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Market uncertainty and the importance of media coverage at earnings announcements☆

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ABSTRACT

We investigate whether increased investor demand for financial information arising from higher market uncertainty leads to greater media coverage of earnings announcements. We also investigate whether greater coverage during times of higher uncertainty further destabilizes financial markets because of greater attention-based trading or, alternatively, improves trading and pricing by lowering investor acquisition and interpretation costs. When uncertainty is higher, we find evidence of greater media coverage of earnings announcements and that the greater coverage leads to improvements in investor informedness, information asymmetry, and intraperiod price timeliness, and greater trade by both retail and institutional investors. In contrast to the media serving an expanded role in improving capital markets during more uncertain times, we fail to find that changes in firm-initiated disclosures lead to similar improvements and find that less frequent analyst forecast revisions exacerbate problems in capital markets during earnings announcements.

1. Introduction

Investors face significant challenges in gathering information about firms' expected future payoffs. As evidence of these challenges, prior research demonstrates that investors are affected by the coverage of earnings information through the media, social networks, equity and credit analyst reports, and other intermediaries (e.g., Blankespoor et al., 2013; Bushee

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et al., 2010; De Franco et al., 2009; Drake et al., 2017; Huang et al., 2014).[3] These studies find evidence of important capital market benefits of greater coverage of earnings information—such as narrower spreads, increased liquidity, and reduced mispricing. Underlying these studies is the notion that investors are constrained in their ability to obtain news or that intermediaries' reports and stories provide additional information beyond firms' earnings releases. Such constraints can arise because investors do not pay the significant costs to be directly informed or have limited cognitive resources to pay attention (e.g., Hong and Stein, 1999; Merton, 1987). Information intermediaries can mitigate these constraints. Greater coverage by intermediaries, however, can also lead to greater problems in financial markets, such as attention-driven trading and momentum trading (e.g., Barber and Odean, 2008).

This study examines whether periods of increased market uncertainty lead the media to expand its role as an intermediary of earnings announcements. We investigate whether higher market-wide investor uncertainty leads to an outward shift in investor demand for financial information that manifests itself through greater media coverage of earnings announcements. Because investors are averse to uncertainty (e.g., Bansal and Yaron, 2004; Drechsler, 2013), their aggregate demand for financial information can grow when market uncertainty increases. We predict an expanded role for the media because it is an information intermediary with extensive readership and broad coverage and one that specializes in the production of relatively low-cost news reports. Because of extensive readership, the production costs of creating stories can be spread more easily across subscribers, leading to lower average costs for producing stories and potential greater profitability. Because of broad market coverage and relatively low production costs, the media can respond to increased demand with an expansion in coverage. We further predict that the media will shift their coverage increasingly to earnings announcements rather than non-earnings announcements because earnings releases have low acquisition costs, are predictable, and typically contain value-relevant information that can help market participants resolve uncertainty. Whether the media shifts coverage based on the level of market uncertainty is unclear, as such actions involve the costly reallocation of resources and higher uncertainty can make it more difficult for media stories to affect investor opinions.

This study also examines how greater media coverage of earnings announcements influences trading and pricing during periods of higher market uncertainty. During such times, increased media coverage of earnings announcements can lead to improved trading and pricing, as evidenced by lower mispricing and information asymmetry, and greater speed of price discovery (e.g., Bushee et al., 2010). However, whether this occurs is unclear, as in other settings, prior research finds that greater media coverage can reduce price efficiency because of resulting attention-driven trading (e.g., Barber and Odean, 2008) and momentum trading (e.g., Hillert et al., 2014), and because of slanted media coverage of news (e.g., Gurun and Butler, 2012).

Using media stories from the RavenPack database during 2004−2013 and the Chicago Board Options Exchange's Volatility Index (VIX) to measure overall market uncertainty,[4] we find that media coverage of earnings announcements increases during periods of higher market uncertainty and that the increased coverage leads to improved trading and price efficiency at earnings announcements.[5] In contrast, we find that media coverage during non-earnings announcement periods decreases with the level of market uncertainty. As higher market uncertainty can lead to important changes in the supply of information by other market participants, which can in turn affect the coverage decisions of the media, our analysis also examines how concurrent changes in firm-initiated disclosure and financial analyst forecasting behavior affect the change in media coverage. During earnings announcements, we find that higher uncertainty leads to less frequent analyst revisions but fail to find a change in firm-initiated disclosures. The decline in analyst revisions, in turn, leads to lower media coverage during periods of greater uncertainty. In contrast, outside of earnings announcements, we find that higher uncertainty leads to relatively fewer firm disclosures but relatively more frequent analyst revisions, which, in turn, result in lower and higher media coverage, respectively.

In further analyses, we provide evidence of when and how the media makes systematic coverage changes during periods of higher market uncertainty. We find greater media coverage when market uncertainty increases for each VIX quartile, suggesting that the media monitors and responds to user demand for financial information at different levels of the VIX. We also find that economic policy uncertainty (Baker et al., 2016), foreign currency volatility, and other sources of market uncertainty are important drivers of the VIX that lead to greater media coverage of earnings announcements. In addition, we show that the lower media coverage found during non-earnings announcement periods is largely explained by the greater coverage of other firms' earnings releases, consistent with non-earnings announcement coverage being crowded out during periods of higher uncertainty. Finally, we show that the media shifts coverage towards short news flash stories that can quickly rebroadcast disclosures, towards bellwether firms (i.e., firms whose earnings are most closely linked to the macroeconomy), away from full stories, and less towards non-bellwether firms.

Regarding how greater coverage at earnings announcements during periods of higher market uncertainty affects capital markets, we find that the greater coverage leads to improvements in trading and pricing. Overall, we find that higher market

[3] Miller and Skinner (2015) provides a discussion of recent developments in this line of research.

[4] We focus on the VIX because it captures investors' expectations about future volatility, is widely followed by market participants, especially the media, and affects the broadest set of listed firms. For instance, the index is often colloquially referred to as “Wall Street's fear gauge” and as “a staple of the financial press” (Loder and Banerji, 2017). The focus on the market's expectation differs from alternative measures of expected future macroeconomic uncertainty (Jurado et al., 2015; Rossi and Sekhposyan, 2015). Other types of common uncertainty (e.g., industry uncertainty) can lead to similar problems for investors.

[5] Price efficiency is defined generally as the extent to which prices and trading capture all information available to market participants.

uncertainty leads to deteriorating capital market conditions at earnings announcements, as evidenced by abnormally higher price changes and trading volume, wider bid-ask spreads, lower depth, reduced intraperiod price timeliness, and increased trade by retail investors but decreased trade by institutional investors. When we focus on how the level of the VIX affects media coverage and then how media coverage affects these capital market outcomes, however, we find that the greater coverage during such times leads to improved investor informedness, as evidenced by higher abnormal price changes and trading volume. We also find improved price efficiency, as evidenced by narrower spreads and greater depth, increased intraperiod price timeliness, and increased trade by not only retail investors but also institutional investors. In addition, when we focus on how the level of the VIX influences firm disclosure and analyst forecast revisions and then how each affects the different capital market outcomes, we find that fewer analyst forecasting revisions during earnings announcements lead to even worse capital market outcomes but that disclosure changes have little impact on capital market outcomes.

These findings offer several important contributions to prior literature. We provide evidence that media coverage increases at earnings announcements during periods of elevated market uncertainty and that the increased coverage in turn leads to improved trading and pricing. This evidence builds on and extends the growing body of research findings of when and in what settings media coverage can make capital markets more or less efficient (e.g., Blankespoor et al., 2018).

In addition, we provide evidence of how the media makes trade-offs during times of higher uncertainty. Prior research shows that media attention clusters around earnings announcements (e.g., Tetlock et al., 2008), however, little evidence exists regarding why that coverage changes over time or across firms. Our results provide evidence that the media's move to expand coverage of earnings announcements crowds out the coverage of non-earnings announcement periods. Our results also provide evidence that journalists write fewer full stories during periods of higher uncertainty but move to more frequent small updates using short news flashes. Further, our results provide evidence of increased coverage of bellwether firms while not increasing coverage as much for non-bellwether firms.

Finally, our findings demonstrate that the importance of media coverage during earnings announcements grows during times of higher market uncertainty relative to other sources of information. In particular, during such times, we find that firm-initiated disclosure is relatively unchanged and that analyst forecast revisions are less frequent at earnings announcements. In addition, in contrast to the activities of the media improving capital market outcomes at earnings announcements, we fail to find similar evidence for firm-initiated disclosures and find that less frequent analyst forecast revisions result in worse capital market outcomes.

2. Background and research hypotheses

2.1. Prior research on the media and earnings announcements

The media plays an influential role as an information intermediary in financial markets.[6] Coverage by the media tends to concentrate on firms that are of greater interest to its readers, individuals, and institutional investors. This leads to greater coverage for larger firms, value stocks, firms with more analyst coverage, firms more widely held by individuals and institutions, greater idiosyncratic volatility stocks, indexed firms, firms with more employees, more heavily traded stocks, and momentum stocks (e.g., Bushee et al., 2010; Drake et al., 2014, 2017; Fang and Peress, 2009; Hillert et al., 2014). Coverage by the media also tends to concentrate during the days around earnings announcements (e.g., Drake et al., 2014; Tetlock et al., 2008; Thompson et al., 1987). Accordingly, the media appears to respond to the demands of individual and institutional investors to follow certain types of firms and to cover earnings releases to meet investor demands.

Media coverage of earnings announcements also has important capital market consequences. For instance, Bushee et al. (2010) finds that media coverage of earnings announcements assists in narrowing bid-ask spreads and increasing depth. Soltes (2011) also finds that greater coverage of earnings information increases trading volume and lowers idiosyncratic volatility. Engelberg and Parsons (2011) shows that local coverage of earnings announcements leads to greater trading by local investors. Drake et al. (2014) demonstrates that cash flow mis-pricing is lower for firms receiving greater coverage of their earnings announcements. Blankespoor et al. (2018) provides evidence that algorithmic articles of firms' earnings announcements produced by the Associated Press and disseminated by large media outlets lead to higher trading volume and liquidity.

2.2. Research hypotheses

2.2.1. Increased media coverage of earnings releases

Coverage of firms' earnings releases by media outlets is a function of the demand for such information, which can vary over time. As shown in Veldkamp (2006), because complementarity in information acquisition can arise, the media can

[6] A large literature examines the role of the media in financial markets: Ahern and Sosyura (2014); Ahn et al. (2019); Blankespoor et al. (2018); Bushee et al. (2010, 2018); Bushman et al. (2017); Drake et al. (2014, 2017); Engelberg and Parsons (2011); Fang et al. (2014); Fang and Peress (2009); Griffin et al. (2011); Guest (2018); Hillert et al. (2014); Klibanoff et al. (1998); Miller (2006); Peress (2014); Solomon (2012); Solomon et al. (2014); Soltes (2011); Tetlock (2007); Tetlock et al. (2008); Tetlock (2010); Thompson et al. (1987); Twedt (2015).

maximize their profitability by obtaining information with a price that will exceed the cost of obtaining and disseminating the information.[7] The investment represents, for instance, the cost of a journalist preparing a story or obtaining non-public information. As the number of purchasers of the information increases, the cost is spread out, making the investment in information more profitable. The relative value of the information obtained will dictate the price that the individual supplier can charge and, accordingly, the expected cost it is willing to incur. The media generally incurs relatively low production costs to acquire information. This is in contrast to other more specialized suppliers of information that incur high production costs (e.g., investment advisors with private newsletters).

Higher demand for media coverage is expected to arise when uncertainty about asset payoffs grows. Veldkamp (2006) demonstrates that important shifts in the aggregate demand for information can occur when common shocks occur to the variance of firms' expected future payoffs, as the shocks to expected payoffs are multiplicative and time-varying. Because news stories become more valuable during such times due to the higher variance of expected payoffs, there should be an outward shift in demand for news stories.[8] Although less formal than Veldkamp (2006), Jensen (1979) also predicts that consumer preferences—especially aversion to ambiguity—shape the demand for news. In addition, this prediction is consistent with prior findings that investors dislike uncertainty, requiring a premium for holding assets with high uncertainty risk (e.g., Bansal and Yaron, 2004; Drechsler, 2013; Kumar, 2009; Ozoguz, 2009; Segal et al., 2015).

Because of the greater demand, periods of higher market uncertainty can lead to significant increases in media coverage. This prediction is premised on the media paying attention to changes in market uncertainty. Consistent with this assumption, as Baker et al. (2016) shows, the top 10 leading U.S. newspapers increase their coverage of major events that create economic policy uncertainty, as measured by their text-based economic policy uncertainty (EPU) index. Also, using an alternative text-based uncertainty measure from front-page articles of the *Wall Street Journal*, Manela and Moreira (2017) shows that the media closely tracks their coverage with information also contained in the VIX.

