other hand, a close relationship with managers helps analysts have a better understanding of firms' operations. Such close relationships help analysts generate EPS forecasts, especially for events with uncertainty, such as repurchase announcements. For instance, Brown et al. (2015) survey sell-side analysts and report that private communication with management is a useful input for analysts' forecasts. Since a closer relationship with managers increases the opportunity to have a private communication with managers, which may give analysts a better idea of firms' repurchase

plans, analysts may be more likely to estimate the number of shares to be repurchased when they revise EPS forecasts after repurchase announcements. Because the above two perspectives provide opposing predictions, I do not make a directional prediction for the impact of analyst-manager relationships on analysts' revised number of shares outstanding after repurchase announcements.

H2a: *The analyst-manager relationship does not impact analysts' revisions of shares outstanding when they revise EPS forecasts after repurchase announcements.*

Second, I investigate the impact of repurchase announcement uncertainties on analysts' revisions of shares outstanding. The information processing cost is higher for firms with higher uncertainty, which may disincentivize analysts to revise their forecasts (Griffin et al. 2018). However, when there is a higher uncertainty, there is a higher demand from the market for forecasts from professionals (Loh and Stulz 2018). Thus, analysts may be more willing to revise shares outstanding to meet the demand. Again, I do not make a directional prediction for the impact of repurchase announcement uncertainties on analysts' revised number of shares outstanding after repurchase announcements.

H2b: *The repurchase announcement uncertainty does not impact analysts' revisions of shares outstanding when they revise EPS forecasts after repurchase announcements.*

In my third hypothesis, I explore whether the numerator-driven EPS forecast revisions, which remove the mechanical increase in EPS forecasts due to expected number of shares to be repurchased, are more indicative of future operating performance than the actual EPS forecast revisions reported by analysts. Shares to be repurchased reduce the estimated number of shares outstanding, which is the denominator of EPS forecasts, and thus mechanically increase the EPS forecasts. However, the EPS increase induced by shares repurchased is because of a smaller denominator, not because of enhanced firm

fundamentals. In other words, the mechanical increase in EPS induced by shares repurchased should not reflect a firm's future operating performance. Therefore, my third hypothesis, which compares the predictive power of actual EPS forecast revisions (EPS forecast revisions as reported by analysts) and numerator-driven EPS forecast revisions (EPS forecast revisions that remove the mechanical impact of estimated shares repurchased from the actual EPS forecast revisions) in predicting firms' future operating performances, is stated as follows:

H3: *The numerator-driven EPS forecast revisions have a higher predictive power for future operating performance than the actual EPS forecast revisions.*

Lastly, I examine if market participants impound the denominator-driven EPS changes into their investment decisions. If the denominator-driven EPS forecasts, or the EPS forecast distortion, reduce the ability of EPS forecasts in predicting future operating performance, then market participants should discount such distortion. In other words, if the market fails to realize and incorporate the distortion, mispricing may occur. Prior literature has mixed findings whether the market discounts the denominator-driven EPS changes, in general. For example, Hribar et al. (2006) finds that market participants discount the repurchase-induced EPS changes at earnings announcements, while Cedergren and Marshall (2019) document a market failure to interpret the denominator-driven EPS changes at earnings announcements. In my study's repurchase announcement setting, it is difficult for the market to predict whether announcing firms will repurchase and how many shares and how much money they will repurchase. Therefore, this study predicts that the market fails to process the implications of the denominator-driven EPS

forecast changes, or EPS forecast distortions, because of the expected shares to be repurchased during the forecast period.

H4: *Market participants fail to incorporate the EPS forecast distortion due to repurchase forecasts when analysts release their EPS forecasts revisions after repurchase announcements.*

CHAPTER 3. SAMPLE AND VARIABLE DEFINITION

3.1 Sample Selection

I use the Securities Data Corporation database (SDC) for repurchase announcement data, CRSP for stock market data, Compustat for accounting data, and I/B/E/S Details for earnings forecast data. I use I/B/E/S Details database for individual analyst forecasts, instead of I/B/E/S Summary for consensus forecasts, because using the individual analyst forecasts solves the stale forecasts problem embedded in consensus forecasts (Brown 1993) and the missing information problem when bold forecasts are dropped (Clement and Tse 2005).[6]

The main sample used in this paper includes all the OMR announcement events from 2005 to 2018. The sample period starts in 2005 because repurchase data became available in 2004 and I need lagged repurchases in the repurchase estimation. The sample period ends in 2018, which is the latest year with complete data. I estimate my analyses at the analyst-OMR announcement level. To mitigate the problems of stale analyst forecasts and confounding factors, the sample only includes forecasts made within 90 days before and within 30 days after repurchase announcements to calculate analyst revisions. In addition, for firms to have time to make repurchases after repurchase announcement, I drop repurchases announced within 30 days before the forecast period ends. Finally, after deleting the observations with missing control variables, the final sample contains 4,784

[6] Brown (1993) points out that consensus forecasts may contain stale forecasts in the I/B/E/S Summary files and using I/B/E/S Detail files can void this problem. Gleason and Lee (2003) and Clement and Tse (2005) find that forecasts that diverge from the consensus and bold forecasts are more priced by the market and contain useful private information. Also, I/B/E/S consensus forecasts may not be appropriate to use. Kaplan et al. (2018) find that I/B/E/S may opportunistically remove certain analyst forecasts from consensus, not simply based on outliers, to facilitate managers' needs, which indicates that consensus forecasts may lose information regarding the analyst revision behaviors.

analyst-firm-quarter observations during 2005-2018 and covers 920 OMR announcements. Table 1 panel A shows the detailed construction process for the repurchase announcement sample.

3.2 Variable Measurement

For each OMR announcement in the repurchase announcement sample, I collect the last quarterly EPS forecast made within 90 days *before* the OMR announcement date (*EPS_PreRepAnn*) from all individual analysts. I then find the first EPS forecast after the OMR announcement (*EPS_PostRepAnn*) from the same analysts to calculate EPS forecast revisions for each individual analyst ($ForecastREV_t$). I require only the availability of *EPS_PreRepAnn*. If *EPS_PostRepAnn* is missing, I treat it as equal to *EPS_PreRepAnn*, i.e., no revision. Figure 1 illustrates a timeline of these two EPS forecasts relative to the OMR announcement date. To mitigate the confounding effect of other significant events, I require the first forecasts after the OMR announcement (*EPS_PostRepAnn*) to be reported within 30 days after the announcement. I also delete the observations with earnings announcements made between the two forecasts.

I only discuss key variables below. Definitions for all other variables are detailed in Appendix A.

Analyst EPS Forecast Revision ($ForecastREV_t$)

My first dependent variable is an analyst's EPS forecast revision after an OMR announcement ($ForecastREV_t$). $ForecastREV_t$ equals the difference between the first EPS estimate made *after* the repurchase announcement and the last EPS estimate made *before* the repurchase announcement, scaled by the stock price at the beginning of the fiscal

quarter, i.e., $ForecastREV_t = [(EPS\_PostRepAnn_t - EPS\_PreRepAnn_t) / Price_{t-1}] \times 1{,}000$, where $EPS\_PostRepAnn_t$ and $EPS\_PreRepAnn_t$ are defined earlier and $Price_{t-1}$ is stock price at the end of quarter t–1. A one cent change in EPS is considered significant, given the consistent findings in the previous literature that market participants penalize firms for even missing the EPS target by one cent (e.g., Hribar et al. 2006). Therefore, the magnitude of price scaled EPS forecast revisions is very small mathematically, so I multiply the measure by 1,000.

Estimated Repurchase-Completion Ratio (Completion Ratio$_t$)

I estimate a repurchase-completion ratio for an OMR announcement using the firm's completion condition for the previous OMR announcement. I obtain the beginning and ending dates for all repurchases associated with the previous OMR announcement from SDC. I divide the number of shares repurchased in the first repurchase by the repurchase interval (= ending date – beginning date + 1) and calculate the shares repurchased per day for the first repurchase, assuming repurchases occur evenly in the repurchase interval. I do the same calculation for the second, third, and all remaining repurchases associated with the previous OMR. I then calculate the cumulative number of shares repurchased from Day 0 (the repurchase announcement date of the previous OMR announcement) to Day d (d = 1, 2, 3, …) after the announcement using the shares repurchased per day for each repurchase discussed earlier, and divide the cumulative number of shares repurchased by the announced number of shares to be repurchased in the previous OMR announcement. The above calculation yields a repurchase-completion ratio for the previous OMR announcement, which indicates the percentage of the announced number of shares that are already repurchased by Day d after the announcement date. If a firm is a first-time

repurchaser and has no prior completion history, I use the industry average completion ratio in the year before the repurchase announcement year as its completion ratio. If a firm's previous repurchase announcement is made over five years before the current announcement, I treat the firm as a first-time repurchaser. Table 1, Panel B, reports the average repurchase-completion ratio for selected number of days after the repurchase announcement date. During the process of constructing the completion ratio variable, I drop the repurchase announcements with reported cumulative completion larger than the announced shares, which I treat as data errors.

Expected Number of Shares to be Repurchased (ExpRepShare$_t$)

ExpRepShare$_t$ is an analyst's expected number of shares to be repurchased between the repurchase announcement date of the current OMR announcement and the fiscal quarter-end date (from the repurchase announcement date to the forecast period-end date, as illustrated in Figure 1). *ExpRepShare*$_t$ = *Announced Shares*$_t$ × *Completion Ratio*$_t$, where *Announced Shares*$_t$ is the announced number of shares to be repurchased in the current OMR announcement, *Completion Ratio*$_t$ is the repurchase-completion ratio at Day N from the *previous* OMR announcement, and Day N = forecast period-end date – repurchase announcement date of the current OMR announcement + 1.

Net Income Revisions (NIREV$_t$)

NIREV$_t$ is the revision of net income (the numerator of EPS forecasts), which is the difference between the first net income forecast after the repurchase announcement date and the last net income forecast before the announcement date, scaled by the market value of common equity at the beginning of the quarter. $NIREV_t$ = {[$EPS\_PostRepAnn_t$ × ($ShareOut_{t-1}$ – $ExpRepShare_t$) – $EPS\_PreRepAnn_t$ × $ShareOut_{t-1}$] / MV_{t-1}} × 1,000,000,

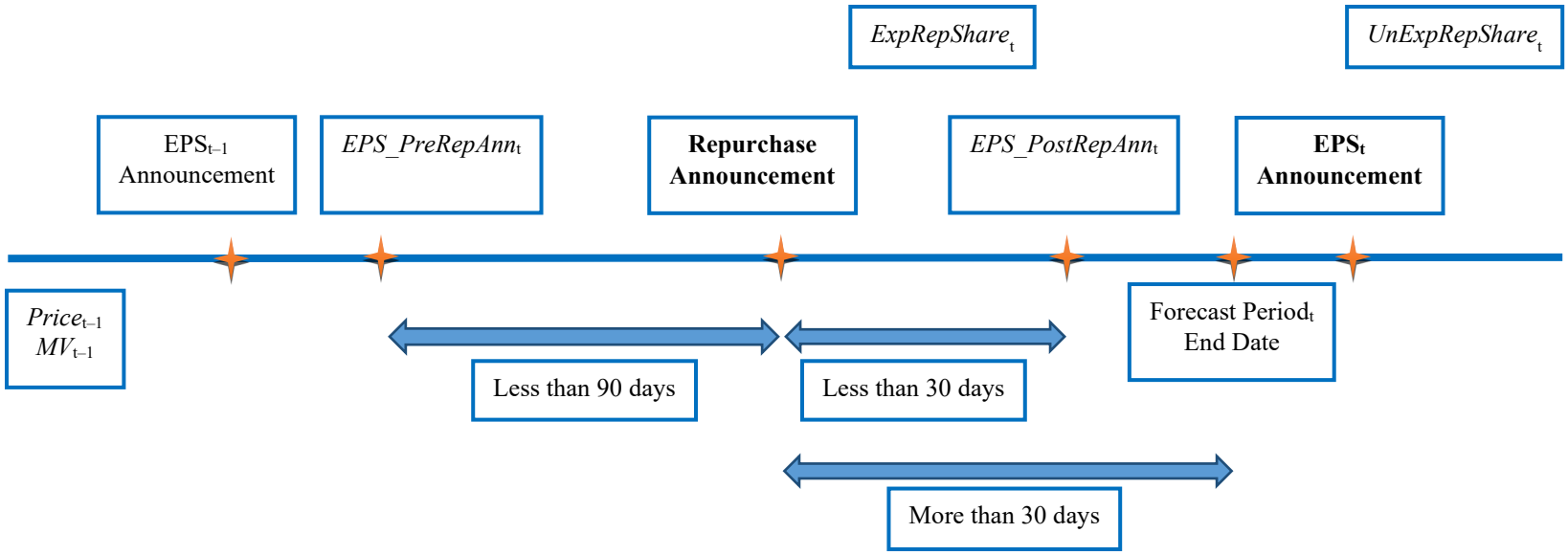
where $ShareOut_{t-1}$ (MV_{t-1}) is the number of common shares outstanding (market value of common equity) at the beginning-of-quarter. For the analyst-firm quarters when analysts provide diluted EPS forecasts, an estimated dilution effect is added to $ShareOut_{t-1}$. Estimated dilution effect is calculated as the difference between the shares used in the diluted EPS calculation and the shares used in the basic EPS calculations in quarter t-1. Because the magnitude of net income revision is very small, I multiply the measure by 1,000,000. ($ShareOut_{t-1} - ExpRepShare_t$) represents the number of shares outstanding that analysts would have used in their EPS forecasts if their estimated number of shares to be repurchased is $ExpRepShare_t$. $EPS\_PostRepAnn_t \times (ShareOut_{t-1} - ExpRepShare_t)$ is an analyst's first net income forecast after the OMR announcement, assuming they considered expected repurchases. Before the OMR repurchase announcement date, since no repurchases would have been expected, the most recent quarter's common shares outstanding would be the share number available to and used by analysts. $EPS\_PreRepAnn_t \times ShareOut_{t-1}$ represents an analyst's last net income forecast before the OMR announcement.

