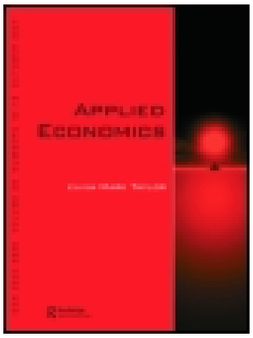

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Mass media effects on trading activities: television broadcasting evidence from Japan

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ABSTRACT
This study examines how information broadcasting through television (TV) media influences stock market activities. Consistent with the effect of TV information to attract investor attention, we find that increased information flow through TV is significantly associated with greater trading volume and larger price change. For information type, *hard* news from business-oriented programmes and earnings-related news strongly contributes to the attention effect, while the effect of *soft* news is weaker. Bid–ask spread widens for more TV information flows, suggesting that new information arrival in the market expands information asymmetry. Finally, the impact of TV is more influential for stocks with more individual shareholders than those with institutional shareholders.

KEYWORDS
Television broadcasting; trading activities; investor attention

JEL CLASSIFICATION
G14; L82

I. Introduction

The mass media is widely recognized as a major public information provider. Empirical work on its role in financial markets has recently emerged, seeking to quantify the effect of media coverage, mainly in terms of print media information, like newspapers. Previous research demonstrates that intensive media reporting is significantly related to increased active stock trading and/or pricing. Theoretically, such empirical findings could be explained by investors' limited cognitive capacity for information. Under limited attention, investors should react significantly to information that attracts their attention. In particular, since individual investors are a class of traders who are more likely to trade under constrained attention than institutional investors are, the effect of mass media on their trading activities could be substantial. In a seminal study, Barber and Odean (2008) provide evidence that more visible information increases more buy orders from individual investors. Some studies find evidence of the attention effect of the print media on trading volume and pricing (e.g. Engelberg and Parsons 2011; Tetlock 2007). Others find that more competing news distracts investors' attention (DellaVigna and Pollet 2009; Hirshleifer, Lim, and Teoh 2009). The purpose of our study is to explore impacts of the media on trading volume, pricing, and market liquidity empirically, using a comprehensive data set of television (TV) programmes from Japan, which have potentially a wide class of audience, including individuals, among various media types.

The type of information that TV conveys can differ from that of the press media because, particularly in our data set, TV has a relatively broader target audience than other information providers, such as newspapers (Engelberg and Parsons 2011). Trading behaviour by individuals has critical implications for good understanding of information processing through mass media in stock markets for various reasons. One is that their capacity to recognize or collect information is more limited than institutional investors, so that, for individuals, news obtained on mass media could more largely affect their trading behaviour (Barber and Odean 2008). Another reason is that individual investors could be typical noise traders who make their trading decisions unreasonably, depending on visible news, so that the price changes temporarily beyond the fundamental value, which creates price pressure on a short-horizon and subsequent return reversal (e.g. Barber and Loeffler 1993; Tetlock 2007).

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We contribute to literature on mass media's effects on stock market in the following ways. First, although the mass media is increasingly attracting the interest of researchers, most extant studies focus on the role of the print media. Despite the large presence of TV, the issue of how the TV media affects the stock market has thus far been largely unaddressed, except for a small number of studies about specific business programmes in the US ('*Morning Call*' in Busse and Green 2002 and '*Mad Money*' in Engelberg, Sasseville, and Williams 2012). For example, in Japan, the shares of advertising expenditure by media type in 2010 were 29.6%, 11% and 13.3% for TV, newspapers and the Internet, respectively.[1] The quantitatively significant presence of TV media constitutes our primary motivation for assessing the effects of this socially and economically important media form. In accordance with significant corporate spending on TV media, an audience survey in 'The Japanese and Television 2010' (Kimura, Sekine, and Manaki 2015) shows that people are exposed to TV media more frequently than other media; 84% of respondents view TV 'every day', while 68% do the same for newspapers and 27% for the Internet, excluding email.[2] Another survey report by the Institute for Information and Communications Policy documents that 'average usage time for primary media in a weekday' is 168 min for TV and 99.8 min for the Internet, while it is just 10.3 min for newspapers.[3] Even after considering that people may obtain a newspaper's information thorough the Internet, TV shares dominant position as information media in our daily life. For the purpose of media usage, 'for obtaining reliable information on what is going on in the world', shows that the percentage is 57.2% for TV and 21.3% for newspaper, indicating news aired by TV also has a high reliability. As a whole, these survey statistics show that TV broadcasting has a larger customer base and broader target audience than newspapers.

Second, extant studies about the effect of TV on trading focus only on a specific TV programme with content related to sell and buy recommendations. Busse and Green (2002) find evidence that TV information over the trading time has a real-time effect on stock price reactions within a few seconds. In addition, some studies examine 'Mad Money', which is a popular TV programme for investors, to provide evidence for the mass media effect (e.g. Engelberg, Sasseville, and Williams 2012; Keasler and McNeil 2010; Lim and Rosario 2010). Our broad coverage of TV programmes, which cover business-oriented news shows to tabloid TV shows, yields more general implications about the media effects of TV, which are not limited to specific events.[4] In addition, by considering alternative types of information, such as corporate official disclosure and newspaper coverage, in the analysis, we can quantitatively compare the heterogeneous effects of multiple information sources on trading.

Furthermore, our data set enables us to conduct more in-depth analysis by categorizing TV programme content into 'soft' and 'hard' information. Recently, several studies on the media effects of financial markets have attempted to differentiate soft from hard information (Demers and Vega 2014; Engelberg 2008). They commonly define hard information as quantitative information, such as earnings numbers typically represented in financial statements, which is generally straightforward for understanding the implications for fundamental values. Soft information is more qualitative, usually a verbal or textual format, and is empirically extracted with a text analysis technique. Interestingly, on the other hand, extant research on media communication argues that the media format with soft news, including tabloid TV shows or talk shows, plays the role of turning the interest of inattentive audiences to socially important issues, like politics (Baum 2002; Prior 2003). Theoretically,

[1]The data source is from *Japanese Advertising Expenditure in 2011* by Dentsu Co. http://www.dentsu.co.jp/news/release/2012/pdf/2012017-0223.pdf. In addition, to show the quantitative presence of TV, the Japanese Ministry of Internal Affairs and Communications estimates the volume of consumed information for the Japanese market each year. Broadcasting services accounted for 73.3% of all information consumed in Japan in the 2009 financial year; the Internet, 11.8%; and the print media, only 8.6%.