To gain further insight, we interviewed senior journalists that have written for major business press outlets including *Bloomberg News*, *Dow Jones Newswires*, *Forbes*, *The Financial Times*, *The New York Times*, and *The Wall Street Journal*. Consistent with our assumption, journalists indicated that the business press actively monitors investor demand for information. For instance, one journalist indicated that "stories get pushed based on what investors are searching for. Our analytics allows us to see what people are looking for and we respond to what the readers are requesting, [based on such inputs as] Google searches, other newspapers, and social media." Our interviews of journalists also included questions about how and why the media shift coverage during periods of market uncertainty (e.g., what types of news stories are more common during periods of greater uncertainty). We discuss the relevant institutional insights gained through our interviews in later sections of the study.

While the media could increase all types of coverage in response to heightened demand for information, we predict that the media will increase their coverage of earnings releases rather than all possible types of news stories. The media face short-term supply constraints that force them to make trade-offs in their coverage decisions. Increasing the supply of stories, particularly original stories, requires costly investments in hiring and training journalists, and in acquiring private information.[9] In addition, the information that firms and other information intermediaries provide may be affected by higher uncertainty; accordingly, the cost of acquiring some types of information may also increase with market uncertainty. Because of these constraints and the media's role as a low-cost information supplier, we predict that the media will shift toward news stories that are relatively low cost, predictable, and relevant. Firms' earnings announcements possess all three attributes. Specifically, the gathering and dissemination of earnings information is relatively inexpensive and firms' announcement dates can be readily anticipated. In addition, as shown in prior research, the media's dissemination of earnings information has important capital market consequences.

Whether the media respond to greater demand for coverage by increasing their capacity to supply coverage or by altering the mix of coverage they provide, however, depends on the net benefit to the media. Despite the increased demand for coverage during periods of higher uncertainty, the needed outlay of expenditures to increase the resources to acquire, process, interpret, and disseminate earnings information could preclude significant coverage changes by the media. Additionally, unlike the demand for greater coverage of specific types of firms (e.g., larger firms), temporary demand shifts brought about by higher market uncertainty can be relatively unpredictable.

[7] Whether the cost is fixed or variable only matters over the very short-run. Within Veldkamp (2006), the cost of a story is primarily fixed as news organizations are constrained in the short-run by their personnel, information, and time for collecting and synthesizing information and then disseminating news stories. Over longer periods virtually all costs are variable, as news organizations can shift almost all production costs. For instance, investments in individual journalists are variable costs. Consistent with this, 100,000 journalists have been fired over the last decade Thompson (2016), while over 10,000 new journalist majors graduate each year (see: https://datausa.io/profile/cip/090401/).

[8] The increased demand can come from readers that follow the firm about which the story is written and readers who are trying to learn about macroeconomic uncertainty through multiple noisy signals from a wide number of firms; the latter can occur as individual firm's earnings reveal important information about the macroeconomy (Anilowski et al., 2007; Bonsall et al., 2013; Aobdia et al., 2014).

[9] The notion that the press is constrained in its provision of news stories is pervasive in practice. Randall (2000) describes the constraints in this way: "There are limits to the process of journalism. Shortage of time and information are two which are endemic." Our interviews with senior journalists indicated that short-term constraints continue today, even in the digital news environment. For instance, one journalist indicated, "all newsrooms are stressed based on the number of people available for coverage."

2.2.2. Capital market consequences of increased coverage of earnings releases

When the level of market uncertainty increases, greater demand for coverage of earnings information can lead to the media having a more important role as an information intermediary. If the media shift resources to increase the dissemination and interpretation of earnings information, a greater number of traders will receive the information and update their beliefs. This can lead to important changes in prices, trading volume, and price efficiency. First, following Holthausen and Verrecchia (1990), larger abnormal price changes will occur if the increased dissemination and interpretation of earnings announcements leads to greater informedness (i.e., the degree to which investors become more informed) and consensus (i.e., the degree of agreement among investors). In addition, larger abnormal trading volume will occur if the increased coverage leads to greater informedness; however, lower (higher) abnormal volume will be observed if the increased coverage leads to greater (lower) consensus. Thus, unlike abnormal price changes, whether higher or lower abnormal trading volume will occur depends on whether lower consensus complements greater informedness or whether greater consensus dominates. Accordingly, the two types of market reactions to earnings announcements can provide different insights into investors' reactions when media coverage grows during periods of higher market uncertainty.

Second, greater media coverage of earnings announcements during such times can lead to trading and pricing being more or less efficient. On one hand, the increased coverage could overcome investor limited attention issues when uncertainty is higher, resulting in improved price efficiency. Prior research suggests that investors face limited attention with regard to firm-specific information (e.g., Bloomfield, 2002; Hirshleifer et al., 2009; Hirshleifer and Teoh, 2003; Merton, 1987; Peng and Xiong, 2006). The media, in their role as an information intermediary, can both disseminate and synthesize the information released in earnings announcements, lowering information acquisition and interpretation costs and improving price efficiency (e.g., Bushee et al., 2010; Fang and Peress, 2009; Tetlock, 2010). Empirical evidence indicates that the media can serve such a role, finding that media coverage reduces mispricing (Drake et al., 2014), information asymmetry (e.g., Blankespoor et al., 2018; Soltes, 2011) and the cost of capital (e.g., Fang and Peress, 2009; Kothari et al., 2009). These findings are consistent with the gradual diffusion of news model of Hong and Stein (1999).

On the other hand, greater coverage could lead to more attention-driven trading at the worst possible time (i.e., higher market uncertainty), resulting in diminished price efficiency. Chan (2003) and Vega (2006) find that price drift is greater for news receiving coverage by the media. Barber and Odean (2008) provides evidence that coverage leads individual investors to purchase stocks receiving attention. Engelberg et al. (2012) offers evidence that stock recommendations from the popular television show *Mad Money* generate attention-based trading and overnight returns that subsequently reverse in later months. Bushee et al. (2018) finds that such attention-driven trading is more pronounced during IPO quiet periods. In addition, Tetlock (2011) shows that individual investors trade on stale news stories and that such trading leads to subsequent price reversals. Further, some case studies provide evidence of large price and volume changes to media coverage that simply rebroadcast news made public months earlier (e.g., Huberman and Regev, 2001). Finally, during heightened market uncertainty, media coverage can have a more pronounced effect on short-term price distortions due to greater investor sensitivity to news (e.g., Garcia, 2013; Williams, 2014). Because of these differing possibilities, we do not make a directional predication regarding how greater media coverage of earnings announcements during periods of higher market uncertainty affects trading and price efficiency.

3. Research design

3.1. Increased media coverage of earnings releases

Our first set of empirical tests examines how market uncertainty leads to systematic increases in media coverage of earnings announcements. We begin by investigating whether media coverage of earnings announcements grows with market uncertainty using the following OLS regression model:

$$LCoverage_X = \alpha_0 + \alpha_1 VIX + \sum \alpha_i Control_i + \varepsilon \quad (1)$$

where $LCoverage_{EA}$ is the natural logarithm of one plus the number of news articles with relevance scores greater than or equal to 90 captured by RavenPack on days $[0, +1]$ relative to the quarterly earnings announcement ($X = EA$); and *VIX* is the average level of the Chicago Board Options Exchange Volatility Index during the period from five days following the announcement of quarter $t-1$ earnings to five days prior to the announcement of quarter t earnings.

We test whether significant increases in media coverage during times of higher market uncertainty are concentrated at earnings announcements or are, alternatively, attributable to increased demand for all types of information. Our approach, similar to that adopted by Bushee et al. (2010), uses non-earnings announcement periods as a benchmark to evaluate the effect of market uncertainty on the coverage of earnings announcements relative to the coverage of other news. Our approach differs from that of Bushee et al. (2010) as we estimate separate models for the earnings announcement and non-earnings announcement periods, rather than one model for abnormal earnings announcement coverage. The dependent variable for the non-earnings announcement periods, $LCoverage_{NonEA}$, is the natural logarithm of one plus the number of stories written about firm i on non-earnings announcement trading days ($X = NonEA$) that fall between the current and most recent prior earnings announcement divided by the number of non-overlapping two-day non-earnings announcement trading days

(for comparability with $LCoverage_{EA}$).[10] We expect that α_1 when $LCoverage_{EA}$ is the dependent variable will be greater than when $LCoverage_{NonEA}$ is the dependent variable.

We also examine how other market participants alter their actions in response to higher market uncertainty and how the media coverage is influenced by their actions. First, we investigate how firms change their disclosure practices in response to higher market uncertainty. Such change can occur if investors demand greater disclosure during more uncertain times. Managers may respond to the heightened demand by increasing their disclosures. Alternatively, managers may decrease their disclosure due to the increased uncertainty. Consistent with managers facing greater costs or limitations of disclosing forward-looking information, Kim et al. (2015) find that managers are less likely to issue management earnings forecasts during periods of elevated macroeconomic uncertainty.[11] Second, we investigate how analysts change their forecasting behavior in response to higher uncertainty. Loh and Stultz (2017) find that during periods of macroeconomic uncertainty analysts work harder by providing more accurate forecasts conditioned on the level of macroeconomic uncertainty and more frequent earnings forecasts. Loh and Stultz (2017) also find, however, that during such times there are significant reductions in analyst ranks, consistent with shrinking compensation and greater attrition. These changes in manager and analyst behavior during periods of higher market uncertainty could lead to changes in media coverage, as their disclosures and forecasts are common sources of information for journalists' stories (Call et al., 2018).

To examine how changing firm disclosure and analyst forecasting practices affect media coverage during periods of higher market uncertainty, we use a mediation model (i.e., path analysis) approach following the suggestions of MacKinnon and Dwyer (1993) and Hayes and Rockwood (2017). Prior accounting research has used path analysis to formally test whether a relationship between X and Y arises through path Z (e.g., Bonsall et al., 2018; Bonsall and Miller, 2017; Landsman et al., 2012; Lang et al., 2012). In our analysis, we decompose the total effect of the relationship between VIX and $LCoverage_X$ in equation (1) into the mediated paths resulting from changes in firm disclosure and analyst forecast revisions and the direct path of $VIX \rightarrow LCoverage_X$. Our mediator variable for firm disclosure is *LForm8K*, the natural logarithm of one plus the number (two-day averaged number) of Form 8-K filings by a firm during the earnings (non-earnings announcement) window. Form 8-Ks are collected from the SEC EDGAR database using an approach similar to Guest (2018). We use the release of Form 8-Ks as they typically relate to material events that arise in day-to-day changes in operations, performance, financial information, governance, and trading (e.g., Lerman and Livnat, 2010). Also, other forms of voluntary disclosure, such as management earnings forecasts and press releases, generally overlap with the release of a Form 8-K. For instance, Chuk et al. (2013) finds that the overlap of management forecasts in Form 8-Ks and press releases is 94 percent but that their inclusion is more common in Form 8-Ks. Our mediator variable for analyst forecasting activity is *LRevisions*, the natural logarithm of one plus the number (two-day averaged number) of analyst earnings forecast revisions made during the earnings (non-earnings announcement) window.

Certain types of firms are more likely to receive media attention than others do, such as large and growing firms. Our control variables are intended to capture the determinants of firms' normal level of media coverage. Specifically, similar to those used in prior related research (e.g., Blankespoor et al., 2018; Bonsall et al., 2018; Bushee et al., 2010; Drake et al., 2014, 2017; Fang and Peress, 2009; Hillert et al., 2014) our control variables (defined in Appendix A) include *AbsEarnSurp*, *NegSurp*, *LMktCap*, *LFollow*, *InstHold*, *IVol*, *Ret*,[12] *SP500Member*, *LEmployee*, *LOwn*, *NasdaqTraded*, *Turnover*, and *MomStrength*. Despite our many controls, our causal interpretation of the findings could be threatened if other (unobservable) factors are correlated with our variable of interest, *VIX*, and $LCoverage_{EA}$. To mitigate this possibility, we conduct our tests using a firm fixed-effects model. This approach provides evidence of how the level of market uncertainty affects within-firm variation in media coverage.

