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The role of the business press in the pricing of analysts' recommendation revisions

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Abstract

We investigate the information-dissemination role of the business press by examining the coverage of analyst recommendation revisions. Consistent with the press providing wider dissemination of analyst reports, we find evidence that coverage of analyst recommendation revisions significantly increases the initial market reaction to these revisions and decreases the subsequent price drift. Furthermore, we find that news flash coverage, rather than in-depth coverage, of a recommendation revision drives both the initial market reaction results and drift results. Finally, we show that broader press coverage influences the activities of large-trade institutional investors but not high-frequency traders. Overall, our findings suggest a complementary role between analysts and the business press: increased dissemination of recommendation revisions, rather than information creation on the part of the business press, serves to better inform the market about analyst recommendation revision decisions.

Keywords Analyst recommendations · Business press · Market reactions

JEL Codes M41 · L82 · G14

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1 Introduction

The role of information intermediaries in capital markets has been of fundamental interest in the finance and accounting literatures for decades. Much of this research focuses on the reports of sell-side equity analysts and how security prices reflect their stock recommendations and earnings forecasts (Ivković and Jegadeesh 2004; Asquith et al. 2005; Bradley et al. 2014; also see Schipper 1991 and Bradshaw 2011 for detailed reviews of this literature). More recently, the literature has begun to explore the role of the business press as an information intermediary in capital markets (see, e.g., Fang and Peress 2009; Bushee et al. 2010; Dougal et al. 2012). Research on the business press is important because the press is generally assumed to have a much broader reach than equity research analysts. Further, changes in the equity research regulatory environment, stemming from the Global Analyst Research Settlement, have prompted traditional equity research departments to rely more heavily on institutional investor trading commissions as their primary source of funding, rather than investment banking (Kadan et al. 2009; Groysberg and Healy 2013; Drake et al. 2017. Thus the role of the business press as an information intermediary is likely to have become more important as equity research analysts have focused more of their work on their portfolios of institutional clients.

Against this backdrop, we examine whether the press serves as an information intermediary to what is arguably the most widely recognized information intermediary in the market—equity analysts.[1] We seek to further understanding of how these two important intermediaries impact capital markets. We address four related research questions. 1) Which analyst and informational characteristics are associated with a reporter's editorial decision to cover a particular analyst recommendation revision and forgo others? 2) Given that analyst recommendation revisions are publicly available upon dissemination by the brokerage, does further dissemination by the press promote a more efficient market response to the information in the revision? 3) If reporters add their own editorial content to the analyst recommendation (rather than simply disseminating it), does that help the market more efficiently process the information in the recommendation revision? 4) Which types of professional investors are influenced by increased dissemination?

Our first question explores the determinants of the press's decision to cover an analyst recommendation revision and therefore is largely descriptive in nature. It is important, however, to begin here because the coverage decision is endogenous, and not accounting for the underlying selection will lead to biased estimates in the analyses that address the second and third questions. Thus it is critical to first identify and understand the determinants of this editorial decision.[2]

Our second question examines whether further dissemination of an analyst recommendation revision by the press impacts the market's reaction to the news. Research has examined the role of the press in covering firm-initiated earnings news (e.g., earnings reports and management guidance). This literature generally finds that further

[1] Miller and Skinner (2015) discuss the importance of media and technology in the dissemination of information, the disclosure of firm-specific news, and the interaction between various information intermediaries.

[2] We acknowledge that this has been done previously, most notably by Rees et al. (2015). We discuss this study in more detail later in the paper.

dissemination of earnings news by the press helps price discovery (Drake et al. 2014; Twedt 2016). To date, however, no study has examined whether further dissemination by the press of third-party information (i.e., company outsiders) helps or hinders the pricing dynamic. This nuance is potentially very important. Analyst recommendations differ from reported earnings in that they represent the *opinion* of a particular company *outsider*. Other analysts covering the firm often arrive at different opinions about the prospects of the firm, even though they are using the same set of public information. Thus the level of uncertainty in an analyst recommendation is greater than that in reported earnings. This is not to say that reported earnings are not subject to some level of uncertainty; accounting restatements occasionally occur. Rather, this distinction stems from the fact that reported earnings are subject to independent audits (and quarterly reviews) and regulatory restrictions that carry with them stiff penalties for inaccuracy or misrepresentation.[3] The recommendations of company outsiders, however, are not subject to similar oversight.[4]

Our third research question follows from the work of Drake et al. (2014), which introduces the idea that the press can play either an information-dissemination role by rebroadcasting news, an information-creation role by producing new information content, or both. Here we explore whether the influence of the press on the pricing of analyst recommendation revisions depends on whether reporters are simply repeating elements of the analyst news verbatim or augmenting it with their own editorial content.

Our final research question examines the types of investors that are influenced by broader dissemination of recommendation revisions by the press. Our ability to address this question is subject to an important data limitation. We obtain our business press data from RavenPack's Dow Jones Edition, which captures *professional* press coverage that is targeted primarily at *professional* investors (Drake et al. 2017). Thus our analyses cannot speak to retail investors. We therefore focus on two types of professional investors: (1) institutional investors that execute large trades, and (2) high-frequency traders that use computer algorithms to execute trades. Research is silent as to whether these professional investors are influenced by variation in press coverage of analyst recommendations.

Our empirical analyses are based on 52,783 recommendation revisions from 2000 to 2015. We find that approximately one-fourth of all analyst recommendation revisions are covered by the business press. Furthermore, the vast majority of revisions (97%) are covered in news flashes that contain virtually no editorial content and simply rebroadcast the news. Only a small portion (3%) are covered in full-length articles that often bring together information from a variety of sources, including managers, analysts, and other market participants, and provide readers of the news with editorial content.[5] This

[3] For example, on Aug 7, 2018, Tesla CEO Elon Musk tweeted his intention to take Tesla private at a price of $420 per share. This announcement prompted an immediate double-digit increase in the firm's stock price. He was subsequently removed as chairman of Tesla but allowed to stay on as CEO. In contrast, any number of analysts have made statements of similar magnitude with no SEC involvement. Note that Mr. Musk later recanted this intention.

[4] We acknowledge that managers also disseminate what could be viewed as *opinions* when they issue guidance; however, these disclosures are more costly than a recommendation revision released by an analyst and should therefore be given more weight by the market.

[5] See Appendix B for examples of news flashes and full-length articles.

finding highlights the fact that the press that serves professional investors is primarily engaged in disseminating recommendation revision information to their clients, rather than providing independent commentary. Our determinants analyses reveal that recommendation revisions are more likely to be covered if they are issued by a larger brokerage, if they are issued by a less-busy analyst, or if the analyst's previous revision received coverage. Furthermore, small firms and those with less press coverage are more likely to have their recommendation revisions covered. This result is important because it suggests that the press *steps in* and plays a role as an information intermediary in the settings in which dissemination is most likely to help the market, that is, when the information environment of the firm is weak.

Next, following Twedt (2016), we use the determinants model to address the fact that the reporter's coverage decision is nonrandom. We use two commonly employed techniques. First, we conduct analyses using a propensity-score matched sample that joins recommendation revisions that are similar across the observable determinants associated with press coverage but have different coverage outcomes (i.e., covered versus noncovered). Second, we use the determinants model to estimate a two-stage Heckman selection model. Using both propensity-score matching and the Heckman approach, we find that revisions covered by the press are associated with a significant increase in initial price reaction and a significant decrease in post-revision drift. These results are consistent with the idea that press coverage of analyst recommendation revisions promotes price discovery and leads to more efficient capital market outcomes. In terms of the economic magnitude of the effects, we find that a one standard deviation increase in recommendation changes not covered by the press is associated with an average abnormal stock return of 2.1% over the three days surrounding the date of recommendation. However, a one standard deviation increase in recommendation changes covered by the press is associated with an average abnormal stock return of 3.1% over the same three days. This spread represents a 50% increase associated with press coverage. With respect to the post-recommendation revision drift, we find that a one standard deviation increase in recommendation changes not covered by the press is associated with an average abnormal stock return of approximately 50 (80) basis points over 20 (60) trading days beginning two days after the date of recommendation. However, a one standard deviation increase in recommendation changes covered by the press is associated with an average abnormal stock return of essentially zero over the same 20 or 60 days. Thus it appears that when recommendation revisions are covered by the press, market participants more quickly incorporate this news into a firm's stock price.

We note that a large proportion of recommendations revisions (roughly 40%) happen within one month of an earnings announcement. This makes interpreting results potentially problematic, because any changes in stock price could arise from information contained in an earnings announcement, which then precipitates a revision. To isolate the effects of press coverage from the effects of earnings announcements, we include an indicator equal to one for all revisions that occur within one month of an earnings announcement in our models. In more restrictive tests, we exclude all revisions within one month of an earnings announcement. In both cases, our results hold.

Our next set of tests investigates the information-dissemination versus information-creation role of the press in the context of recommendation revisions. Here we find that the larger initial reaction and smaller drift are driven exclusively by news flashes, and there is no significant effect when full-length articles are released. These results are

consistent with prior literature, which finds that broader dissemination by the press promotes more efficient capital market outcomes, but they are inconsistent with the notion that additional press commentary promotes similar increases in efficiency.

Our final set of tests explores which types of professional investors are influenced by press coverage of recommendation revisions. We find results consistent with increased large-trade institutional investors trading following recommendation revisions that are covered by the media and no differential trading activity for high-frequency traders. These results are consistent with large institutional investors having their attention drawn to recommendation revisions that are covered in the press and then trading on this new information.

This study contributes to the literature in several ways. First, we contribute to the emerging literature that investigates the impact of the business press on capital markets by examining how coverage decisions influence the pricing of analyst information. Research in this area examines the media's familiarity with certain analysts and how this familiarity impacts the market reactions to analyst reports and the career outcomes of the analysts (Bonner et al. 2007; Rees et al. 2015). The focus of these studies is on full articles in the print media that cite or discuss a specific analyst. Importantly, the media coverage examined in this work is focused on the *people* involved. Our study contributes to this line of research by shifting the focus of the press coverage to the analyst's *report*, while controlling for the media's familiarity with any particular analyst. We further extend the literature by examining news flashes that are pushed to professional investors immediately after the analyst report is made public; the primary role of such news flashes is to disseminate, rather than create, information. Our analyses shift the timing of the press coverage from an analysis of market reactions influenced by *prior* press coverage (Bonner et al. 2007; Rees et al. 2015) to those influenced by *concurrent* press coverage. Finally, we extend this line of research by examining the types of professional investors (i.e., institutional investors and high-frequency traders) that are influenced by the press coverage.

We also provide further support for the idea that the benefit of press coverage arises from the broader dissemination of information (consistent with the work of Drake et al. 2014 and Twedt 2016), rather than through analysis and creation of new information. Our findings reveal a general lack of interest by the business press in providing editorial commentaries about the recommendation, which may suggest that the reporters either generally agree with the analyst revision or do not have the expertise, time, or interest to provide further commentary.[6] Thus the addition of editorial commentary by the reporter may capture cases where there is a greater level of uncertainty or disagreement. We leave more in-depth examination of this phenomenon to future researchers.

Finally, our study contributes new evidence on the topic of price formation. Our results are consistent with the ideas expressed by Lee (2001) that prices do not converge to fundamental value by fiat but rather require the time and effort of various market participants. Our findings suggest that price formation is more efficient when information intermediaries act in concert to more broadly disseminate the news. A large

[6] Untabulated results indicate that full coverage is more likely when a recommendation revision differs greatly from the consensus recommendation. In our manual inspection of full-length articles, we observe that these articles generally agree with the analysts' recommendations but provide more in-depth explanations of why the analysts chose to revise their recommendations.

body of research investigates the impact of sell-side analysts in capital markets, and a much smaller, separate line of research investigates the role of the business media. Our study is among the first to examine the *interplay* between these two important information intermediaries. We identify a situation in which the activities of analysts and reporters create helpful synergies; broader dissemination of recommendation revisions by the press appears to magnify the benefits of analysts' reports. This finding contrasts with conventional wisdom that the business press and analysts act as substitutes (Fang and Peress 2009).

The rest of the paper is organized as follows. Section 2 reviews the literature and develops hypotheses. Section 3 outlines our research design. Section 4 discusses the data and reports our findings. Section 5 concludes.

2 Literature review and hypotheses

A long line of literature examines the relation between dissemination and capital market outcomes. In perfectly efficient markets, broader dissemination of information will not affect price discovery because, once released, the information will instantaneously be transferred to all market participants and impounded into price (Merton 1987). However, theoretical work has demonstrated that, when information transfer is not instantaneous, the release of information will lead to different information sets across different investors (Bloomfield 2002; Hirshleifer and Teoh 2003). Because price can be seen as the weighted average of investor beliefs and information is gradually incorporated into price, broader dissemination will, in theory, act to homogenize investor information sets and lead to less disagreement and more efficient pricing (Grossman and Stiglitz 1980; Hong and Stein 1999).

On the whole, the literature provides mixed evidence on whether broader dissemination of accounting information leads to more efficient capital market outcomes, though the evidence from the more recent studies generally suggests that it does. Chan (2003) documents significant drift in stock prices after the publication of press articles, particularly when the news is bad, and Vega (2006) finds that firms with more recent press coverage experience greater post-earnings announcement drift. In contrast, Peress (2008) finds that press coverage of earnings announcements reduces drift, although this effect decreases with the number of other firms covered by the press on the same day. Bushee et al. (2010) find that greater press coverage reduces information asymmetry. Drake et al. (2014) provide evidence that press coverage alleviates certain types of mispricing (i.e., cash flow mispricing) but not other types (i.e., accrual mispricing). Finally, Twedt (2016) finds that press coverage of management earnings guidance increases the speed with which prices reflect the guidance information.