Table 1 Sample

Panel A. Repurchase Announcement Sample Construction	**Repurchase Announcements**	**No. of Observations**
Repurchase announcement Firm-Quarters from 2005-2018	11,898	
Minus: Failed matching with IBES or Compustat	(5,755)	
Minus: Firm-Quarters without analyst forecasts within 90 days before repurchase announcement or missing IBES data	(2,999)	
Minus: Firm-Quarters with fiscal quarter ends within one month after repurchase announcement	(760)	
Repurchase announcements used in the sample	2,384	22,169
Minus: Missing variables used to calculate EPS revision, net income revision or expected shares repurchased	(1,337)	(16,024)
Minus: Missing control variables	(127)	(1,361)
Final Sample	920	4,784

Panel B. Repurchase Completion Speed

Number of Days after Repurchase Announcement	Cumulative Repurchases As a % of Announced Repurchase Shares	Cumulative Repurchases As a % of Outstanding Shares
0	2.54%	0.29%
10	4.90%	0.41%
20	7.86%	0.60%
30	10.35%	0.78%
40	12.41%	0.90%
50	14.05%	1.02%
60	15.33%	1.11%
70	15.74%	1.16%
80	16.81%	1.23%
90	17.69%	1.30%
100	18.35%	1.37%



$ForecastREV_t = (EPS\_PostRepAnn_t - EPS\_PreRepAnn_t) / Price_{t-1}$
$ExpRepShare_t = Announced\ Shares_t \times Completion\ Ratio_t$
$NIREV_t = [EPS\_PostRepAnn_t \times (ShareOut_{t-1} - ExpRepShare_t) - EPS\_PreRepAnn_t \times ShareOut_{t-1}] / MV_{t-1}$

Figure 1 EPS Revision Timeline – Around Repurchase Announcement

Figure 1 shows the timeline this study uses to define analysts' EPS forecast revisions around the repurchase announcement dates and to estimate the shares to be repurchased for the forecast period. It takes the last EPS forecast before the repurchase announcements (*EPS_PreRepAnn*) and the first EPS forecast after the repurchase announcements (*EPS_PostRepAnn*) to calculate the EPS forecast revisions (*ForecastREV*). To keep only the analysts that are actively following the repurchase firm, I require the last EPS forecasts before the repurchase announcement to be within 90 days; to mitigate the influence of the confounding events on analysts' EPS forecast revisions, I require the first EPS forecast after the repurchase announcement to be with 30 days after the announcement, and I also drop the observations with EPS announcements during the revision period; and finally, I keep only the firms with a forecast period end date more than 30 days from the repurchase announcement date so that firms have sufficient time to conduct repurchases.

CHAPTER 4. RESEARCH METHODS AND EMPIRICAL RESULTS

4.1 Descriptive Statistics

Table 2 shows the summary statistics for the repurchase announcement sample. *ForecastREV* is EPS revision after a repurchase announcement. Its mean value of -0.014 is significantly negative (p = 0.050), while its median value of 0.000 is insignificant. The numerator-driven EPS forecast revision (*NDForecastREV*) has significantly negative mean (-0.233, p = 0.000) and median value (-0.075, p = 0.000). As mentioned in section 2.2, there are mixed findings about the directions of analysts' EPS forecast revisions in the previous literature. This study first provides additional evidence that analysts revise their EPS forecast downward after repurchase announcements on average, but the median revisions are zero. Moreover, the summary statistics show some preliminary evidence that numerator-driven EPS forecast revisions (*NDForecastREV*) are more negative in both magnitude and significance level than actual EPS forecast revisions (*ForecastREV*). This result offers a possibility of using the *NDForecastREV* to synthesize the previous mixed findings about the analyst EPS forecast directions.

ExpRepShare is analysts' estimates of shares to be repurchased based on a firm's previous repurchase-completion ratio or its previous industry average repurchase-completion ratio for first repurchasers. *UnExpRepShare* is the unexpected number of shares repurchased, and its mean value is significantly positive, indicating that analysts on average underestimate the shares to be repurchased by firms. *NIREV* is analysts' revision of net income, the numerator of EPS forecasts after a repurchase announcement, and its mean value is significantly negative. Overall, the above results suggest that, on average, analysts

revise EPS and net income downward after repurchase announcements, and they tend to underestimate the number of shares to be repurchased. All variables are defined in Appendix A.

4.2 Analyst EPS Forecast Revisions after OMR Announcements

This section examines whether analysts revise their forecasts of shares outstanding (the denominator of EPS forecasts) downward according to their expected number of shares to be repurchased when they revise their EPS forecasts after an OMR announcement. Analysts' expected number of shares to be repurchased after repurchase announcements (*ExpRepShare*) is not directly observable. To test whether analysts incorporate *ExpRepShare* in their EPS forecasts after repurchase announcements, I follow Hertzel and Jain (1991) and O'Brien (2014) and use EPS revisions after repurchase announcements (*ForecastREV*) as the dependent variable in Equation (1) below.

$$\begin{aligned} ForecastREV_t = {} & a_0 + a_1 ExpRepShare_t + a_2 NIREV_t + a_3 CashAsset_{t-1} + a_4 DebtRatio_{t-1} \\ & + a_5 DivPayer_{t-1} + a_6 LogAT_{t-1} + a_7 RETE_{t-1} + a_8 ROCAA_{t-1} + a_9 CapExp_{t-1} \\ & + a_{10} LogMV_{t-1} + a_{11} BTM_{t-1} + a_{12} ROA_{t-1} + a_{13} Follow_{t-1} + a_{14} FpedatsGap_{t-1} \\ & + a_{15} DaysFF_{t-1} + a_{16} DaysLF_{t-1} + a_{17} numFORE_{t-1} + a_{18} Experience_{t-1} \\ & + a_{19} BrokerSize_{t-1} + a_{20} GDPG_{t-1} + a_{21} tb3ms_{t-1} + i.FF48IND + i.Year \\ & + i.Qtr + \varepsilon, \end{aligned} \quad (1)$$

ForecastREV is the EPS forecast revisions for the quarter t after the OMR announcement. *ExpRepShare* is the expected number of shares to be repurchased from the OMR announcement date to the fiscal quarter-end date. *NIREV* is the revision of net income, the numerator of EPS forecasts. The control variables include firm, analyst, and macro level variables, mostly following O'Brien (2014) and Berger et al. (2018). All the control variables are in the quarter t-1 before the repurchase announcement date. Appendix A contains the detailed definitions of all variables.

The variable of primary interest is *ExpRepShare*. If analysts incorporate *ExpRepShare* in their EPS forecasts after the OMR announcement, their EPS forecasts are mechanically increased due to the decrease in the number of shares outstanding. This induces a positive relation between *ForecastREV* and *ExpRepShare*. Because I control for *NIREV* (the numerator of EFS forecasts) in Equation (1), the coefficient on *ExpRepShare* captures only the downward revision of shares outstanding (the denominator of EPS revisions), not the revision of net income (the numerator of EPS revisions). In other words, all the potential net income related information signaled by the repurchase activities are controlled. A positive coefficient on *ExpRepShare* ($a_1 > 0$) is consistent with H1, suggesting that analysts revise the number of shares outstanding downward after the OMR announcement based on their expected number of shares to be repurchased (*ExpRepShare*).

Table 3 shows the main results. The significantly positive coefficient on *ExpRepShare* in Model 1 and Model 2 indicates that analysts revise the denominator of EPS forecasts (the number of shares outstanding) downward based on the expected number of shares to be repurchased (*ExpRepShare*) after OMR announcements, consistent with H1. The coefficient on *NIREV* is also significantly positive in Model 1 and Model 2, suggesting that analysts also revise the numerator, net income, of EPS forecasts after the OMR announcement. To compare the influence magnitude between *ExpRepShare* and *NIREV*, with different scales, I standardize the dependent and all the independent variables in Model 2 Std, and the results show that *NIREV* has a higher influence on *ForecastREV* than *ExpRepShare*, and this difference is significant at the 1% significance level (untabulated).

I further examine analysts' share adjustments under different conditions. First, in model 3, I consider the possibility that analysts may regularly update their forecasts of

repurchases, with or without repurchase announcements. I split the *ExpRepShare* into the portion with routine repurchase forecasts (*ExpRepModel*) and the rest updated with only the new information in repurchase announcements (*ExpRep-ExpRepModel*). I use the two-stage repurchase estimation model provided by Hribar et al. (2006) to estimate *ExpRepModel*. I find that the potential routine repurchase forecast (*ExpRepModel*) is marginally related to *ForecastREV*, while the remaining portion (*ExpRep-ExpRepModel*) is still highly significant in predicting *ForecastREV*, and the difference between the two portions in predicting *ForecastREV* is statistically significant (untabulated).

Second, if analysts revise their EPS forecast based on estimated repurchases, then the unexpected repurchase portion (*UnExpRepShare*) should not be related to their EPS forecast revision. I examine this counterfactual in Model 4. While *ExpRepShare* and *NIREV* are still positively significant, the *UnExpRepShare* is insignificant, suggesting that analysts can only include the expected portion of repurchases in their forecasts, not the unexpected portion.

Third, I test if the magnitude of expected repurchases influences analysts' use of the expected share changes in their EPS forecasts. Model 6 shows that expected repurchase shares' impact on EPS amount increases the likelihood analysts impound repurchases in their forecasts. However, I do not find a significant moderating effect of the large repurchases, defined as the top quintile expected repurchase shares as a percent of outstanding shares, on forecast revisions, although the positive coefficient of the interaction is in the expected direction.

Finally, I test the influence of mandatory repurchase disclosure rule on analysts' EPS forecasts. Before 2004, firms are not required to report their actual repurchases or to

follow their announced repurchase plans. In other words, they can announce open market repurchases to send positive signals without pursuing their announced plans, and what is worse, the market would have no idea how many shares firms actually repurchased. Starting from 2004, the SEC proposed a Rule 10b-18 amendments, requiring firms to disclose detailed repurchase information, including the shares repurchased and repurchase price in each month, in their 10Q/10K reports. This rule greatly increased the transparency of firms' repurchases. In model 7, I find that as expected, analysts are more likely to estimate repurchases and impound the share change effects in their EPS forecasts.

Overall, the results from Table 3 supports my first hypothesis that analysts impound the estimates of changes in outstanding shares, based on the estimated shares to be repurchased, into their EPS forecasts and thus EPS forecast revisions after repurchase announcements.