[2]Another advantage of TV media is multiple modality. Several examine find that since TV stimulates multiple sensors, including visual, the cognitive response may be higher than other media, such as print (Dijkstra, Buijtels, and Van Raaij 2005; Jacoby, Hoyer, and Zimmer 1983).

[3]See, 'Year 2016 Survey Report on Media Utilization Time and Information Acquisition Behavior (in Japanese)', Ministry of Internal Affairs and Communications 2017.
(URL: http://www.soumu.go.jp/menu_news/s-news/01iicp01_02000064.html).

[4]Apart from economy and finance literature, there are some studies for the mass media effect on social and political matters. Kearney and Levine (2015) provide evidence for the effect of TV programmes on the social issue of teen pregnancy. DellaVigna and Kaplan (2007) find evidence that Fox News Network affects voting behaviour.

people's psychological demand for entertainment could increases the popularity of TV programmes with a combination of political news and entertainments. In finance literature, Dorn and Sengmueller (2009) provide evidence for the claim that individuals who seek entertainment in investing trade more aggressively. Partly based on these prior studies, we utilize the uniqueness of wide coverage of TV programme content data at the two levels: *TV programmes* and *session contents*. TV programmes are classified into hard business news programmes and more general soft news programmes. We assume that TV programmes specializing in business and finance transmit relatively 'hard' news that is directly connected to corporate information useful for trading, while other programmes covering more general news and/or entertainment information broadcast relatively 'soft' information. Alternatively, by scrutinizing the summary contents of TV programme sessions, we divide the sessions into earnings-related (hard) news and other (soft) news, given that earnings should be numerical information widely used in trading and that the significant impact on pricing and trading volume has been demonstrated in academics. We examine the question of whether soft information contributes to attracting more investor attention or whether hard information has strong power for attention grabbing.

Finally, we analyse the information–trading relationship by employing daily trading and TV data covering about 800 firms appearing on TV. With this rich firm-daily data set, we can accurately assess the impact of information release on trading activities, than with less frequent weekly or monthly data particularly. In addition, the wide cross-sectional coverage allows us to examine differences of company characteristics. Specifically, we investigate the question of whether the mass media effect of TV on trading is greater for firms with significant ownership of individual shareholders.

Our main results are summarized as follows. Consistent with the investor attention effect, we identify that the inflow of information through TV media significantly increases trading volume, even after controlling for other types of information flows, like corporate disclosure and newspaper coverage. In addition, the daily price significantly changes with the arrival of TV information, suggesting that investors utilize information that TV media transmits. We find no evidence to support the short-term return reversal surrounding TV. Different to prior research, TV information is unlikely to be the main driver for noise trading. For market liquidity, the bid–ask spread increases with TV information flows, indicating that news from TV tends to expand information asymmetries among investors. Information type is important. Hard information from business-oriented content contributes to investor attention grabbing, rather than soft information. In terms of investor identity, the mass media effect of TV on market activities is concentrated in stocks held by more individual shareholders, suggesting that retail investors are more likely to be dependent on mass media coverage.

The remainder of the article is organized as follows. Section II reviews the literature on the effect of the media on financial markets and market liquidity, developing our empirical hypotheses. Section III describes the data set mainly for TV broadcasting records. Section IV presents the empirical results. Finally, Section V concludes the article.

II. Media effects on market activities and the related literature

Trading volume, pricing and investor attention

We adopt trading volume as a key variable to measure trading behaviour, and hypothesize that, if TV information attracts more investor attention, it leads to more trading volume. Given the limitation of cognitive ability of investors, trading volume could be stimulated for events that collect more investor attention. When an investor selects one stock out of a large universe, the search cost should be high so that the investor has a bias to pick up a stock with more visibility. In the seminal study of Barber and Odean (2008), the importance of investor attention in trading behaviour is asserted by demonstrating that individual investors' buy orders are responsive to salient information, such as previous extremely large price changes. Some recent studies find that a Google search volume index as a proxy for investor attention is positively related to active trading volume and return (Da, Engelberg, and Gao 2011; Vozlyublennaia 2014; Han, Wu, and Yin 2018).

For the relationship between mass media and attention, a growing body of literature on print media has taken up the challenge of clarifying the role of the mass media in the intermediation of information to the public. Prior research provides evidence consistent with the argument that active newspaper coverage for a firm attracts more investor attention, and thus, results in more trading. Engelberg and Parsons (2011) confirm the causal effect of press media coverage on stock markets by using local newspaper outlets and local investor trading volume. Peress (2014) demonstrates that there is significant decline of trading volume during no-news days by newspaper company strikes. In the context of Internet information, Antweiler and Frank (2004) examine large message boards for retail investors and find that optimistic opinions expressed there had a significant effect on trading volume. Likewise, Antunovich and Sarkar (2006) demonstrate that stock recommendations on Internet sites increased intraday liquidity as measured by market spread and depth.[5]

We examine the effect of TV information on pricing, and hypothesize that, if TV information attracts more investor attention, it leads to larger price changes. Following this argument, Huberman and Regev (2001) demonstrate interesting evidence supporting the mass media effect that the market price moved in a significant upward direction in response to an article of a new cancer drug reported in the *New York Times*, even though this new information had already been available in a scientific journal. Consistent with this, Tetlock, Saar-Tsechansky, and Macskassy (2008) find that the extent of pessimistic content for individual firms has the ability to predict future earnings performance and conclude that the media plays an important role in conveying information that is sometimes 'difficult to quantify' to markets. In addition, Fang and Peress (2009) find lower excess returns for stocks receiving more press coverage, consistent with the efficient pricing of information. Cervellati, Ferretti, and Pattitoni (2014) find evidence for the attention-grabbing effect of print media by using the published second-hand information about analyst recommendations. Griffin, Hirschey, and Kelly (2011) provide international evidence that price changes around public information flows is greater for developed countries.