Note that research has generally examined press coverage of *firms'* disclosures of key financial information, such as realized earnings or management guidance. In contrast, this paper focuses not on the dissemination of earnings information by managers but rather on the dissemination of *opinions* expressed by firm *outsiders*, sell-side analysts, in their stock recommendations. These recommendations reflect the opinion of a particular individual, and the views expressed can vary from those of other analysts who cover the same company and base their analyses on a similar public information set.

Ex ante, it is unclear whether broader dissemination of analyst recommendations will lead to more or less efficient pricing. The more recent studies discussed above generally provide evidence that broader dissemination of a firm-initiated disclosures, such as earnings, is associated with positive capital market effects (e.g., Twedt 2016). Thus it may be that the dissemination effects would also be observed for analyst recommendation revisions. The rationale here is similar to that proposed elsewhere. That is, broader dissemination of value-relevant information, such as analyst recommendations, should increase the visibility of this information to traders, which will reduce information acquisition costs and lead to more efficient pricing (Grossman and Stiglitz 1980; Bloomfield 2002; Drake et al. 2014). There are, however, important differences between firm-initiated disclosures of earnings information disseminated to investors and information produced by firm outsiders (i.e., financial analysts). We argue that these differences could have the opposite effect and lead to less efficient pricing. This prediction is motivated by several factors.

First, the market signal associated with analyst recommendations is noisier than that of firm-generated financial information, because analysts have carte blanche to say whatever they want. Firm managers, on the other hand, are subject to legal and regulatory restrictions on what they disclose and how. This represents a unique feature of analyst recommendations, in contrast to firm-generated press releases. This distinction matters because analysts are not legally obligated to report fully or truthfully, if their incentives are not aligned with the incentives of investors. This leads to a loss of information and a decrease in the perceived precision of analyst research (Fischer and Stocken 2001; Morgan and Stocken 2003; Fischer and Stocken 2010). Analysts may choose to withhold some private information or release a noisy signal, because of desires to curry favor with management (Lim 2001) or incentives to garner investment banking business (Beyer and Guttman 2012).

While untruthful or inaccurate disclosures are almost always costly to managers (Beyer et al. 2010), it is not clear whether inaccurate opinions are costly to analysts. In fact, the evidence of Groysberg et al. (2011) suggests that stock recommendation performance and forecast accuracy have little bearing on the compensation of analysts. Survey evidence also indicates that analysts are not compensated primarily for the performance of their recommendations but instead are compensated largely according to their industry knowledge (Brown et al. 2015).[7] Analysts self-report that issuing forecasts well below consensus, which will influence their recommendations, can increase their credibility with their clients. When this is combined with the fact that analysts also have incentives to curry favor with management (their primary source of private information) by issuing optimistic recommendations, it is less clear that the net effect of these recommendations is to promote a stronger and clearer information environment.

Second, it is important to recognize that the literature provides mixed evidence regarding the informativeness of analyst recommendations to investors in the first

[7] We also acknowledge that analysts face clear career incentives to issue useful research (Hong et al. 2000; Hong and Kubik 2003). However, these career concerns appear to be secondary to characteristics like optimism and industry knowledge (more optimistic analysts are more likely to be promoted). These studies further highlight the conflicts analysts face when making their recommendations, and they make it less clear whether broader dissemination of these recommendations will be a net benefit for the pricing of securities. Furthermore, Brown et al. (2015) demonstrate that mutual fund managers herd on recommendations, and this herding has proved to be price destabilizing as mutual funds hold a higher level of stock.

place. While research, including by Womack (1996), Bradley et al. (2014), and Li et al. (2015), provides evidence that recommendations are informative, other studies, such as by Altinkilic and Hansen (2009) and Chen et al. (2005), provide conflicting evidence. In addition, Loh and Stulz (2011) show that only 12% of recommendation revisions in their sample trigger significantly large market reactions and that influential recommendation changes come only from a subset of skilled analysts.

Third, in addition to the uncertain nature of analyst recommendations and inevitable disagreement among analysts, the coverage decisions of the business press could result in greater disagreement among investors. The coverage decisions of reporters are a function of their incentives to write articles about a particular recommendation.[8] One of the main objectives of the press is to attract greater readership and thereby maximize subscription and advertising revenues (Bushee et al. 2010). The press could accomplish this objective by covering recommendations that strongly diverge from consensus and thus are more newsworthy. This, in turn, could result in a broader dissemination of less informative recommendations, which could trigger correlated trading in certain classes of investors (e.g., retail investors) who are less equipped to evaluate the informativeness of the recommendation. This sort of trading could impede price discovery (Drake et al. 2017).

Given the preceding discussion, it is unclear whether broad dissemination of analyst recommendations by the business press will lead to more or less efficient pricing. Thus whether the press plays a role in the pricing of opinions issued by analysts is an open empirical question that leads to our first two hypotheses, stated as follows in the null form.

- *H1: The initial stock market reaction to recommendation revisions is no different when these revisions are covered by the business press.*

- *H2: Press coverage of recommendation revisions does not influence post-recommendation revision drift.*

When covering a recommendation revision, reporters choose whether to simply pass on the key information via a news flash (dissemination) or to add editorial comments or analysis via a full article. In the case of flash coverage, the capital market benefits stem from the idea that the news flash makes the news—in this case, the analyst recommendation revision—more visible to more investors (Soltes 2010; Li et al. 2011; Drake et al. 2014). In addition to providing these broader dissemination benefits, full news articles could communicate supplemental information to the market. Full new articles that appear in print media (e.g., *The Wall Street Journal*) are also more likely to be consumed by nonprofessional investors who do not have access to news flashes. While research provides evidence that reporters do generate value-relevant information (Miller 2006), it is still unclear whether the additional information provided by the reporter helps or hinders the processing of the analyst revision. Bushee et al. (2010) find that media editorials increase information asymmetry around earnings announcements. Drake et al. (2014) find no evidence that additional editorial content helps in the pricing of accounting information disclosed with earnings announcements. Amiram et al. (2016) suggest that new information can either increase or decrease information

[8] In fact, the business press does not cover all the recommendations issued. Table 2 Panel A shows that only about 25% of recommendation revisions receive coverage.

asymmetry, depending on an investor's information set. Overall, it is not clear which role (if any) the press plays in influencing the incorporation of recommendation revisions into prices. This leads to our third hypothesis.

- *H3: The way in which the business press disseminates recommendation revisions (via flash or full coverage) does not influence any observed coverage effects*

3 Research design

3.1 Determinants of business press coverage of analyst recommendations

To examine the determinants of the press coverage of analysts' recommendations, we estimate the following logistic regression, with standard errors clustered by firm and quarter.[9]

$$\begin{aligned} Pr(Press\_Cover = 1)_t = {} & \alpha_0 + \alpha_1 Abs\_Recommendation\_Change_t + \alpha_2 AllStar_t \\ & + \alpha_3 Forecast\_Accuracy_t \\ & + \alpha_4 Recommendation\_Horizon_t + \alpha_5 Firm\_Experience_t \\ & + \alpha_6 General\_Experience_t + \alpha_7 Broker\_Size_t \\ & + \alpha_8 Industry\_Coverage_t + \alpha_9 Firm\_Coverage_t \\ & + \alpha_{10} Prior\_Press\_Cover\_Analyst_t \\ & + \alpha_{11} ABS\_ABN\_RET_t + \alpha_{12} ABN\_TURN_t + \alpha_{13} SUE_t \\ & + \alpha_{14} LNMVE_t + \alpha_{15} MTB_t + \alpha_{16} LNANALYST_t \\ & + \alpha_{17} INST\_HOLD_t + \alpha_{18} LNEMPLOYEE_t \\ & + \alpha_{19} LNOWN_t + \alpha_{20} Qt1\_TURN_t + \alpha_{21} Qt1\_VOLAT_t \\ & + \alpha_{22} Prior\_Press\_Cover\_Firm_t + \alpha_{23} SP1500_t + \varepsilon_t \quad (1) \end{aligned}$$

where *Press_Cover* is an indicator variable equal to 1 if an analyst's recommendation is covered by the business press and 0 otherwise. We include a very broad set of analyst- and firm-level characteristics that could be associated with the probability that the press will cover analysts' recommendations. We acknowledge that, while our approach is largely exploratory, our objective here is to explain as much of the variation in the reporter's endogenous decision to cover a particular recommendation as possible, as the model constitutes the first stage in both the Heckman selection model and the propensity-score matched model. First, Rees et al. (2015) find that the press is more likely to quote analysts who have characteristics that research finds to be associated with the *quality* of the analyst. Accordingly, we control for *Institutional Investor* All

[9] Inferences remain unchanged when we use probit regression, instead of logistic regression.

Stars (*AllStar*), the accuracy of the analyst in predicting the firm's prior quarter earnings (*Forecast_Accuracy*), the analyst's firm-specific and general experience (*Firm_Experience, General_Experience*), the brokerage resources available to the analysts (*BrokerSize*), and the timeliness of the analyst's recommendations (*Recommendation_Horizon*). We also include two analyst characteristics associated with analyst busyness, which may indicate poorer quality reports by capturing variation in the relative number of industries an analyst covers (*Industry_Coverage*) and the relative number of firms an analyst covers (*Firm_Coverage*) (e.g., Mayew 2008).

To capture variation in analyst characteristics, we follow Clement and Tse (2005) and scale each of the continuous characteristic variables to range from 0 to 1, using a transformation that preserves the relative distances among each characteristic's measures for firm j in quarter t. The relative measures of the analyst characteristics take the following form.

$$Characteristics_{j,t} = \frac{Characteristic\_raw_{i,j,t} - min\left(Characteristic\_raw_{j,t}\right)}{max\left(Characteristic_{raw\,j,t}\right) - min\left(Characteristic\_raw_{j,t}\right)},$$

where high $Characteristic_{i,\ j,\ t}$ values indicate that analyst i scores high on *Characteristic_raw*, relative to other analysts who follow firm j in quarter t.[10] We also control for the celebrity status of the analysts. Bonner et al. (2007) find that the press tends to focus on a subset of celebrity analysts, whom they identify using media coverage of the analyst. We proxy for this potential status by identifying whether any recommendation for any firm that is issued by an analyst is covered by the business press at least once during the 30 days prior to the date of his or her current recommendation for a firm (*Prior_Press_Cover_Analyst*).

Next, we include three variables that capture the magnitude of the information content of the recommendation revision. Information demand from investors may be higher for analyst recommendations that have greater information content. We capture the information content of recommendations by including the absolute value of recommendation changes (*Abs_Recommendation_Change*), absolute value of abnormal stock returns around recommendation dates (*ABS_ABN_RET*), and abnormal share turnover around recommendation dates (*ABN_TURN*).

We also control for a broad set of firm- and industry-level variables that are potentially correlated with the information environment of the firm. We include earnings surprise (*SUE*), because recent research finds that post-earnings announcement drift relates to press coverage (Vega 2006; Peress 2008; Drake et al. 2014). We include firm size (*LNMVE*) to control for market demand for information about the firm (Bushee et al. 2010). We include analyst following (*LNANALYST*), because some argue that analyst and press coverage are substitutes (Fang and Peress 2009). Thus *LNANALSYST* controls for the potential effect of analyst coverage on press coverage. Because institutional investors are the major clientele of newswires (Soltes 2010), recommendation revisions for firms with greater institutional ownership will be more likely to receive coverage. We therefore include the percentage of institutional ownership (*INST_HOLD*). To control for growth opportunities, we include market-to-book ratio (*MTB*).

[10] As a robustness test, we also use the sample means/medians in computing the relative analyst characteristics and obtain similar results (untabulated).

Finally, the amount of attention a firm receives may also be associated with the press coverage decision. We include three proxies for investor attention: prior quarter stock-return volatility (*Qt1_VOLAT*), prior quarter market-adjusted share turnover (*Qt1_TURN*), and membership in the S&P 1500 (*SP1500)* (Li et al. 2011). We also include a proxy for the amount of attention a firm receives from the general press. Specifically, we include the firm's recent general coverage in the business press during the prior month (*Prior_Press_Cover_Firm*). All variables are measured at fiscal quarter *t*, prior to the revision announcements.

3.2 Selection bias

Prior literature documents that press coverage is not random (Bushee et al. 2010; Soltes 2010), so observable and unobservable factors related to the decision to cover a particular analyst recommendation revision may be associated with the stock market pricing of the information released in the recommendation revision announcements. To alleviate this potential selection bias, we employ two methods common in the literature: the Heckman selection model and propensity-score matching.

In the first stage of the Heckman method, we model the likelihood that an analyst recommendation revision receives coverage in the press using a logistic regression. We first estimate the model for press coverage, regardless of the type of coverage, using the dependent variable, *Press_Cover*. Then, following Drake et al. (2014), we investigate press coverage through news flashes and full articles separately, because the type of coverage may be determined by a different weighting of factors. To estimate the model for news flash coverage (full article coverage), we use a dependent variable, *Flash_Cover* (*Full_Cover*), an indicator variable equal to 1 if an analyst recommendation is covered in a news flash (full article) disseminated by the press and 0 otherwise.