4.3 Cross-Sectional Analysis of Analyst's Revisions of Shares Outstanding

In this section, I use equation (1) in subsamples with high or low moderating variables to investigate the factors affecting analysts' revisions of shares outstanding when they revise their EPS forecasts after repurchase announcements. I focus on whether analyst-manager relationships and repurchase announcement uncertainties moderate analysts' revisions of the shares component of EPS forecasts.

lnDaysFollow is the log of the number of days in which an analyst follows a firm, which proxies the relationships between analysts and managers. Before the logged form, the average (median) time analysts follow a firm is approximately five (three) years. *CommonUncert* is the uncertainty of the OMR announcements that is the same to all

analysts, and *OverallUncert* includes the common uncertainty and the uncertainty related to analysts' private information. The difference between *OverallUncert* and *CommonUncert* is the idiosyncratic uncertainty that is associated with analysts' private information (*AnalystUncert*). Both uncertainty measures follow the spirits of Barron et al. (1998) and Lehavy et al. (2011). Specifically, *OverallUncert* equals (1 – 1/*NumAnalyst*) × *Dispersion* + *Accuracy*, and *CommonUncert* equals (*Accuracy – Dispersion*/*NumAnalyst*). *NumAnalyst* is the number of analysts providing forecasts after the OMR announcements, *Dispersion* is the standard deviation of the EPS forecasts after the OMR announcements, and *Accuracy* is the difference between the actual EPS for the forecast quarter and *EPS_PostRepAnn*. I create ranked variables of *lnDaysFollow*, *CommonUncert* and *AnalystUncert* to deciles, while the top decile subsample includes the firms with the highest and the bottom decile subsample has firms with the lowest number of days followed and uncertainty levels. I then examine equation (1) in the top and bottom decile subsamples separately.

Table 4 shows that *ExpRepShare* is significantly positive in both the high and low *lnDaysFollow* subsamples, while the untabulated results show that the coefficient of *ExpRepShare* is significantly more positive in the subsample with high *lnDaysFollow* (p = 0.000). *ExpRepShare* is significantly positive in the subsamples with low *CommonUncert* or high *AnalystUncert*, but insignificant in the subsamples with high *CommonUncert* or low *AnalystUncert*. These results indicate that *lnDaysFollow* influences analysts' share adjustment behaviors, with regard to the extent to which analysts adjust shares in EPS forecasts but not whether analysts adjust shares. Further studies are needed to figure out why the days analysts following a firm influence the adjustment extent. Uncertainties

around repurchase announcements that are common to all analysts and that are specific to individual analysts both influence analysts' share adjustment behaviors but in different directions. Analysts only adjust shares when there are low common uncertainties but high analyst-specific uncertainties. The possible explanations are that when there are high uncertainties that are specific to individual analysts, different individuals have different interpretations of the repurchase announcement events, so investors may have high demand of different analysts' interpretations which drives analysts' forecasts. On the other hand, when there are high uncertainties that are common to analysts, the uncertainties may be at the broad level which generates high costs for analysts to provide forecasts. At the same time, the demand for individual analysts' interpretations is not as high, given the common uncertainties are the same for everyone and thus different interpretations may not be as informative.

Overall, these results are consistent with the arguments that length of time an analyst following a firm and uncertainties all influence analysts' share forecast behaviors. Specifically, analysts who follow firms for a longer period adjust shares, based on expected repurchases, to a greater extent when they revise their EPS forecasts after repurchase announcements. Analysts adjust their estimations of outstanding shares, based on expected repurchases, only when the uncertainties around repurchase announcements that are common to analysts are low and when the uncertainties that are specific analysts are high.

4.4 Actual versus Numerator-driven EPS Forecast Revisions in Predicting Future Operating Performance

In this section, I use equation (2) to examine whether the numerator-driven EPS forecast revisions or the actual EPS forecast revisions have a higher predictive power for future operating performance.

$$\begin{aligned} FutureROA = {} & c_0 + c_1 ForecastREV\ (NDForecastREV) + c_2 CashAsset + c_3 DebtRatio \\ & + c_4 DivPayer + c_5 LogAT + c_6 RETE + c_7 ROCAA + c_8 CapExp + c_9 LogMV \\ & + c_{10} BTM + c_{11} Follow + c_{12} FpedatsGap + c_{13} DaysFF + c_{14} DaysLF \\ & + c_{15} numFORE + c_{16} Experience + c_{17} BrokerSize + c_{18} GDPG + c_{19} tb3ms \\ & + c_{20} ROA + i.FF48IND + i.Year + i.Qtr + \varepsilon, \end{aligned} \quad (2)$$

FutureROA is the future ROA (earnings before interest and taxes scaled by total assets) in the one to four quarters after the repurchase announcements, controlling the ROA in the quarter before the repurchase announcements. I compare the EPS revisions as actually reported by analysts (*ForecastREV*), which is the forecast revision measure I have been using the previous sections, with the numerator-driven EPS revisions that remove the mechanical impact of expected number of shares to be repurchased on EPS forecasts (*NDForecastREV*) to find out which one has higher predictive power of future ROA. As we recall, *ForecastREV* (= $[(EPS\_PostRepAnn_t - EPS\_PreRepAnn_t) / Price_{t-1}] \times 1{,}000$). The calculation of *NDForecastREV* uses the numerator-driven EPS forecasts after repurchase announcements (*NDEPS_PostRepAnn*), which removes the repurchase-induced component from the post repurchase announcement EPS forecasts (*EPS_PostRepAnn*). That is, I utilize the same shares outstanding, the most recent quarter's shares outstanding, for both the *EPS_PreRepAnn* and the *NDEPS_PostRepAnn* calculations, so no repurchases' impacts are included in the *NDEPS_PostRepAnn*. The

difference between the two revisions is defined as the EPS forecast distortions (*Distortion*).[7]

Table 5 presents the results. *ForecastREV* is not significant in any of the four future ROA prediction horizons. *ForecastREV*, thus, does not predict future ROA. In contrast, *NDForecastREV* predicts future ROA for at least four quarters after the repurchase announcements, consistent with H3 that removing the mechanical impact of repurchased shares on EPS forecasts can make the numerator-driven EPS revisions better reflect a firm's future performance.

These results support my third hypothesis that comparing with the EPS forecast revisions as reported by analysts, the numerator-driven EPS forecast revisions that remove the mechanical impact of share changes on EPS better predict firms' future operating performances.

4.5 Market Mispricing to EPS Forecast Distortion

This section tests the last hypothesis whether market participants succeed or fail to process the implications of share changes from expected repurchases in using analysts' EPS forecast revisions.

First, I calculate the EPS forecast distortion (*Distortion*) as the difference between the analysts' released actual EPS forecast revisions (*ForecastREV*) and the numerator-

[7] The detailed calculation of the $NDEPS\_PostRepAnn_t$ is as follows: I first use $EPS\_PostRepAnn_t$ and $ExpRepShare_t$ to back out the net income forecast, which is $EPS\_PostRepAnn_t \times (ShareOut_{t-1} - ExpRepShare_t)$, and then I calculate the $NDEPS\_PostRepAnn_t$ as if no repurchases were estimated, so it equals $EPS\_PostRepAnn_t \times (ShareOut_{t-1} - ExpRepShare_t) / ShareOut_t$. The $NDEPS\_PostRepAnn_t$ is $EPS\_PostRepAnn_t - EPS\_PostRepAnn_t \times ExpRepShare_t/ShareOut_{t-1}$. Estimated dilution effects, which equals to the difference between the common shares used to calculate the diluted EPS and the common shares used to calculate the basic EPS in quarter t-1, is added to $ShareOut_{t-1}$ if analysts provide diluted EPS forecasts.

driven EPS forecast revisions after removing the mechanical effects of share changes (*NDForecastREV*). Essentially, *Distortion* is the same as the denominator-driven forecast revisions and the mechanical effects of share changes on EPS forecast changes. I then form portfolios by ranking the observations into quintiles, based on the *Distortion* in table 6 panel A and the absolute value of *Distortion* in panel B. In order to keep as many observations, I do not drop the observations missing control variables to be used in the return regression analysis. The abnormal buy-and-hold returns, in the one to four quarter after analysts release their first EPS forecast after repurchase announcements, are significantly higher in the top *Distortion* quintile than in the bottom quintile. The magnitude of the difference is economically significant, with 3.1% to 9.6% difference. To mitigate the concern that the firms in different *Distortion* quintiles already have different returns to begin with, I then calculate the difference between the future abnormal returns and the abnormal returns in the quarter before analysts release EPS forecasts. The results are robust.

Second, in panel C, I use OLS regression to examine the mispricing, controlling for firm and analyst characteristics, time and industry fixed effects, and previous returns. I find negative coefficient of *Distortion* in one to three quarter ahead abnormal returns, but not the four quarter ahead abnormal returns.

Overall, the results support my last hypothesis that market participants fail to impound the share change estimates due to expected repurchases in analysts' EPS forecast revisions, making significant portfolio abnormal return differences. In other words, this section finds a significantly negative stock price drift for firms with extreme EPS *Distortion*, a pricing anomaly.

Table 2 Summary Statistics

Variables	N	Mean	Std	Min	Median	Max
ForecastREV	4,784	-0.014	0.496	-2.993	0.000	2.138
NDForecastREV	4,784	-0.233	0.746	-4.749	-0.075	2.049
ExpRepShare	4,784	0.013	0.019	0.000	0.006	0.100
UnExpRepShare	4,784	0.001	0.024	-0.094	0.003	0.059
RepImpact	4,784	0.912	2.053	0.000	0.000	13.000
NIREV	4,784	-0.415	1.513	-11.386	-0.082	2.580
CashAsset	4,784	0.183	0.167	0.005	0.129	0.714
DebtRatio	4,784	0.203	0.172	0.000	0.183	0.742
DivPayer	4,784	0.560	0.496	0.000	1.000	1.000
LogAT	4,784	8.640	1.669	4.951	8.593	12.118
RETE	4,784	0.639	1.748	-10.384	0.731	5.898
ROCAA	4,784	0.052	0.037	-0.013	0.046	0.214
CapExp	4,784	0.022	0.028	0.000	0.014	0.157
LogMV	4,784	15.531	1.685	11.530	15.617	19.358
BTM	4,784	0.062	0.090	-0.014	0.037	0.644
ROA	4,784	0.020	0.018	-0.035	0.018	0.101
Follow	4,784	2.692	0.563	1.099	2.773	3.584
numFollow	4,784	16.875	7.795	3	16	36
FpedatsGap	4,784	3.831	0.226	3.401	3.829	4.263
DaysFF	4,784	4.380	0.411	1.946	4.500	4.691
DaysLF	4,784	3.808	0.988	0.693	4.407	4.654
numFORE	4,784	0.278	0.400	0.000	0.000	1.386
Experience	4,784	7.970	0.992	5.198	8.126	9.361
BrokerSize	4,784	4.247	1.014	1.099	4.357	5.894
GDPG	4,784	2.137	1.223	-3.900	2.400	3.900
tb3ms	4,784	0.012	0.017	0.000	0.002	0.050

This table provides the summary statistics for all the main variables used in the models. *ForecastREV* is the actual analyst EPS forecast revisions, and the *NDForecastREV* is the numerator-driven EPS forecast revisions, assuming no share adjustments are used in analysts' EPS forecasts. *ExpRepShare* is analysts' estimation of shares to be repurchased by firms between the repurchase announcement date and the forecast period end date. *UnExpRepShare* is the unexpected shares repurchased by firms, which is the difference between the actual repurchase shares and the expected repurchase shares. *NIREV* is analysts' net income component revisions. *ForecastREV* and *NDForecastREV* are scaled by stock price, *ExpRepShare* and *UnExpRepShare* are scaled by outstanding shares, and *NIREV* is scaled by market value. Section 3 provides detailed calculations of these variables. See Appendix A for the definitions of all the variables.