3.2. Capital market consequences of increased coverage of earnings releases

3.2.1. Changing investor informativeness and consensus

Our next set of empirical tests examines the extent to which capital market outcomes during earnings announcements are negatively affected by higher market uncertainty and whether higher media coverage during such periods worsens or improves trading and pricing. We investigate these issues using the below model:

$$CapMktOutcome = \delta_0 + \delta_1 VIX + \sum \delta_i Control_i + \upsilon \tag{2}$$

We first examine how investor informativeness and consensus change around earnings announcements. We investigate whether abnormal price changes at earnings announcements increase when market uncertainty is higher using $|AbnReturn|$,

[10] Our approach is equivalent to Bushee et al. (2010) except that it allows for the estimation of separate coefficients in the earnings and non-earnings announcement periods. Specifically, Bushee et al. (2010) measure abnormal press coverage as: $ABN\_PRESS = Ln((1+PRESS_{EVENT})/(1+PRESS_{PRE}))$. Accordingly, by the quotient rule, coefficient estimates when using ABN_PRESSequal those from the separate estimation of $Ln(1+PRESS_{EVENT})$minus those from the separate estimation of $Ln(1+PRESS_{PRE})$.

[11] Nagar et al. (2019) find, however, that managers are more likely issue forecasts when economic policy uncertainty is higher.

[12] We control for firm-specific returns to alleviate concerns that good or bad news determines the level of media coverage. We do not directly control for market-level returns, however, as prior work by Romer (1990), Fernández-Villaverde et al. (2011), Fernández-Villaverde et al. (2015), and Barrero et al. (2017) demonstrates, changes in the business cycle are caused by shocks to macroeconomic uncertainty.

defined as the absolute value of the raw return minus the CRSP value-weighted index return during the earnings announcement period $[0, +1]$. Our measure of abnormal price changes follows Tetlock et al. (2008) and Tetlock (2011). As Tetlock et al. (2008) show, controlling for traditional risk factors has little effect on abnormal return calculations focused on short-window announcements of firm-specific news. Because the pre-disclosure precision of information should be lower when market uncertainty is higher and the release of earnings information should lead to greater belief revisions (Veldkamp, 2006), abnormal price changes should be higher when market uncertainty is higher.

We also examine whether there is abnormal trading volume when market uncertainty is higher using *AbnVol*, defined as share turnover during the earnings announcement period $[0, +1]$ less the median two-day share turnover of consecutive two-day periods during the non-announcement period. The non-announcement period is comprised of all dates between five trading days subsequent to the release date of quarter $t-1$ earnings and five trading days prior to the release date of quarter t earnings. Our measure of abnormal volume is similar to that used in Barron et al. (2018). We expect that abnormal trading volume surrounding earnings announcements will be higher when market uncertainty is higher. This prediction assumes again that pre-disclosure precision of information is lower when market uncertainty is higher and that the release of earnings information leads to greater belief revisions. In models of trading volume (Kim and Verrecchia, 1991a, b), greater differential precision of information before earnings announcements can lead to greater revisions to investors' beliefs when earnings are released. Empirical studies examining earnings announcements support this prediction (e.g., Bamber et al., 2011). However, if the release of earnings during such times leads to greater investor consensus dominating greater informativeness, lower abnormal trading volume will be observed.

We directly investigate whether increased media coverage during periods of higher market uncertainty is responsible for the predicted changes in prices and trading volume in equations (2) and (3) using path analysis. Specifically, we decompose the total effect of the relationship between *VIX* and |*AbnReturn*| and *AbnVol* into mediated paths resulting from changes in media coverage, as well as changes in firm disclosure and analyst forecast revisions. Our mediator variables are $LCoverage_{EA}$, *LForm8K*, and *LRevisions*. For |*AbnReturn*| and *AbnVol*, the combined indirect paths of $VIX \rightarrow LCoverage_{EA} \rightarrow |AbnReturn|$ and $VIX \rightarrow LCoverage_{EA} \rightarrow AbnVol$ are of primary interest. Control variables included in the analyses are the same as equation (1) and are consistent with those used in prior related research.

3.2.2. Changing price efficiency

Abnormal price changes and trading volume around earnings announcements could yield results that are caused by more information being available to investors through greater media coverage or by uninformed investors trading more in response to greater coverage. Accordingly, our last set of tests explores whether price efficiency improves or declines around earnings announcements.

3.2.2.1. Information asymmetry. Greater coverage by the media at earnings announcements can reduce information asymmetry (i.e., narrower bid-ask spreads and greater depth). Examining different samples of firms, Bushee et al. (2010), Soltes (2011), and Blankespoor et al. (2018) find supporting evidence of a reduction in information asymmetry. During periods of increased market uncertainty, greater coverage could also lead to improvements in information asymmetry (e.g., lower spreads and greater depth), have no effect given the increased market uncertainty, or even lead to greater information asymmetry as the increased market uncertainty could provide sophisticated investors with an information advantage at earnings announcements. We investigate how increased market uncertainty affects information asymmetry at earnings announcements using two variables for information asymmetry: *AbnSpread* is the weighted average effective bid-ask spread during the earnings announcement period $[0, +1]$ less the median two-day weighted average effective bid-ask spread of consecutive two-day periods during the non-announcement period and *AbnDepth* is the weighted average bid and offer depth during the earnings announcement period $[0, +1]$ less the median two-day weighted average bid and offer depth of consecutive two-day periods during the non-announcement period. Following Holden and Jacobsen (2014) and Blankespoor et al. (2018), weighted average amounts are based on the amount of time during each trading day that the spreads and depth are in force. Similar to our investor informativeness and consensus tests, we examine the mediated paths arising from changes in media coverage, as well as disclosure and analyst forecast revisions, for *AbnSpread*, *AbnDepth*, in this and later tests. We also use the same control variables.

3.2.2.2. Intraperiod price timeliness. Greater media coverage of earnings announcements can also increase the speed by which earnings information is impounded into prices. Along these lines, Twedt (2015) finds that greater media dissemination of the release of management earnings forecast leads to greater efficiency in the incorporation of the information into price. Blankespoor et al. (2018), however, do not find that greater dissemination of automated articles by the Associated Press of earnings releases leads to greater speed of price discovery. During periods of higher market uncertainty, how greater media coverage affects price discovery is again unclear as the greater interpretation and dissemination of earnings information could speed price discovery, or alternatively, it could lead to biased or uninformed trading, particularly by retail investors. Our investigation of this possibility begins with examining how higher market uncertainty affects intraperiod price timeliness

using *IPT*, defined as the adjusted intraperiod timeliness measure measured over the six-day earnings announcement window suggested by Blankespoor et al. (2018).[13] Larger *IPT* values are consistent with faster price discovery.

3.2.2.3. Trade by retail and non-retail investors. The greater attention and dissemination brought about by greater media coverage at earnings announcements can lead to more trade by retail investors. Consistent with such a possibility, Blankespoor et al. (2018) finds more retail trading volume following greater dissemination of automated articles by the Associated Press. When market uncertainty is higher, greater coverage could lead to more or less trade by retail investors. Such time periods could make retail investors more reluctant to trade due to the greater uncertainty, despite greater dissemination. Alternatively, it could make retail investors more likely to trade given heightened investor sensitivity and greater media dissemination of earnings information. In addition, the greater media coverage can lead to more trade by institutional investors, as the greater coverage increases the informedness of institutional investors. Accordingly, the actions of institutional investors provide greater insight into whether abnormal trading volume increases are attributable to increased investor informedness. The possibility exists that greater coverage at earnings announcement can lead to greater investor consensus, however, resulting in abnormally lower trading.

We examine these possibilities using two variables for abnormal trading: *AbnRetailVol* is share turnover by retail investors during the earnings announcement period $[0, +1]$ less the median two-day share turnover by retail investors of consecutive two-day periods during the non-announcement period, which is comprised of all dates between five trading days subsequent to the release date of quarter $t-1$ earnings and five trading days prior to the release date of quarter t earnings and *AbnNonRetailVol* is share turnover by non-retail investors during the earnings announcement period $[0, +1]$ less the median two-day share turnover by non-retail investors of consecutive two-day periods during the non-announcement period. The non-announcement period is comprised of all dates between five trading days subsequent to the release date of quarter $t-1$ earnings and five trading days prior to the release date of quarter t earnings. Retail trades are identified and separated from non-retail trades using the approach created by Boehmer et al. (2017) and adopted in recent related research (e.g., Bushee et al., 2018; Guest, 2018; Israeli et al., 2017). Unlike prior studies' use of trade size to identify retail trades, the Boehmer et al. (2017) approach relies on retail trades being filled off-exchange in broker's inventory or through wholesalers (identified as FINRA Trade Reporting Facility Trades with exchange code “D” trades on TAQ with small price improvements).

4. Sample and empirical results

4.1. Data and sample description

We begin our sample construction by selecting the intersection of the CRSP database and all quarterly earnings announcements in Compustat during the 2004–2013 period, yielding 291,449 observations. The availability of control variables for our regression analyses reduces the sample further to 112,725 firm-quarter (earnings announcement) observations. Following von Beschwitz et al. (2017), we collect news stories from the Dow Jones edition of the RavenPack 3.0 news database with news stories beginning in January 2004 and ending in December 2013.[14] During our sample period, the RavenPack database covers approximately 8000 companies and tracks nearly 10 million unique news stories. For each story, RavenPack records a score, called Relevance, to indicate the prominence of a firm within the story with higher values corresponding to the greater prominence of a firm within the story. We count news stories each day as the number of news flashes or full (i.e., original) articles with a relevance score of at least 90 from the Dow Jones news service. As discussed by Drake et al. (2014), RavenPack's relevance score leads to the isolation of articles that focus on the companies in our sample. In addition, RavenPack's identification of articles as news flashes or full articles allows us to examine the possible asymmetric supply of news flashes relative to full articles. News stories that relate to stock prices or trade imbalances are dropped because a large number of these stories are automatically generated, and stories that relate to insider trading are dropped because of changes in their coverage during the sample period (Rogers et al., 2016). We winsorize all continuous variables in our sample at the 1st and 99th percentile sample values.

Table 1 presents descriptive statistics for variables used in our earnings announcement analyses and for the coverage variables used in our non-earnings announcement period analyses. During the two-day window starting on the earnings announcement date, there are, on average, 11 news articles. Of these articles, approximately 5.6 are news flashes and 2.3 are original news stories. The average news flashes and original news stories do not sum to the average total articles because RavenPack also includes press releases and tabular material (e.g., a firm's income statement) in its news coverage. Media

[13] As the internet appendix of Blankespoor et al. (2018) details, the original IPT measure of Butler et al. (2007) assumes that no return overreaction and reversal occurs during the five-day measurement window; the adjusted measure corrects for this possibility. Potential alternative measures of the efficiency of price responses to earnings information include cross-sectional differences in earnings response coefficients and longer-term post earnings announcement drift. Consistent with prior research examining the price effects of the media (e.g., Blankespoor et al., 2018), we focus on intraperiod price timeliness as these alternative measures further require conditioning on the market's expectation of earnings surprises.

[14] Our sample period ending in 2013 avoids the dramatic increase in robo-journalism started by the Associated Press in 2014 (Blankespoor et al., 2018). However, other automated news flashes occur during our sample period to some extent at earnings releases (e.g., Dow Jones Newswire on February 12, 2013, “Clearwire Corp 4Q Loss/Shr 29c”). This would affect our tests if earnings announcement and non-earnings announcement news flashes are automated in systematic ways that occur in tandem with changes in market uncertainty.

Table 1
Descriptive statistics.