The Heckman selection model requires an instrument to satisfy the exclusion restriction. This instrument must be an exogenous variable included in the first-stage model that is assumed not to affect the dependent variables in the second-stage regressions. Following Drake et al. (2014), we use press coverage of the prior year's earnings announcement for firm *i* (*Prior_Press_Cover_EA*) as our instrument, because the coverage of the prior year's earnings announcement is likely to be associated with coverage of current analyst recommendation revisions, but it is unlikely to affect future stock returns due to its lagged nature. We estimate an expanded version of Eq. (1), which adds the instrument to the equation, and then calculate the inverse Mills ratio (*InverseMills*), which is included in the second-stage regressions. We replace the dependent variable in Eq. (1) with *Flash_Cover* and *Full_Cover* and repeat this estimation procedure to compute the inverse Mills ratio separately for the news flash and full article coverage models, respectively.[11]

[11] Following the recommendations of Lennox et al. (2012), we conduct additional tests to determine the validity of this instrument. In untabulated results, we test the exclusion restriction. First, we verify that our instrument (coverage of the prior period earnings announcement) is associated with press coverage of current analyst recommendation revisions but not with current stock returns on the date of the revisions and the post-recommendation revision return drift. Second, we also sequentially estimate the logit model in Panel B of Table 3, with one control variable being omitted each time, and find that our results are unaffected. Third, following Bushee et al. (2003), we remove all control variables from the model (except the instrumental variable) and again find that our inferences are unaffected.

Second, we also employ propensity-score matching to identify a sample of recommendation revisions that did not receive newswire coverage (the control group) but are otherwise similar across observable dimensions to the recommendation revision that received the coverage (the treatment group). To do this, we estimate Eq. (1) on our sample of 52,783 recommendation revision observations. We then match (without replacement) each recommendation revision observation that received newswire coverage with a noncovered recommendation revision from the same year that has the closest propensity score within a maximum distance of 1%. This procedure yields 16,567 observations in the covered sample and 16,567 observations in the noncovered matched sample.

3.3 Tests of hypotheses

To test whether the initial market reaction to recommendation revisions is greater when the revisions are covered in newswires (H1), we estimate the following OLS regression with standard errors clustered by firm and quarter.[12]

$$\begin{aligned} Abn\_Return(-1,+1)_t = {} & \gamma_0 + \gamma_1 Recommendation\_Change_t + \gamma_2 Press\_Cover_t \\ & + \gamma_3 Recommendation\_Change_t * Press\_Coverage_t \\ & + \gamma_4 AllStar_t + \gamma_5 Forecast\_Accuracy_t \\ & + \gamma_6 Recommendation\_Horizon_t + \gamma_7 Firm\_Experience_t \\ & + \gamma_8 General\_Experience_t + \gamma_9 Broker\_Size_t \\ & + \gamma_{10} Industry\_Coverage_t + \gamma_{11} Firm\_Coverage_t \\ & + \gamma_{12} Prior\_Press\_Cover\_Analyst_t + \gamma_{13} ABS\_ABN\_RET_t \\ & + \gamma_{14} ABN\_TURN_t + \gamma_{15} SUE_t + \gamma_{16} LNMVE_t + \gamma_{17} MTB_t \\ & + \gamma_{18} LNANALYST_t + \gamma_{19} INST\_HOLD_t \\ & + \alpha_{20} LNEMPLOYEE_t + \gamma_{21} LNOWN_t + \gamma_{22} Qt1\_TURN_t \\ & + \gamma_{23} Qt1\_VOLAT_t + \gamma_{24} Prior\_Press\_Cover\_Firm_t \\ & + \gamma_{25} SP1500_t + Industry\ Fixed + Quarter\ Fixed + \end{aligned} \quad (2)$$

where *Abn_Return(−1, +1)* is the raw buy-and-hold stock return over (t = −1, +1) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same three days (t = 0 is the date of the recommendation revision). The variable of interest is the interaction between *Recommendation_Change* and *Press_Cover*, where *Recommendation_Change* is the signed change of recommendations and *Press_Cover* is an indicator variable equal to 1 for recommendations that received newswire coverage and 0 otherwise. If the initial stock market reaction to

[12] In all regressions, we use fiscal quarter fixed effects. The results hold when we use calendar quarter fixed effects.

recommendation revisions covered in newswires is greater than those not covered, we expect the coefficient of that interaction (γ_3) to be significantly positive. We include all of the determinants from the first-stage model into the model as control variables. (See appendix 1 for variable definitions.)

Next, to test whether press coverage alleviates the post-recommendation revision drift (H2), we estimate the following OLS regression with standard errors clustered by firm and quarter.

$$\begin{aligned} Abn\_Return(+2,+20\ or\ +2,+60)_t = {} & \delta_0 + \delta_1 Recommendation\_Change_t \\ & + \delta_2 Press\_Cover_t \\ & + \delta_3 Recommendation\_Change_t * Press_{Cover\,t} \\ & + Control\ Variables + Industry\ Fixed \\ & + Quarter\ Fixed + \vartheta_t, \end{aligned} \tag{3}$$

where *Abn_Return(+2, +20 or + 2, +60)* is the raw buy-and-hold stock return over (t = +2, +20 or + 2, +60) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same three days. (t = 0 is the date of the recommendation revision.) Consistent with our second hypothesis, if the business press coverage contributes to alleviating the drift, we expect the coefficient of the interaction between *Recommendation_Change* and *Press_Cover* (δ_3) to be significantly negative. Control variables in Eq. (3) are the same as those in Eq. (2).

Lastly, to test whether the effects of the press coverage on the stock market pricing of recommendation revisions arise mainly from its information-dissemination role or its information-creation role (H3), we estimate the following OLS regression with standard errors clustered by firm and quarter.

$$\begin{aligned} & Abn\_Return(-1,+1,+2,+20\ or\ +2,+60)_t \\ & = \omega_0 + \omega_1 Recommendation\_Change_t + \omega_2 Flash\_Cover_t + \omega_3 Full\_Cover_t \\ & \quad + \omega_4 Recommendation\_Change_t * Flash_{Cover\,t} \\ & \quad + \omega_5 Recommendation_{Change_t} * Full_{Cover\,t} + Control\ Variables \\ & \quad + Industry\ Fixed + Quarter\ Fixed + \nu_t, \end{aligned} \tag{4}$$

where *Abn_Return(−1, +1, +2, +20 or + 2, +60)* is the raw buy-and-hold stock return over (t = −1, +1, +2, +20 or + 2, +60) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same period. (t = 0 is the date of the recommendation revision.) *Flash_Cover* (*Full_Cover*) is an indicator variable equal to 1 if a recommendation is covered in a news flash (full article) disseminated and 0 otherwise. If the press coverage affects the stock market through its dissemination (creation) role, we expect the coefficient of the interaction between *Recommendation_Change* and *Flash_Cover* (*Full_Cover*) to be significantly positive in the initial stock market reaction tests

and significantly negative in the post-recommendation revision drift tests. Control variables in Eq. (4) are the same as those in Eq. (2).

We estimate Eqs. (2), (3), and (4) using the full sample, the Heckman two-stage method, and the propensity-score matched sample. When we estimate these three models using the Heckman method, we include *InverseMills* as an additional control variable as part of the Heckman selection model. When we estimate the models using the propensity-score matched sample, we exclude *InverseMills* from the model.

4 Empirical results

4.1 Data and sample

We test our predictions using business press data from RavenPack's Dow Jones Edition. This dataset includes the full Dow Jones news archive, which consists of all Dow Jones Newswires and *Wall Street Journal* articles and identifies whether a particular article relates to firm-specific events, such as earnings announcements (examined in prior research) or analysts' recommendation revisions (our focus).[13] We obtain data on analysts' recommendations from the Institutional Brokers Estimate System (I/B/E/S). We focus on recommendation revisions and not the recommendation levels, because prior research shows that recommendation changes are more informative to markets (e.g., Boni and Womack 2006; Jegadeesh and Kim 2010). We obtain financial statement data from Compustat, stock returns and volume data from the Center for Research in Security Prices (CRSP), and data on institutional ownership from Thomson Reuters.

To construct our sample, we first collect from I/B/E/S all the recommendations issued between 2000 and 2015. We begin our sample in 2000, because RavenPack provides data from January 1, 2000. We then compute recommendation revisions and exclude reports with missing revisions. After merging these revisions with data from the CRSP/Compustat Merged Database, we have a total of 315,266 recommendations. We then apply additional procedures to identify recommendations covered by the press, which we denote as *Covered*, and recommendations not covered by the press, which we denote as *Not Covered*.[14]

We construct the *Covered* sample as follows. First, because RavenPack's firm identifier is the ISIN, we require each firm-recommendation observation to have a nonmissing ISIN in Compustat. Second, to match each recommendation revision to the article that covered that revision, we require that 1) each article have the same

[13] The Dow Jones news archive has been used in numerous accounting and finance studies (e.g., Barber and Odean 2007; Tetlock 2010; Drake et al. 2014).

[14] This identification is complicated by the fact that RavenPack does not include the level of recommendation or the identity of the brokerage or analyst, so we cannot match the article to each recommendation in cases where there are multiple recommendations by different brokerages for a given firm within a short period. However, RavenPack includes the direction of the recommendation revision and provides the article's headline, which includes a brokerage name. We manually read the headline to extract a brokerage name and use the name as well as the direction of the revision to identify the article that actually covered the revision.

ISIN as that for each firm-recommendation, 2) each article report the same direction of the revision as the actual revision, and 3) each article be issued within two days of the revision date.[15] These requirements remove 175,182 recommendations (= 362 + 174,820), leaving 140,084 matched recommendations. Next, we manually read the headline of each of the articles matched to each recommendation from the second step to check whether the brokerage name mentioned in the headline is the same as that issuing the actual recommendation.[16] This procedure removes an additional 60,033 recommendations. Lastly, we exclude reiterated recommendations and require nonmissing variables used in the determinants model, which removes 57,700 recommendations. This leaves 22,351 recommendation revisions covered by the press.

To construct the *Not Covered* sample, we first exclude those covered revisions (80,051 recommendations) from the total revision sample merged with Compustat (315,266 recommendations) and then further exclude 31 revisions, due to unidentifiable brokerage names. After requiring no reiterated recommendations and nonmissing determinants and control variables, we have a total of 30,432 recommendation revisions not covered by the press. In total, we use 52,783 recommendation revisions (22,351 + 30,432) in our determinants model. Table 1 provides a detailed description of how we arrive at our final sample.

4.2 Distribution of analysts' recommendation revisions

Table 2, Panel A, shows that about 25% of analysts' recommendation revisions are covered in the press. Panel B of Table 2 shows that about 97% of the revisions are covered in news flashes, and only 3% are covered in full articles. This suggests that a majority of the coverage in our sample rebroadcasts the basic information about the revisions, such as the identity of the brokerage and the direction of the revision, without providing any additional editorial content or analysis.[17] Panel C of Table 2 presents the percentage of upgrades, downgrades, and reiterations for all and covered revisions. Two findings are noteworthy here. First, we observe more downgrades than upgrades both in the full set of revisions and in the covered revisions. Second, the percentage of reiterations for covered revisions is much smaller than that for all revisions. Panel D of Table 2 reveals that among the covered revisions, news flashes cover more downgrades than upgrades (53.74% for downgrades versus 49.12% for upgrades), whereas full articles cover more upgrades than downgrades (52.38% for upgrades versus 47.84% for downgrades).

[15] Bradley et al. (2014) show that, for a significant portion of recommendations covered in newswires, the reported I/B/E/S time stamp is delayed, relative to the newswire stamp, on average, by about 3.7 h with a median of 1.6 h. We therefore make the simplifying assumption that any article that mentions an analyst's recommendation revision for a firm within two days of the revision date relates to that revision. To ensure an unambiguous match, we manually read all the headlines of articles matched to each recommendation in the second step.

[16] This task was accomplished with the help of four research assistants, who manually read and matched (confirmed) each headline.

[17] Drake et al. (2014) note that about 68% of earnings announcements are covered in news flashes, which is lower than the news-flash coverage of analyst recommendation revisions. This finding suggests that for earnings announcements (as opposed to analysts' recommendations), the media is more likely to immediately produce and disseminate additional related content than to simply repeat basic facts about earnings.

Table 1 Sample Composition

Total I/B/E/S recommendations issued between 2000 and 2015	517,528	
Missing recommendation revisions	(177,430)	
Exclude recommendation revisions not merged to Compustat	(24,832)	
Total recommendation revisions merged to Compustat		315,266
	Covered	
Exclude recommendation revisions for firms without ISIN on Compustat	(362)	
Exclude recommendation revisions not covered by any article that has the same ISIN, reports the same direction of revisions, and is issued within two days around recommendation dates	(174,820)	
Exclude recommendation revisions that cannot be matched to any article due to different or unidentifiable brokerage names	(60,033)	
Recommendation revisions covered by the business press		80,051
Exclude reiterated recommendations	(2227)	
Missing determinant and control variables used in the determinants model	(55,473)	
Final recommendation revisions covered by the business press		22,351
	Not Covered	
Exclude recommendation revisions covered by the business press	(80,051)	
Exclude recommendation revisions that cannot be matched to any article due to unidentifiable brokerage names	(31)	
Recommendation revisions not covered by the business press		235,184
Exclude reiterated recommendations	(73,009)	
Missing determinant and control variables used in the determinants model	(131,743)	
Final recommendation revisions not covered by the business press		30,432
Final sample used in the determinants model		52,783

4.3 Determinants of the business press coverage of analysts' recommendation revisions

Table 3, Panel A, provides descriptive statistics of determinants and control variables in Eq. (1). The mean of *Press_Cover* for our sample is 0.423, which indicates that, out of 52,783 recommendation revisions, 42.3% (i.e., 22,327 revisions) are covered in the press. The mean (median) of *Abs_Recommendation_Change* is 1.399 (1), which indicates that on average, recommendation revisions reflect an upgrade or downgrade of approximately one level. We also find that approximately 8.9% of analysts in our sample are *AllStar* analysts, and about 76% of our sample firms are members of the S&P 1500 stock index.