Table 3 Analyst Revisions after Repurchase Announcements

	DV = *ForecastREV*							
	Model 1	Model 2	Model 2 Std	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	0.297	-0.038	0.749*	-0.022	-0.024	-0.028	-0.061	-3.285**
	(1.594)	(-0.117)	(1.723)	(-0.068)	(-0.072)	(-0.085)	(-0.198)	(-2.217)
ExpRepShare	7.807***	8.269***	0.321***		7.645***	5.978***	5.099***	4.046***
	(7.172)	(7.253)	(7.253)		(6.015)	(3.861)	(3.031)	(4.152)
NIREV	0.247***	0.273***	0.834***	0.273***	0.274***	0.275***	0.278***	0.047***
	(9.431)	(10.125)	(10.125)	(10.113)	(10.126)	(10.207)	(10.633)	(4.453)
ExpRep - ExpRepModel				8.224***				
				(7.194)				
ExpRepModel				4.998*				
				(1.944)				
UnExpRepShare					-0.625			
					(-1.010)			
ExpRepShare × LargeRep						4.089		
						(1.475)		
ExpRepShare × RepImpact							0.667**	
							(2.370)	
ExpRepShare × HighDis								0.101**
								(2.208)
LargeRep						-0.126		
						(-1.243)		
RepImpact							-0.010	
							(-0.798)	
HighDis								0.301***
								(2.928)
NIREV × HighDis								0.028***
								(3.195)
CashAsset		0.014	0.005	0.015	0.013	0.015	0.037	0.051
		(0.138)	(0.138)	(0.146)	(0.135)	(0.151)	(0.391)	(0.278)
DebtRatio		0.251**	0.087**	0.250**	0.257**	0.256**	0.273***	0.278
		(2.480)	(2.480)	(2.484)	(2.522)	(2.538)	(2.670)	(1.611)
DivPayer		-0.011	-0.021	-0.006	-0.010	-0.010	-0.013	-0.009
		(-0.349)	(-0.349)	(-0.207)	(-0.324)	(-0.334)	(-0.428)	(-0.167)

Table 3 Continued

	Model 1	Model 2	Model 2 Std	Model 3	Model 4	Model 5	Model 6	Model 7
lnAT		-0.007	-0.024	-0.005	-0.007	-0.007	-0.019	-0.018
		(-0.342)	(-0.342)	(-0.243)	(-0.317)	(-0.335)	(-0.852)	(-0.561)
RETE		-0.008	-0.030	-0.008	-0.008	-0.008	-0.007	-0.009
		(-1.395)	(-1.395)	(-1.269)	(-1.375)	(-1.326)	(-1.220)	(-1.240)
ROCAA		1.220**	0.092**	1.305**	1.269**	1.248**	1.060**	0.512
		(2.131)	(2.131)	(2.295)	(2.176)	(2.169)	(2.026)	(0.768)
CapExp		-0.690	-0.039	-0.685	-0.721	-0.731	-0.687	-1.318
		(-1.520)	(-1.520)	(-1.489)	(-1.561)	(-1.605)	(-1.567)	(-1.160)
lnMV		-0.001	-0.004	-0.007	-0.004	-0.003	0.004	-0.003
		(-0.055)	(-0.055)	(-0.319)	(-0.172)	(-0.115)	(0.175)	(-0.093)
BTM		1.279***	0.233***	1.290***	1.265***	1.272***	1.461***	0.481**
		(3.469)	(3.469)	(3.435)	(3.425)	(3.397)	(3.797)	(2.311)
ROA		1.738	0.064	1.665	1.695	1.787*	1.866**	2.846**
		(1.606)	(1.606)	(1.552)	(1.550)	(1.691)	(1.964)	(2.241)
Follow		0.005	0.006	0.007	0.007	0.006	0.004	0.053
		(0.189)	(0.189)	(0.278)	(0.260)	(0.238)	(0.148)	(1.391)
lnFpedatsGap		0.036	0.016	0.052	0.041	0.040	0.034	0.115
		(0.656)	(0.656)	(0.931)	(0.733)	(0.728)	(0.606)	(1.553)
DaysFF		0.015	0.012	0.015	0.015	0.018	0.013	0.039
		(1.105)	(1.105)	(1.096)	(1.124)	(1.304)	(0.920)	(1.506)
DaysLF		0.001	0.002	0.001	0.001	0.000	0.001	-0.012
		(0.193)	(0.193)	(0.204)	(0.155)	(0.027)	(0.225)	(-1.444)
numFORE		0.017	0.014	0.017	0.017	0.017	0.016	-0.048
		(0.643)	(0.643)	(0.623)	(0.630)	(0.637)	(0.594)	(-1.093)
lnExperience		-0.005	-0.011	-0.006	-0.005	-0.006	-0.005	-0.015
		(-1.064)	(-1.064)	(-1.100)	(-1.072)	(-1.094)	(-1.090)	(-1.493)
lnBrokerSize		0.010*	0.020*	0.010*	0.010*	0.009	0.010*	0.000
		(1.691)	(1.691)	(1.711)	(1.709)	(1.620)	(1.684)	(0.053)
GDPG		0.010	0.023	0.009	0.010	0.008	0.012	0.007
		(0.678)	(0.678)	(0.655)	(0.689)	(0.579)	(0.821)	(0.600)
tb3ms		2.323	0.078	2.101	2.347	2.589	3.127	-0.458
		(0.837)	(0.837)	(0.742)	(0.842)	(0.920)	(1.162)	(-0.386)

Table 3 Continued

	Model 1	Model 2	Model 2 Std	Model 3	Model 4	Model 5	Model 6	Model 7
IND Year Qtr FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm Cluster	YES	YES	YES	YES	YES	YES	YES	YES
N	4,784	4,784	4,784	4,784	4,784	4,784	4,784	5,815
Adj. R^2	0.448	0.495	0.495	0.495	0.495	0.495	0.504	0.226

Table 3 shows the results of analysts' share adjustment behaviors. Model 1 and Model 2 examine the main effect of estimated repurchase shares (*ExpRepShare*) on analysts' EPS forecast revisions (*ForecastREV*), with and without control variables, respectively. In order to compare the relative influence of *ExpRepShare* and *NIREV*, which have very different scales, Model 2 Std standardize all the dependent and independent variables to create comparable magnitudes. Model 3 to Model 7 further explore analysts' share adjustment behaviors under different scenarios. Model 3 split the *ExpRepShare* into the portion that can be estimated based on firms' regular repurchases (*ExpRepModel*) and the portions that are based on the incremental repurchase information from repurchase announcements (*ExpRep-ExpRepModel*). Model 4 includes the unexpected repurchase shares (*UnExpRepShare*). Model 5 investigates the moderating effect of large repurchase (*LargeRep*), which is the top quintile of repurchases as a percent of outstanding shares, on analysts' share adjustments. Model 6 examines the moderating effect of the impact of estimated shares to be repurchased on EPS forecasts (*RepImpact*) on analysts' share adjustments. Model 7 inspects the effect of mandatory repurchase disclosure (*HighDis*) on analysts' share and net income adjustments. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.

[A.] In model 2 Std, I standardize all the dependent and independent variables to compare the relative explanation power of *ExpRepShare* and *NIREV* on *ForecastREV*. The coefficients on *ExpRepShare* and *NIREV* are 0.332 and 0.803, respectively, and they are significantly different, with *p-value* of *0.000*. See Appendix A for variable definitions.

Table 4 Analyst-Manager Relationship and Uncertainty Cross-Sectional Tests

DV = *ForecastREV*						
	M1 *lnDaysFollow*		**M2 *CommonUncert***		**M3 *AnalystUncert***	
	Bottom Decile	**Top Decile**	**Bottom Decile**	**Top Decile**	**Bottom Decile**	**Top Decile**
Intercept	-0.147	3.580*	0.341	0.404	0.458*	-0.561
	(-0.510)	(1.896)	(1.114)	(0.534)	(1.893)	(-0.607)
ExpRepShare	0.258***	0.399***	0.500***	0.191	0.071	0.668***
	(5.096)	(4.384)	(5.366)	(1.612)	(1.478)	(3.664)
NIRev	0.755***	1.024***	1.054***	0.580***	0.319***	1.232***
	(6.601)	(6.872)	(12.737)	(3.756)	(4.571)	(7.959)
CashAsset	-0.025	-0.149*	0.116	0.061	-0.091**	0.559**
	(-0.563)	(-1.652)	(1.246)	(0.792)	(-1.960)	(1.965)
DebtRatio	0.057	0.012	0.239**	0.123*	-0.011	0.166
	(1.596)	(0.114)	(2.467)	(1.670)	(-0.268)	(1.055)
DivPayer	-0.142	-0.127	-0.295**	0.044	0.059	0.514*
	(-1.442)	(-1.000)	(-2.090)	(0.357)	(0.512)	(1.903)
lnAT	-0.001	0.096	-0.411***	0.019	-0.107	-0.121
	(-0.008)	(0.476)	(-2.783)	(0.056)	(-1.005)	(-0.608)
RETE	0.008	-0.054	0.134	-0.219*	-0.017	-0.177
	(0.215)	(-0.870)	(1.099)	(-1.741)	(-0.502)	(-0.892)
ROCAA	0.124*	0.206*	0.024	0.305	0.011	-0.133
	(1.939)	(1.671)	(0.185)	(1.503)	(0.251)	(-0.852)
CapExp	-0.008	0.011	-0.125	0.006	0.051	0.072
	(-0.189)	(0.181)	(-1.492)	(0.032)	(1.022)	(0.647)
lnMV	0.036	-0.340	0.138	0.283	0.103	0.112
	(0.386)	(-1.491)	(1.346)	(0.808)	(1.094)	(0.661)
BTM	0.204**	0.239	0.496***	0.208*	0.096*	0.293
	(2.310)	(1.263)	(4.820)	(1.737)	(1.935)	(1.450)
ROA	-0.081	0.027	0.182**	0.019	0.010	0.237
	(-1.404)	(0.274)	(1.990)	(0.124)	(0.147)	(1.430)
Follow	-0.011	0.146**	0.191**	-0.072	0.005	-0.080
	(-0.278)	(2.021)	(2.186)	(-1.017)	(0.099)	(-0.478)
lnFpedatsGap	-0.012	-0.009	0.185**	0.032	0.102**	0.164
	(-0.345)	(-0.173)	(2.438)	(0.365)	(2.274)	(1.309)
DaysFF	-0.034	0.037	0.004	-0.001	-0.002	0.012
	(-1.418)	(1.250)	(0.185)	(-0.043)	(-0.142)	(0.440)
DaysLF	0.070**	-0.035	0.043	0.037	0.028	0.016
	(2.422)	(-0.664)	(1.198)	(1.259)	(1.125)	(0.439)
numFORE	0.052	0.022	0.055	-0.006	-0.001	0.029
	(1.229)	(0.403)	(1.401)	(-0.138)	(-0.033)	(0.970)
lnExperience	-0.018	0.061	-0.027	-0.002	-0.013	-0.040
	(-0.792)	(0.419)	(-0.753)	(-0.092)	(-0.636)	(-0.928)
lnBrokerSize	0.010	-0.040	0.021	0.031	0.011	0.016
	(0.386)	(-1.133)	(0.322)	(1.066)	(0.525)	(0.206)
GDPG	0.161**	-0.038	0.091	0.039	-0.003	0.006
	(2.120)	(-0.488)	(0.650)	(0.414)	(-0.055)	(0.024)
tb3ms	0.067	0.546*	-0.176	0.012	-0.371	-0.530
	(0.316)	(1.751)	(-0.668)	(0.027)	(-1.354)	(-0.811)
IND Year Qtr FE	YES		YES		YES	
Firm Cluster	YES		YES		YES	
N	555	457	555	383	522	409
Adj. R^2	0.472	0.567	0.746	0.573	0.368	0.776

Table 4 explores the factors influencing analysts' share adjustment behaviors. M1 examines analysts' share adjustments separately in the subsamples with long (Top Decile) and short (Bottom Decile) periods analysts following a firm (*lnDaysFollow*). M2 and M3 examines analysts shares adjustments in the subsamples with high and low levels of uncertainties that are common to all analysts (*CommonUncert*) and that are specific to individual analysts (*AnalystUncert*), respectively. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.

Table 5 Actual EPS Forecast Revisions vs. Numerator-driven EPS Forecast Revisions – Predicting Future Performance

	DV = ROA_t		**DV = ROA_{t+1}**		**DV = ROA_{t+2}**		**DV = ROA_{t+3}**	
Intercept	-0.049**	-0.048**	-0.033*	-0.031*	-0.043**	-0.042**	-0.039**	-0.038**
	(-2.505)	(-2.505)	(-1.742)	(-1.714)	(-2.338)	(-2.339)	(-2.274)	(-2.271)
ForecastREV	0.000		-0.001		-0.000		-0.000	
	(0.051)		(-0.650)		(-0.354)		(-0.249)	
NDForecastREV		0.002**		0.001*		0.001**		0.001**
		(2.336)		(1.912)		(2.016)		(2.035)
CashAsset	-0.015***	-0.015***	-0.010**	-0.010**	-0.006	-0.007	-0.010**	-0.011**
	(-2.751)	(-2.872)	(-1.960)	(-2.067)	(-1.249)	(-1.356)	(-2.109)	(-2.216)
DebtRatio	-0.008*	-0.007*	-0.008*	-0.008*	-0.009**	-0.009**	-0.006	-0.006
	(-1.752)	(-1.733)	(-1.955)	(-1.950)	(-2.213)	(-2.213)	(-1.526)	(-1.512)
DivPayer	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002
	(0.759)	(0.708)	(0.584)	(0.547)	(0.915)	(0.878)	(1.011)	(0.972)
lnAT	-0.006***	-0.006***	-0.005***	-0.004***	-0.004**	-0.004**	-0.004***	-0.004***
	(-3.772)	(-3.738)	(-2.744)	(-2.686)	(-2.516)	(-2.462)	(-2.774)	(-2.726)
RETE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.323)	(0.323)	(0.577)	(0.586)	(0.547)	(0.556)	(0.736)	(0.745)
ROCAA	0.152***	0.159***	0.123***	0.129***	0.147***	0.153***	0.179***	0.184***
	(3.284)	(3.489)	(2.708)	(2.873)	(3.333)	(3.541)	(4.297)	(4.536)
CapExp	-0.023	-0.023	-0.039	-0.039	-0.069**	-0.069**	-0.092***	-0.092***
	(-0.793)	(-0.807)	(-1.268)	(-1.274)	(-2.134)	(-2.147)	(-3.001)	(-3.020)
lnMV	0.006***	0.006***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***
	(3.754)	(3.752)	(2.883)	(2.858)	(2.933)	(2.918)	(3.113)	(3.100)
BTM	0.034***	0.033***	0.023*	0.022*	0.026**	0.025**	0.025**	0.024**
	(2.892)	(2.873)	(1.927)	(1.888)	(2.163)	(2.133)	(2.178)	(2.147)
ROA	0.099	0.098	0.135	0.133	0.095	0.093	0.103	0.102
	(0.951)	(0.952)	(1.295)	(1.291)	(1.034)	(1.028)	(1.224)	(1.224)
Follow	0.004***	0.004**	0.003**	0.003**	0.003**	0.003*	0.003**	0.003**
	(2.602)	(2.534)	(2.246)	(2.180)	(1.969)	(1.898)	(2.199)	(2.126)
lnFpedatsGap	-0.002	-0.001	-0.002	-0.002	0.000	0.000	-0.000	-0.000
	(-0.592)	(-0.582)	(-0.843)	(-0.856)	(0.006)	(0.005)	(-0.110)	(-0.107)