	Mean	Std. Dev.	Q1	Median	Q3
Dependent variables:					
$Coverage_{EA}$	10.989	9.806	5.000	9.000	14.000
$Coverage_{EA,Flash}$	5.580	5.039	3.000	4.000	7.000
$Coverage_{EA,Orig}$	2.321	3.988	0.000	1.000	2.000
$Coverage_{NonEA}$	0.651	1.065	0.111	0.340	0.727
$Coverage_{NonEA,Flash}$	0.253	0.389	0.000	0.122	0.321
$Coverage_{NonEA,Orig}$	0.190	0.488	0.000	0.045	0.160
$\lvert AbnReturn \rvert$	0.047	0.039	0.019	0.036	0.062
AbnVol	0.025	0.039	0.002	0.011	0.031
AbnSpread	0.050	0.827	−0.012	0.007	0.049
AbnDepth	0.015	0.388	−0.188	0.024	0.222
IPT_{Adj}	3.320	1.861	2.690	3.827	4.530
AbnRetailVol	0.049	0.108	0.000	0.014	0.052
AbnNonRetailVol	0.759	1.264	0.038	0.340	1.007
Variables of interest:					
VIX	21.919	9.523	15.009	19.347	24.784
EPU	128.974	39.076	99.543	135.782	159.120
OilVol	35.348	12.861	28.970	31.467	35.984
CurrVol	11.207	3.604	8.675	10.311	12.481
OtherUncertainty	0.075	2.728	−1.401	−0.452	1.833
Form8K	0.920	0.495	1.000	1.000	1.000
Revisions	4.158	5.381	0.000	2.000	6.000
AbsEarnSurp	0.005	0.088	−0.009	0.001	0.010
NegSurp	0.455	0.498	0.000	0.000	1.000
Control variables:					
MktCap	3662.290	10510.699	130.704	551.850	2222.413
BM	0.633	0.599	0.279	0.503	0.828
Follow	9.668	8.265	3.000	7.000	14.000
InstHold	0.619	0.304	0.376	0.693	0.878
IVol	0.425	0.256	0.243	0.360	0.532
Ret	−0.038	0.542	−0.294	0.030	0.279
S&P500Member	0.131	0.338	0.000	0.000	0.000
Employee	8.003	19.902	0.270	1.300	5.500
Own	11.949	40.695	0.240	1.045	5.499
NasdaqTraded	0.523	0.499	0.000	1.000	1.000
Turnover	0.009	0.008	0.004	0.007	0.012
MomStrength	0.315	0.399	0.077	0.181	0.384

Table 1 presents descriptive statistics for the samples and variables used in the analysis. The descriptive statistics are for quarterly earnings announcements from 2004 to 2013 from Compustat, equity market information from CRSP, news stories from RavenPack, and intraday trading and price information from the NYSE's Daily TAQ database. All variables are defined in Appendix A.

coverage is dramatically lower, on average, during non-earnings announcement periods. This pattern exists for total coverage (average of 0.7 stories), news flashes (average of 0.3 stories), and original articles (average of 0.2 stories). This indicates that the nature of the demand for and supply of information at earnings announcements differs from other days during the fiscal quarter. The panel presents descriptive statistics for the other variables used in our analyses.

4.2. Increased media coverage of earnings releases

4.2.1. Primary results

Our first set of empirical results relates to whether media coverage of earnings announcements increases during periods of higher uncertainty. Panel A of Table 2 presents the formal path analysis for our mediation tests using equation (1) for earnings announcement and non-earnings announcement periods. We find that the direct path $VIX \rightarrow LCoverage_{EA}$ is significantly positive in column (1). This indicates that media coverage of earnings announcements grows with market uncertainty. In contrast, the direct path $VIX \rightarrow LCoverage_{NonEA}$ is significantly negative in column (2). The reduction in coverage during non-earnings announcement periods could be the result of constraints faced by the media. For instance, the increase in coverage of earnings announcements could limit the media's ability to cover non-earnings announcement events; a possibility we explore later. Also, the coefficient estimate for *VIX* during earnings announcements is significantly greater than the estimate during non-earnings announcement periods, as shown in column (3). The coefficient for abnormal media coverage at

Table 2
Abnormal media coverage of earnings announcements and market uncertainty: Primary results.

	(1)		(2)		(3)	
	$X = EA$		$X = Non-EA$		Diff.	
	Coef.	Bootstrap z	Coef.	Bootstrap z	Coef.	Bootstrap z
Panel A: Path analysis						
Direct path:						
VIX → LCoverage$_X$	**0.0030****	**2.54**	**−0.0008****	**−2.08**	**0.0038*****	**3.40**
Mediated paths:						
I. *VIX → LForm8K*	0.0003	1.25	−0.0004**	−2.20	0.0006**	2.38
II. *LForm8K → LCoverage$_X$*	0.3863***	14.89	1.8610***	38.83	−1.4747***	−29.83
Indirect effect via *LForm8K* (I × II)	0.0001	1.26	−0.0007**	−2.19	0.0008**	2.45
III. *VIX → LRevisions*	−0.0011**	−2.43	0.0006***	3.45	−0.0017***	−3.09
IV. *LRevisions → LCoverage$_X$*	0.0226***	4.15	0.3683***	20.56	−0.3458***	−20.41
Indirect effect via *LRevisions* (III × IV)	−0.0000**	−1.96	0.0002***	3.41	−0.0002***	−3.39
Total indirect effect (I × II + II × IV)	0.0001	0.90	−0.0005	−1.35	0.0005	1.53
Total effect	0.0031**	2.54	−0.0013***	−4.13	0.0044***	3.42
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			
z-test: Direct = I × II	2.45**		−0.20		2.58**	
z-test: Direct = III × IV	2.55**		−2.57**		3.57**	

	(1)	(2)	(3)
	LCoverage$_{EA}$	*LCoverage$_{NonEA}$*	Diff.
Panel B: Mediated regression			
VIX	**0.0030*****	**−0.0008****	**0.0038*****
	(3.08)	**(-2.40)**	**(3.69)**
LForm8K	0.3863***	1.8610***	−1.4747***
	(14.68)	(37.30)	(−26.14)
LRevisions	0.0226***	0.3683***	−0.3458***
	(3.95)	(20.18)	(−18.08)
AbsEarnSurp	0.0621*		
	(1.72)		
NegSurp	0.0153***		
	(3.33)		
LMktCap	0.0058	0.0146***	−0.0088
	(0.39)	(2.98)	(−0.57)
BM	0.0402***	0.0022	0.0380**
	(2.75)	(0.48)	(2.49)
LFollow	0.0901*** (6.15)	−0.0015 (-0.34)	0.0916*** (5.99)
InstHold	0.1479***	−0.0184	0.1663***
	(2.76)	(−1.04)	(2.94)
IVol	−0.0628	0.0382***	−0.1011**
	(−1.60)	(3.91)	(−2.49)
Ret	0.0049	0.0026	0.0023
	(0.24)	(0.65)	(0.11)
S&P500Member	−0.0822	−0.0196	−0.0626
	(−1.33)	(−0.78)	(−0.94)
LEmployee	0.0725***	0.0255***	0.0470***
	(5.05)	(5.14)	(3.10)
LOwn	−0.0102	0.0027	−0.0129*
	(−1.52)	(1.13)	(−1.81)
NasdaqTraded	0.0895	0.0274	0.0620
	(1.25)	(1.27)	(0.83)
Turnover	2.3816**	1.4690***	0.9126
	(2.32)	(3.87)	(0.83)
MomStrength	0.0035	0.0065***	−0.0030
	(0.54)	(2.93)	(−0.45)
Firm Fixed Effects	Yes	Yes	
Observations	112,725	112,725	
Adjusted R^2	0.758	0.771	

Table 2 examines the relationship between market uncertainty (*VIX*) and media coverage. Panel A presents path analysis of the association with firm-initiated disclosures (*LForm8K*) and analyst forecast revisions (*LRevisions*) as mediator variables. Panel B presents regression results from the estimation of 1 using ordinary least squares. The analyses in both panels include results for an earnings-announcement period sample (as well as for a non-earnings-announcement period sample for comparison). The dependent variable, *LCoverage$_X$*, is the natural logarithm of one plus the number of news stories for a firm on the day of or the day after a quarterly earnings announcement ($X = EA$) or the average during all two-day windows during the matched non-earnings announcement period ($X = NonEA$). The sample period covers quarterly earnings announcements from 2004 to 2013 and corresponding non-earnings announcement periods. All other variables are defined in Appendix A. Column (3) reports the statistical test of the difference between the estimated coefficients on *VIX*in columns (1) and (2) using a stacked regression model. T -statistics are shown in parentheses below estimated coefficients and use standard errors that are clustered two-way by firm and year-quarter. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

earnings announcements in column (3) of 0.0038 indicates that during an average earnings announcement a moderate increase in *VIX* from the first to third quartile leads to a 6.12 percent increase in the average number of stories).[15] For a more extreme change in market uncertainty, the effect is considerably higher. A large change in *VIX* from the bottom decile (12.225) to the top decile (30.929) leads to the average number of abnormal stories during earnings announcements increasing by 11.83 percent.

Regarding how market uncertainty affects firm-initiated disclosure and analyst revisions, during earnings announcements the indirect path for *LForm8K* (i.e., the path $VIX \rightarrow LForm8K$ multiplied by $LForm8K \rightarrow LCoverage_X$) and *LRevisions* is insignificant.[16] During non-earnings announcement periods, however, the indirect paths for *LForm8K* and *LRevisions* are significantly negative and positive, respectively. The coefficient differences for *LForm8K* and *LRevisions* presented in column (3) indicate that the abnormal indirect paths are significantly positive and negative, respectively. The differences in behavior during and outside earnings announcement periods likely reflect variation in the demand for information and the constraints faced by managers and analysts in providing information and updating their forecasts. Overall, however, the differences in these indirect paths largely offset, leading to the direct path of $VIX \rightarrow LCoverage_X$ being similar in magnitude as the total effect (e.g., 0.0067 relative to 0.0079 in column (3)). As shown in the last two rows of Panel A, the direct path for $VIX \rightarrow LCoverage_{EA}$ leads to a significantly larger increase in media coverage than the indirect paths for *LForm8K* and *LRevisions* during earnings announcements, and the direct path $VIX \rightarrow LCoverage_{NonEA}$ leads to a significantly larger decrease in media coverage than the indirect path for *LRevisions* outside of earnings announcement periods.

Panel B reports the underlying mediated regression results. As expected, the coefficient estimates for the variables of interest are the same as the direct effects reported in Panel A. For the control variables, we find that media coverage of earnings announcements is significantly higher for firms with greater analyst following (*LFollow*), greater institutional holdings (*InstHold*), higher returns (*Ret*), membership in the S&P 500 (*SP500Member*), more employees (*LEmployee*), more dispersed ownership (*LOwn*), and more turnover (*Turnover*). In addition, we find that coverage is significantly lower for firms with higher market capitalization (*LMktCap*), lower growth (*BM*), greater idiosyncratic volatility (*IVol*), and listed on NASDAQ (*NasdaqTraded*).[17] This evidence is consistent with demand by shareholders, employees, and others determining media coverage of earnings announcements. Similar results are found for non-earnings announcement coverage; however, we find that greater coverage for firms with higher market capitalization (*LMktCap*), greater idiosyncratic volatility (*IVol*), and lower returns (*Ret*). These differences across the earnings and non-earnings periods likely reflect differential demands and supply for coverage of earnings and non-earnings information—e.g., institutional investors could have greater demand for the dissemination of earnings information versus non-earnings information.

Next, we turn to more detailed analyses to provide greater insight into how and why the media make earnings announcement coverage decisions. We first examine the role of the level of market uncertainty and specific sources of uncertainty on such decisions. We next explore if greater coverage of earnings announcements during periods of higher market uncertainty "crowds out" the coverage of non-earnings news of other firms. We then investigate whether the media focus on certain types of news stories and firms when market uncertainty grows.

4.2.2. What levels of the VIX and types of uncertainty underlying the VIX are most important?

An interesting issue is at what levels of market uncertainty the media shift coverage of earnings announcements. For instance, the highest levels of the VIX, particularly during the 2007–2009 financial crisis, could be responsible for our findings given the extreme levels of market uncertainty. To explore this issue in greater detail, we estimate a piecewise regression for quartiles of the VIX. We drop *VIX* from equation (1) and include four VIX variables, VIX^{Q1}, VIX^{Q2}, VIX^{Q3}, and VIX^{Q4}, for each quartile of the VIX.[18] In Panel A of Table 3, we find that higher uncertainty within each quartile of the VIX leads to greater abnormal media coverage of earnings announcements, as shown in column (3). For instance, in the lowest quartile, we find direct paths (e.g., $VIX^{Q1} \rightarrow LCoverage_X$) for VIX^{Q1} during earnings announcements of 0.101 and during non-earnings announcement periods of −0.0016. The abnormal media coverage direct paths for the second, third, and fourth quartiles are similar: 0.0088, 0.0078, and 0.0086, respectively. These abnormal coverage sensitivities are over twice as high as those in our primary analysis in reported in Table 2, demonstrating the importance of allowing for differing levels of the VIX. Together, this evidence indicates that the media shift earnings announcement coverage across different levels of the VIX, not just for the highest levels.

Another interesting issue is what specific types of uncertainty underlying the VIX lead to greater media coverage. For instance, greater political-related events could lead to reductions in business press coverage, due to resources being diverted away to such issues, or an expansion in business press coverage, as market participants' demand for financial information increases. As prior research (e.g., Alfaro et al., 2018; Barrero et al., 2017; Stein and Wang, 2016) finds, shocks to aggregate

[15] That is, $\{e^{[0.0030\times(24.784-15.009)]}-1\}\times\left[\frac{1+10.989}{10.989}\right]-\{e^{[-0.0008\times(24.784-15.009)]}-1\}\times\left[\frac{1+0.651}{0.651}\right]$. The calculation adjusts for $LCoverage_{EA}$ being constructed as the natural logarithm of one plus the number of news stories.