To understand the relationship between mass media information and pricing further, we address the question of whether TV information flows are associated with investor overreaction on a short-term and return reversal. When investors react to news excessively over the relevant valuation, price pressure from noise trading should temporarily emerge, but subsequently be reversed. Tetlock (2007) uses a text analysis technique to conclude that pessimistic content in the *Wall Street Journal* is related to stock price falls, and the reversal thereafter. This finding suggests that media reports can account for the overreaction of investors. By contrast, Peress (2014) finds that return reversal is greater over the period of newspaper strikes (no media days), which is inconsistent with the noise trading hypothesis.

Only a limited number of finance studies have examined the TV media effect on trading volume and pricing. By focusing on specific TV programmes that contain stock recommendations, several studies provide evidence of the strong and temporal effects of TV on the stock market. Busse and Green (2002) examine stock recommendations in *Morning Call and Midday Call* on CNBC and find that prices quickly respond to reports within just a few seconds and trading intensity doubles in the first minute after information release. Some studies consistently find that recommendations aired on *Mad Money* on CNBC induce significant overnight price changes, but exhibit reversal thereafter (Engelberg, Sasseville, and Williams 2012; Keasler and McNeil 2010; Neumann and Kenny 2007). This finding is consistent with the argument that individual investors watching the TV programme over-reacted to noisy information unrelated to fundamentals or already capitalized on the prices.[6] Similarly, Kim and Meschke (2014) investigate interviews with company chief executive officers on CNBC and document significant positive abnormal returns and strong return reversal after the interviews were broadcast.[7] Our analysis is similar to prior studies that examine price

[5]To gain insights about trading activities of individuals, the alternative approach is to scrutinize tick data closely by splitting orders by size (Barber, Odean, and Zhu 2009) or accounts of retail customers for brokerage houses (e.g. Barber and Odean 2008).

[6]Lim and Rosario (2010) provide evidence for the forecasting ability of Jim Cramer on Mad Money over a long run.

[7]Takeda and Yamazaki (2006) shed light on a popular Japanese TV programme covering anecdotal story of companies, and find that significant stock price responses around the broadcasting events over a short-run window. Kim (2013) finds that the overconfidence tone of CEO interviews aired on CNBC has a significant impact on market reactions around the turnovers.

response and return reversal, but differs in its diverse coverage of TV programmes from hard to soft news.

Market liquidity and information asymmetries

We examine market liquidity measures to identify how information through TV is characterized. Specifically, we address the question of whether TV information flows mitigate information asymmetry among investors or enlarge the informational gap. Theoretical research demonstrates that liquidity is associated with information asymmetry built on the adverse selection framework. Glosten and Milgrom (1985) prove theoretically that a more severe information gap between informed and uninformed investors invokes wider spreads as a means of compensating for the information risk that liquidity providers incur. Kim and Verrecchia (1994) derive the prediction that the release of earnings information leads to lower liquidity because the new information enhances the ability of informed traders to interpret the news, and then, it expands the informational gap between informed and uninformed investors. To test the purported relationship between market information and market liquidity, subsequent research considers how proxy variables for information flows or institutional settings are related to information environments associated with liquidity, including studies on earnings information (e.g. Lee, Mucklow, and Ready 1993; Krinsky and Lee 1996; Affleck-Graves, Callahan, and Chipalkatti 2002). Bushee et al. (2010) and Sankaraguruswamy, Shen, and Yamada (2013) find that more news coverage for firms is associated with narrower spreads.

III. Data and variables

Information flow: TV broadcasting, disclosure and newspapers

Since a limited number of companies dominates broadcast networks in Japan, our empirical setting offers good prospects for correctly evaluating the effect of information flows through the TV media by utilizing a relatively clean sample. Across the entire Japanese broadcasting market, the revenue share of terrestrial broadcasting, including Nippon Hoso Kyokai (NHK; the national public broadcaster), the 5 major commercial broadcasting networks and the 13 independent stations, was about 76.4% for the 2009 financial year. In addition, the revenue share of each of the key Tokyo stations (NTV, TBS, Fuji TV, TV Asahi and TV Tokyo, in decreasing order of revenue share) for the five networks is more than 70%, and the share of airtime for self-produced programmes, except for those produced by the key stations, is only about 15%. In other words, the content of Japanese TV broadcasting is quite concentrated, despite an apparently fragmented market. Therefore, we can easily reflect national TV broadcasting content by investigating TV programmes offered by the key Tokyo stations only.[8]

TV programmes aired in the Tokyo metropolitan area geographically cover seven prefectures (Tokyo, Kanagawa, Saitama, Chiba, Ibaraki, Gunma and Tochigi), and it shares approximately 34.4% of all households in Japan (based on Basic Resident Register in March 2010). Actual cover rate is further increased because TV programmes are distributed over other regions through networks. Note that the number of distributed stations is different by each network or each programme. For example, TV programmes ranked as 1–4 in Table 2 are aired by TV Tokyo and distributed in other five metropolitan areas – such as Osaka and Aichi, among others – with coverage for approximately 70% of all households.[9] The situations in other commercial networks are similar. The programmes ranked as 5–7 are aired by NHK, public channels like BBC, which covers almost 100% of all households in Japan through network distribution.

The TV programme data are provided by M-data Corporation, a media-related marketing research company, and cover full TV programmes aired by broadcast companies in the Tokyo area, including NTV, TBS, Fuji TV, TV Asahi and TV Tokyo.[10] The firm sample comprises firms listed on the First

[8]The market impact of TV might remain significant in Japan. According to the Survey of National Living Hours conducted every five years by the NHK, the typical Japanese spends more than three hours a day watching TV (3 h 28 min to be exact, according to the 2010 survey), and this behaviour has been relatively stable for the past 20 years.

[9]See the official website of TV Tokyo, http://www.tv-tokyo.co.jp/kaisha/company/network.html.

[10]Records from M-data are downloadable from Nikkei Telecom 21, which is operated by Nikkei group and is one of the largest and most reliable economic databases, covering numerous newspapers, magazines and other media. However, in this study, the bulk of the data set is kindly provided for academic use all at once by M-data.