Table 5 Continued

	DV = ROA_t		DV = ROA_{t+1}		DV = ROA_{t+2}		DV = ROA_{t+3}	
DaysFF	-0.001*	-0.001*	-0.000	-0.001	-0.000	-0.000	-0.001	-0.001
	(-1.888)	(-1.914)	(-0.758)	(-0.805)	(-0.775)	(-0.802)	(-1.249)	(-1.269)
DaysLF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.420)	(0.381)	(0.508)	(0.489)	(0.863)	(0.843)	(0.958)	(0.936)
numFORE	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001
	(0.408)	(0.412)	(0.620)	(0.611)	(0.951)	(0.951)	(1.239)	(1.241)
lnExperience	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.053)	(0.166)	(0.146)	(0.264)	(0.567)	(0.677)	(0.447)	(0.559)
lnBrokerSize	0.000	0.000	0.000**	0.000**	0.001***	0.001***	0.000**	0.000**
	(0.738)	(0.681)	(2.173)	(2.135)	(3.029)	(3.007)	(2.369)	(2.340)
GDPG	0.002*	0.002*	0.002**	0.002**	0.002**	0.002**	0.002**	0.002**
	(1.901)	(1.853)	(2.168)	(2.131)	(2.116)	(2.072)	(2.095)	(2.048)
tb3ms	0.329	0.343	0.200	0.209	0.112	0.123	0.020	0.030
	(1.439)	(1.496)	(1.009)	(1.053)	(0.583)	(0.636)	(0.111)	(0.168)
IND Year Qtr FE	YES		YES		YES		YES	
Firm Cluster	YES		YES		YES		YES	
N	4,781	4,781	4,781	4,781	4,784	4,784	4,784	4,784
Adj. R^2	0.457	0.461	0.428	0.430	0.468	0.470	0.518	0.521

Table 5 compares the actual analyst EPS forecast revisions (*ForecastREV*) and the numerator-driven analyst EPS forecast revisions (*NDForecastREV*) in predicting firms' future operating performance (*ROA*) for one to four quarters ahead, starting from the forecasting quarter t. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.

Table 6 Market Mispricing to EPS Distortion

Panel A. Portfolios formed based on EPS distortion

EPS Distortion (*Distortion*)			Abnormal Buy-and-Hold Returns				Abnormal Buy-and-Hold Returns Diff			
Quintile	Obs.	Mean	[m1, m3]	[m1, m6]	[m1, m9]	[m1, m12]	[m1, m3]	[m1, m6]	[m1, m9]	[m1, m12]
0	336	-0.0591	0.0481	0.0390	0.0816	0.0935	0.0810	0.0708	0.1108	0.1275
1	335	0.0305	0.0046	0.0719	0.0845	0.0876	0.0232	0.0909	0.1029	0.1105
2	336	0.0805	0.0231	0.0609	0.0452	0.0681	0.0312	0.0697	0.0536	0.0760
3	335	0.1861	0.0316	0.0424	0.0334	0.0483	0.0485	0.0615	0.0522	0.0678
4	335	1.5600	0.0170	-0.0052	0.0106	-0.0029	0.0402	0.0170	0.0315	0.0240
	1677									
Hedge return (#0 - #4)			0.0310***	0.0442***	0.0710***	0.0964***	0.0408**	0.0537**	0.0793***	0.1035***
t-statistics			(2.620)	(2.606)	(3.124)	(3.814)	(2.202)	(2.335)	(2.883)	(3.355)

Panel B. Portfolios formed based on absolute EPS distortion

EPS Distortion (*Distortion*)			Abnormal Buy-and-Hold Returns				Abnormal Buy-and-Hold Returns Diff			
Quintile	Obs.	Mean	[m1, m3]	[m1, m6]	[m1, m9]	[m1, m12]	[m1, m3]	[m1, m6]	[m1, m9]	[m1, m12]
0	336	0.0037	0.0515	0.0446	0.0892	0.0881	0.0851	0.0771	0.1190	0.1231
1	335	0.0322	0.0042	0.0757	0.0922	0.0958	0.0195	0.0921	0.1081	0.1153
2	336	0.0829	0.0247	0.0623	0.0429	0.0764	0.0312	0.0695	0.0496	0.0825
3	335	0.1898	0.0307	0.0356	0.0248	0.0410	0.0527	0.0597	0.0487	0.0656
4	335	1.6136	0.0133	-0.0092	0.0061	-0.0067	0.0356	0.0116	0.0257	0.0193
	1677									
Hedge return (#0 - #4)			0.0383***	0.0538***	0.0832***	0.0948***	0.0495***	0.0655***	0.0933***	0.1038***
t-statistics			(3.299)	(3.220)	(3.738)	(3.847)	(2.691)	(2.868)	(3.443)	(3.422)

Panel C. Return Regression (DV = Future Abnormal Buy-and-Hold Return)

	DV = *Return*$_{[m1\sim m3]}$		**DV = *Return*$_{[m1\sim m6]}$**		**DV = *Return*$_{[m1\sim m9]}$**		**DV = *Return*$_{[m1\sim m12]}$**	
Intercept	-0.000	(-0.002)	0.309	(0.782)	0.464	(1.105)	0.902*	(1.741)
Distortion	-0.042*	(-1.871)	-0.113***	(-2.845)	-0.106**	(-2.268)	-0.080	(-1.321)
CashAsset	0.160*	(1.882)	0.357***	(2.901)	0.450***	(3.097)	0.553***	(3.215)
DebtRatio	-0.003	(-0.044)	-0.048	(-0.565)	0.007	(0.064)	0.113	(0.842)
DivPayer	0.004	(0.165)	0.020	(0.579)	0.041	(1.011)	0.024	(0.481)
lnAT	0.011	(0.563)	0.039	(1.292)	0.058*	(1.908)	0.025	(0.596)
RETE	0.010*	(1.668)	0.017	(1.591)	-0.002	(-0.195)	-0.012	(-0.885)
ROCAA	-0.235	(-0.532)	-0.491	(-0.747)	-0.538	(-0.670)	-0.376	(-0.410)
CapExp	-0.038	(-0.115)	-0.706	(-1.330)	-0.926	(-1.441)	-1.484*	(-1.959)
lnMV	0.006	(0.274)	-0.016	(-0.474)	-0.045	(-1.320)	-0.041	(-0.928)
BTM	-0.005	(-0.035)	-0.282	(-1.151)	-0.378	(-1.404)	-0.070	(-0.183)
ROA	1.048	(1.424)	2.107**	(2.066)	1.648	(1.250)	0.994	(0.637)
Follow	-0.085***	(-3.076)	-0.079**	(-2.053)	-0.086*	(-1.874)	-0.045	(-0.810)
lnFpedatsGap	0.036	(0.919)	-0.008	(-0.134)	0.062	(0.892)	-0.016	(-0.227)
DaysFF	-0.021**	(-2.059)	-0.038**	(-2.540)	-0.044**	(-2.374)	-0.035*	(-1.668)
DaysLF	0.000	(0.062)	-0.000	(-0.030)	-0.002	(-0.166)	0.004	(0.421)
numFORE	0.001	(0.075)	0.009	(0.485)	-0.002	(-0.074)	0.003	(0.106)
lnExperience	-0.000	(-0.077)	-0.010	(-1.441)	-0.010	(-1.197)	-0.010	(-0.969)
lnBrokerSize	0.006	(1.341)	0.012**	(2.407)	0.017***	(2.701)	0.022**	(2.504)
GDPG	-0.031*	(-1.914)	-0.029*	(-1.672)	-0.009	(-0.384)	0.011	(0.330)
tb3ms	2.186	(0.869)	2.195	(0.526)	-1.507	(-0.276)	-9.607	(-1.543)
Return$_{[m-3\sim m-1]}$	-0.010	(-0.117)	0.010	(0.088)	-0.050	(-0.374)	0.258*	(1.726)
IND Year Qtr FE and Firm Cluster	YES		YES		YES		YES	
N	749		749		749		749	
Adj. R^2	0.291		0.281		0.290		0.308	

Table 6 investigates whether investors recognize and process the implications of the denominator-driven EPS forecast revisions (*Distortion* = the denominator-driven EPS forecast revisions). Panel A and Panel B form portfolios to five groups, based on the *Distortion* and the absolute value of *Distortion*, respectively. I then compare the future abnormal buy-and-hold return (three to twelve month ahead) and the future abnormal return after subtracting the previous abnormal returns between the top and bottom *Distortion* quintiles. Panel C uses OLS regression to further examine the impact of *Distortion* on abnormal returns after controlling for firm and analyst level characteristics and the previous returns. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.

CHAPTER 5. ADDITIONAL ANALYSIS

5.1 Analyst EPS Revisions After Repurchase Announcement – Alternative Model

Additionally, I use alternative models to examine my main research question whether analysts adjust their forecasts of the share component of the EPS forecasts after repurchase announcements. In the first alternative model, I redefine the net income revision (*NIREV*) as the difference between the net income component forecasts before and after repurchase announcements using the same number of shares. Specifically, *NIREV* used in the model is calculated as $EPS\_PreRepAnn_{t} \times ShareOut_{t-1}$ subtracted by $EPS\_PostRepAnn_{t} \times ShareOut_{t-1}$, scaled by MV_{t-1}, and times 1,000,000.

The second alternative model learns from Hertzel and Jain (1991) when they examine whether Value Line mechanically adjust the forecast of shares outstanding. Net income forecast before (after) repurchase announcements equals the EPS forecasts before (after) announcements multiply the outstanding share forecasts before (after) announcements. Treating the net income forecast revisions as zero for mechanical share adjustment, the dependent variable in the alternative model is EPS forecast revisions as a percent of the last EPS forecasts before the repurchase announcements, and the independent variable is estimated repurchase shares as a percent of the difference between the common shares outstanding and the estimated repurchase shares.

In these two alternative models, the untabulated results show that the coefficient of repurchase shares is significantly positive. After controlling for the unexpected portion, the estimated repurchase shares are still significantly positive, while the unexpected portions are insignificant.

5.2 Analysts' Use of EPS Forecast Revisions in Price Forecasts and Recommendations

In Section 4.4, I find that numerator-driven EPS forecast revisions are more indicative of future firm performance than actual EPS forecast revisions. One of the motivations analysts to provide accurate earnings forecast is to use it as an input in their stock recommendations (Brown et al. 2015). In this section, I explore which EPS revisions do analysts use in their own price target forecasts and stock recommendations. I re-estimate Equation (2) after changing the dependent variable to target price revision (*PriceREV*) or recommendation revisions (*RecomREV*). *PriceREV* is the difference between the first price forecast after the repurchase announcement and the last price forecast before the announcement, scaled by the beginning-of-quarter stock prices. *RecomREV* is the difference between the fist recommendation after repurchase announcement and the last recommendation before the announcement, and is reversely coded so that the larger number means higher recommendation. Because the value of *RecomREV* shows ranks, I use ordered logistic regression for this model. I use the OLS regression for the price forecast revision model.