Column (1) in Panel B of Table 3 presents the results of estimating Eq. (1). Columns (2), (3), and (4) report the results from estimating an expanded version of Eq. (1), which adds the instrumental variable *Prior_Press_Cover_EA* as part of the Heckman selection model. Column (1) reveals that analyst recommendations are

Table 2 Distribution of Analysts' Recommendation Revisions

Panel A: Percentage of Recommendation Revisions Covered versus Not Covered

	Frequency	Percentage
Covered	80,051	25.39%
Not Covered	235,184	74.61%
Total	315,235	100%

Panel B: Percentage of Recommendation Revisions Covered in News Flashes versus Full Articles

	Frequency	Percentage
News Flash	77,716	97.1%
Full Article	2335	2.92%
Total	80,051	100%

Panel C: Percentage of Recommendation Revisions for All versus Covered

Recommendation Revision	All		Covered	
	Frequency	Percentage	Frequency	Percentage
Up	109,286	34.67%	37,167	46.43%
Down	130,713	41.47%	40,657	50.79%
Reiterate	75,236	23.87%	2227	2.78%
Total	315,235	100%	80,051	100%

Panel D: Percentage of Recommendation Revisions for Covered: News Flashes versus Full Articles

Recommendation Revision	News Flash		Full Article	
	Frequency	Percent	Frequency	Percent
Up	35,949	49.12%	1218	52.38%
Down	39,545	53.74%	1112	47.84%
Reiterate	2222	2.86%	5	0.21%
Total	77,716	100%	2335	100%

more likely to be covered when they are issued by analysts who work for larger brokerages and cover fewer companies. We also find that the press is more likely to cover revisions issued by analysts whose recommendations have been covered in the past. Interestingly, we find that the coefficient on *General_Experience* is negative and the coefficient on *Industry_Coverage* is positive. These findings suggest that recommendations issued by analysts who are more experienced and cover fewer industries are less likely to be covered. This result is unexpected and warrants further investigation. In untabulated analysis, we find that *General_Experience* (*Industry_Coverage*) is highly correlated with *Firm_Experience (Firm_Coverage)*. When *Firm_Experience (Firm_Coverage)* is removed from the regression, the coefficient on *General_Experience* (*Industry_Coverage*) is no longer significant. With respect to firm-level characteristics, we find that smaller firms and those with more negative earnings surprise and greater institutional holdings are more likely to have their recommendation revisions covered by the press.

Table 3 Determinants of the Business Press Coverage of Analysts' Recommendation Revisions

Panel A: Descriptive Statistics

Variable Name	Obs	Mean	Q1	Median	Q3	Std.
Press_Cover	52,783	0.423	0	0	1	0.494
Prior_Press_Cover_EA	52,783	0.907	0	1	1	0.290
Recommendation_Change	52,783	−0.113	−1	−1	1	1.491
Abs_Recommendation_Change	52,783	1.399	1	1	2	0.530
AllStar	52,783	0.089	0	0	0	0.285
Forecast_Accuracy	52,783	0.681	0.500	0.772	0.926	0.297
Recommendation_Horizon	52,783	40.572	6	42	69	31.340
Firm_Experience	52,783	0.392	0.133	0.316	0.600	0.321
General_Experience	52,783	0.292	0.136	0.250	0.393	0.207
BrokerSize	52,783	0.355	0.115	0.252	0.585	0.291
Industry_Coverage	52,783	0.160	0.067	0.133	0.211	0.132
Firm_Coverage	52,783	0.215	0.143	0.197	0.262	0.107
Prior_Press_Cover_Analyst	52,783	0.282	0	0	1	0.450
ABS_ABN_RET	52,783	0.062	0.015	0.036	0.077	0.075
ABN_TURN	52,783	20.517	−1.614	5.618	22.058	44.532
SUE	52,783	0.000	0.000	0.000	0.002	0.008
LNMVE	52,783	8.070	6.936	7.964	9.143	1.549
MTB	52,783	1.934	1.092	1.455	2.249	1.326
LNANALYST	52,783	2.658	2.303	2.639	2.996	0.453
INST_HOLD	52,783	0.753	0.638	0.776	0.887	0.194
LNEMPLOYEE	52,783	2.040	0.952	1.856	2.912	1.307
LNOWN	52,783	4.814	3.892	4.645	5.602	1.257
Qtl_TURN	52,783	0.003	−0.003	0.001	0.007	0.011

Table 3 (continued)

Qt1_VOLAT	52,783	0.496	0.287	0.407	0.596	0.313
Prior_Press_Cover_Firm	52,783	0.271	0	0	1	0.444
SP1500	52,783	0.763	1	1	1	0.425

Panel B: Determinants of Recommendation Revisions Press Coverage

Dependent Variable	**Prob(Press_Cover = 1)**	**Prob(Press_Cover = 1)**	**Prob(Full_ Cover = 1)**	**Prob(Flash_ Cover = 1)**
	(1)	**(2)**	**(3)**	**(4)**
Analyst-Level Charcteristics				
Prior_Press_Cover_EA		1.477***	1.606***	1.425***
		(0.000)	(0.000)	(0.000)
Abs_Recommendation_Change	0.028	0.006	0.157	−0.007
	(0.449)	(0.879)	(0.149)	(0.859)
AllStar	−0.040	−0.031	0.467***	−0.106**
	(0.416)	(0.545)	(0.000)	(0.046)
Forecast_Accuracy	−0.044	−0.039	0.002	−0.036
	(0.257)	(0.310)	(0.986)	(0.350)
Recommendation_Horizon	0.000	0.000	−0.000	0.000
	(0.631)	(0.677)	(0.851)	(0.654)
Firm_Experience	0.030	0.009	−0.156	0.019
	(0.475)	(0.824)	(0.300)	(0.628)
General_Experience	−0.136*	−0.093	−0.334	−0.072
	(0.093)	(0.239)	(0.296)	(0.366)
BrokerSize	1.514***	1.548***	3.149***	1.363***
	(0.000)	(0.000)	(0.000)	(0.000)
Industry_Coverage	0.407***	0.348**	−1.256***	0.385***
	(0.007)	(0.017)	(0.007)	(0.007)

Table 3 (continued)

Firm_Coverage	−0.992***	−1.062***	−0.743	−0.991***
	(0.000)	(0.000)	(0.312)	(0.000)
Prior_Press_Cover_Analyst	1.147***	1.139***	−0.012	1.129***
	(0.000)	(0.000)	(0.891)	(0.000)
ABS_ABN_RET	0.133	0.222	0.251	0.214
	(0.655)	(0.449)	(0.843)	(0.457)
ABN_TURN	−0.000	−0.000	−0.000	−0.000
	(0.976)	(0.476)	(0.997)	(0.518)
Firm-Level Characteristics				
SUE	−2.471**	−1.855	−1.110	−1.606
	(0.041)	(0.110)	(0.929)	(0.186)
LNMVE	−0.073***	−0.079***	0.023	−0.079***
	(0.009)	(0.001)	(0.814)	(0.001)
MTB	−0.016	−0.003	0.145***	−0.011
	(0.226)	(0.822)	(0.001)	(0.308)
LNANALYST	0.054	0.057	−0.118	0.074*
	(0.236)	(0.170)	(0.509)	(0.080)
INST_HOLD	0.590***	0.361***	0.114	0.367***
	(0.000)	(0.000)	(0.736)	(0.000)
LNEMPLOYEE	−0.044**	−0.029	0.164***	−0.038**
	(0.036)	(0.132)	(0.005)	(0.037)
LNOWN	0.095***	0.071***	0.250***	0.054**
	(0.006)	(0.005)	(0.007)	(0.033)
Qt1_TURN	−3.040*	−2.493	37.753***	−4.258***
	(0.092)	(0.125)	(0.000)	(0.008)

Table 3 (continued)

Qtl_VOLAT	−0.728***	−0.612***	−2.841***	−0.526***
	(0.000)	(0.000)	(0.000)	(0.000)
Prior_Press_Cover_Firm	0.194***	0.118***	0.016	0.118***
	(0.000)	(0.000)	(0.874)	(0.000)
SP1500	−0.096*	−0.090*	−0.348**	−0.064
	(0.059)	(0.050)	(0.014)	(0.154)
Constant	−0.986***	−2.093***	−8.044***	−2.022***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of Observations	52,783	52,783	52,783	52,783
Firm and Quarter Clustering	Yes	Yes	Yes	Yes
Pseudo R-squared	0.090	0.111	0.180	0.101

Panel A: This table presents the descriptive statistics. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles

Panel B: This table presents regression results from the estimation of Eq. (1). Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles. Robust standard errors are clustered by both firm and year-quarter

* Statistical significance at the 0.10 level for two-sided tests

** Statistical significance at the 0.05 level for two-sided tests

*** Statistical significance at the 0.01 level for two-sided tests

Next, we present the estimation results that include the instrument *Prior_Press Cover_EA* in columns (2), (3), and (4) of Panel B. We find that *Prior_Press_Cover_EA* is significantly positively associated with the current press coverage of analysts' recommendation revisions, which is consistent with the requirement for a valid instrument.

We also use the estimation results for Eq. (1) to construct our propensity-score matched sample. Here we compute the propensity scores and use these scores to match each covered recommendation observation to a noncovered recommendation observation. Our propensity-score matching results in a final sample of 16,567 covered observations matched with 16,567 noncovered observations. To ensure that these samples are similar across all observable dimensions, except for the treatment effect (i.e., newswire coverage), we examine the covariate balance in Table 4. The first (second) three columns report means (medians) of the independent variables in Eq. (1) for both covered and noncovered observations and the difference in the means (medians). The third (sixth) column indicates no significant differences in the means (medians) for the vast majority of the variables. Only two (eight) of the 23 variables exhibit a significant difference in means (medians), which indicates that a reasonable covariate balance is achieved. To ensure that these differences do not drive our results, we include those variables as control variables in our subsequent analyses. Including all variables in Eq. (1) as control variables in subsequent tests does not change our inferences.

4.4 The effects of the business press coverage of analysts' recommendation revisions on the stock market pricing of the revisions

To investigate the effects of the business press coverage of analysts' recommendation revisions on the stock market pricing, we first perform a univariate analysis on three-day stock market reaction centered on the I/B/E/S-reported recommendation announcement dates and on the post-recommendation revision drift. Table 5, Panel A, shows that, for our full sample, we find three-day abnormal returns of 3.0% for upgrades and −4.2% for downgrades.[18] Three-day abnormal returns for covered upgrades (downgrades) are about 1.1% (0.8%) greater (smaller) than those for noncovered upgrades (downgrades), indicating that investors react more strongly to revisions disseminated by the press. These differences are not only statistically but also economically significant. The results suggest that a 1.1% difference in returns is approximately 36% of the average returns for upgrades (1.1%/3% = 0.36). Also, a −0.8% difference is approximately 20% of the average returns for downgrades (−0.84%/−4.17% = 0.20).

The press may influence the stock market reaction to revisions by disseminating either new or existing information to a broader class of investors. To investigate whether the stronger market reaction to covered revisions is driven by the press's information-dissemination role, in Panel A, we also compare revisions covered in news flashes with those covered in full articles. We find that upgrades (downgrades) covered

[18] The size of these returns is comparable to that found previously. For example, Womack (1996) finds 3.3% (−4.3%) of three-day abnormal returns for upgrades (downgrades). Jegadeesh and Kim (2010) find 2.29%, −3.40%, and −0.12% of two-day abnormal returns following recommendation revisions for upgrades, downgrades, and reiterations, respectively.