Section of the Tokyo Stock Exchange (TSE), excluding financial firms, because of their specific regulatory environment. The sample period covers 1-year daily observations from 1 January 2010 to 31 December 2010 (no. of trading days = 245).[11] The TV data set records the different sessions in a given programme separately, and when a company appears more than once in one programme, we count it as multiple TV news. For example, one TV programme *Emorning*, aired on TV Tokyo, is organized by several sessions, such as 'market conditions', 'The Top Line' and 'Tokyo market' for durations lasting from seconds to 10 min. We use a session (not programme) as our minimum unit to count the news frequency. We use only the programme session records classified in the business-related category by M-data because our primary concern is the effect on trading activity for individual firms.[12] To identify the firm name in a programme, we employ the list of company attributes published by Nikkei FQ, including the company's full name and abbreviation, and then, we match the TV data set to the list of firm names. Firms that are mentioned on TV programmes at least once over the sample year 2010 are selected (no. of firms = 860). This results in 209,271 firm-day observations for the actual analysis.

We employ two additional data sources to control for information flows other than through the TV media. The first comprises official disclosures by companies on the TSE disclosure system. The other is press media coverage sourced from Nikkei Telecom 21. This data source covers Japan's largest business and economic newspaper, the *Nikkei*, and two other business publications, the *Nikkei Marketing Journal* and *Nikkei Industry*.[13] For all of the information flow data sets, we simply count the number of articles per day with official disclosure (*Disclosure*), press media (*Newspaper*) and TV programme (*TV*) coverage. When the release of information is on a non-trading day (e.g. a public holiday), we count it as the next trading day. For newspapers, we count the morning edition as the current day and the evening edition as the next day.

TV content classification: soft and hard news

Table 1 provides the frequencies of the count variable (*TV*) by broadcasting company. The programmes on TV Tokyo most frequently include the sample firms. This is because TV Tokyo is affiliated with the Nikkei Group, the largest business information vendor in Japan, and is akin to a counterpart of CNBC in the US. In fact, as we observe next, it broadcasts many business news programmes. The second is NHK, which is the Japanese public broadcasting association, corresponding to the BBC in the UK. The other four are private broadcasting companies covering a broader range of programmes, not oriented to business information.

Table 2 displays TV programmes with higher frequency of coverage for firms using three categories (categories I, I, and III). For the later analysis, this is important since the division between soft and hard news is useful to understand the characterization of information that TV conveyed. There is no full consensus for soft/hard news definitions owing to the multifaceted aspects. Nonetheless, here we adopt the criteria based on 'news topics' used in media according to the review of Reinemann et al. (2011). In other words, a programme format mainly covering business and finance topics is labelled as hard news, which could be valuable for investors as direct information sources for trading. On the other hand, a programme format including diverse topics (e.g. politics, sports and celebrities) is labelled soft

Table 1. TV media coverage by broadcasting company.

Broadcasting company	Frequency	Percentage
TV Tokyo (TX)	17,370	63.67
NHK (Nippon Hoso Kyokai)	2,808	10.29
Nippon Television (NTV)	1,978	7.25
TV Asahi (EX)	1,963	7.2
TBS (Tokyo Broadcasting System Television)	1,959	7.18
Fuji Television (CX)	1,204	4.41
Total	27,282	100

Frequency indicates the aggregated number of TV media coverage for sample firms by broadcasting company over the period from 1 January 2010 to 31 December 2010. NHK is the national public broadcasting corporation and the others are commercial networks.

[11]One reason for this particular sampling period is our limitation accessing longer period data; in addition, the high-speed transaction system (TSE Arrowhead) began operations in 2010, and therefore, this period enables us to minimize the effects of different transaction systems on the results.

[12]The original database includes records in a number of other categories, including politics and international affairs, social affairs, culture and entertainment, and sports.

[13]Aman (2013) uses the same database and analyses the relationship between information flows and stock price clashes.

Table 2. TV programmes ranked by total coverage for sample firms.

Rank	TV programme title	Broadcasting company	Category I	Category II	Category III	Frequency	Starting time
1	Emorning	TV Tokyo	Business	Wide show	Business	8,553	8:56 AM
2	NEWSFINE	TV Tokyo	Business	Wide show	Business	4,764	3:30 PM
3	World Business Satellite	TV Tokyo	Business	News/reports	Business	1,857	11:00 PM
4	News Morning Satellite	TV Tokyo	Business	News/reports	Business	1,570	5:45 AM
5	Ohayou Nippon	NHK	Others	News/reports	News/reports	767	4:30 AM
6	BIZspo	NHK	Others	News/reports	News/reports	566	11:25 PM
7	Zoom in SUPER	NTV	Others	Wide show	Wide show	556	5:20 AM
8	NEWS	NHK	Others	News/reports	News/reports	554	12:45 AM
9	Yajiuma Plus	TV Asahi	Others	Wide show	Wide show	406	5:25 AM
10	Hiruobi	TBS	Others	Wide show	Wide show	389	11:00 AM
11	Asa Zuba	TBS	Others	Wide show	Wide show	344	5:30 AM
12	Houdou Station	TV Asahi	Prime time news	News/reports	Prime time news	290	9:54 PM

(Category I) *Business*: Four business-oriented news programmes aired on TV Tokyo. *Prime time news*: six general news shows aired in prime time zone from 7 PM to 11 PM. *Others*: TV programmes except for business-related and prime time news. (Category II): M-data Corporation provides this category list. *News/reports*: general news shows. *Wide show*: tabloid news show. (Category III) Mixed with categories I and II.

news. As claimed in prior literature on media communication (Baum 2002; Prior 2003), this has the benefit of potentially attracting a less attentive audience although the information quality might be lower.

Category I (C.I) is from the authors' own manual judgement: *Business, Prime time news* and *Others*. For *Business* classification, TV Tokyo offers the top four programmes with the largest coverage on air, all of which are oriented to business and finance news, as follows: *Emorning* in the morning, *NEWSFINE* in the afternoon, *World Business Satellite* at night and *News Morning Satellite* in the early morning. These programmes are organized to provide traders and/or business people with directly valuable corporate and market news. *Prime time news* comprises representative news shows covering a wider range of news, including social, politics, economics and sport, aired in the prime time zone, which generally has a higher viewership rate in the Japanese broadcasting industry (7–11 PM). Specifically, *NEWS7* and *NEWS WATCH9* are from NHK, *NEWS23* from TBS, *Houdou Station* from TV Asahi, *News Japan* from Fuji TV and *News Zero* from NTV. *Others* represents the other programmes. Based on C.I, *Business* is a proxy for hard news. In addition, *Prime time news* and *Others* are expected to capture soft news.