Table 7 shows the results. In the *PriceREV* model, the coefficients of *ForecastREV* and *NDForecastREV* are both positively significant, but *ForecastREV* is significantly larger than *NDForecastREV (untabulated)*. Given that the numerator-driven forecast revision (*NDForecastREV*) better predicts a firm's future performance than the actual forecast revision (*ForecastREV*) and *NDForecastREV* is on average smaller than *ForecastREV*, analysts may over-estimate the price target by relying more on *ForecastREV*. I empirically test the possibility of over-predicting stock price. The untabulated results show that the average price forecasts before repurchase announcements

are higher than the actual price for the forecasted period, but the average price forecasts after the repurchase announcements are higher than the actual price to a higher extent. The absolute price forecast errors after the repurchase announcements are significantly higher than the absolute forecast errors before the announcements (forecast error difference = 0.217, $p < 0.001$).

In the *RecomREV* model with only fixed effects controlled, the coefficient of *ForecastREV* is significantly positive while coefficient of *NDForecastREV* is insignificant. After controlling other firm and analyst characteristics in the model, either revision is insignificant, although the coefficient of *ForecastREV* is larger than *NDForecastREV* at glance. One reason of the lack of statistical significance in the model with all controls may be because of the small sample size in the recommendation test, which reduces the power of the test.

These results indicate that analysts rely more on their released actual EPS forecast revisions rather than the numerator-driven EPS forecast revisions in estimating the target prices and in making buy and sell recommendations (with limited evidence). The results also show preliminary evidence of analysts over-estimating future stock price by relying on their actual EPS forecast revisions instead of the numerator-driven revisions.

5.3 Actual EPS Forecast versus Numerator-Driven EPS Forecast in Predicting Stock Price and Making Stock Recommendation

In Section 4.4, I examine whether reported or numerator-driven EPS forecast revisions are more indicative of future firm performance. In this section, I test which of the two better predicts firms' actual EPS. I re-estimate Equation (2) after changing the dependent variable to perfect revisions (*PrefectREV*). *PerfectREV* is calculated as the

difference between the actual EPS in analysts' forecast quarters and the last EPS forecasts before OMR announcements (*EPS_PreRepAnn*). *EPS_PreRepAnn* acts as an anchor, based on which analysts update their EPS forecasts after OMR announcements. If analysts made perfect EPS forecasts, then their updated EPS forecasts would be the same as the actual EPS. In other words, if they made perfect EPS revisions after OMR announcements, the revisions would be the difference between the actual EPS and their last forecasts before OMR announcements, which is *PerfectREV*. Therefore, the relationship between analysts' EPS revisions and *PerfectREV* reflects how much analysts' revised EPS forecasts become closer to the actual EPS. A higher relationship indicates a higher-quality EPS forecast update. Thus, the coefficient difference of actual *ForecastREV* and *NDForecastREV* shows which revisions better forecast the actual EPS.

From Table 8, although both revisions predict actual EPS, *ForecastREV* has a stronger relationship with *PerfectREV* than *NDForecastREV*. Therefore, the EPS forecasts as reported by analysts provide a more accurate forecasts of actual EPS, comparing with the numerator-driven forecasts that remove the denominator-driven forecasts from analyst reported forecasts.

5.4 Analyst EPS Forecast Revisions Based on Actual Repurchases

Since there is a shortage of studies examining whether analysts adjust the share component when there is a change in outstanding shares in a timely manner, I use the actual repurchase implementation setting to further investigate this question when there is no estimation of repurchases needed. Specifically, I examine if analysts incorporate shares repurchased into their EPS forecasts after the actual number of shares repurchased is released and thus does not need to be estimated. Although firms are required to disclose

their repurchases in 10K/10Q filings, many firms disclose their shares repurchased in their earnings announcements (Huang et al. 2019). Therefore, this section examines whether analysts change their share estimates based on actually reported shares repurchased after the earnings announcements.

As shown in Figure 2, to calculate forecast revisions after the earnings announcement dates ($ForecastREV\_EarnAnn_{t+1}$), I compare the last EPS forecast made before the earnings announcements ($EPS\_PreEarnAnn_{t+1}$) with the first EPS forecast made after the earnings announcements ($EPS\_PostEarnAnn_{t+1}$). I use Equation (3) to examine whether analysts revise the number of shares outstanding downward after actual number of shares repurchased is released at earnings announcement date. I include all repurchase and non-repurchase firms in the sample. There are 529,599 observations in this earnings announcement sample

$$\begin{aligned} ForecastREV\_EarnAnn_{t+1} = {} & d_0 + d_1 RepShare + d_2 NIREV\_EarnAnn_{t+1} + d_3 CashAsset \\ & + d_4 DebtRatio + d_5 DivPayer + d_6 LogAT + d_7 RETE + d_8 ROCAA \\ & + d_9 CapExp + d_{10} LogMV + d_{11} BTM + d_{12} ROA + d_{13} Follow + d_{14} DaysFF \\ & + d_{15} DaysLF + d_{16} numFORE + d_{17} Experience + d_{18} BrokerSize \\ & + d_{19} GDPG + d_{20} tb3ms + i.FF48IND + i.Year + i.Qtr + \varepsilon, \end{aligned} \quad (3)$$

$ForecastREV\_EarnAnn_{t+1}$ is analysts' revisions of the EPS forecast for the following quarter when the current quarter earnings is announced, scaled by the stock price at the beginning of the fiscal quarter. *EPS_PreEarnAnn* and *EPS_PostEarnAnn* are constructed similarly to the OMR announcement setting, except that they represent the forecasts for the following quarter and are measured around the earnings announcement date, when the actual repurchase shares are known to the public for most repurchase firms. *RepShare* is the actual number of shares repurchased in a quarter. Shares repurchased reduce the number of shares outstanding, and thus increase $ForecastREV\_EarnAnn_{t+1}$. So,

a positive coefficient on *RepShare* is consistent with analysts incorporating actual shares repurchased in their EPS forecasts after earnings announcements and thus in their EPS forecast revisions ($ForecastREV\_EarnAnn_{t+1}$).

I further split the actual shares repurchased, *RepShare*, into the expected (*ExpRepShareModel*) and unexpected (*UnExpRepShareModel*) portions based a firm's routine repurchase behaviors, and the estimation follows the two-stage repurchase estimation model derived in Hribar et al. (2006) on pages 18-19. From Figure 2, we can see that before the current quarter earnings announcement (EPS_t Announcement), if analysts have made an estimation of repurchased shares, the expected shares ($ExpRepShareModel_t$) would have been included in their last revision before the earnings announcement. It is the unexpected portion ($UnExpRepShareModel_t$) that would change their estimations of the outstanding shares. Similarly, after EPS_t Announcement, if analysts made expectations of the following quarter's shares ($ExpRepShareModel_{t+1}$), they would include $ExpRepShareModel_{t+1}$ in the outstanding share estimates when they forecast the following quarter's EPS (EPS_{t+1}), but they cannot include the unexpected portion ($UnExpRepShareModel_{t+1}$) that is not known until EPS_{t+1} is announced. In other words, if analysts estimate and impound the routine shares repurchased by firms when they adjust their EPS estimates, $UnExpRepShareModel_t$ and $ExpRepShareModel_{t+1}$ would impact their EPS revisions, and this is what I find based on the results shown in Table 9. Model 1 shows that both *RepShare* and *NIREV_EarnAnn* have significantly positive coefficients, indicating that when analysts revise their EPS forecasts, they adjust both the numerator and denominator components. Model 2 shows that only the $UnExpRepShareModel_t$ and $ExpRepShareModel_{t+1}$ significantly impact analysts' EPS revisions.

As an alternative measure of expected repurchases for each period, I assume analysts simply use the actual repurchase shares from the most recent quarter as the estimated shares for each of the forecast quarters. Model 3 presents the results. Since analysts use the same estimated shares to be repurchased for each forecast quarter, $ExpRepShare_t$ *and* $ExpRepShare_{t+1}$ are the same, so I only include the expected repurchase shares once in the *RepShare* variable. I still find that the *UnExpRepShare* is still significant, but not the $UnExpRepShare_{t+1}$ which is not known until the earnings announcement date for quarter t+1.

Overall, this section finds that analysts adjust the share component based on repurchases when they forecast EPS after they know the shares repurchased, and they also make expectations of the shares to be repurchased in their forecast quarters before they know the actual repurchases. These results provide more evidence to support the first hypothesis that analysts adjust their EPS forecasts based on the estimation of the share changes.

5.5 Identification of Individual Analysts' Share Adjustment Decisions

In this section, I identify a subsample of analysts who do or do not adjust shares in their financial indicator forecasts, not limited to EPS forecasts. The method I use to identify the analysts is based on some groups of measures with both total and per share numbers available for each analyst-firm-quarter when they measure the same character of a firm, provided by IBES Details. I back out the number of shares used in an analyst's forecast by dividing the total amount by the per share amount. The first group of measure is based on total EBITDA (EBT) divided by EBITDA per share (EBS), the second group is based on net asset value (NAV) and book value per share (BPS), and the third group is based on net

income (NET) and earnings per share (EPS). The number of shares calculated using three methods provided by the three groups of measure have a higher than 99% correlation, indicating that the number of shares so backed out is reliable. I then calculate the number of shares used by analysts in their forecasts using the average of the three calculated shares. I require at least one of the three calculated shares to be available to be included in the sample.

I identify an analyst-firm-quarter with repurchase adjustment in the forecast as those whose first shares estimation after the OMR announcement (*Share_PostRepAnn*) is less than the last shares estimation before the OMR announcement (*Share_PreRepAnn*). Based on this identification, in the sample of 156 analyst-firm-quarters, 103 (66%) observations adjust shares in the financial indicator forecasts. I then compare the absolute forecast error of shares repurchased, which is the absolute value of (*Share_PostRepAnn – Share_PreRepAnn – RepShare)*, between the two groups of analysts. The untabulated results show that the analyst-firm-quarters that adjust shares to be repurchased in their forecasts has a smaller shares repurchased forecast error than the group that does not adjust shares, with p-value of 0.052. In other words, analysts' repurchase estimations used in their forecasts are indicative of a firm's future actual repurchase implementation.

In addition, there is a limitation in my paper that I use my estimation of shares to be repurchased based on the completion ratios of announced shares to proxy analysts' estimations of shares. Using this small sample of the analyst-firm-quarters that incorporate estimated share changes in the EPS forecasts, I am able to back out the change in the number of shares used in the forecasts. I compare the share changes embedded in analysts' forecasts with analysts' expected number of shares to be repurchased using my estimation

method (*ExpRepShare*), and I find a 52% correlation between these two share measures, which provides some grounds that my estimate (*ExpRepShare*) is a reasonable proxy for the shares used in analysts' EPS forecasts.

Table 7 Actual EPS Forecast Revisions vs. Numerator-driven EPS Forecast Revisions – Use in Analyst Forecasts

	DV = *PriceREV*		**DV = *PriceREV***		**DV = *RecomREV***		**DV = *RecomREV***	
Intercept	0.152	-1.206	0.198	-1.838				
	(0.443)	(-1.045)	(0.587)	(-1.602)				
ForecastREV	0.971***	0.972***			0.888*	0.870		
	(7.069)	(7.039)			(1.784)	(1.572)		
NDForecastREV			0.469***	0.473***			0.458	0.482
			(4.884)	(4.797)			(1.277)	(1.127)
CashAsset		0.288		0.166		-2.751		-2.718
		(0.686)		(0.383)		(-0.785)		(-0.774)
DebtRatio		0.197		0.338		-1.284		-0.979
		(0.590)		(0.945)		(-0.641)		(-0.465)
DivPayer		0.145		0.131		1.421**		1.262**
		(0.871)		(0.777)		(2.203)		(2.043)
lnAT		-0.090		-0.048		-0.399		-0.272
		(-1.004)		(-0.516)		(-0.994)		(-0.573)
RETE		0.017		0.013		-0.140		-0.188
		(0.559)		(0.410)		(-0.632)		(-0.871)
ROCAA		-3.408		-1.098		-9.723		-7.626
		(-1.381)		(-0.427)		(-0.650)		(-0.488)
CapExp		1.199		0.485		29.366*		28.579*
		(0.581)		(0.236)		(1.747)		(1.712)
lnMV		0.121		0.090		0.217		0.144
		(1.354)		(0.959)		(0.536)		(0.309)
BTM		0.372		0.164		0.475		-0.077
		(0.547)		(0.231)		(0.131)		(-0.019)
ROA		4.266		4.525		13.996		15.635
		(1.053)		(1.049)		(0.600)		(0.709)
Follow		-0.107		-0.128		1.052		1.011
		(-1.168)		(-1.376)		(1.073)		(1.050)
lnFpedatsGap		-0.275		-0.163		0.288		0.399
		(-1.157)		(-0.689)		(0.186)		(0.255)

Table 7 Continued

	DV = *PriceREV*		**DV = *PriceREV***		**DV = *RecomREV***		**DV = *RecomREV***	
DaysFF		0.145		0.172*		0.933***		1.010***
		(1.611)		(1.890)		(2.757)		(2.913)
DaysLF		0.044		0.031		-0.141		-0.131
		(0.972)		(0.673)		(-0.451)		(-0.412)
numFORE		0.173		0.194*		-1.121		-1.193
		(1.539)		(1.690)		(-1.312)		(-1.468)
lnExperience		0.029		0.030		-0.327*		-0.355*
		(0.862)		(0.859)		(-1.649)		(-1.781)
lnBrokerSize		0.002		0.006		-0.088		-0.049
		(0.037)		(0.141)		(-0.295)		(-0.154)
GDPG		-0.016		-0.021		-0.877**		-0.857**
		(-0.233)		(-0.285)		(-2.048)		(-2.147)
tb3ms		10.986		18.181		-1.222		3.429
		(0.750)		(1.229)		(-0.011)		(0.031)
IND Year Qtr FE & Firm Cluster	YES		YES		YES		YES	
N	2,791	2,791	2,791	2,791	650	650	650	650
Adj. R^2/Pseudo R^2	0.100	0.102	0.072	0.073	0.208	0.286	0.197	0.277

Table 7 explores whether analysts use the actual analyst EPS forecast revisions (*ForecastREV*) or the numerator-driven analyst EPS forecast revisions (*NDForecastREV*) in the revisions of setting their price target forecasts (DV = *PriceREV*) or in making stock buy-and-sell recommendations (DV = *RecomREV*). Since stock recommendations use ranked variables, I use ordered logistic regression in the *RecomREV* model. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.