Table 4 Covariate Balance between Propensity Score Matched Pairs

Variables	Mean Difference (t-test)			Median Difference (Wilcoxon Rank Sum Test)		
	Press_Cover = 0 (16,567 obs)	Press_Cover = 1 (16, 567 obs)	Diff. (*p* value)	Press_Cover = 0 (16, 567 obs)	Press_Cover = 1 (16, 567 obs)	Diff. (*p* value)
Abs_Recommendation_Change	1.392	1.397	0.005	1.000	1.000	0.000
AllStar	0.093	0.089	−0.004	0.000	0.000	0.000
Forecast_Accuracy	0.679	0.681	0.001	0.770	0.770	0.000
Recommendation_Horizon	40.540	40.614	0.074	42.000	42.000	0.000
Firm_Experience	0.395	0.393	−0.002	0.333	0.333	0.000
General_Experience	0.290	0.290	0.000	0.250	0.250	0.000**
BrokerSize	0.381	0.369	−0.012***	0.279	0.293	0.015
Industry_Coverage	0.153	0.156	0.002	0.133	0.133	0.000***
Firm_Coverage	0.208	0.209	0.002	0.192	0.197	0.005***
Prior_Press_Cover_Analyst	0.299	0.285	−0.014***	0.000	0.000	0.000***
ABS_ABN_RET	0.062	0.062	0.000	0.035	0.038	0.003***
ABN_TURN	21.001	20.792	−0.209	5.123	7.216	2.093***
SUE	0.000	0.000	0.000	0.000	0.000	0.000
LNMVE	8.060	8.073	0.014	7.941	7.968	0.027
MTB	1.939	1.935	−0.004	1.455	1.470	0.015
LNANALYST	2.662	2.666	0.004	2.639	2.708	0.069
INST_HOLD	0.759	0.759	0.000	0.779	0.782	0.003
LNEMPLOYEE	2.022	2.032	0.009	1.841	1.846	0.005
LNOWN	4.800	4.810	0.010	4.618	4.655	0.037
Qt1_TURN	0.003	0.003	0.000	0.001	0.000	−0.000*
Qt1_VOLAT	0.480	0.483	0.002	0.400	0.398	−0.002

Table 4 (continued)

Variables	Mean Difference (t-test)			Median Difference (Wilcoxon Rank Sum Test)		
	Press_Cover = 0 (16,567 obs)	Press_Cover = 1 (16, 567 obs)	Diff. (*p* value)	Press_Cover = 0 (16, 567 obs)	Press_Cover = 1 (16, 567 obs)	Diff. (*p* value)
Prior_Press_Cover_Firm	0.284	0.276	−0.008	0.000	0.000	0.000
SP1500	0.762	0.762	−0.001	1.000	1.000	0.000*

This table presents the descriptive statistics. Variable definitions are provided in Appendix 1. All continuous variables are winsorized at the 1st and 99th percentiles

Table 5 Descriptive Statistics for Initial Market Reaction and Post-Recommendation Revision Drift Analyses

Panel A: Event and Drift Abnormal Returns

Holding Period (Trading Days, Relative to the Date of Recommendation)	Full Sample		Covered		Not Covered		Covered			
							News Flash		Full Article	
	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down
[−1, +1]	3.00%	−4.17%	3.65%	−4.70%	2.56%	−3.86%	3.67%	−4.74%	3.11%	−3.16%
[+2, +20]	0.41%	−0.27%	0.31%	−0.24%	0.48%	−0.29%	0.29%	−0.26%	0.84%	0.27%
[+2, +40]	0.41%	−0.39%	0.32%	−0.31%	0.48%	−0.44%	0.29%	−0.33%	1.01%	0.59%
[+2, +60]	0.42%	−0.66%	0.27%	−0.57%	0.52%	−0.71%	0.23%	−0.58%	1.33%	−0.19%
[+2, +80]	0.36%	−0.67%	0.20%	−0.47%	0.46%	−0.78%	0.16%	−0.47%	1.44%	−0.42%
[+2, +100]	0.27%	−0.79%	0.17%	−0.57%	0.34%	−0.91%	0.13%	−0.57%	1.25%	−0.64%
[+2, +120]	0.29%	−0.90%	0.21%	−0.57%	0.33%	−1.08%	0.19%	−0.57%	0.91%	−0.62%

Panel B: Descriptive Statistics

Variables	Full Sample			Propensity-Score Matched		
	Press_Cover = 0 (30,432 obs)	Press_Cover = 1 (22,351 obs)	Diff. (p value)	Press_Cover = 0 (16,567 obs)	Press_Cover = 1 (16.567 obs)	Diff. (p value)
Abn_Return(−1, +1)	−0.012	−0.007	0.005***	−0.009	−0.010	0.000
Abn_Return(+2, +20)	0.000	0.001	0.001***	0.000	0.001	0.000
Abn_Return(+2, +60)	−0.001	0.000	0.001	0.000	0.000	0.000
Recommendation_Change	−0.140	−0.078	0.062***	−0.106	−0.098	0.008
AllStar	0.069	0.116	0.047***	0.093	0.089	−0.004
Forecast_Accuracy	0.683	0.679	−0.004	0.679	0.681	0.001
Recommendation_Horizon	40.183	41.101	0.918***	40.540	40.614	0.074
Firm_Experience	0.387	0.399	0.012***	0.395	0.393	−0.002

Table 5 (continued)

General_Experience	0.290	0.295	0.005***	0.290	0.290	0.000
BrokerSize	0.299	0.431	0.132***	0.381	0.369	−0.012***
Industry_Coverage	0.159	0.161	0.002	0.153	0.156	0.002
Firm_Coverage	0.214	0.216	0.002**	0.208	0.209	0.002
Prior_Press_Cover_Analyst	0.180	0.421	0.241***	0.299	0.285	−0.014***
ABS_ABN_RET	0.065	0.058	−0.007***	0.062	0.062	0.000
ABN_TURN	21.700	18.905	−2.795***	21.001	20.792	−0.209
SUE	0.000	0.000	0.000**	0.000	0.000	0.000
LNMVE	8.038	8.115	0.077***	8.060	8.073	0.014
MTB	1.961	1.896	−0.065***	1.939	1.935	−0.004
LNANALYST	2.650	2.667	0.017***	2.662	2.666	0.004
INST_HOLD	0.744	0.766	0.022***	0.759	0.759	0.000
LNEMPLOYEE	2.01	2.08	0.07***	2.022	2.032	0.009
LNOWN	4.797	4.837	0.04***	4.800	4.810	0.010
Qt1_TURN	0.004	0.003	−0.001***	0.003	0.003	0.000
Qt1_VOLAT	0.521	0.461	−0.06***	0.480	0.483	0.002
Prior_Press_Cover_Firm	0.263	0.282	0.019***	0.284	0.276	−0.008
SP1500	0.755	0.774	0.019***	0.762	0.762	−0.001
EA_Dummy	0.766	0.738	−0.028***	0.765	0.737	−0.028***

Holding Period Return is a raw buy-and-hold stock return over (t = day n, day m) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same period (t = 0 is the date of the recommendation revision). ***Press_Cover*** is an indicator variable equal to 1 if an analyst recommendation is covered by the business press and 0 otherwise. ***Flash_Cover*** is an indicator variable equal to 1 if an analyst recommendation is covered in a news flash disseminated by the business press and 0 otherwise. ***Full_Cover*** is an indicator variable equal to 1 if an analyst recommendation is covered in full article disseminated by the business press and 0 otherwise

in news flashes generate 0.6% (1.6%) greater (smaller) returns than those covered in full articles. These findings suggest that the press influences stock market reaction to revisions mainly through its information-dissemination role.

Regarding the post-recommendation revision drift, Table 5, Panel A, shows that the drift for covered revisions, especially those covered in new flashes, is significantly smaller than that for the noncovered revisions.[19] For example, the difference between the three-month drifts [+2, +60] of covered and noncovered upgrades is −0.25% (0.27% - 0.52%), which is about 60% of the average drift for upgrades (0.25/0.42 = 0.60). Similarly, for downgrades, the difference is 0.14% (−0.57-(−0.71%)), which is about 21% of the average drift for downgrades (0.14/0.66 = 0.21).

In Table 5, Panel B, we present descriptive statistics for the variables used in Eqs. (2), (3), and (4) for the full and propensity-score matched samples. Although many of the control variables exhibit significantly different means between the samples of covered and noncovered revisions before matching, only three variables (*BrokerSize*, *Prior_Pres_Cover_Analyst*, and *EA_Dummy*) show differences after matching; these variables are included as control variables in subsequent analyses and do not affect results.

One limitation of testing the effects of the press coverage of analysts' recommendation revisions on the stock market is that many of the revisions coincide with earnings announcements. This inhibits disentangling the effect of the coverage from that of the earnings announcements. We explore this potential confound in Table 6. Here we find that for approximately 40% of firms with an earnings announcement issued within one month around the date of recommendation, the sign of the recommendation revision is opposite to the sign of unexpected earnings, and vice versa. For example, Table 6, Panel A, shows that 61,808 downgrades (24,177 upgrades) are preceded by unexpected earnings (i.e., *SUE*) that beat (miss) consensus analyst earnings forecasts. For these observations, the post-recommendation revision drift is contaminated, at least in part, by the post-earnings announcement drift moving in the opposite direction. Panel B (Panel C) also shows that about 41% (48%) of revisions coincide with (are followed by) the announcement of unexpected earnings with the opposite sign.

To isolate the effects of the business press coverage from the effects of earnings announcements, we use two approaches. First, we expand Eq. (2) through Eq. (4) by adding an indicator variable, *EA_Dummy*, which equals one if a firm made an earnings announcement within one month around the date of the recommendation revision (otherwise zero), and the interaction of *EA_Dummy* with variables of interest. Second, we estimate those three equations excluding observations with *EA_Dummy* equal to one from our sample.

As mentioned previously, we also conduct analyses using Heckman's two-stage procedure and propensity-score matching. In Tables 7 through 9, we present the results using the full sample, the Heckman second-stage model, and the propensity-score matched sample. For each of the three approaches, we then present three sets

[19] It is hard to find prior studies that allow us to directly compare the size of the drift, given that prior studies use different samples, conditioning variables, and event windows. It is worth pointing out that the drift is bigger for older samples. Our sample period is between 2000 and 2015. Mikhail et al. (2004) use a sample between 1985 and 1999 and show that the one-month drift for upgrades (downgrades) is between 0.51% and 0.87% (between −0.62% and − 0.86%).

Table 6 Distribution of Unexpected Earnings and Recommendation Revisions

		Revision		Total
		Down	Up	
Panel A: Firms with Earnings Announcements Issued within One Month prior to the Date of Recommendation				
SUE[−30, −1]	Miss	32,438	24,177	56,615
	Meet	12,918	9342	22,260
	Beat	61,808	57,003	118,811
	Total	107,164	90,522	197,686
Panel B: Firms with Earnings Announcements Issued at the Date of Recommendation				
SUE[0]	Miss	2484	850	3334
	Meet	812	351	1163
	Beat	3651	2814	6465
	Total	6947	4015	10,962
Panel C: Firms with Earnings Announcements Issued within One Month after the Date of Recommendation				
SUE[+1, +30]	Miss	29,096	20,492	49,588
	Meet	1546	1086	2632
	Beat	49,550	45,280	94,830
	Total	80,192	66,858	147,050

of estimation results. The first column presents results from the base model, the second column reports results from including *EA_Dummy* as a control variable, and the third column shows results from excluding observations where *EA_Dummy* equals 1.

4.4.1 Test of H1: The effects of the business press coverage on the initial market response to analysts' recommendation revisions

Table 7 presents the results of estimating Eq. (2). Consistent with prior studies, the first column reveals that the coefficient on *Recommendation_Change* is significantly positive, indicating that analysts' recommendation revisions are informative to stock market investors. Consistent with H1, the coefficient on the interaction between *Recommendation_Change* and *Press_Cover* is also significantly positive. As shown in the second and third columns, the coefficient remains positive and significant when *EA_Dummy* and its interactions are included or when observations with *EA_Dummy* equal to one are excluded from the analysis. In addition, columns (4) through (9) show that the significantly positive coefficient is robust to including the inverse Mills ratio calculated in the first-stage regression as well as to using the propensity-score matched sample. The positive coefficient on the interaction term is consistent in all nine specifications and suggests that the initial stock market reaction to analysts'

Table 7 The Effects of the Business Press Coverage on the Initial Market Reaction to Analysts' Recommendation Revisions

Dependent Variable	Abn_Return(−1, +1)								
	Full Sample			Heckman Second-Stage			Propensity-Score Matched		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Analyst-Level Charcteristics									
Recommendation_Change	0.018***	0.014***	0.014***	0.018***	0.014***	0.014***	0.018***	0.014***	0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Press_Cover	0.000	0.002	0.001	0.000	0.002	0.001	0.000	0.001	0.001
	(0.765)	(0.249)	(0.496)	(0.884)	(0.301)	(0.548)	(0.865)	(0.640)	(0.737)
Recommendation_Change*Press_Cover	0.004***	0.006***	0.007***	0.004***	0.006***	0.007***	0.005***	0.007***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EA_Dummy		0.003			0.003			0.001	
		(0.126)			(0.126)			(0.660)	
EA_Dummy*Recommendation_Change		0.005***			0.005***			0.004***	
		(0.000)			(0.000)			(0.000)	
EA_Dummy*Press_Cover		−0.002			−0.002			−0.001	
		(0.243)			(0.242)			(0.691)	
EA_Dummy*Recommendation_Change*Press_Cover		−0.003**			−0.003**			−0.003*	
		(0.023)			(0.024)			(0.092)	
Constant	0.069***	0.067***	0.092***	0.074***	0.071***	0.096***	0.110***	0.110***	0.030**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.035)
Control Variables	Included			Included			Included		
Number of Observations	52,783	52,783	13,273	52,783	52,783	13,273	33,134	33,134	8262

Table 7 (continued)

Dependent Variable	Abn_Return(−1, +1)								
	Full Sample			Heckman Second-Stage			Propensity-Score Matched		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.262	0.263	0.293	0.262	0.263	0.293	0.262	0.262	0.282

This table presents regression results from the estimation of Eq. (3). All continuous variables are winsorized at the 1st and 99th percentiles. Robust standard errors are clustered by both firm and year-quarter

* Statistical significance at the 0.10 level for two-sided tests

** Statistical significance at the 0.05 level for two-sided tests

*** Statistical significance at the 0.01 level for two-sided tests

recommendation revisions is greater when the revisions are covered by the press.[20] In terms of the economic magnitude of the effects, the estimation results in column (3) suggest that a one standard deviation increase in recommendation changes covered (not covered) by the press is associated with an average abnormal stock return of 3.1% (2.1%) over the three days surrounding the date of recommendation, which is equivalent to a 50% increase associated with press coverage.