[16] In later analyses, with some exceptions, we only report the indirect paths for brevity rather than each coefficient estimate along each path. The full results are provided in the internet appendix.

[17] The finding of lower coverage for firms with greater idiosyncratic volatility is consistent with the evidence in Soltes (2011) of market benefits for firms with greater media coverage.

[18] For brevity, we only report the direct paths for this analysis and those that follow. The full set of results for each analysis are reported in the online appendix.

Table 3
Abnormal media coverage of earnings announcements and market uncertainty: What levels of the VIX and sources of uncertainty underlying the VIX are most important?

	(1)		(2)		(3)	
	$X = EA$		$X = Non-EA$		Diff.	
	Coef.	Bootstrap z	Coef.	Bootstrap z	Coef.	Bootstrap z
Panel A: Path analysis for quartiles of the *VIX*						
Direct paths:						
$\mathbf{VIX^{Q1} \rightarrow LCoverage_X}$	**0.0101*****	**4.03**	**−0.0016**	**−0.98**	**0.0117*****	**5.05**
$\mathbf{VIX^{Q2} \rightarrow LCoverage_X}$	**0.0075*****	**3.33**	**−0.0013**	**−0.88**	**0.0088*****	**4.02**
$\mathbf{VIX^{Q3} \rightarrow LCoverage_X}$	**0.0068*****	**3.78**	**−0.0010**	**−1.04**	**0.0078*****	**2.84**
$\mathbf{VIX^{Q4} \rightarrow LCoverage_X}$	**0.0076*****	**4.24**	**−0.0010**	**−1.47**	**0.0086*****	**4.30**
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			
Panel B: Path analysis for sources of uncertainty underlying the VIX						
Direct paths:						
$\mathbf{VIX^{EPU} \rightarrow LCoverage_X}$	**0.0618*****	**7.14**	**−0.0030**	**−0.72**	**0.0647*****	**6.52**
$\mathbf{VIX^{OilVol} \rightarrow LCoverage_X}$	**0.0036**	**0.99**	**0.0004**	**0.07**	**0.0033**	**0.59**
$\mathbf{VIX^{CurrVol} \rightarrow LCoverage_X}$	**0.0196*****	**2.70**	**−0.0059**	**−0.96**	**0.0255****	**2.54**
$\mathbf{VIX^{OtherUncert} \rightarrow LCoverage_X}$	**0.0138*****	**3.20**	**0.0028**	**1.46**	**0.0110****	**2.37**
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			
z-tests:						
$VIX^{EPU} = VIX^{OilVol}$	6.20***		−0.48		4.66***	
$VIX^{EPU} = VIX^{CurrVol}$	3.74***		0.39		2.63***	
$VIX^{EPU} = VIX^{OtherUncert}$	4.96***		−1.26		5.13***	

Table 3 presents more detailed analyses of the relationship between market uncertainty (*VIX*) and media coverage. Panel A presents results from a piecewise model across sample quartiles of market uncertainty. Panel B presents results from the estimation of a modified version of 1 with predicted components of *VIX*(all variables are standardized) using economic policy uncertainty from (Baker et al., 2016) (VIX^{EPU}), oil price volatility (VIX^{OilVol}), and the average volatility of the seven currencies designated by the Federal Reserve Board as "major" currencies ($VIX^{CurrVol}$) included as regressors of interest in place of *VIX*. The residual value of *VIX*($VIX^{OtherUncert}$) is also included as a regressor. See Appendix B for the estimation of *VIX*onto *EPU*, *OilVol*, and *CurrVol*. The dependent variable, $LCoverage_X$, is the natural logarithm of one plus the number of news stories for a firm on the day of or the day after a quarterly earnings announcement ($X = EA$) or the average during all two-day windows during the matched non-earnings announcement period ($X = NonEA$). All other variables are defined in Appendix A. In Panel A, the sample period covers quarterly earnings announcements from 2004 to 2013 and corresponding non-earnings announcement periods. In Panel B, the sample period covers quarterly earnings announcements from November 2005 to December 2013 and corresponding non-earnings announcement periods. Columns (3) report the statistical tests of differences between the estimated coefficients in columns (1) and (2) using a stacked regression model. T-statistics are shown in parentheses below estimated coefficients and use standard errors that are clustered two-way by firm and year-quarter. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

market uncertainty are caused by economic policy uncertainty (e.g., debates over the U.S. debt ceiling, participation in wars overseas, and fiscal policy), variation in the price of oil, and exchange rates.

Fig. 1 shows how the three sources of uncertainty vary with the VIX over time. The first index, EPU, captures economic policy uncertainty.[19] The second index, oil price uncertainty or the oil price volatility index, is the closing price of the CBOE crude oil ETF volatility index. The third index, exchange rate uncertainty or the currency volatility index, is the mean volatility index of the following volatility indices: CBOE FX Euro Volatility index, FX Yen Volatility Index, FX British Pound Volatility Index, and the EuroCurrency Volatility Index. To facilitate comparisons, each index uses month-end values and each series is transformed to a standard normal distribution. As the figure shows, the different sources of uncertainty are related but have some differences. For instance, similar to Baker et al. (2016), the EPU index is dramatically higher during tight presidential elections, Gulf Wars I and II, the 9/11 attacks, the failure of Lehman Brothers, the 2011 debt ceiling dispute, and other major battles over fiscal policy.[20] In contrast, the oil price volatility index rises dramatically in 2007 during a rapid oil price increase while other indices are unaffected. In addition, economic policy uncertainty decreases after Obama's reelection without a similar decrease in other indices. The spikes in uncertainty common to most of the indices are during the global banking crisis, the European debt crisis, and the U.S. debate on the debt ceiling.

We investigate how these underlying sources of aggregate market uncertainty, as well as unexplained variation in the VIX, individually contribute to abnormal media coverage. Variables for each of the three indexes are denoted as *EPU*, *OilVol*, and

[19] Baker et al. (2016) measures this as the relative frequency of the trio of terms "uncertainty" or "uncertain"; "economic" or "economy"; and one of the following policy terms: "Congress," "deficit," "Federal Reserve," "legislation," "regulation," or "White House" (including variants like "uncertainties," "regulatory," or "the Fed" in the top 10 leading newspapers in the United States. We appreciate the public posting of the EPU index by Scott Baker, Nick Bloom, and Steven Davis and the data from Barrero et al. (2017).

[20] Nagar et al. (2019) provide evidence that changes in economic policy uncertainty are important for individual firms, leading to higher bid-ask spreads and lower responses to earnings releases.

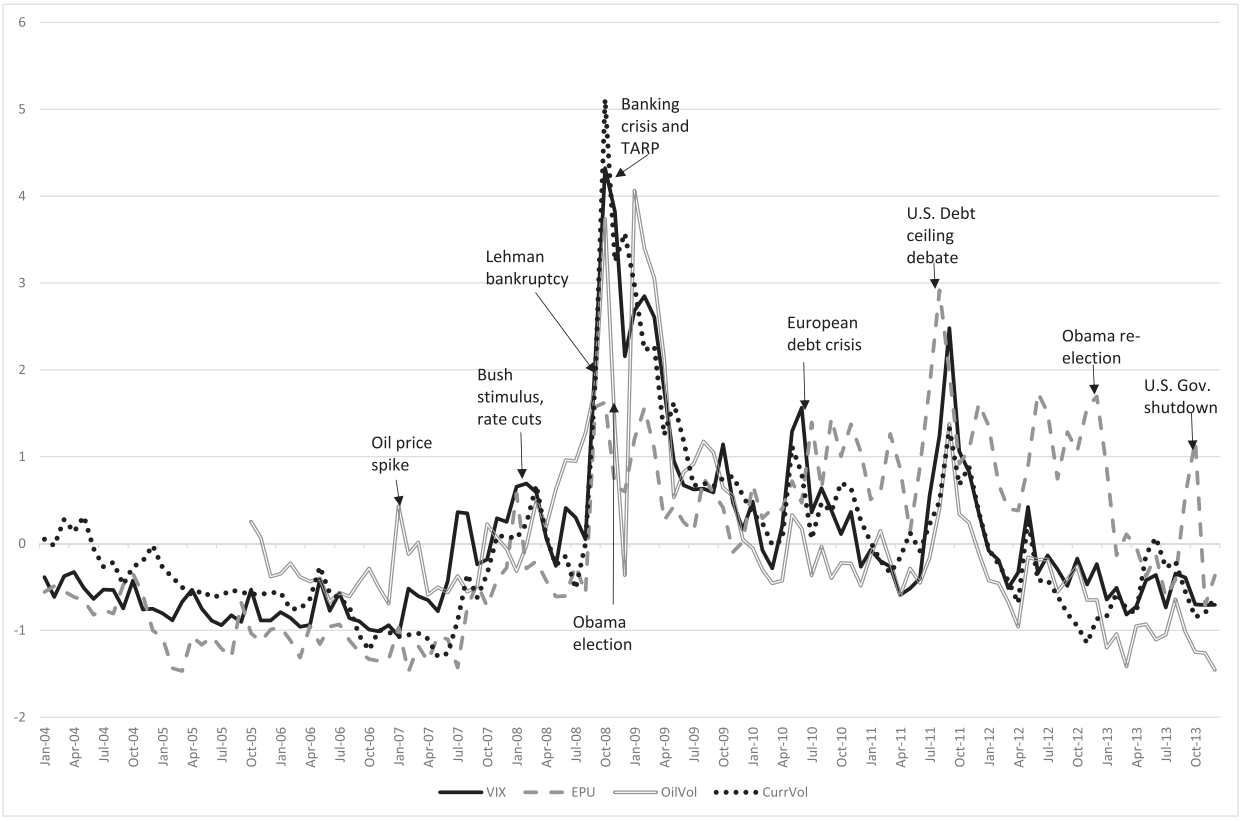

Fig. 1. The VIX and underlying sources of market uncertainty. Fig. 1 plots the month-end options volatility index (VIX), economic policy uncertainty index (EPU), crude oil price volatility index (OilVol), and average currency volatility index (CurrVol). All indices are standardized.

CurrVol. To directly examine how each influences the VIX, we first regress each variable on *VIX* using monthly observations. As shown in Appendix B, all three variables are significantly positive and jointly explain 89.7 percent of the variation in *VIX*. We then investigate the role of each by using the predicted value of each, denoted as VIX^{EPU}, VIX^{OilVol}, and $VIX^{CurrVol}$, respectively, rather than *VIX* in Equation (1). The residual from the first-stage regression is also included as a measure of other sources of uncertainty, denoted as VIX^{Other}, that affect the VIX. To ease comparability, all variables are standardized. In Panel B of Table 3, we find that VIX^{EPU}, $VIX^{CurrVol}$, and VIX^{Other} lead to greater abnormal media coverage of earnings announcements. As indicated by the significant *z*-tests in the last rows of Panel B, VIX^{EPU} is relatively more important for changes in earnings announcement coverage than VIX^{OilVol}, $VIX^{CurrVol}$, and VIX^{Other}. This suggests that the media make the greatest changes when economic policy uncertainty shocks occur.

4.2.3. Does increased earnings announcement coverage crowd out non-earnings announcement coverage?

Our primary findings suggest that media coverage of non-earnings announcement stories falls with market uncertainty. Consistent with the views of the senior journalists whom we interviewed, one possibility for this decline is that the increased earnings announcement coverage for other firms crowds out the coverage of firms' non-earnings announcement news. We test this possibility by further mediating equation (1) for non-earnings announcement coverage by including $LCoverage_{EA,Other}$, the amount of other firms' earnings announcement coverage during the same two-day window, as a mediator variable. The results of this analysis are presented in Table 4. As shown, the indirect path of VIX → $LCoverage_{EA,Other}$ is significantly positive, consistent with our earlier findings that higher market uncertainty leads to greater coverage of earnings announcements. In addition, the indirect path of $LCoverage_{EA,Other} \rightarrow LCoverage_{NonEA}$ is significantly negative, consistent with the coverage of other firms' earnings announcements leading to reduced coverage of firms' non-earnings announcement news. Combined, the indirect effect attributable to $LCoverage_{EA,Other}$ is significantly negative, providing evidence that non-earnings announcement coverage is crowded out by the increased coverage of other firms' earnings announcements during periods of higher market uncertainty. In the last row of Table 4, we also provide evidence that the

Table 4
Abnormal media coverage of non-earnings announcement periods and market uncertainty: Does increased earnings announcement coverage of other firms crowd out non-earnings announcement coverage?