Table 8 Actual EPS Forecast Revisions vs. Numerator-Driven EPS Forecast Revisions – Predicting EPS

	DV = *PerfectREV*		DV = *PerfectREV*	
Intercept	-0.015	(-0.005)	-0.695	(-0.206)
ForecastREV	1.207***	(6.240)		
NDForecastREV			0.706***	(4.367)
CashAsset	1.569	(1.541)	1.358	(1.325)
DebtRatio	-1.226*	(-1.666)	-1.007	(-1.329)
DivPayer	-0.543	(-1.566)	-0.590*	(-1.711)
lnAT	0.612**	(2.400)	0.697***	(2.732)
RETE	-0.007	(-0.118)	-0.019	(-0.311)
ROCAA	-0.691	(-0.068)	2.248	(0.215)
CapExp	-5.151	(-1.021)	-6.084	(-1.184)
lnMV	-0.516**	(-2.001)	-0.574**	(-2.208)
BTM	-1.508	(-0.676)	-1.911	(-0.835)
ROA	45.336**	(2.015)	47.049**	(2.069)
Follow	-0.012	(-0.051)	-0.068	(-0.282)
lnFpedatsGap	0.780	(1.571)	0.934*	(1.881)
DaysFF	0.107	(0.905)	0.148	(1.235)
DaysLF	-0.031	(-0.374)	-0.052	(-0.590)
numFORE	-0.228	(-1.275)	-0.209	(-1.144)
lnExperience	0.004	(0.088)	0.001	(0.028)
lnBrokerSize	-0.026	(-0.623)	-0.025	(-0.589)
GDPG	-0.028	(-0.147)	-0.054	(-0.289)
tb3ms	-5.361	(-0.171)	4.262	(0.133)
IND Year Qtr FE	YES		YES	
Firm Cluster	YES		YES	
N	4,784		4,784	
Adj. R^2	0.176		0.167	

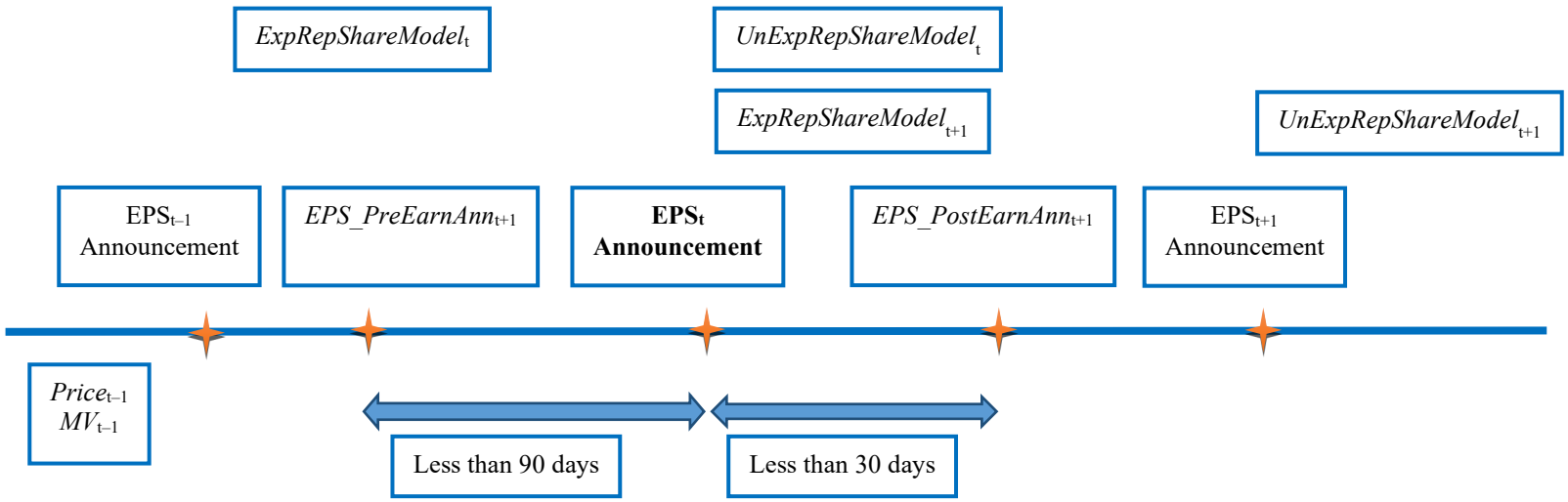
Table 8 compares the actual analyst EPS forecast revisions (*ForecastREV*) and the numerator-driven analyst EPS forecast revisions (*NDForecastREV*) in predicting firms' actual EPS for the forecasting quarter. To take into account of the analysts' EPS forecast before the repurchase announcement, the dependent variable in this table is the revisions that are needed to achieve the actual EPS (*PerfectREV*), which is the difference between the actual EPS and analysts' last EPS forecasts before repurchase announcements. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.

Table 9 Analyst Revisions after Actual Shares Repurchased are Released

DV = *ForecastREV_EarnAnn$_{t+1}$*

	Model 1 RepModel		**Model 2RepModel**		**Model 3 PreRep**	
Intercept	2.048***	(4.115)	1.980***	(3.929)	2.063***	(4.087)
RepShare$_t$	0.075***	(9.647)				
ExpRepShareModel$_t$			-0.004	(-0.165)		
UnExpRepShareModel$_t$			0.066***	(5.795)		
ExpRepShareModel$_{t+1}$			0.073***	(2.892)		
UnExpRepShareModel$_{t+1}$			0.006	(0.581)		
UnExpRepSharePreRep$_t$					0.081***	(14.735)
ExpRepSharePreRep$_{t+1}$					0.074***	(6.839)
UnExpRepSharePreRep$_{t+1}$					0.005	(0.582)
NIRev_EarnAnn	0.785***	(48.954)	0.785***	(48.891)	0.786***	(49.125)
CashAsset	0.350***	(3.089)	0.353***	(3.091)	0.364***	(3.210)
DebtRatio	-0.097	(-1.416)	-0.103	(-1.549)	-0.107	(-1.544)
DivPayer	0.189***	(5.964)	0.191***	(5.962)	0.189***	(6.002)
lnAT	0.165***	(3.870)	0.174***	(4.089)	0.169***	(4.015)
RETE	0.004	(1.038)	0.004	(1.103)	0.004	(0.865)
ROCAA	-1.242***	(-5.365)	-1.255***	(-5.407)	-1.235***	(-5.344)
CapExp	0.935**	(2.495)	0.895**	(2.372)	0.963**	(2.564)
lnMV	-0.288***	(-5.546)	-0.288***	(-5.480)	-0.289***	(-5.569)
BTM	117.054**	(2.237)	100.719**	(2.051)	115.317**	(2.200)
ROA	7.454***	(8.686)	7.479***	(8.724)	7.493***	(8.734)
Follow	0.256***	(9.444)	0.250***	(9.150)	0.247***	(9.598)
DaysFF	-0.035***	(-3.409)	-0.033***	(-3.269)	-0.035***	(-3.434)
DaysLF	0.001	(0.077)	0.001	(0.081)	0.001	(0.090)
numFORE	-0.031*	(-1.887)	-0.029*	(-1.753)	-0.032*	(-1.934)
lnExperience	-0.000	(-0.075)	-0.000	(-0.004)	-0.001	(-0.198)
lnBrokerSize	0.033***	(4.624)	0.032***	(4.505)	0.033***	(4.598)
GDPG	0.018*	(1.948)	0.018*	(1.877)	0.017*	(1.853)
tb3ms	0.672	(0.290)	1.710	(0.740)	0.935	(0.404)
IND Year Qtr FE	YES		YES		YES	
Firm Cluster	YES		YES		YES	
N	529,599		528,716		531,598	
Adj. R^2	0.729		0.729		0.730	

Table 9 shows the results of analysts' share adjustment behaviors after the actual repurchase shares become available. Model 1 examines the actual shares repurchased during quarter t (*RepShare*), and how analysts adjust their EPS forecasts for quarter t+1 based on the actual repurchases released in firms' earnings announcements. Model 2 and Model 3 examines whether analysts make regular estimations of the shares to be repurchased based on the two-stage repurchase estimation model used in Hribar et al. (2006) and based on firms' previous quarter's repurchased shares, respectively. Variable definitions are in Appendix A. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively, based on two-tailed tests. The numbers in the parenthesis are t-statistics. t-statistics are based on the standard errors clustered at the firm level.



$ForecastREV\_EarnAnn_{t+1} = (EPS\_PostEarnAnn_{t+1} - EPS\_PreEarnAnn_{t+1}) / Price_{t-1}$

$RepShare_t = Number\ of\ Shares\ Repurchased_t$

$NIREV\_EarnAnn_{t+1} = [EPS\_PostEarnAnn_{t+1} \times (ShareOut_{t-1} - RepShare_t) - EPS\_PreEarnAnn_{t+1} \times ShareOut_{t-1}] / MV_{t-1}$

Figure 2 EPS Revision Timeline – Around Earnings Announcement

Figure 2 shows the timeline this study uses to define analysts' EPS forecast revisions around earnings announcement dates and to estimate the shares to be repurchased for the forecast period t+2. It takes the last EPS forecast before the earnings announcements (*EPS_PreEarnAnn*) and the first EPS forecast after the earnings announcements (*EPS_PostEarnAnn*) to calculate the EPS forecast revisions (*ForecastREV_EarnAnn*). To keep only the analysts that are actively following the repurchase firm, I require the last EPS forecasts before the earnings announcement to be within 90 days; to mitigate the influence of the confounding events on analysts' EPS forecast revisions, I require the first EPS forecast after the earnings announcement to be within 30 days after the announcement.

CHAPTER 6. CONCLUSIONS

This paper examines analysts' EPS denominator forecast behaviors using the repurchase announcement setting. The main findings are as follows. First, analysts revise their estimates of the outstanding shares downward when they make EPS forecasts, based on the expected shares to be repurchased during the analysts' forecast periods. Moreover, when a repurchase announcement has a high common uncertainty, analysts are less likely to incorporate the estimated share changes in their forecast in response to the higher demand from the market, while the length of the relationship between analysts and firms increase the likelihood of the share estimation. Second, this paper finds that impounding the shares estimation into EPS forecasts can increase the EPS forecast accuracy, but the EPS forecasts increase that is induced by the smaller shares scaler reduces the predictive power of analysts' EPS revisions over a firm's future operating performance. Third, analysts rely more on the actual EPS forecast revisions than on the numerator-driven EPS forecast revisions in their target price forecast model, and the market participants fail to process the implications of the denominator-driven EPS forecasts. Taking long and short positions in the top and bottom quintile portfolios based on the denominator-driven EPS forecasts incurs economically significant abnormal returns.