Our finding of the greater market response to recommendation revisions covered by the press adds to the literature on analysts' recommendations and the business press two ways. First, the finding provides additional evidence that analysts' recommendation revisions are informative.[21] If they were not, broadcasting the revisions to a broader class of investors should not significantly and systematically affect market pricing. Second, the finding also implies that analysts and the business press have a complementary relationship. The greater market response to covered recommendation revisions indicates that reporters help broadcast analysts' summaries and interpretations of new information. To our knowledge, this complementary relationship has not been examined before. In fact, Fang and Peress (2009) suggest that analyst coverage and media coverage are substitutes. This implication also speaks to the call by Miller and Skinner (2015) for research on the interaction between information intermediaries.

4.4.2 Test of H2: The effects of the business press coverage on the post-recommendation revision drift

Table 8 presents the results of estimating Eq. (3). Table 8, Panel A (B), reports the results for one-month (three-month) post-recommendation revision drift. First, Panel A of Table 8 shows that the coefficient on *Recommendation_Change* is significantly positive, which is consistent with prior research and provides evidence for one-month post-recommendation revision drift. With respect to H2, we find that the coefficient on the interaction between *Recommendation_Change* and *Press_Cover* is insignificant. However, the coefficient becomes negative and significant when *EA_Dummy* and its interaction terms are included, as shown in the second column, or when observations with *EA_Dummy* equal to 1 are excluded, as shown in the third column. On the other hand, the coefficient on the triple interaction among *EA_Dummy*, *Recommendation_Change*, and *Press_Cover* is positive and significant. These findings suggest that, consistent with our concern, the post-recommendation revision drift is significantly influenced by the post-earnings announcement drift moving in the opposite direction. The negative and significant coefficient on the interaction between *Recommendation_Change* and *Press_Cover* is also robust to including the inverse Mills ratio and using the propensity-score matched sample. As Panel B of Table 8 shows, we find similar results

[20] We also note that the coefficient on the triple interaction among *EA_Dummy*, *Recommendation_Change*, and *Press_Cover* is significantly negative. This negative coefficient is consistent with our concern that the stock market reaction to recommendation revisions is contaminated by the reaction to earnings announcements.

[21] There is no conclusive evidence on the informativeness of analysts' recommendations. Some studies, including those by Womack (1996), Bradley et al. (2014), and Li et al. (2015), provide evidence for the informational role of the recommendations. On the other hand, other papers, including those by Altinkilic and Hansen (2009) and Chen et al. (2005), provide conflicting evidence. Loh and Stulz (2011) also show that only about 12% of recommendation revisions in their sample are influential in returns and that influential recommendation changes come only from a subset of skilled analysts.

Table 8 The Effects of the Business Press Coverage on the Post-Recommendation Revision Drift

Panel A: One-Month Post-Recommendation Revision Drift									
Dependent Variable	**Abn_Return(+2, +20)**								
	Full Sample			**Heckman Second-Stage**			**Propensity-Score Matched**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Analyst-Level Charcteristics									
Recommendation_Change	0.001**	0.004***	0.003***	0.001**	0.004***	0.003***	0.001	0.005***	0.005***
	(0.012)	(0.004)	(0.006)	(0.014)	(0.004)	(0.006)	(0.103)	(0.000)	(0.000)
Press_Cover	0.001	−0.001	−0.002	0.001	−0.001	−0.001	0.001	−0.002	−0.002
	(0.654)	(0.698)	(0.419)	(0.639)	(0.712)	(0.612)	(0.734)	(0.389)	(0.419)
Recommendation_Change*Press_Cover	−0.001	−0.003**	−0.003*	−0.001	−0.003**	−0.003*	−0.000	−0.005***	−0.005***
	(0.477)	(0.050)	(0.072)	(0.487)	(0.050)	(0.070)	(0.642)	(0.002)	(0.004)
EA_Dummy		0.003			0.003			0.003	
		(0.167)			(0.164)			(0.185)	
EA_Dummy*Recommendation_Change		−0.003**			−0.003**			−0.005***	
		(0.041)			(0.044)			(0.000)	
EA_Dummy*Press_Cover		0.002			0.002			0.003	
		(0.435)			(0.439)			(0.107)	
EA_Dummy*Recommendation_Change*Press_Cover		0.003*			0.003*			0.006***	
		(0.063)			(0.068)			(0.001)	
Constant	0.025	0.022	0.006	0.024	0.021	−0.010	−0.084***	−0.085***	0.009
	(0.173)	(0.234)	(0.864)	(0.136)	(0.193)	(0.794)	(0.000)	(0.000)	(0.550)
Control Variables	Included	Included	Included						
Number of Observations	52,783	52,783	13,273	52,783	52,783	13,273	33,134	33,134	8262
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8 (continued)

Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.016	0.016	0.031	0.016	0.016	0.032	0.018	0.019	0.033
Panel B: Three-Month Post-Recommendation Revision Drift									
Dependent Variable	**Abn_Return(+2, +60)**								
	Full Sample			**Heckman Second-Stage**			**Propensity-Score Matched**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Analyst-Level Charcteristics									
Recommendation_Change	0.003***	0.005***	0.005***	0.003***	0.005***	0.005***	0.003***	0.006***	0.007***
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.002)	(0.003)	(0.001)	(0.003)
Press_Cover	−0.001	0.001	0.001	−0.001	0.002	0.002	−0.000	0.002	0.002
	(0.757)	(0.772)	(0.829)	(0.834)	(0.729)	(0.684)	(0.941)	(0.615)	(0.707)
Recommendation_Change*Press_Cover	−0.002	−0.006**	−0.006**	−0.002	−0.006**	−0.006**	−0.001	−0.006**	−0.006**
	(0.271)	(0.015)	(0.018)	(0.274)	(0.015)	(0.018)	(0.327)	(0.044)	(0.049)
EA_Dummy		0.004			0.004			0.004	
		(0.301)			(0.295)			(0.211)	
EA_Dummy*Recommendation_Change		−0.003			−0.003			−0.004	
		(0.105)			(0.100)			(0.143)	
EA_Dummy*Press_Cover		−0.003			−0.003			−0.003	
		(0.542)			(0.539)			(0.465)	
EA_Dummy*Recommendation_Change*Press_Cover		0.006**			0.006**			0.006*	
		(0.037)			(0.035)			(0.073)	
Constant	−0.192***	−0.195***	−0.112*	−0.199***	−0.202***	−0.142**	0.153***	0.150***	0.408***
	(0.000)	(0.000)	(0.057)	(0.000)	(0.000)	(0.017)	(0.000)	(0.000)	(0.000)
Control Variables	Included			Included			Included		

Table 8 (continued)

Number of Observations	52,783	52,783	13,273	52,783	52,783	13,273	33,134	33,134	8262
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.022	0.022	0.025	0.022	0.022	0.025	0.021	0.021	0.029

This table presents regression results from the estimation of Eq. (3). All continuous variables are winsorized at the 1st and 99th percentiles. Robust standard errors are clustered by both firm and year-quarter

*Statistical significance at the 0.10 level for two-sided tests

** Statistical significance at the 0.05 level for two-sided tests

*** Statistical significance at the 0.01 level for two-sided tests

using the three-month post-recommendation revision drift. Overall, the significantly negative coefficient on the interaction between *Recommendation_Change* and *Press_Cover* provides evidence consistent with H2 and indicates that press coverage significantly reduces the post-recommendation revision drift.

In terms of the economic magnitude of the effects, the results in Table 8, Panel A (B), column (3), suggest that a one standard deviation increase in recommendation changes not covered by the press is associated with an average abnormal stock return of approximately 50 (80) basis points over 20 (60) trading days beginning two days after the date of recommendation. In contrast, the results indicate that a one standard deviation increase in recommendation changes covered by the business press is associated with an average abnormal stock return of essentially zero over the same 20 or 60 days.

4.4.3 Test of H3: cross-sectional analysis of the effects of the business press coverage on the stock market pricing – news flash versus full article

In this subsection, we examine whether the effects of press coverage on the initial stock market reaction to analysts' recommendation revisions and on the post-recommendation revision drift are attributable to news flash coverage, full article coverage, or both types of coverage. Table 9 presents the estimation results for Eq. (4), which includes two indicator variables, *Flash_Cover* and *Full_Cover*, to identify recommendation revisions covered in news flashes and full articles, respectively, and their interactions with recommendation changes. As shown in Panel A of Table 9, we find that the coefficient on the interaction between *Recommendation_Change* and *Flash_Cover* is positive and significant in all nine regressions, whereas the coefficient on the interaction between *Recommendation_Change* and *Full_Cover* is insignificant. These findings indicate that the greater stock market reaction to recommendation revisions covered in the press, as documented in Table 7, arises mainly from the greater stock market reaction to the revisions covered in news flashes, rather than full articles. Panels B and C of Table 9 show that the coefficient on the interaction between *Recommendation_Change* and *Flash_Cover* is negative and significant when *EA_Dummy* and its interaction terms are included and when observations with *EA_Dummy* equal to 1 are excluded. On the other hand, the coefficient on the interaction between *Recommendation_Change* and *Full_Cover* is insignificant in all regressions. These findings indicate that the smaller drift of the covered revisions, as documented in Table 8, arises mainly from the smaller drift of revisions covered in new flashes, rather than full articles.

We conduct a number of untabulated cross-sectional tests to explore whether full articles influenced the pricing of recommendation revisions in certain subsamples. Specifically, we examine subsamples based on (1) firm characteristics, such as firm size, institutional ownership, and analyst following; (2) analyst characteristics, such as brokerage size, past forecast accuracy, experience, All-Star status, and portfolio complexity; (3) revision characteristics, such as the degree to which the recommendation revision deviates from consensus; and (4) article characteristics, such as length. None of these tests yield significant results in any of the subsamples investigated. Overall, the evidence presented in Table 9 indicates that the press significantly improves the initial market pricing of information contained in analysts' recommendation revisions and

Table 9 Cross-sectional Analysis of the Effects of Business Press Coverage on Stock Market Pricing – News Flash versus Full Article

Panel A: Initial Market Reaction to Recommendation Revisions

Dependent Variable	**Abn_Return(−1, +1)**								
	Full Sample			**Heckman Second-Stage**			**Propensity Score Matched**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Recommendation_Change	0.018***	0.014***	0.014***	0.018***	0.014***	0.014***	0.018***	0.014***	0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Flash_Cover	0.000	0.002	0.001	0.000	0.002	0.001	0.000	0.001	0.001
	(0.750)	(0.294)	(0.525)	(0.866)	(0.349)	(0.580)	(0.881)	(0.713)	(0.784)
Full_Cover	0.001	0.008**	0.006	0.001	0.008**	0.006	0.002	0.008*	0.007
	(0.763)	(0.021)	(0.229)	(0.778)	(0.025)	(0.221)	(0.385)	(0.083)	(0.188)
Recommendation_Change*Flash_Cover	0.004***	0.007***	0.007***	0.004***	0.007***	0.007***	0.005***	0.007***	0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Recommendation_Change*Full_Cover	−0.002	0.001	0.001	−0.002	0.001	0.001	−0.001	0.001	−0.000
	(0.356)	(0.762)	(0.810)	(0.351)	(0.761)	(0.788)	(0.701)	(0.828)	(0.949)
Control Variables	Included	Included	Included						
Number of Observations	52,783	52,783	13,273	52,783	52,783	13,273	33,134	33,134	8262
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.263	0.263	0.293	0.263	0.263	0.293	0.262	0.262	0.282

Table 9 (continued)

Panel B: One-Month Post-Recommendation Revision Drift									
Dependent Variable	**Abn_Return(+2, +20)**								
	Full Sample			**Heckman Second-Stage**			**Propensity-Score Matched**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Recommendation_Change	0.001**	0.004***	0.003***	0.001**	0.004***	0.003***	0.001	0.005***	0.005***
	(0.013)	(0.004)	(0.006)	(0.015)	(0.004)	(0.006)	(0.106)	(0.000)	(0.000)
Flash_Cover	0.000	−0.001	−0.002	0.000	−0.001	−0.001	0.001	−0.002	−0.002
	(0.692)	(0.662)	(0.386)	(0.678)	(0.676)	(0.589)	(0.735)	(0.365)	(0.387)
Full_Cover	0.001	0.002	0.001	0.001	0.002	0.001	−0.003	0.002	0.002
	(0.768)	(0.742)	(0.917)	(0.751)	(0.728)	(0.854)	(0.530)	(0.774)	(0.842)
Recommendation_Change*Flash_Cover	−0.001	−0.003*	−0.003*	−0.001	−0.003**	−0.003*	−0.001	−0.005***	−0.005***
	(0.396)	(0.051)	(0.074)	(0.402)	(0.049)	(0.076)	(0.531)	(0.003)	(0.004)
Recommendation_Change*Full_Cover	0.003	−0.002	−0.001	0.003	−0.002	−0.001	0.006**	−0.004	−0.003
	(0.187)	(0.570)	(0.719)	(0.189)	(0.573)	(0.728)	(0.029)	(0.335)	(0.464)
Control Variables	Included			Included			Included		
Number of Observations	52,783	52,783	13,273	52,783	52,783	13,273	33,134	33,134	8262
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.016	0.016	0.031	0.016	0.016	0.032	0.018	0.019	0.033