Category II (C.II) is provided by the data vender, *M-data*, and includes 'Wide show (tabloid TV show)' (65.56%), 'News/reports' (32.64%), 'Documentary' (1.28%), 'Entertainment' (0.40%) and 'Sports news' (0.11%). Note that 'Wide show' is translated into English directly from Japanese and refers to a specific genre that provides broader topics, akin to 'tabloid TV shows'. Generally speaking, 'Wide shows' are live on the air for a few hours. They cover diverse information on both current/political news, as well as daily life, celebrity news and social issues. This adds entertainment to general news, and thereby, could increase viewership.

Category III mixes C.I (by the authors) with C.II (by M-data) to fit our financial market analysis. The defect of C.II is that it is too rough, and 'Wide shows' are allocated very high percentage shares, while the business-related category is ignored. We reallocate the programmes labelled *Business* and *Prime time news* in C.I as 'Business' and 'Prime time news', respectively, in C.III. After this adjustment, C.III consists of seven categories, specifically two categories in C.I ('Business' and 'Prime time news') and five originating from C.II ('News/reports', 'Wide show', 'Documentary', 'Sports' and 'Variety').

An alternative approach to soft/hard news is to identify each set of summary content of TV sessions recorded in our data set. Recent finance research on text information extracts soft information, including sentiment and uncertainty, as opposed to hard information, including earnings numbers (Engelberg 2008; Demers and Vega 2014). Partly built on the prior idea, we use a simple methodology to judge which content is soft or hard. Among various types of corporate information, earnings-related news could be most important information directly and broadly utilized for the valuation. In fact, numerous prior studies on market reactions to earnings releases have consistently demonstrated significant price changes around the events (Neuhierl, Scherbina, and Schlusche 2013; Vega 2006). We classify the content by searching several keywords concerning earnings release. First, *TV Earnings I* is

defined as the number of TV sessions that include the word '*kessan*' ('financial result' in English). *TV Others I* is defined as the difference between the total TV count and the earnings-related count (i.e. *TV* – *TV Earnings I*). *TV Earning I* is a proxy variable for hard news, and *TV Others I* is a proxy for soft news. In addition, to check the sensitivity of our earning news variable, we create another earnings-related news count to cover wider content. *TV earnings II* and *TV Others II* are defined as the number of TV sessions with more keywords.[14]

Trading activities measures

Daily trading volume data come from The Japan Daily Stock Price Database by Nikkei Media Marketing. We compute turnover rate by denominating the amount of trading volume by the number of shares outstanding. Then, to detrend a time series of trading volume, following prior methodology (Neuhierl, Scherbina, and Schlusche 2013), we subtract the average value of the log of the turnover rate over $t - 10$ to $t - 29$ (*Abn turnover*). The abnormal return is defined as raw returns minus market returns, which is calculated by the value-weighted average of stock returns listed on the TSE's first section. *Abs price change* is the absolute value of abnormal returns.

We include several additional variables in the analysis. *Mkt cap* is market capitalization at the close of trade in order to take the firm size into account. *Mkt trading* is the averaged turnover rate for stocks listed on the TSE's first section. The turnover and price change on the previous trading day are included (*Abn turnover* ($t - 1$) and *Abs price change* ($t - 1$), respectively). In addition, to control for any calendar effect, we include day-of-the-week and month dummies.

Liquidity measures

We construct our liquidity measures using the Nikkei NEEDS historical tick database. The database contains intraday transaction data on the limit order book during trading hours for the stocks listed on TSE first section. All trade and quote records are time-stamped to the nearest minute.[15] We use the relative quoted half-spread and market depth as measures of liquidity. The spread is the difference between the prevailing bid and ask quotes divided by the midquote. Given that the difference between the best bid and ask quotes is regarded as the transaction cost that investors have to cover for a round-trip transaction, the market becomes more liquid as the spread narrows. Constructing the daily spread (*Spread*), we calculate the quoted time-weighted average of spread for each stock for each day (basis point). We define market depth as the amount of shares available at the first best bid and first best ask prices in the limit order book. We use the variable indicating market depth, as the Yen amount of quote, specifically defined as the number of shares at the first best bid and first best ask quote multiplied by the price in the limit order book. Similar to the spread, we use the time-weighted average for each stock for each trading day (*Depth*).

IV. Empirical results

Descriptive statistics

Table 3 provides descriptions of the variables used in the study. Average TV coverage (*TV*) is 0.130, indicating that a typical firm is covered by TV programmes once in 8 days, which is larger than the average count for disclosure per day (*Disclosure*) 0.091. The average number of references in newspapers (*Newspaper*) is 0.313. For TV content classifications, the frequency of *TV Earnings I* is on average 0.014, and its percentage share is 10.7% of total TV count. The share of *TV earnings II* defined more broadly is far greater (25.1%). The averages of *Business* and *Prime time news* are 0.080 and 0.005, respectively, so their shares relative to TV are 61% and 3.5%, respectively.

As in Table 4, the correlation between press media coverage (*Newspaper*) and disclosure (*Disclosure*) is 0.267. The positive correlation indicates that the press media covers a wider range of news items, including disclosure announcements as a subset, along with their own original or

[14]The keywords include '*rieki*' (earnings/profits), '*uriage*' (sales), '*kuroji*' (surplus), '*akaji*' (deficit), '*zou-shu*' (increased sales), '*zou-eki*' (increased profits), '*gen-shu*' (decreased sales) and '*gen-eki*' (decreased profits).

[15]The information content in the database is almost equivalent to that disseminated by the exchanges, and the database is one of the most trusted databases on intraday transaction data available for the Japanese stock market.

Table 3. Descriptive statistics.