	(1)	Bootstrap *z*
	$LCoverage_{NonEA}$	
	Coef.	
Direct path:		
VIX → LCoverage$_{NonEA}$	**−0.0001**	**−0.09**
Mediated paths:		
I. *VIX* → *LForm8K*	−0.0004**	−2.30
II. *LForm8K* → $LCoverage_{NonEA}$	1.8629***	39.84
Indirect effect via *LForm8K*(I × II)	−0.0007**	−2.28
III. *VIX* → *LRevisions*	0.0006***	3.57
IV. *LRevisions* → $LCoverage_{NonEA}$	0.3676***	20.72
Indirect effect via *LRevisions*(III × IV)	0.0002***	3.53
V. VIX → LCoverage$_{EA,Other}$	**0.0025*****	**2.73**
VI. LCoverage$_{EA,Other}$ → LCoverage$_{NonEA}$	**−0.2846*****	**−5.54**
Indirect effect via LCoverage$_{EA,Other}$(V × VI)	**−0.0007*****	**−4.46**
Total indirect effect (I × II+III × IV+ V × VI)	−0.0012**	−2.46
Total effect	−0.0013***	−4.47
Controls	Yes	
Firm Fixed Effects	Yes	
z-test: (V × VI) = (I × II)	−0.24	
z-test: (V × VI) = (III × IV)	−5.39***	

Table 4 presents path analysis results from estimating the role of media coverage of other earnings announcements in crowing out the media coverage of firms' non-earnings announcement periods. The path analysis uses the amount of other firms' earnings announcement coverage ($LCoverage_{EA,Other}$), firm-initiated disclosures (*LForm8K*), and analyst forecast revisions (*LRevisions*) as mediator variables. The dependent variable, $LCoverage_{NonEA}$, is the natural logarithm of one plus the average number of news stories for a firm during all two-day windows during the non-earnings announcement period. The sample period covers firm-quarter observations from 2004 to 2013. All other variables are defined in Appendix A. *T* -statistics are shown in parentheses below estimated coefficients and use standard errors that are clustered two-way by firm and year-quarter. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

reduction in coverage from the indirect effect attributable to $LCoverage_{EA,Other}$ is statistically different from the increase in coverage brought about by the increased frequency in analyst revisions outside of earnings announcement periods.

4.2.4. Does the media shift to specific types of news stories and firms?

Active monitoring of user demand for information can lead the media to shift their coverage toward certain types of news stories and firms and away from others during periods of increased market uncertainty. Consistent with such shifts taking place, our interviews of journalists indicated that greater inferred demand during such times can lead to greater dissemination of earnings information through quick and simple stories that re-iterate key metrics in earnings releases. In addition, during periods of greater uncertainty, journalists pointed out that there is more news and more opportunities to provide more information. Because of these changes, journalists suggested that a story can get split across multiple reporters rather than just one reporter and can lead to reporters sticking with a particular firm for a longer period of time. The shift in coverage can lead to a reduction in the number of by-lined stories, especially enterprise stories (e.g., investigations about wrongdoing), as newsrooms are stressed by the number of journalists available for coverage. Together, this anecdotal evidence suggests that during times of higher uncertainty the media could move to increase the number of news flashes relative to the number of original stories, which could decrease.[21]

We formally investigate whether the media make such shifts in news stories by examining coverage decisions separately for news flashes, $LCoverage_{X,Flash}$, and original articles, $LCoverage_{X,Orig}$. $LCoverage_{X,Flash}$, is the natural logarithm of one plus the number of news flashes for a firm on the day of or the day after a quarterly earnings announcement ($X = EA$) or during the two-day averaged non-earnings announcement period ($X = NonEA$). $LCoverage_{X,Orig}$, is the natural logarithm of one plus the number of original news stories for a firm on the day of or the day after a quarterly earnings announcement ($X = EA$) or during the two-day averaged non-earnings announcement period ($X = NonEA$). The test of our prediction is that the coefficient for $LCoverage_{EA,Flash}$ is greater than that for $LCoverage_{EA,Orig}$. The formal test for the difference in coefficients is conducted by stacking the separate equations.

Panels A and B of Table 5 provide the results for $LCoverage_{EA,Flash}$ and $LCoverage_{EA,Orig}$ as dependent variables, respectively. The results indicate that news flash coverage is more sensitive to increases in market uncertainty than original articles. For

[21] As Drake et al. (2014) shows, news flash stories typically only rebroadcast a disclosure and are relatively short articles, containing on average 42 words. In contrast, full article stories can rebroadcast a disclosure but also include reporter-generated information and are much more extensive stories, containing on average 248 words.

Table 5
Abnormal media coverage of earnings announcements and market uncertainty: Does the media shift to specific types of news stories and firms?

	(1)		(2)		(3)	
	$X = EA$		$X = Non-EA$		Diff.	
	Coef.	Bootstrap z	Coef.	Bootstrap z	Coef.	Bootstrap z
Panel A: Path analysis for news flashes						
Direct path:						
VIX → LCoverage$_{X,Flash}$	**0.0067*****	**6.07**	**0.0003**	**1.25**	**0.0063*****	**5.79**
Mediated paths:						
(I) *VIX → LForm8K → LCoverage$_{X,Flash}$*	0.0001	1.23	−0.0004**	−2.16	0.0005**	2.52
(II) *VIX → LRevisions → LCoverage$_{X,Flash}$*	−0.0000**	−2.07	0.0002***	3.43	−0.0002***	−3.53
Total effect	0.0067***	6.00	0.0001	0.39	0.0066***	5.53
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			
z-test: Direct = (I)	5.96***		2.31**		5.24***	
z-test: Direct = (II)	6.08***		0.40		5.97***	
Panel B: Path analysis for original articles						
Direct path:						
VIX → LCoverage$_{X,Orig}$	**−0.0075****	**−2.37**	**−0.0017*****	**−5.14**	**−0.0058****	**−2.03**
Mediated paths:						
(I) *VIX → LForm8K → LCoverage$_{X,Orig}$*	0.0001	1.17	−0.0003**	−2.22	0.0004**	2.52
(II) *VIX → LRevisions → LCoverage$_{X,Orig}$*	−0.0000**	−2.16	0.0001***	3.19	−0.0001***	−3.67
Total effect	−0.0075**	−2.33	−0.0020***	−5.91	−0.0055*	−1.88
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			
z-test: Direct = (I)	−2.40**		−3.92***		−2.17**	
z-test: Direct = (II)	−2.34**		−5.42***		−1.99**	
Panel C: Moderated path analysis for bellwether and non-bellwether firms						
Direct paths:						
VIX → LCoverage$_{X}$	**0.0031*****	**2.45**	**−0.0009****	**−2.11**	**0.0041*****	**3.35**
VIX × Bellwether$_{High}$ → LCoverage$_{X}$	**0.0032*****	**2.92**	**−0.0009**	**−0.96**	**0.0040*****	**2.61**
VIX × Bellwether$_{Low}$ → LCoverage$_{X}$	**−0.0072*****	**−2.99**	**−0.0008***	**−1.22**	**−0.0064****	**−2.50**
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			
Panel D: Moderated path analysis for early and late announcing firms						
Direct paths:						
VIX → LCoverage$_{X}$	**0.0031****	**2.56**	**−0.0007***	**−1.95**	**0.0038*****	**3.41**
VIX × EarlyEA → LCoverage$_{X}$	**0.0001****	**2.07**	**−0.0002**	**−0.41**	**0.0003**	**1.14**
VIX × LateEA → LCoverage$_{X}$	**−0.0008*****	**−3.48**	**−0.0004**	**−0.98**	**−0.0004****	**−2.23**
Controls	Yes		Yes			
Firm Fixed Effects	Yes		Yes			

Table 5 presents results from estimating the association between market uncertainty (*VIX*) and different types of media coverage. Panels A and B presents path analyses of the association for news flashes and original articles with firm-initiated disclosures (*LForm8K*) and analyst forecast revisions (*LRevisions*) as mediator variables, respectively. Panel C presents path analysis of the association with firm-initiated disclosures (*LForm8K*) and analyst forecast revisions (*LRevisions*) as mediator variables and bellwether status as a moderator based on the R^2 from a regression of firm earnings on several macroeconomic series (Bonsall et al., 2013) with *Bellwether$_{High}$* and *Bellwether$_{Low}$* defined as indicators for firms in the upper and lower quartiles of the sample R^2 distribution. Panel D presents path analysis of the association with firm-initiated disclosures (*LForm8K*) and analyst forecast revisions (*LRevisions*) as mediator variables and with earnings announcement timing as a moderator based on firms' predicted earnings announcement timing with *EarlyEA* and *LateEA* defined as indicators for firms in the upper and lower quartiles of earnings announcement timing for a fiscal quarter. The analyses in all panels include results for an earnings-announcement period sample (as well as for a non-earnings-announcement period sample for comparison). The dependent variable *LCoverage$_{X,Flash}$* (*LCoverage$_{X,Orig}$*) is the natural logarithm of one plus the number of news flashes (original articles) for a firm on the day of or the day after a quarterly earnings announcement ($X = EA$) or the average during all two-day windows during the matched non-earnings announcement period ($X = NonEA$). The sample period covers quarterly earnings announcements from 2004 to 2013 and corresponding non-earnings announcement periods. All other variables are defined in Appendix A. Column (3) reports the statistical tests of differences between the estimated coefficients in columns (1) and (2) using a stacked regression model. T-statistics are shown in parentheses below estimated coefficients and use standard errors that are clustered two-way by firm and year-quarter. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

news flash stories during earnings announcements, the direct path estimate for *VIX* of 0.0067 is significantly positive. For original articles during earnings announcements, the direct path estimate of −0.0075 is significantly negative. In untabulated tests, the difference in the *VIX* coefficients of 0.0142 for the two types of stories is significantly positive. For news flashes, during non-earnings announcement trading days, we find that the direct path estimate for *VIX* is insignificant. In addition, we find that the positive coefficient for *VIX* during earnings announcement periods is significantly greater than that during non-earnings announcement periods; the difference of 0.0063 is much larger than the difference of 0.0038 observed for our primary analysis, which combines news flashes with original articles. This evidence indicates that news-flash coverage during earnings announcements grows with market uncertainty but is relatively unaffected outside of earnings announcements. For

Table 6
Market uncertainty and abnormal earnings-announcement return volatility and trading volume: The mediating influence of media coverage

	$DV = \|AbnReturn\|$		$DV = AbnVol$	
	(1)		(2)	
	Coef.	Bootstrap z	Coef.	Bootstrap z
Direct path:				
$VIX \rightarrow DV$	0.000285***	3.90	0.0000932***	3.23
Mediated paths:				
(I) **$VIX \rightarrow LCoverage_{EA} \rightarrow DV$**	**0.000279*****	**2.60**	**0.000170****	**2.35**
(II) $VIX \rightarrow LForm8K \rightarrow DV$	0.00000956	1.23	0.00000596	1.16
(III) $VIX \rightarrow LRevisions \rightarrow DV$	−0.00000360**	−2.15	−0.00000269**	−2.16
Total effect	0.000569***	5.88	0.000267***	2.96
Controls	Yes		Yes	
Firm Fixed Effects	Yes		Yes	
z-test: (I) = (II)	2.50**		2.26**	
z-test: (I) = (III)	2.63***		2.39**	

Table 6 presents path analysis results from estimating the mediating role of media coverage ($LCoverage_{EA}$) on the association between market uncertainty (VIX) and earnings announcement abnormal stock return volatility and trading volume. The dependent variables are: $|AbnReturn|$, the absolute value of raw return minus the CRSP value-weighted index return during the earnings announcement period $[0, +1]$and $AbnVol$, the share turnover during the earnings announcement period $[0, +1]$less the median two-day share turnover of consecutive two-day periods during the non-announcement period (all dates between five trading days subsequent to the release date of quarter $t-1$earnings and five trading days prior to the release of quarter t earnings). The sample period covers quarterly earnings announcements from 2004 to 2013. All other variables are defined in Appendix A. T -statistics are shown in parentheses below estimated coefficients and use standard errors that are clustered two-way by firm and year-quarter. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

original articles, during non-earnings announcement periods, the direct path estimate for VIX is significantly negative and, in untabulated tests, is statistically more negative than the estimate during earnings announcement periods. The last two rows in Panels A and B indicate that the changes in coverage from the direct paths of $VIX \rightarrow LCoverage_{EA}$ and $VIX \rightarrow LCoverage_{NonEA}$, as well as the differences in estimates, are significantly greater (in absolute value) than the indirect paths for $LForm8K$ and $LRevisions$, with the exception of $VIX \rightarrow LCoverage_{NonEA}$ not being significantly greater than the indirect path for $LRevisions$.