Table 9 (continued)

Panel C: Three-Month Post-Recommendation Revision Drift

Dependent Variable	**Abn_Return(+2, +60)**								
	Full Sample			**Heckman Second-Stage**			**Propensity-Score Matched**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Recommendation_Change	0.003***	0.005***	0.005***	0.003***	0.005***	0.005***	0.003***	0.006***	0.007***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.003)	(0.001)	(0.002)
Flash_Cover	−0.001	0.002	0.002	−0.000	0.002	0.003	−0.000	0.003	0.002
	(0.791)	(0.689)	(0.767)	(0.867)	(0.644)	(0.618)	(0.987)	(0.505)	(0.607)
Full_Cover	−0.008	−0.015	−0.012	−0.007	−0.015	−0.011	−0.010	−0.022*	−0.020
	(0.247)	(0.156)	(0.354)	(0.261)	(0.163)	(0.401)	(0.263)	(0.097)	(0.163)
Recommendation_Change*Flash_Cover	−0.002	−0.006**	−0.006**	−0.002	−0.006**	−0.006**	−0.002	−0.006**	−0.006**
	(0.211)	(0.017)	(0.018)	(0.211)	(0.016)	(0.022)	(0.268)	(0.050)	(0.049)
Recommendation_Change*Full_Cover	0.005	−0.004	−0.004	0.005	−0.004	−0.004	0.008	−0.003	−0.003
	(0.220)	(0.449)	(0.518)	(0.220)	(0.453)	(0.508)	(0.126)	(0.653)	(0.607)
Control Variables	Included	Included	Included						
Number of Observations	52,783	52,783	13,273	52,783	52,783	13,273	33,134	33,134	8262
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.022	0.022	0.025	0.022	0.022	0.026	0.021	0.021	0.029

This table presents regression results from the estimation of Eq. (4). All continuous variables are winsorized at the 1st and 99th percentiles. Robust standard errors are clustered by both firm and year-quarter

* Statistical significance at the 0.10 level for two-sided tests

** Statistical significance at the 0.05 level for two-sided tests

*** Statistical significance at the 0.01 level for two-sided tests

substantially mitigates the delayed pricing of the information through its information-dissemination role and not through its information-creation role. That is, as the number of news flashes covering an analyst's recommendation revision increases, the pricing of the information in the revision improves. Consistent with prior studies, we conclude that news flashes increase the visibility of the information among investors and this broader dissemination results in increased price efficiency (Li et al. 2011; Drake et al. 2014). These results, however, are subject to an important caveat. Table 2, Panel B, reveals that full articles account for only 2.92% of our sample. It could be the case that a lack of statistical power is contributing to the lack of statistical evidence. Thus one should exercise caution when drawing conclusions about the ability of full press articles to influence the market response to recommendation revisions.

4.5 Additional analyses: analysis of the effects of the business press coverage on different types of professional investors

In this section, we examine whether two types of professional investors are influenced by the increased dissemination of analyst recommendation revisions by the business press. For these tests, we tabulate the results using the propensity-score matched sample and the propensity-score matched sample that excludes recommendations issued around earnings announcements.[22] Specifically, we examine whether large-trade institutional investors, algorithmic traders, or both are influenced by the broader dissemination of analyst recommendation revisions. First, we follow Bushee et al. (2018) to examine institutional investor trades around press releases of recommendation revisions. Because large trades should reflect only institutional investor activity, we examine the change in large trades around the press release date of recommendation revisions. We define large trades as those greater than or equal to $50,000. Following Blankespoor et al. (2018), we define abnormal trading volume for large trades (*ABN_LARVOL*) as the firm's daily average shares traded over days [0, +2] divided by total shares outstanding, minus the firm's trailing average over days [−41, −11]. Table 10, Panel A, reports regression results of abnormal trading volume for large trades (*ABN_LARVOL*), following the press coverage of recommendation revisions. Columns (1) and (2) report results for our propensity-score matched samples and our matched sample excluding recommendation revisions in the temporal vicinity of an earnings announcement, respectively. In both columns, we find that *Press_Cover* is significantly positively associated with *ABN_LARVOL*, indicating that institutional investor trades are significantly higher for recommendation revisions that are covered by the press than for those that are not.

Next, we examine whether results from our market reaction tests are also driven by algorithmic trades typically executed by high-frequency traders via computer algorithms. Recent research finds that high-frequency traders rapidly incorporate public information into price, including the information in earnings announcements (Bhattacharya et al. 2017), futures prices (Zhang 2012), and macro news announcements (Brogaard et al. 2014). However, no study has examined whether algorithmic traders incorporate and trade on analyst information. To capture algorithmic trades, we use measures developed by Weller (2017), which rely on new data made available by

[22] The results are similar when we use our alternative specifications.

Table 10 Additional Analyses: Institutional Investors versus Algorithmic Traders

Panel A: Analysis of Large Trades around News Article Releases		
Dependent Variable	**ABN_LARVOL**	
	PSM Sample	**Propensity-Score Matched Sample Excluding Observations with EA_Dummy Equal to 1**
	(1)	**(2)**
Press_Cover	0.001**	0.001**
	(0.011)	(0.010)
Abs_Recommendation_Change	0.001*	0.001
	(0.052)	(0.213)
AllStar	0.001	−0.000
	(0.271)	(0.838)
Forecast_Accuracy	0.001	0.001
	(0.232)	(0.248)
Recommendation_Horizon	0.000	0.000**
	(0.844)	(0.023)
Firm_Experience	0.001	0.000
	(0.284)	(0.663)
General_Experience	0.001	0.003*
	(0.146)	(0.099)
BrokerSize	0.002***	0.003***
	(0.001)	(0.004)
Industry_Coverage	−0.001	−0.002
	(0.684)	(0.409)
Firm_Coverage	−0.001	−0.004
	(0.593)	(0.290)

Table 10 (continued)

Prior_Press_Cover_Analyst	−0.001**	−0.001
	(0.030)	(0.172)
ABS_ABN_RET	0.086***	0.075***
	(0.000)	(0.000)
ABN_TURN	0.000***	0.000***
	(0.000)	(0.000)
SUE	−0.003	−0.016
	(0.881)	(0.676)
LNMVE	0.001***	−0.000
	(0.003)	(0.723)
MTB	0.000	0.000
	(0.769)	(0.585)
LNANALYST	−0.000	−0.001
	(0.686)	(0.191)
INST_HOLD	0.003	0.000
	(0.106)	(0.881)
LNEMPLOYEE	0.000	0.001*
	(0.203)	(0.095)
LNOWN	−0.000	0.001
	(0.323)	(0.174)
Qt1_TURN	−0.136***	−0.131***
	(0.000)	(0.000)
Qt1_VOLAT	−0.010***	−0.014***
	(0.000)	(0.000)
Prior_Press_Cover_Firm	−0.000	0.000
	(0.413)	(0.754)

Table 10 (continued)

SP1500	0.001**	0.002**
	(0.030)	(0.014)
Constant	0.009*	0.036***
	(0.076)	(0.000)
Number of Observations	25,575	6399
Adjusted R-squared	0.118	0.181
Industry and Quarter Fixed Effects	Yes	Yes
Firm and Quarter Clustering	Yes	Yes

Panel B: Analysis of Algorithmic Trading

Sample	**Propensity-Score Matched Sample**				**Propensity-Score Matched Sample Excluding Observations with EA_Dummy Equal to 1**			
	Algorithmic trading on the press release date of recommendation revisions		**Average algorithmic trading over three days surrounding the press release date of recommendation revisions**		**Algorithmic trading on the press release date of recommendation revisions**		**Average algorithmic trading over three days surrounding the press release date of recommendation revisions**	
	Abn_Return (−1, +1)	**Abn_Return (+2, +20)**	**Abn_Return (−1, +1)**	**Abn_Return (+2, +20)**	**Abn_Return (−1, +1)**	**Abn_Return (+2, +20)**	**Abn_Return (−1, +1)**	**Abn_Return (+2, +20)**
Dependent Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Recommendation_Change	0.016***	0.004	0.017***	0.003	0.009**	0.011**	0.008***	0.007
	(0.000)	(0.105)	(0.000)	(0.166)	(0.020)	(0.038)	(0.000)	(0.195)
Press_Cover	0.007*	0.010*	0.007	0.008	−0.010*	0.004	−0.010*	0.005
	(0.086)	(0.069)	(0.142)	(0.125)	(0.064)	(0.638)	(0.071)	(0.671)
Press_Cover*Recommendation_Change	0.008**	−0.003	0.007**	−0.001	0.015**	−0.009*	0.014***	−0.004
	(0.011)	(0.268)	(0.047)	(0.532)	(0.011)	(0.057)	(0.001)	(0.427)
High_Algorithm	0.005	0.008***	0.004	−0.000	0.003	0.012	−0.006	0.019

Table 10 (continued)

	(0.155)	(0.001)	(0.281)	(0.987)	(0.644)	(0.241)	(0.382)	(0.140)
Recommendation_Change* High_Algorithm	−0.008***	−0.006	−0.008***	−0.005	−0.003	−0.006	−0.002	0.000
	(0.000)	(0.133)	(0.000)	(0.216)	(0.497)	(0.285)	(0.476)	(0.939)
Press_Cover* High_Algorithm	−0.005	−0.014***	−0.005	−0.010*	0.009	−0.021*	0.009	−0.021
	(0.276)	(0.002)	(0.417)	(0.082)	(0.156)	(0.090)	(0.194)	(0.158)
Press_Cover*Recommendation_Change * High_Algorithm	−0.003	0.005	−0.000	0.002	−0.007	−0.000	−0.004	−0.007
	(0.388)	(0.323)	(0.969)	(0.521)	(0.306)	(0.972)	(0.419)	(0.347)
Control Variables	Included	Included	Included	Included	Included	Included	Included	Included
Number of Observations	3247	3247	3233	3233	768	768	765	765
Adjusted R-squared	0.284	0.050	0.282	0.050	0.360	0.173	0.354	0.171
Industry and Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and Quarter Clustering	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel A presents regression results of abnormal trading volume for large trades (*ABN_LARVOL*), which is computed as a firm's daily average shares traded over days [0, +2] for large trades, divided by total shares outstanding, minus the firm's trading average over days [−41, −11]. We define large trades as trades greater than or equal to $50,000. Panel B presents regression results from the estimation of Eq. (4). *High_Algorithm* is an indicator variable equal to 1 if a firm's factor score on the date of the press release of a recommendation revision is greater than the median factor score on the same date in columns (1), (2), (5) and (6) or if a firm's average factor score over three days around the press release is greater than the median average factor score over the same period in columns (3), (4), (7), and (8), and 0 otherwise. The factor score is created from a factor analysis of three algorithmic trading proxies developed by Weller (2017) (i.e., the log of odd lot volume ratio, the log of trade-to-order volume ratio, and the log of cancel-to-trade ratio). All continuous variables are winsorized at the 1st and 99th percentiles. Robust standard errors are clustered by both firm and year-quarter

* Statistical significance at the 0.10 level for two-sided tests

** Statistical significance at the 0.05 level for two-sided tests

*** Statistical significance at the 0.01 level for two-sided tests

the SEC's Market Information Data Analytic System (MIDAS). These data are available starting in 2012. Weller (2017) develops four proxies for algorithmic trading based on features of trades that are consistent with algorithms. We construct a composite variable (factor score) created from a factor analysis of the four algorithmic trading proxies: the log of odd lot volume ratio, the log of trade-to-order volume ratio, the log of cancel-to-trade ratio, and the average trade size.[23]

We test whether the results from the market reaction tests are concentrated in the subsample of firms with high algorithmic trading on and around the press release date. To do this, we group the sample into high versus low algorithmic trading, using the median factor score on the press release date or the median average factor score over the three days around the press release date. Columns (1) through (4) in Panel B of Table 10 report results for our propensity-score matched samples, and columns (5) through (8) present results for our matched sample excluding recommendation revisions in the temporal vicinity of an earnings announcement. In all eight columns, we find that the coefficient on the triple interaction among *Press_Cover*, *Recommendation_Change*, and *High_Algorithm* is not significant. Thus we find no evidence that algorithmic trading activity differs between recommendation revisions covered by the business press and those not covered by the business press. Taken together, the results in Table 10 indicate that institutional investors appear to be influenced by the broader dissemination of analyst recommendation revisions and trade more for covered revisions. This is not true of high-frequency traders. This suggests that institutional investors benefit more from the broader dissemination of these analyst disclosures.

5 Conclusion

We examine the information-dissemination role of the business press for analyst recommendation revisions. We find evidence that broader coverage by the press is associated with a stronger initial market reaction to a recommendation revision as well as less post-revision drift. These two findings are consistent with the press providing broader dissemination of analyst reports. In further analysis, we find that our results are driven by large-trade institutional investors and by news flash coverage (essentially simple repetition of analyst reports), rather than full-length article coverage. This suggests that, in our setting, the press adds value more through broadcasting the analyst recommendation revision broadly than through independent analysis and commentary. However, this might also suggest that, when the business press simply repeats information contained in recommendations, the market interprets this as evidence that these revisions are credible, but, when the press provides additional coverage, the market interprets the additional coverage as casting doubt on the credibility. These results are all robust to controlling for (and excluding) contamination of the information environment by news contained in recent earnings announcements.