Variable	Mean	SD	Min.	2nd quartile	Median	3rd quartile	Max.
TV	0.130	0.807	0	0	0	0	65
TV Earnings I	0.014	0.170	0	0	0	0	26
TV Others I	0.116	0.759	0	0	0	0	65
TV Earnings II	0.033	0.267	0	0	0	0	34
TV Others II	0.098	0.694	0	0	0	0	58
Business	0.080	0.444	0	0	0	0	14
Prime time news	0.005	0.090	0	0	0	0	10
Disclosure	0.091	0.420	0	0	0	0	33
Newspaper	0.313	0.864	0	0	0	0	27
Turnover	0.005	0.018	0.000	0.001	0.003	0.005	2.400
Abn turnover	0.003	0.223	−2.181	−0.079	−0.014	0.052	5.179
Excess return	0.030	1.947	−89.857	−0.909	−0.066	0.836	99.656
Abs price change	1.240	1.502	0.000	0.403	0.874	1.606	99.656
Spread	19.358	20.042	1.757	7.621	12.799	23.488	423
Depth	33.849	441.720	0.020	1.703	4.809	17.247	52684
Mkt cap (mil Yen)	278576	713616	10.311	23,094	61978	215656.9	1.45E+07
Mkt trading	0.0051	0.0011	0.0029	0.0043	0.0050	0.0058	0.0087

TV is the number of television broadcasting. *Disclosure* is the number of official disclosure released on Tokyo Stock Exchange. *Newspaper* is the number of press coverage by the newspapers; the Nikkei, the Nikkei Marketing Journal and Nikkei Industry. *Turnover* is the ratio of trading volume to the number of shares outstanding. *Abn turnover* is the difference between turnover and the past 20-day average turnover. *Excess Return* is the daily raw return minus market return for TSE. *Abs price change* is the absolute value of *Excess return. Spread* is the bid–ask spread divided by the midquote. *Depth* is the market depth, defined as the amount value of shares at the first best bid and first best ask prices. *Mkt cap* is firm size defined as market capitalization. *Mkt trading* is the average turnover rate for all the stocks listed on TSE 1st section. *TV Earnings I* is the number of TV coverage that includes the word 'kessan' ('financial result' in English). *TV Others I* is the TV count except for the earnings-related TV coverage. *TV Earnings II* is the number of TV coverage with more widely defined earnings-related keywords such as sales, profits etc. *TV Others II* is defined as the number of TV coverage without the widely defined earnings keywords. *Business* is the TV coverage by four business-oriented news programmes aired on TV Tokyo. *Prime time news* is the TV coverage by six general news shows aired in prime time zone from 7 PM to 11 PM.

Table 4. Correlation matrix.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	*TV*	1						
(2)	*Disclosure*	0.0678	1					
(3)	*Newspaper*	0.4006	0.2673	1				
(4)	*Turnover*	0.0230	0.0485	0.0379	1			
(5)	*Abs price change*	0.0063	0.1578	0.0396	0.3235	1		
(6)	*Spread*	−0.0813	−0.0112	−0.1079	0.0018	0.1366	1	
(7)	*Depth*	0.0602	0.0041	0.0853	0.0104	−0.0056	0.0090	1
(8)	*Mkt cap*	0.4222	0.0270	0.4339	−0.0142	−0.0706	−0.2108	0.0894

TV is the number of media coverage by television broadcasting. *Disclosure* is the number of official disclosure released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper coverage. *Turnover* is the ratio of trading volume to the number of shares outstanding. *Abs price change* is the absolute value of daily raw return minus market return for TSE. *Spread* is the bid–ask spread divided by the mid-quote. *Depth* is the market depth, defined as the amount of shares at the first best bid and first ask best prices. *Mkt cap* is firm size defined as market capitalization.

interpretative articles concerning disclosure information.[16] However, the correlation between *TV* and *Disclosure*, 0.0678, is less than that between *Newspaper* and *Disclosure*. This indicates that the TV media is generally less likely to report official corporate disclosure than is the press media. Rather, the high positive correlation between *TV* and *Newspaper*, 0.400, suggests that the content of TV news is similar to the articles that newspapers report. As shown in the correlation matrix in Table 4, the three information variables have positive associations with the turnover rate and excess return although their size is small.

Turnover and price change sorted by information count

Table 5 sets out the averages of the turnover and price change measures sorted by the count of news releases per day. From panel A, we observe that the mean turnover tends to increase with the level of TV coverage (*TV*). In particular, it seems that the gap of turnover from $TV = 0$ to $TV = 1$ is remarkable and for more than $TV = 2$, while the positive marginal impact becomes smaller. Similarly, increased newspaper media coverage involves active trading; in addition, an increase in corporate disclosure is related to greater turnover rate. At first impression, while this simple

[16]More precisely, business newspapers do not necessarily cover all disclosure releases. In addition, our use of multiple newspaper sources can produce more duplicated media coverage for a firm.

Table 5. Turnover and absolute price change sorted by information counts.

(A) Turnover (× 1000)				(B) Abs price change			
Disclosure				*Disclosure*			
N of info counts	Mean	SD	N of obs.	N of info counts	Mean	SD	N of obs.
0	0.498	1.791	195,841	0	1.189	1.369	195,841
1	0.703	2.049	9,826	1	1.697	2.279	9,826
2	0.951	2.119	2,360	2	2.526	3.285	2,360
3	1.100	3.115	803	3	2.910	3.295	803
≥4	1.297	4.111	441	≥4	3.828	4.297	441
Newspaper				*Newspaper*			
N of info counts	Mean	SD	N of obs.	N of info counts	Mean	SD	N of obs.
0	0.487	1.593	171,135	0	1.213	1.407	171,135
1	0.618	2.716	23,130	1	1.300	1.734	23,130
2	0.677	2.392	9,003	2	1.416	1.842	9,003
3	0.695	2.181	3,095	3	1.488	2.137	3,095
≥4	0.786	2.916	2,908	≥4	1.555	2.473	2,908
TV				*TV*			
N of info counts	Mean	SD	N of obs.	N of info counts	Mean	SD	N of obs.
0	0.503	1.766	195,990	0	1.238	1.483	195,990
1	0.754	2.931	7,910	1	1.300	1.863	7,910
2	0.722	1.609	2,787	2	1.205	1.365	2,787
3	0.669	1.085	1,000	3	1.221	1.623	1,000
≥4	0.625	2.298	1,584	≥4	1.245	1.871	1,584

TV is the number of the reference to sample firm by television broadcasting. *Disclosure* is the number of official disclosure released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper coverage. *Turnover* is the ratio of trading volume to the number of shares outstanding. *Abs price change* is the absolute value of excess return defined as raw return minus market return (%).

univariate comparison does not control for other factors, the observed trend is consistent with the notion that greater information flow through TV appears to attract investor attention and lead to more trading. As shown in panel B with regard to price movements, we find only a weak increase of absolute price change in response to an increase of TV coverage from 0 to 1. For *Newspaper* and *Disclosure*, we find there is a clear trend that more information flows induce an increase in price change.