User demand for earnings information can also increase or decrease for certain types of firms during periods of higher market uncertainty. First, we expect greater demand for earnings information of bellwether firms relative to non-bellwether firms. As Anilowski et al. (2007), Aobdia et al. (2014), and Bonsall et al. (2013) observe, bellwether firms' disclosures can be a source of important information about macroeconomic activity, as evidenced by significant aggregate stock market responses to the release bellwether firms' management earnings forecasts. By focusing on the news regarding bellwether firms, the media can provide answers to investors regarding a bellwether firm's uncertainty but, more importantly, provide information to investors about macroeconomic uncertainty in general. Second, we expect greater demand for earnings information of early announcing firms in a quarter relative to late announcing firms. As Savor and Wilson (2016) finds, the earnings announcements of early announcing firms provide greater information about aggregate earnings in a given period; this result is intuitive as less information is known earlier in the quarter. Our interviews of journalists suggest that changes in demand for those types of firms can occur during periods of higher market uncertainty.

We separately examine whether the expansion of coverage during earnings announcements is more pronounced for bellwether and early announcing firms by including interactions of VIX with $Bellwether$ and $EarlyAnnouncer$. $Bellwether$ is an indicator variable with a value of one if the explanatory power of various macroeconomic indices for a firm's earnings is in the upper quartile of the sample distribution (Bonsall et al., 2013), and zero otherwise. $EarlyAnnouncer$ is an indicator variable with a value one if a firm's expected earnings announcement date is in the earliest quartile in a given fiscal quarter (Savor and Wilson, 2016), and zero otherwise. In addition, we explore whether firms whose earnings are less informative about aggregate uncertainty lose coverage or have less of an increase in coverage during times of higher uncertainty. We investigate this possibility by including interactions of VIX with $Non-Bellwether$ and $LateAnnouncer$. $Non-Bellwether$ is an indicator variable with a value of one if the explanatory power of various macroeconomic indices for a firm's earnings is in the lower quartile of the sample distribution (Bonsall et al., 2013), and zero otherwise. $LateAnnouncer$ is an indicator variable with a value one if a firm's expected earnings announcement date is in the latest quartile in a given fiscal quarter Savor and Wilson (2016), and zero otherwise. We expect a positive coefficient on the interaction of VIX with $Bellwether$ and VIX with $EarlyAnnouncer$, and a negative coefficient on the interaction of VIX with $Non-Bellwether$ and VIX with $LateAnnouncer$.

Panels C and D of Table 5 present the moderated path analysis findings for bellwether versus non-bellwether firms and early versus late announcing firms, respectively. Only the direct paths are reported for parsimony; the detailed mediated paths are reported in the online appendix. In Panel C, for bellwether firms, the interaction $VIX \times Bellwether$ is significantly positive for abnormal earnings announcement coverage. The estimate of the of 0.0041 indicates that the coverage of bellwether firms at earnings announcements is much more sensitive to market uncertainty. An interquartile-range increase in

Table 7
Market uncertainty and earnings-announcement price efficiency: The mediating influence of media coverage

	$DV = AbnSpread$		$DV = AbnDepth$	
	(1)		(2)	
	Coef.	Bootstrap z	Coef.	Bootstrap z
Panel A: Path analysis for information asymmetry				
Direct path:				
$VIX \rightarrow DV$	0.00412***	2.86	−0.0131***	−4.18
Mediated paths:				
(I) **VIX → $LCoverage_{EA}$ → DV**	**−0.000762*** **	**−3.18**	**0.00116*** **	**3.83**
(II) $VIX \rightarrow LForm8K \rightarrow DV$	−0.0000281	−0.98	0.0000412	1.21
(III) $VIX \rightarrow LRevisions \rightarrow DV$	0.0000149*	1.78	−0.0000108	−1.59
Total effect	0.00334**	2.32	−0.0119***	−5.71
Controls	Yes		Yes	
Firm Fixed Effects	Yes		Yes	
z-test: (I) = (II)	−3.04***		3.67***	
z-test: (I) = (III)	−3.24***		3.86***	

	$DV = IPT_{Adj}$	
	(1)	
	Coef.	Bootstrap z
Panel B: Path analysis for intraperiod price timeliness		
Direct path:		
$VIX \rightarrow DV$	−0.0136***	−4.00
Mediated paths:		
(I) **VIX → $LCoverage_{EA}$ → DV**	**0.00339*** **	**5.37**
(II) $VIX \rightarrow LForm8K \rightarrow DV$	0.000140	1.18
(III) $VIX \rightarrow LRevisions \rightarrow DV$	−0.000106**	−2.10
Total effect	−0.0102**	−2.32
Controls	Yes	
Firm Fixed Effects	Yes	
z-test: (I) = (II)	5.06***	
z-test: (I) = (III)	5.52***	

	$DV = AbnRetailVol$		$DV = AbnNonRetailVol$	
	(1)		(2)	
	Coef.	Bootstrap z	Coef.	Bootstrap z
Panel C: Path analysis for trade by retail and non-retail investors				
Direct path:				
$VIX \rightarrow DV$	0.00233**	2.22	−0.00688**	−2.03
Mediated paths:				
(I) **VIX → $LCoverage_{EA}$ → DV**	**0.000678*** **	**2.46**	**0.000648*** **	**2.33**
(II) $VIX \rightarrow LForm8K \rightarrow DV$	0.0000241	1.20	0.0000453	1.17
(III) $VIX \rightarrow LRevisions \rightarrow DV$	−0.00000706**	−2.04	−0.0000505**	−2.02
Total effect	0.00303***	2.74	−0.00624*	−1.88
Controls	Yes		Yes	
Firm Fixed Effects	Yes		Yes	
z-test: (I) = (II)	2.36**		2.15**	
z-test: (I) = (III)	2.49**		2.50***	

Table 7 presents path analysis results from estimating the mediating role of media coverage ($LCoverage_{EA}$) on the association between market uncertainty (VIX) and earnings announcement liquidity and price efficiency. The sample period covers quarterly earnings announcements from 2004 to 2013. The Panel A analyses investigate information asymmetry; the dependent variables are *AbnSpread*, the weighted average effective spread over trading days [0, +2] of the earnings announcement, where the weights are number of trades, minus the weighted average effective spread over trading days [−41,−11], multiplied by 100, and *AbnDepth*, the natural logarithm of the weighted average bid and offer dollar depth over trading days [0, +2] of the earnings announcement, where the weights are time in force, over the weighted average bid and offer dollar depth over trading days [−41,−11] (Blankespoor et al., 2018). The Panel B analysis investigates price efficiency; the dependent variable is IPT_{Adj}, the speed with which earnings information is impounded into price, measured over the six-day earnings announcement window and adjusted for overreaction and subsequent reversal to the final cumulative abnormal return (Blankespoor et al., 2018). The Panel C analyses investigate abnormal trade by retail and non-retail traders; the dependent variables are *AbnRetailVol*, the firm's daily average retail percentage of shares traded during days [0, +2] relative to the earnings announcement, minus the equivalent amount over days [−41, −11], multiplied by 100, and *AbnNonRetailVol*, the firm's daily average non-retail percentage of shares traded during days [0, +2] relative to the earnings announcement, minus the equivalent amount over days [−41, −11], multiplied by 100 (Blankespoor et al., 2018). The sample period covers quarterly earnings announcements from 2004 to 2013. All other variables are defined in Appendix A. T -statistics are shown in parentheses below estimated coefficients and use standard errors that are clustered two-way by firm and year-quarter. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

the VIX leads to a 22.09 percent increase in the average number of stories for bellwether firms. For non-bellwether firms, the interaction $VIX \times Non-Bellwether$ is significantly negative. The estimate of −0.0064, when considered together with the estimate for other firms of 0.0041, indicates that the coverage of non-bellwether firms is relatively insensitive to market uncertainty. An interquartile-range increase in the VIX leads to a 0.04 percent increase in the average number of stories for non-bellwether firms. In Panel D, we fail to find that the interaction $VIX \times EarlyAnnouncer$ for abnormal earnings announcement coverage is significant. For late announcing firms, however, we find that the interaction $VIX \times LateAnnouncer$ is significantly negative. The estimate of −0.0004 suggests only a modest lower sensitivity to market uncertainty. Together, this evidence is consistent with the media responding to changing demand for earnings information during periods of increased market uncertainty by increasing their coverage of bellwether firms and increasing their coverage less for non-bellwether and late announcing firms.

4.3. Capital market consequences of increased coverage of earnings releases

Having established that the supply of media stories during earnings announcements increases when there is higher market uncertainty, we next turn to how the change in coverage affects capital markets. We use path analyses to directly test whether the increased supply leads to changes in investor consensus and informedness and price efficiency.

4.3.1. Changing investor consensus and informativeness

Table 6 presents the results from estimating the mediated analyses for abnormal price changes, $|AbnReturn|$, and abnormal stock return volatility, *AbnVol*, using bootstrapped standard errors clustered by firm and year-quarter (MacKinnon et al., 2004). In column (1), the significantly positive indirect path $VIX \rightarrow LCoverage_{EA} \rightarrow |AbnReturn|$ indicates that greater media coverage associated with higher uncertainty leads to greater abnormal return volatility. The coefficient estimate of 0.000279 implies that an increase in *VIX* from its first to third quartile value leads to a 5.8 percent $(0.000279 \times (24.784 - 15.009) \div 0.047)$ increase in abnormal volatility at earnings announcements through increased media coverage relative to the mean level in our sample. We also find that the indirect path of $VIX \rightarrow LForm8K \rightarrow |AbnReturn|$ is insignificant but find evidence that the indirect path of $VIX \rightarrow LRevisions \rightarrow |AbnReturn|$ is statistically negative, suggesting that higher market uncertainty leads to fewer analyst revisions and, in turn, lower abnormal return volatility. As shown in the last two rows of the table, we find that the indirect path for $LCoverage_{EA}$ is significantly greater than the indirect paths for *LForm8K* and *LRevisions*. This evidence suggests that coverage by the media has relatively greater influence on abnormal return volatility during periods of higher market uncertainty than firm-initiated disclosures and analyst forecast revisions. The significantly positive direct path from *VIX* to $|AbnReturn|$ indicates that abnormal stock return volatility is higher during periods of higher market uncertainty after taking into account the media, firm-initiated disclosure, and analyst forecast revisions.

In column (2), we find similar evidence for abnormal trading volume. The indirect path of $VIX \rightarrow LCoverage_{EA} \rightarrow AbnVol$ is significantly positive. The coefficient estimate of 0.000170 indicates that an increase in *VIX* from its first to third quartile value leads to a 4.3 percent $(0.000170 \times (24.784 - 15.009) \div 0.039)$ increase in abnormal volatility at earnings announcements through increased media coverage relative to the mean level in our sample. We also find that the indirect path of $VIX \rightarrow LForm8K \rightarrow AbnVol$ is insignificant, the indirect path of $VIX \rightarrow LRevisions \rightarrow AbnVol$ is significantly negative, and the direct path of $VIX \rightarrow AbnVol$ is significantly positive.

4.3.2. Changing price efficiency

The increased abnormal stock price volatility and trading volume suggest that the greater media coverage during periods of higher market uncertainty lead to greater investor informedness. In this sub-section, we go further and explore whether greater coverage leads to greater price efficiency.

4.3.2.1. Information asymmetry. Panel A of Table 7 provides the results of our formal path analysis for abnormal spreads and depth. We find that the indirect path estimates $VIX \rightarrow LCoverage_{EA} \rightarrow AbnSpread$ and $VIX \rightarrow LCoverage_{EA} \rightarrow AbnDepth$ are significantly negative and positive, respectively. This evidence suggests that greater coverage during periods of higher uncertainty leads to important improvements in information asymmetry. When compared to the positive and negative direct path estimates of $VIX \rightarrow AbnSpread$ and $VIX \rightarrow AbnDepth$, the findings suggest that media coverage helps mitigate increased information asymmetry brought about by increased market uncertainty. The coefficient estimates for the indirect paths for media coverage of −0.000762 and 0.00116 indicate that an increase in *VIX* from its first to third quartile value leads to a 14.9 percent $(-0.000762 \times (24.784 - 15.009) \div 0.050)$ decrease in abnormal spreads and a 75.6 percent $(0.00116 \times (24.784 - 15.009) \div 0.015)$ increase in abnormal depth at earnings announcements through increased media coverage relative to the mean. We do not find that the indirect path estimates for firm disclosures and analyst forecast revisions lead to change in information asymmetry, with the exception of the significantly positive indirect path $VIX \rightarrow LRevisions \rightarrow AbnSpread$. This finding indicates that fewer analyst revisions at earnings announcements during periods of market uncertainty lead to higher abnormal spreads. The last two rows of Panel A show that the indirect path estimates for $LCoverage_{EA}$ have a statistically greater effect on abnormal spreads and depth than the indirect paths for *LForm8K* and *LRevisions*.