This paper focuses on the one-quarter-ahead EPS forecast because this forecast horizon is relevant to the most recent forecast period and is widely used by the market. Analysts provide forecasts for different forecast horizons, from one to four quarters ahead quarterly forecasts to multiple future years' yearly forecasts. The shorter the period after firms announce repurchases, the smaller the number of shares is to be repurchased. Therefore, the one-quarter-ahead horizon has the lowest power finding analysts estimating

shares to be repurchased in the forecast quarter. Therefore, the results found in this forecast horizon can be generalized to other longer forecast horizons.

This paper contributes to the understanding to an analysts' forecast feature about their estimations of the EPS denominator, which is not covered by the prior literature. It also shows the importance of knowing this feature by comparing the information content of the EPS revisions before and after removing the repurchase induced EPS revisions. Based on the empirical evidence, this paper argues that EPS forecast number providers should report both the numerator and the denominator components of the EPS forecast, especially after the events that may change the number of outstanding shares. The EPS forecast users should also be aware of how much of the EPS change is because of the share changes when they utilize analyst EPS forecasts in making investment decisions.

This paper also has implications for future research. First, prior literature provides mixed evidence regarding whether analysts revise their EPS forecasts upward or downward after repurchase announcements. The summary statistics in this study reveal that the numerator-driven EPS forecast revisions are significantly more negative than the actual EPS forecast revisions, which reveals a possibility of using the numerator-driven EPS forecast revisions to reconcile those mixed findings. Second, there is a widely established literature finding firms opportunistically repurchase shares in order to increase their actual EPS to meet or beat analysts' EPS forecast targets (e.g., Hribar et al. (2006)). Since this study finds that analysts already make shares adjustment in their EPS forecasts, future study can examine whether it is the unexpected repurchases, or the difference between the actual repurchases and the estimable repurchases, drive the possibility of using repurchases to meet or beat earnings targets. Third, both the practice and academia have been criticizing

repurchase firms for spending money on repurchases instead of on investing in employment and potential projects. Moreover, many firms borrow money to repurchase and even financially constraint firms also conduct repurchases, which is inconsistent with the regular conditions for repurchase firms. Based on the results of this study, I propose a possibility that since analysts expect actual repurchases after repurchase announcements by upwardly adjusting their EPS forecasts, the repurchase announcing firms may be pressured to conduct repurchases to meet analysts' expectations, even when they are not in the best condition to conduct repurchases. Furthermore, as discussed in this study, it is difficult for the general market to estimate a firm's actual repurchase implementation before earnings or 10Q/10K is released. Future studies can examine management earnings guidance for repurchase announcing firms and discover whether the guidance provides any information that can help market participants predict firms' repurchase implementation. Researchers can also investigate whether analysts' share adjustment behaviors are influenced by firms' earnings announcement guidance.

Finally, one limitation of this study is that as mentioned in many prior research, analyst forecast behaviors are black boxes. Because I do not have access to the number of shares used in individual analysts' EPS forecasts, I constructed a measure to estimate the shares used in their forecasts. Although I use a small sample to validate this share estimation measure, it will be more convincing if future studies can get individual analysts' EPS forecast reports and find out the actual number of shares used in their forecasts. Also, if researchers can get access to real analysts and conduct surveys, they can ask them the share-estimation related questions to validate the preliminary evidence of analysts' share forecast behaviors found in this study. Even with the limitation, this study takes the first

step and brings out an area that researchers can study and market participants should take into account when they make investment decisions.

APPENDIX A VARIABLE DEFINITIONS

Variables	Definition	DataSource
Dependent Variables		
$EPS\_PreRepAnn_t$	The last quarterly EPS forecast before the repurchase announcement date (within 90 days before the announcement date) for quarter t.	I/B/E/S, SDC
$EPS\_PostRepAnn_t$	The first quarterly EPS forecast after the repurchase announcement date (within 30 days after the announcement date) for quarter t.	I/B/E/S, SDC
$NDEPS\_PostRepAnn_t$	Numerator-driven first EPS forecast after the repurchase announcement date = $EPS\_PostRepAnn_t$ * ($ShareOut_{t-1}$ – $ExpRepShare_t$) / $ShareOut_{t-1}$. *ShareOut* and *ExpRepShare* are defined in the Main Independent Variable section.	I/B/E/S, SDC
$ForecastREV_t$	Actual analyst EPS forecast revisions after the repurchase announcement = [($EPS\_PostRepAnn_t$ – $EPS\_PreRepAnn_t$) / $Price_{t-1}$] ×1,000, where $Price_{t-1}$ is stock price at the end of quarter t–1.	I/B/E/S, SDC
$NDForecastREV_t$	Numerator-driven analyst EPS forecast revisions after the repurchase announcement = [($NDEPS\_PostRepAnn_t$ – $EPS\_PreRepAnn_t$) / $Price_{t-1}$] ×1,000	I/B/E/S, SDC
$Distortion_t$	EPS forecast distortion = Denominator-driven forecast revisions = ($EPS\_PostRepAnn_t$ – $NDEPS\_PostRepAnn_t$)/$Price_{t-1}$.	Compustat
ROA_{t+n}	Future ROA during the n quarters after repurchase announcements, where n = 0, 1, 2, 3. ROA = operating income / total assets.	Compustat
$EPS\_PreEarnAnn_{t+1}$	The last quarterly EPS forecast before the earnings announcement date (within 90 days before the announcement date) for quarter t+1.	I/B/E/S, SDC
$EPS\_PostEarnAnn_{t+1}$	The first quarterly EPS forecast after the earnings announcement date (within 30 days after the announcement date) for quarter t+1.	I/B/E/S, SDC
$ForecastREV\_EarnAnn_{t+1}$	Analyst EPS forecast revision after the earnings announcement = [($EPS\_PostEarnAnn_{t+1}$ – $EPS\_PreEarnAnn_{t+1}$) / $Price_{t-1}$] × 1,000, where $Price_{t-1}$ is stock price at the end of quarter t–1.	I/B/E/S, SDC
$PriceREV_t$	Target price revision = first price forecast after the repurchase announcement minus the last price forecast before the repurchase announcement, divided by the beginning-of-quarter stock price ($Price_{t-1}$).	I/B/E/S
$RecomREV_t$	Recommendation revision = first recommendation after the repurchase announcement minus the last recommendation before the repurchase announcement, times (-1).	I/B/E/S
$Return_{[m1\sim mn]}$	Abnormal buy-and-hold returns from 1 to n months after analyst release the first forecast after repurchase announcements, where n = 3, 6, 9, 12. Abnormal returns = buy-and-hold returns – equal weighted returns.	CRSP
$PerfectREV_t$	Perfect revision after a repurchase announcement = actual EPS – $EPS\_PreRepAnn_t$.	I/B/E/S

APPENDIX A Continued

Variables	Definition	DataSource
Main Independent Variables		
$RepShare_t$	Number of shares repurchased in quarter t.	Compustat
$Announced\ Shares_t$	Announced number of shares to be repurchased in an repurchase announcement in quarter t.	SDC
$Completion\ Ratio_t$	Completion ratio = cumulative repurchase-completion ratio at the forecast quarter end date. Completion ratio is based on the completion schedule from a firm's previous repurchase announcement. First-time repurchasers follow the completion schedule based on their industry average repurchase-completion ratios in the year before the repurchase announcement.	SDC
$ExpRepShare_t$	Analysts' expected number of shares to be repurchased after a repurchase announcement = $Announced\ Shares_t \times Completion\ Ratio_t$.	Compustat, CRSP, SDC
$UnExpRepShare_t$	Unexpected number of shares repurchased = $RepShare_t - ExpRepShare_t$.	Compustat
$NIREV_t$	Net income revision after a repurchase announcement = $\{[EPS\_PostRepAnn_t \times (ShareOut_{t-1} - ExpRepShare_t) - EPS\_PreRepAnn_t \times ShareOut_{t-1}] / MV_{t-1}\} \times 1{,}000{,}000$, where $ShareOut_{t-1}$ is the number of common shares outstanding at quarter t–1 and adds dilution effect for analysts reporting diluted EPS forecasts, and MV_{t-1} is the market value of common equity at quarter t–1. Dilution effect is calculated as the difference between the common shares used in the diluted EPS calculation and the common shares used in the basic EPS calculation.	I/B/E/S, Compustat, CRSP
$lnDaysFollow_{t-1}$	The relationship between an analyst and the manager = natural log of the number of days in which the analyst follows the firm as of quarter t-1.	I/B/E/S
$OverallUncert_{t-1}$	Overall uncertainty that includes the common uncertainty ($CommonUncert_t$) and the uncertainty related to analysts' private information following Barron et al. (1998) and Lehavy et al. (2011) = $(1 - 1/NumAnalyst) \times Dispersion + Accuracy$. *Dispersion* is the standard deviation of analyst forecasts after repurchase announcements.	I/B/E/S
$CommonUncert_{t-1}$	Common uncertainty of a repurchase announcement that is the same to all analyst following Barron et al. (1998) and Lehavy et al. (2011) = $Accuracy - Dispersion/NumAnalyst$.	I/B/E/S
$AnalystUncert_{t-1}$	Idiosyncratic uncertainty related to the private information from analysts = $OverallUncert_t$ - $CommonUncert_t$	I/B/E/S
$ExpRepShareModel_t$	The predicted repurchase dollar value using the two-stage prediction model following Hribar et al. (2006) divided by price. Negative expected repurchases are replaced by 0.	Compustat, CRSP, SDC
$UnExpRepShareModel_t$	Unexpected number of shares repurchased from model estimation = $RepShare_t - ExpRepShareModel_t$.	Compustat
$NIREV\_EarnAnn_{t+1}$	Net income revision after an earnings announcement = $\{[EPS\_PostEarnAnn_{t+1} \times (ShareOut_{t-1} - RepShare_t) - EPS\_PreEarnAnn_{t+1} \times ShareOut_{t-1}] / MV_{t-1}\} \times 1{,}000{,}000$, where $ShareOut_{t-1}$ is the number of common shares outstanding at quarter t–1 and MV_{t-1} is the market value of common equity at quarter t–1.	I/B/E/S, Compustat, CRSP

APPENDIX A Continued

Variables	Definition	DataSource
Control Variables – all control variables in models are lagged variables in quarter t-1		
$CashAsset_{t-1}$	Cash and cash equivalents divided by total assets (Compustat data item "cheq" divided by "atq")	Compustat
$DebtRatio_{t-1}$	The sum of short-term debt (Compustat data item "dlcq") and long term debt ("dlttq") divided by total assets ("atq").	Compustat
$Div/Price_{t-1}$	Common stock dividends per share (Compustat data item "dvpspq") divided by the price per share ("prccq")	Compustat
$DivPayer_{t-1}$	An indicator variable equal to one if the one-quarter-lagged Div/Price ratio for a particular firm is greater than zero (and zero otherwise)	Compustat
$LogAT_{t-1}$	The natural log of firm assets (Compustat data item "atq")	Compustat
$RETE_{t-1}$	Retained earnings (Compustat data item "req") divided by total equity (Compustat data item "teqq")	Compustat
$ROCAA_{t-1}$	Return on Cash-Adjusted Assets; Operating income (Compustat data item "oibdpq") divided by average assets less cash and cash equivalents (average of "atq" over the current quarter minus the average of "cheq" over the current quarter)).	Compustat
$CapExp_{t-1}$	The sum of all capital expenditures (Compustat data item "capxq") over the prior four quarters divided by average assets less cash and cash equivalents (average of "atq" over the current quarter minus the average of "cheq" over the current quarter)) over the prior four quarters.	Compustat
$LogMV_{t-1}$	Natural log of the market value of equity = Log((prc/cfacpr) ×(shrout/cfacshr))	Compustat
BTM_{t-1}	Book value of equity scaled by the market value of equity.	Compustat
ROA_{t-1}	Earnings before interest and taxes scaled by total assets. = ibq/atq	Compustat
$FOLLOW_{t-1}$	Natural log of analyst coverage.	I/B/E/S
$numFORE_{t-1}$	Natural log of the number of times the analyst forecasted the previous quarter's earnings.	I/B/E/S
$DaysFF_{t-1}$ $(DaysLF_{t-1})$	Natural log of the number of days between the analyst's final (first) forecast of the current quarter's earnings and the current quarter's earnings announcement.	I/B/E/S
$Experience_{t-1}$	Natural log of the number of years since the analyst's first forecast in I/B/E/S.	I/B/E/S
$BrokerSize_{t-1}$	Natural log of the number of analysts at the analyst's brokerage.	I/B/E/S
$FpedatsGap_{t-1}$	Natural log of the number of days between the repurchase announcement date and forecast period end date	I/B/E/S, SDC
$GDPG_{t-1}$	Real GDP growth over the one-year-ahead quarter	FRED
$tb3ms_{t-1}$	3-month treasury bill rate	FRED

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