[23] Higher odd lot and cancel-to-trade ratios indicate more algorithmic trading, and higher trade-to-order volume and trade sizes indicate less algorithmic trading. Accordingly, we multiply the trade-to-order volume and trade size variables by negative one before entering them into the factor analysis. We note that the four proxies for algorithmic trading converge to a single factor that explains 65% of the underlying variation with an Eigenvalue of 2.61.

Overall, our findings support the complementary roles of analysts and the business press. Broader dissemination of recommendation revisions appears to promote more efficient capital market outcomes by increasing the ease with which market participants can process new information. We shed new light on the relation between two information intermediaries and provide evidence that this relation leads to more efficient capital market outcomes. Finally, we provide evidence that the misaligned incentives between analysts and investors do not appear to fully cancel out the informativeness of analyst recommendations. Our findings may be of interest to academics seeking to better understand the interplay between information intermediaries and consumers of information provided by these information intermediaries. Future research in this area could further investigate the types of investors that are influenced by press coverage, particularly in the retail space that is outside the scope of our data and tests. Future work could also further examine the impact of the editorial content of full press articles.

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Appendix 1. Variable Definitions

Variable	Definition
Press_Cover	An indicator variable equal to 1 if an analyst recommendation is covered by the business press and 0 otherwise
Stock_Recommendation	*Stock_Recommendation* is coded as follows: Strong Sell = 1 Sell = 2 Hold = 3 Buy = 4 Strong Buy = 5
Recommendation_Change	The difference between current and previous recommendations issued by an analyst for a firm
Abs_Recommendation_Change	The absolute value of *Recommendation_change*
AllStar	An indicator variable equal to 1 if an analyst was recognized as a member of Institutional Investor's All-America Research Team as of the most recent prior year and 0 otherwise
Forecast_Accuracy	A rank of the absolute forecast error of the analyst's earnings forecast for the most recent quarter prior to the recommendation date, multiplied by −1. The absolute forecast error is calculated as the absolute value of an analyst's earnings forecast for a quarter minus actual earnings for the quarter divided by the stock price measured at the beginning of the fiscal quarter. Relative forecast accuracy is calculated as the forecast accuracy of analyst *i* following firm *j* in quarter *t* minus the lowest forecast accuracy by any analyst following firm *j* in quarter *t*, with this difference scaled by the range in forecast accuracy for all analysts following firm *j* in quarter *t*.
Recommendation_Horizon	The difference between the current and previous recommendation announcement dates (in days)
Firm_Experience	The number of years an analyst has covered a firm. Relative firm experience is calculated as the firm experience for analyst *i* following firm *j* in quarter *t* minus the smallest firm experience by any analyst following firm *j* in

(continued)

Variable	Definition
	quarter *t*, with this difference scaled by the range in the firm experience for all analysts following firm *j* in quarter *t*.
General_Experience	General experience is defined as the number of years an analyst has covered any firm. Relative general experience is calculated as the general experience for analyst *i* following firm *j* in quarter *t* minus the smallest general experience by any analyst following firm *j* in quarter *t*, with this difference scaled by the range in the general experience for all analysts following firm *j* in quarter *t*.
BrokerSize	Broker size is defined as the total number of analysts employed by a brokerage for which an analyst has worked as of the most recently completed calendar year prior to the recommendation date. Relative broker size is calculated as the broker size for analyst *i* following firm *j* in quarter *t* minus the smallest broker size of any analyst following firm *j* in quarter *t*, with this difference scaled by the range in broker size for all analysts following firm *j* in quarter *t*.
Industry_Coverage	Industry coverage is defined as the number of industries covered by an analyst during the most recently completed calendar year prior to the recommendation date. Relative industry coverage is calculated as the industry coverage of analyst *i* following firm *j* in quarter *t* minus the smallest industry coverage by any analyst following firm *j* in quarter *t*, with this difference scaled by the range in industry coverage for all analysts following firm *j* in quarter *t*.
Firm_Coverage	The number of firms covered by an analyst during the most recently completed calendar year prior to the recommendation date. Relative firm coverage is calculated as the firm coverage of analyst *i* following firm *j* in quarter *t* minus the lowest firm coverage by any analyst following firm *j* in quarter *t*, with this difference scaled by the range in firm coverage for all analysts following firm *j* in quarter *t*.
Prior_Press_Cover_Analyst	An indicator variable equal to 1 if any recommendation issued by an analyst is covered by the business press at least once during the 30 days prior to the recommendation date and 0 otherwise
ABS_ABN_RET	The absolute value of the difference between a firm's raw stock returns and the value-weighted market return on the recommendation date
ABN_TURN	The difference between a firm's share turnover and the market's share turnover on the recommendation date, where a firm's turnover is computed as daily CRSP trading dollar volumes divided by the market value of shares outstanding on the recommendation date and the market share turnover is calculated as the average daily turnover for all stocks listed on CRSP on the recommendation date
SUE	The difference between the current quarter's earnings per share and analysts' consensus earnings per share forecasts, scaled by the standard deviation of this difference during the last eight quarters, including the current quarter
LNMVE	The log of outstanding shares times closing stock price on the fiscal quarter end date
MTB	Book assets minus book equity plus market equity, all divided by book assets. Market equity is calculated as the fiscal-quarter closing price times the shares outstanding. Book equity is defined as stockholder's equity minus preferred stock plus balance-sheet deferred taxes and investment tax credit. If balance-sheet deferred taxes and investment tax credit is missing, it is set to zero. If stockholder's equity is not available, it is replaced by common equity plus preferred stock par value, or assets minus liabilities. Preferred stock is preferred stock redemption value, or preferred stock par value.

(continued)

Variable	Definition
LNANALYST	The log of 1 plus the number of analysts providing one-quarter-ahead earnings forecasts at least once during the fiscal quarter
INST_HOLD	The percentage of institutional ownership on the fiscal quarter-end date
LNEMPLOYEE	The log of 1 plus the number of employees (Compustat Annual #29)
LNOWN	The log of 1 plus the number of shareholders (Compustat Annual #100)
Qt1_TURN	Quarter t-1's share turnover minus quarter t-1's market share turnover
Qt1_VOLAT	Quarter t-1's return volatility computed as the standard deviation of the log of 1 plus daily return, multiplied by the square root of 252
Prior_Press_Cover_Firm	An indicator variable equal to 1 if a firm is covered by the business press at least once during the 30 days prior to the date of the recommendation revision and 0 otherwise
SP1500	An indicator variable equal to 1 if a firm is a member of the S&P 1500 stock index in year *t* and 0 otherwise
Abn_Return (−1, +1)	Raw buy-and-hold stock return over (t = −1, +1) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same three-day period (t = 0 is the date of the recommendation revision)
Abn_Return (+2, +20)	Raw buy-and-hold stock return over (t = +2, +20) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same three-day period (t = 0 is the date of the recommendation revision)
Abn_Return (+2, +60)	Raw buy-and-hold stock return over (t = +2, +60) minus the return to a benchmark portfolio formed based on size, book-to-market, and momentum over the same three-day period (t = 0 is the date of the recommendation revision)
EA_Dummy	An indicator variable equal to 1 if a firm made an earnings announcement within one month around the date of the recommendation revision and 0 otherwise
Prior_Press_Cover_EA	An indicator variable equal to 1 if the prior year's earnings announcement for firm i is covered by the business press and 0 otherwise
Flash_Cover	An indicator variable equal to 1 if an analyst recommendation is covered in a news flash disseminated by the business press and 0 otherwise
Full_Cover	An indicator variable equal to 1 if an analyst recommendation is covered in a full article disseminated by the business press and 0 otherwise
ABN_LARVOL	A firm's daily average shares traded over days [0, +2] for large trades, divided by total shares outstanding, minus the firm's trading average over days [−41, −11]. We define large trades as trades greater than or equal to $50,000.
High_Algorithm	An indicator variable equal to 1 if a firm's factor score on the date of a press release of a recommendation revision is greater than a median factor score on the same date or if a firm's average factor score over three days around the press release is greater than a median average factor score over the same period, and 0 otherwise. Factor score is created from a factor analysis of four algorithmic trading proxies developed by Weller (2017) (i.e., the log of odd lot volume ratio, the log of trade-to-order volume ratio, the log of cancel-to-trade ratio, and the average trade size).

Appendix 2. Example Articles

This appendix contains news flashes (B.1) and excerpts from full articles (B.2) about analysts' recommendation revisions. The excerpts from the full articles illustrate the potential role of the press in producing information regarding analysts' recommendation revisions and conveying this information to the market.

News Flashes

- The following news flash was published in Dow Jones Newswires on January 15, 2004:

DJ UBS Upgrades Apple Computer To Buy From Neutral >AAPL.
(END) Dow Jones Newswires.

- The following news flash was published in Dow Jones Newswires on December 19, 2008:

eBay Cut To Mkt Perform From Outperform By Bernstein.
(END) Dow Jones Newswires

- The following news flash was published in Dow Jones Newswires on September 24, 2012:

United States Steel Corp Cut To Neutral From Buy By Citigroup.
(END) Dow Jones Newswires.

Excerpts from Full Articles

- The following article excerpt was published in Dow Jones Newswires on February 15, 2001:

Prudential Cuts Amazon −2: Sell Ratings Extremely Rare.
By Ross Snel Of DOW JONES NEWSWIRES.

NEW YORK (Dow Jones)—Prudential Securities analyst Mark Rowen has lowered his investment rating on shares of Amazon.com Inc. (AMZN) to sell from hold, declaring that there is greater downside risk for holders of the online retailer's shares than there is upside potential.

In a research note Thursday, Rowen wrote that he was prompted to re-examine Amazon's stock valuation by "anemic" growth in the Seattle company's core book, music and video business.

Rowen lowered his price target on Amazon's shares to $9 from $20.

Sell and strong-sell ratings from Wall Street analysts are extremely rare. They account for only 1% of all outstanding stock ratings, according to First Call/Thomson Financial.

Faye Landes, an analyst at Sanford C. Bernstein, has an underperform rating on Amazon, her firm's lowest rating. Sanford Bernstein, however, does not have an

investment banking business, so its analysts are perceived to be free of the pressure that investment banking firm analysts sometimes face.

Holly Guthrie, Rowen's counterpart at Janney Montgomery Scott, had cut her rating on Amazon shares to sell last October but raised it back to hold in late December.

Rowen's move is the latest blow for Amazon, which is coming under increasing pressure to show it can make it to profitability before it runs out of cash.

Last week, Lehman Brothers' convertible debt analyst Ravi Suria, who for some time has been sharply critical of Amazon, issued a scathing report that questioned Amazon's levels of working capital and its ability to continue operating through the remainder of the year.

Amazon's shares traded lower on the news and were recently changing hands at $14.13, down 31 cents, or 2.2%. Volume was 2.2 million shares, compared with daily average volume of 9.4 million shares.

(MORE TO FOLLOW) Dow Jones Newswires.

- The following article excerpt was published in Dow Jones Newswires on April 24, 2007:

Merrill Cuts Wendy's Intl To Sell, Questioning 2007 Targets.

By Richard Gibson Of DOW JONES NEWSWIRES.

Merrill Lynch & Co. (MER), challenging management's performance forecasts, downgraded shares of Wendy's International Inc. (WEN) Tuesday to sell from neutral.

"Expect more bad news than good," restaurant analyst Rachael Rothman wrote in a 24-page report explaining her action.

Lowering her earnings estimates for this year and next, she said, "We believe Wendy's is likely to miss several of its 2007 guidance targets," among them per-share earnings, same-store sales, restaurant margin expansion and earnings before interest, taxes, depreciation and amortization, or Ebitda.

"This is the fourth year in a row that management has targeted 3% to 4% same-store sales growth. In each of the last three years, management has missed its target by between 1% and 7%," Rothman said.

She also said the hamburger chain's planned rollout of breakfast, combined with recent increases in minimum wages, "will make it difficult for WEN to achieve significant labor leverage" this year.

The analyst lowered her current-quarter earnings estimate to 33 cents a share, compared with Street expectations of 40 cents. She expects year earnings of $1.12 compared with the analyst average of $1.27, and she sees fiscal 2008 earnings of $1.40, compared with the average of $1.65, according to Thomson Financial.

Wendy's had no immediate comment on the report.

Shares of Wendy's were trading recently at $32.14, down 71 cents, or 2.2%, on the New York Stock Exchange. Volume was 2.2 million compared with average daily volume of 1.6 million.

-By Richard Gibson, Dow Jones Newswires; 515–282-6830; dick.gibson@dowjones.com

(END) Dow Jones Newswires.

- The following article excerpt was published in Dow Jones Newswires on June 12, 2012:

Bernstein upgrades Boeing to outperform.

Bernstein Research on Tuesday said it is upgrading Boeing Co. (BA) to outperform from market perform, and revising its target price to $92, up considerably from $85 previously. In its report, Bernstein said it improved its outlook on the production rate and delivery of the aircraft maker's 787 commercial model, and that it believes the recent share price decline at Boeing "is an overreaction to macroeconomic difficulties". Bernstein also noted that it will retain its below-consensus EPS estimates for the company through 2012 and 2013, but recommends that investors "ignore" negative earnings revisions and focus on the outlook and deliveries for the 787 program. Boeing shares closed at $70.11 on Monday.

(END) Dow Jones Newswires.

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