Regression results: trading volume and price change

Table 6 displays our baseline results for the impact of TV coverage on trading behaviour. To minimize the likelihood of endogeneity issues from unobserved variables as much as possible, we include *Newspaper* and *Disclosure* as other major information sources and estimate models with firm fixed effects.[17]

$$Abn\ Turnover_{it} = \beta_0 + \beta_1 TV_{it} + \beta_2 Disclosure_{it} + \beta_3 Newspaper_{it} + \beta_4 Control_{it} + u_{it}$$

Our first key finding is that *TV* is positively and significantly associated with the trading volume variable (*Abn turnover*). For example, the estimated coefficient of TV is 0.0053 at the 1% significance level after controlling for other information flows (*Disclosure* and *Newspaper*). This is clearly consistent with the investor attention hypothesis that more TV news attracts more investors' attention, and thereby, leads to more active trading. *Disclosure* and *Newspaper* are positively and significantly related to trading volume as well. For the economic impacts of information flows, a 1 SD increase in *TV* generates an increase of 0.0192 SD in *Abn turnover*. The corresponding values of *Disclosure* and *Newspaper* are 0.105 SD and 0.0312 SD, respectively. The scale of impact is largest for *Disclosure*, the second largest is for *Newspaper*, and the scale of *TV* is weaker than that for the other two information flows. Overall, these findings support the argument that TV media plays an additional role of transmitting information to investors, controlling for other types of media.

Next, we perform regressions with price change as the dependent variable.

[17]The instrumental variable (IV) approach is popular for resolving endogeneity. However, it is often difficult to find a good IV, and it is well known that inappropriate IVs elevate unfavourable statistical properties for estimates. Therefore, we attempt to address this issue with alternative information sources and fixed effects. See Larcker and Rusticus (2010) and Roberts et al. (2013).

Table 6. Baseline result for effect of information flows on trading volume.

Dep. var: *Abn turnover*	(1)	(2)
TV	0.0053***	0.0061***
	[3.41]	[3.83]
Disclosure	0.0558***	0.0553***
	[21.84]	[22.01]
Newspaper	0.0081***	0.0093***
	[7.80]	[8.86]
TV(t − 1)		−0.0029***
		[−4.31]
Disclosure(t − 1)		−0.0098***
		[−7.03]
Newspaper(t − 1)		−0.0035***
		[−5.31]
Abn turnover(t − 1)	0.6685***	0.6720***
	[55.55]	[55.68]
Log Mkt trading	0.3621***	0.3631***
	[29.62]	[29.74]
Log Mkt cap	−0.0021	−0.0018
	[−0.20]	[−0.17]
Constant	−0.1458	−0.1522
	[−0.56]	[−0.59]
R^2	0.4861	0.4872
F-value	633.02***	635.92***
N	209,271	209,271

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. The *t*-statistics are in square brackets. *** indicates statistical significance at 1%. *Abn turnover* is abnormal turnover defined as the log-transformed turnover rate minus the average value of log turnover over past 20 days. *TV* is the number of television broadcasting coverage. *Disclosure* is the number of corporate disclosure officially released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper articles. *Mkt trading* is the average turnover rate for all the stocks listed on TSE 1st section. *Mkt cap* is firm size defined as market capitalization. The notation '(*t* − 1)' means one trading day lag. To save space, the results of day-of-week dummies, monthly dummies and firm fixed effect are compressed.

Table 7. Effect of information flows on price change.

Dep. var.: *Abs price change*	(1)	(2)
TV	0.0321***	0.0362***
	[2.92]	[3.18]
Disclosure	0.4743***	0.4743***
	[21.50]	[21.49]
Newspaper	0.0902***	0.0906***
	[9.73]	[9.43]
TV(t − 1)		−0.0186***
		[−3.87]
Disclosure(t − 1)		0.0029
		[0.14]
Newspaper(t − 1)		0.0051
		[0.92]
Abs price change(t − 1)	0.1714***	0.1713***
	[4.25]	[4.19]
Log turnover(t − 1)	0.1334***	0.1334***
	[5.57]	[5.65]
Log Mkt cap	−0.3469	−0.3464
	[−0.85]	[−0.85]
Constant	10.5492	10.5378
	[1.05]	[1.05]
R^2	0.1109	0.1109
F-value	137.29***	122.36***
N	209,271	209,271

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. The *t*-statistics are in square brackets. *** indicates statistical significance at 1%. *Abs price change* is the absolute value of excess return defined as raw return minus market return (%). *TV* is the number of television broadcasting coverage. *Disclosure* is the number of corporate disclosure officially released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper articles. *Turnover* is the turnover rate defined as the trading volume deflated by total number of shares outstanding. *Mkt cap* is firm size defined as market capitalization. The notation '(*t* − 1)' means one trading day lag. To save space, the results of day-of-week dummies, monthly dummies and firm fixed effect are compressed.

$$Abs\ price\ change_{it} = \beta_0 + \beta_1 TV_{it} + \beta_2 Disclosure_{it} + \beta_3 Newspaper_{it} + \beta_4 Control_{it} + u_{it}$$

The result for pricing effect is displayed in Table 7. An increase in TV broadcasting is associated with greater absolute price change. In line with prior studies on the media effect on pricing observed in the press media (Griffin, Hirschey, and Kelly 2011; Peress 2014), TV media also shift the equilibrium price on a daily level by transmitting information to the markets. For comparison of the economic impacts, a 1 SD change of each information flow generates 0.017 SD (*TV*), 0.132 SD (*Disclosure*) and 0.051 SD (*Newspaper*) changes of *absolute price change*, respectively, indicating that, as well as trading volume regressions, the scale of TV is weaker than the other two variables. The 1-day lag of TV, *TV*(*t* − 1), exhibits a negative and significant sign, indicating that the impact of TV on price could be short lived. We address this time lag issue in details in next, and then, later sections.