4.3.2.2. Intraperiod price timeliness. Panel B presents the results of the path analysis for intraperiod price timeliness. The indirect path estimate for $VIX \rightarrow Coverage_{EA} \rightarrow IPT_{Adj}$ is significantly positive. This evidence indicates that greater media coverage due to higher market uncertainty increases intraperiod price timeliness. The coefficient estimate of 0.00339 implies an increase of 1.00 percent for an interquartile increase in the VIX. In contrast, the direct effect estimate of $VIX \rightarrow IPT_{Adj}$ is statistically negative. Accordingly, while periods of market uncertainty lead to slower intraperiod price timeliness at earnings announcements, firms with greater media coverage during such times face relatively faster price timeliness. In addition, the indirect path $VIX \rightarrow LRevisions \rightarrow IPT_{Adj}$ is significantly negative, indicating that fewer analyst revisions when market uncertainty is higher leads to slower intraperiod price timeliness at earnings announcements. The last two rows of Panel B indicate that the positive indirect path estimate for intraperiod price timeliness related to media coverage is significantly greater than the indirect path estimates related to firm-initiated disclosures and analyst forecast revisions.

4.3.2.3. Trade by retail and non-retail investors. Panel C gives the results of the path analyses for retail and non-retail trading volume. The indirect paths estimates for $VIX \rightarrow LCoverage_{EA} \rightarrow AbnRetailVol$ and $VIX \rightarrow LCoverage_{EA} \rightarrow AbnNonRetailVol$ are significantly positive. We also find that the direct path estimates $VIX \rightarrow AbnRetailVol$ and $VIX \rightarrow AbnNonRetailVol$ are significantly positive and negative, respectively. These findings suggest that—while greater market uncertainty leads to greater and lower abnormal volume by retail investors and non-retail investors—the greater media coverage of earnings releases during such times leads to greater abnormal volume by both types of traders. In contrast to this evidence for coverage by the media, we find that fewer analyst forecast revisions during such times leads to decreased volume by both retail and non-retail traders, as indicated by the significantly negative indirect path estimates. As shown in the last two rows, the positive indirect path estimates for $LCoverage_{EA}$ are significantly greater than the indirect paths for *LForm8K* and *LRevisions*.

Together, the evidence suggests that greater media coverage when market uncertainty is higher mitigates greater information asymmetry and delayed intra-period price timeliness at earnings announcements, and leads to greater trade by both retail and institutional traders, which presumably are not subject to limited attention trading biases. With regard to other important providers of information during such times, we are unable to find evidence that firm-initiated disclosures improve the efficiency of capital markets and find evidence that less frequent analyst forecast revisions at earnings announcements leads to reduced price efficiency.

5. Conclusion

This study provides evidence of how the media serves an enhanced role as an information intermediary of earnings information during periods of increased market uncertainty. We find when the VIX is higher the media increase their coverage of earnings announcements relative to coverage outside of earnings announcements. This evidence is consistent with the media responding to increased demand for financial information during uncertain times. We find that such increases occur across different levels of the VIX, not just during the most extreme levels, and occur when increases in the VIX are attributable to changes in economic policy uncertainty, foreign currency volatility, and other sources of market uncertainty. We also find that the media trade off how they cover firms in response to market uncertainty. The increase in media coverage is most pronounced for short news flashes that can quickly but briefly disseminate new information. Full length articles, in contrast, decline. The increase in media coverage is also greater for bellwether firms and less for non-bellwether firms. In contrast to the media expanding its role as an information intermediary during uncertain times, we find little evidence that other providers of information increase their supply of information at earnings announcements. Firms do not change the frequency of their disclosures and financial analysts reduce the number of their forecast revisions.

We also find that the increased media coverage of earnings announcements during periods of higher market uncertainty leads to greater trading volume for both retail and institutional investors, larger price reactions, narrower spreads and greater depth, and greater intraperiod timeliness. These changes are in sharp contrast to the overall worsening of capital market outcomes that occur during periods of higher market uncertainty. In addition, these changes are in contrast to the effect of firm-initiated disclosure, which we fail to find alter capital market outcomes, and analyst forecast revisions, which decline in frequency and result in even worse capital market outcomes at earnings announcements.

These findings provide important new insights into how changes in aggregate market uncertainty alter the media's timing, content, and dissemination of information to market participants and how these changes improve capital market outcomes at earnings announcements. In addition, these findings provide insight into how the media makes trade-offs in coverage during periods of elevated market uncertainty. These findings also provide insight into how different providers of information—firms, analysts, and the media—alter their behavior and influence capital market outcomes when there is higher market uncertainty.

Data availability

All data are publicly available from the sources identified in the text.

Appendix A

The variables for each empirical analysis are described in detail below.

Variable	Description
$LCoverage_{EA}$	The natural logarithm of one plus the number of news articles with relevance scores greater than or equal to 90 captured by RavenPack on days $[0,+1]$ relative to the quarterly earnings announcement
$LCoverage_{EA,Flash}$	The natural logarithm of one plus the number of news flashes with relevance scores greater than or equal to 90 captured by RavenPack on days $[0,+1]$ relative to the quarterly earnings announcement
$LCoverage_{EA,Orig}$	The natural logarithm of one plus the number of original news stories with relevance scores greater than or equal to 90 captured by RavenPack on days $[0,+1]$ relative to the quarterly earnings announcement
$LCoverage_{NonEA}$	The natural logarithm of one plus the average number of news articles with relevance scores greater than or equal to 90 captured by RavenPack during all two-day windows during the matched non-earnings announcement period
$LCoverage_{NonEA,Flash}$	The natural logarithm of one plus the average number of news flashes with relevance scores greater than or equal to 90 captured by RavenPack during all two-day windows during the matched non-earnings announcement period
$LCoverage_{NonEA,Orig}$	The natural logarithm of one plus the average number of original news stories with relevance scores greater than or equal to 90 captured by RavenPack during all two-day windows during the matched non-earnings announcement period
$\lvert AbnReturn\rvert$	The absolute value of raw return minus the CRSP value-weighted index return during the earnings announcement period $[0,+1]$
AbnVol	The share turnover during the earnings announcement period $[0,+1]$ less the median two-day share turnover of consecutive two-day periods during the non-announcement period, which is comprised of all dates between five trading days subsequent to the release date of quarter $t-1$ earnings and five trading days prior to the release of quarter t earnings
AbnSpread	The weighted average effective spread over trading days $[0,+2]$ of the earnings announcement, where the weights are number of trades, minus the weighted average effective spread over trading days $[-41,-11]$, multiplied by 100 (from Blankespoor et al., 2018)
AbnDepth	The natural logarithm of the weighted average bid and offer dollar depth over trading days $[0,+2]$ of the earnings announcement, where the weights are time in force, over the weighted average bid and offer dollar depth over trading days $[-41,-11]$ (from Blankespoor et al., 2018)
IPT_{Adj}	The speed with which earnings information is impounded into price, measured over the six-day earnings announcement window and adjusted for overreaction and subsequent reversal to the final cumulative abnormal return (from Blankespoor et al., 2018)
AbnRetailVol	The firm's daily average retail percentage of shares traded during days $[0,+2]$ relative to the earnings announcement, minus the equivalent amount over days $[-41,-11]$, multiplied by 100 (from Blankespoor et al., 2018)
AbnNonRetailVol	The firm's daily average non-retail percentage of shares traded during days $[0,+2]$ relative to the earnings announcement, minus the equivalent amount over days $[-41,-11]$, multiplied by 100 (from Blankespoor et al., 2018)
VIX	The average level of the Chicago Board Options Exchange Volatility Index during the period from five days following the announcement of quarter $t-1$ earnings to five days prior to the announcement of quarter t earnings
EPU	The average level of economic policy uncertainty index from Baker et al. (2016) during the period from five days following the announcement of quarter $t-1$ earnings to five days prior to the announcement of quarter t earnings
OilVol	The average level of oil price volatility during the period from five days following the announcement of quarter $t-1$ earnings to five days prior to the announcement of quarter t earnings
CurrVol	The average level of volatility of the seven currencies designated by the Federal Reserve Board as "major" currencies during the period from five days following the announcement of quarter $t-1$ earnings to five days prior to the announcement of quarter t earnings
VIX^{EPU}	The predicted value of *VIX* using *EPU* from a regression of *VIX* on *EPU*, *OilVol*, and *CurrVol* (see Appendix B)
VIX^{OilVol}	The predicted value of *VIX* using *OilVol* from a regression of *VIX* on *EPU*, *OilVol*, and *CurrVol* (see Appendix B)
$VIX^{CurrVol}$	The predicted value of *VIX* using *CurrVol* from a regression of *VIX* on *EPU*, *OilVol*, and *CurrVol* (see Appendix B)
$VIX^{OtherUncert}$	Residual uncertainty from a regression of *VIX* on *EPU*, *OilVol*, and *CurrVol* (see Appendix B)
LForm8K	The natural logarithm of one plus the number (two-day averaged number) of Form 8-K filings by a firm during the earnings (non-earnings announcement) window
LRevisions	The natural logarithm of one plus the number (two-day averaged number) of analyst earnings forecast revisions made during the earnings (non-earnings announcement) window
AbsEarnSurp	The absolute value of the seasonally adjusted change in earnings before extraordinary items scaled by market capitalization at the beginning of the fiscal quarter
NegSurp	An indicator variable equal to one if the seasonally adjusted change in earnings before extraordinary items is negative and zero otherwise
LMktCap	The natural logarithm of market value of equity
BM	Book value of stockholders' equity divided by market capitalization
LFollow	The natural logarithm of one plus the number of equity analysts following the firm during the most recent fiscal quarter
InstHold	Percentage of shares held by institutional investors
IVol	Annualized standard deviation of weekly residual returns based on the following model from Bandarchuk and Hilscher (2013): $r_{it}=a_i+b_i r_{mt}+\gamma_i r_{It}+e_{it}$
Ret	Buy-and-hold equity return during the previous twelve months
SP500Member	Indicator variable set equal to one if a firm is a member of the S&P 500 market index and zero otherwise
LEmployee	The natural logarithm of the number of employees
LOwn	The natural logarithm of the number of shareholders
NasdaqTraded	Indicator variable set equal to one if a firm's common shares trade on the NASDAQ and zero otherwise
Turnover	Average share volume divided by shares outstanding using daily stock market data over the last six months
MomStrength	Absolute value of the difference between the firm's stock return over the previous six months and the median stock return over the same period (Bandarchuk and Hilscher, 2013)

Bellwether	An indicator variable with a value of one if the explanatory power of various macroeconomic indices for a firm's earnings is in the upper quartile of the sample distribution (Bonsall et al., 2013), and zero otherwise
Non − Bellwether	An indicator variable with a value of one if the explanatory power of various macroeconomic indices for a firm's earnings is in the lower quartile of the sample distribution (Bonsall et al., 2013), and zero otherwise.
EarlyAnnouncer	An indicator variable with a value one if a firm's expected earnings announcement date is in the earliest quartile in a given fiscal quarter Savor and Wilson (2016), and zero otherwise
LateAnnouncer	An indicator variable with a value one if a firm's expected earnings announcement date is in the latest quartile in a given fiscal quarter Savor and Wilson (2016), and zero otherwise

Appendix B

Underlying sources of uncertainty driving the level of the VIX.

The table below provides the results from the estimation of a time-series regression of ***VIX*** on economic policy uncertainty from Baker et al. (2016) (***EPU***), oil price volatility (***OilVol***), and the average volatility of the seven currencies designated by the Federal Reserve Board as "major" currencies (***CurrVol***) using monthly-level observations during our sample period of November 2005 through December 2013. Each variable is a significant determinant of the VIX and combined the variables explain 89.7 percent of the variation in ***VIX***. The predicted values, denoted $\boldsymbol{VIX}^{\boldsymbol{EPU}}$, $\boldsymbol{VIX}^{\boldsymbol{OilVol}}$, and $\boldsymbol{VIX}^{\boldsymbol{CurrVol}}$, respectively, along with the residual, denoted $\boldsymbol{VIX}^{\boldsymbol{OtherUncert}}$, are used in place of VIX in Panel B of Table 3.

	(1)
	VIX
EPU	0.0197** (2.20)
OilVol	0.1637** (2.56)
CurrVol	1.9470*** (7.31)
Constant	−8.2803*** (−5.09)
Observations	98
Adjusted R^2	0.897

T -statistics are shown in parentheses below estimated coefficients and use Newey and West (1987) standard errors with four lags. *, **, and *** indicate two-sided statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

Appendix C. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jacceco.2019.101264.

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