To compare impacts of three information variables more clearly, we include longer lags in the trading volume and price models. In Table 8, we find that *Disclosure* have many significantly positive lag terms from *t* − 4 to *t* − 9, indicating the corporate disclosure exerts a long-lasting influence on traders' activities. On the other hand, overall lag terms of *TV* (and *Newspaper*) exhibit less statistical significance on trading along with partly negative coefficients, consistent with the contemporaneous effect over the short run. Therefore, our earlier baseline finding that the economic impact of TV is smaller than that of disclosure (Table 6) could be driven by this different pattern of lagged effects. For the pricing model, three information variables have a common pattern of insignificant coefficients for long lags, indicating that the effect of pricing could be timelier than that of trading volume.

Table 8. Regression result for information flows with longer lags.

Lag	*TV(t–s)*	*Disclosure(t–s)*	*Newspaper(t–s)*
Dep. var: *Abn turnover*			
(*t*)	0.0063***	0.0556***	0.0091***
(*t*–1)	−0.0030***	−0.0101***	−0.0032***
(*t*–2)	0.0006	−0.0036***	−0.0008
(*t*–3)	0.0006	0.0011	−0.0007
(*t*–4)	0.0000	0.0023***	0.0008
(*t*–5)	0.0013*	0.0030***	−0.0003
(*t*–6)	−0.0002	0.0020**	−0.0001
(*t*–7)	0.0009*	0.0029***	0.0002
(*t*–8)	0.0004	0.0032***	−0.0002
(*t*–9)	−0.0014***	0.0031***	0.0004
(*t*–10)	0.0008*	0.0002	−0.0014***
R^2	0.4905		
F-value	348.11***		
N	200,671		
Dep. var.: Abs price change			
(*t*)	0.0357***	0.4750***	0.0890***
(*t*–1)	−0.0192***	0.0016	0.005
(*t*–2)	0.0025	−0.0013	−0.0051
(*t*–3)	0.0103	0.0137	0.0032
(*t*–4)	0.0042	0.0062	−0.0028
(*t*–5)	0.0005	−0.002	−0.0004
(*t*–6)	0.0021	−0.0094	−0.0014
(*t*–7)	0.0035	0.0028	0.0022
(*t*–8)	−0.001	−0.0019	0.0025
(*t*–9)	−0.0063	0.0032	0.0011
(*t*–10)	0.0071*	−0.0132*	0.0044
R^2	0.1037		
F-value	64.72***		
N	200,671		

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on TSE 1st with more than equal to one television media coverage. The *t*-statistics are in square brackets. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively. *Abn Turnover* is abnormal turnover. *Abs price change* is the absolute value of excess return (%). *TV* is the number of television broadcasting coverage. *Disclosure* is the number of corporate disclosure. *Newspaper* is the number of newspaper articles. The notation '(*t–s*)' means *s* trading day lag. To save space, the results of day-of-week dummies, monthly dummies, firm fixed effects and the other control variables are compressed.

Table 9. Result for TV effect with television programme category.

Category I	*Abn turnover*	*Abs price change*	Category II	*Abn turnover*	*Abs price change*
Business	0.0163***	0.0829***	*News/reports*	−0.0036	−0.0230*
	[8.29]	[5.16]		[−1.58]	[−1.75]
Prime time news	−0.0053	−0.1049*	*Wide show*	0.0128***	0.0787***
	[−0.54]	[−1.84]		[6.63]	[4.69]
Others	−0.0008	0.0158	*Documentary*	−0.0027	0.0014
	[−0.65]	[1.41]		[−0.60]	[0.04]
			Sports	0.0081	0.1254
				[0.37]	[0.64]
			Variety	−0.006	−0.0986
				[−0.35]	[−1.21]
R^2	0.4862	0.1113	R^2	0.4216	0.073
F-value	590.58***	128.99***	*F*-value	556.77***	111.87***
N	209,271	209,271	*N*	209,271	209,271

Category III	*Abn Turnover*	*Abs price change*
Business	0.0164***	0.0838***
	[8.31]	[5.20]
Prime time news	−0.0055	−0.1089*
	[−0.56]	[−1.89]
News/reports	−0.0022	0.001
	[−1.04]	[0.05]
Wide show	0.0004	0.0301
	[0.25]	[1.53]
Documentary	−0.003	−0.0008
	[−0.69]	[−0.03]
Sports	0.0157	0.1264
	[0.74]	[0.64]
Variety	−0.0008	−0.0791
	[−0.05]	[−0.96]
R^2	0.4224	0.0731
F-value	522.76***	105.30***
N	209,271	209,271

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. *Abn turnover* is abnormal turnover. *Abs price change* is absolute value of excess return (%). (Category I) *Business*: Four business-oriented news programmes aired on TV Tokyo. *Prime time news*: six general news shows aired in prime time zone from 7 PM to 11 PM *Others*: TV programmes except for business-related and prime time news. (Category II): M-data Corporation provides this category list. *News/reports*: general news shows. *Wide show*: tabloid news show. *Documentary*: documentary programmes. *Sports*: sports news. *Variety*: entertainment shows. (Category III) Mixed with categories I and II. The *t*-statistics are in square brackets. *** and * indicate statistical significance at 1% and 10%, respectively. To save space, the results of day-of-week dummies, monthly dummies, firm fixed effect and the other control variables are compressed.

Information type: hard versus soft information

Different from prior research on a specific programme targeting investors (Busse and Green 2002; Engelberg, Sasseville, and Williams 2012), the uniqueness of our TV data set, which covers a wide range of TV programmes, enables us to evaluate what type of information conveyed by TV has a significant impact on investor attention. Specifically, we classify TV into hard and soft information, as displayed in Table 9. For category I, which the authors manually judged, the coefficient of *Business* (hard news) is positive and significant, while *Prime time news* and *Others* (soft news) are negatively and insignificantly associated with trading. In addition, for the price change, *Business news* is significantly and positively associated with the absolute daily return. As a whole, the media coverage through business-related broadcasting should be most important to transmit corporate information to investors, than other types of TV programmes. For category II, directly provided from M-data, *Wide show* (tabloid TV show) has positive and significant estimates on trading and pricing. However, after we added *Business* and *Prime time news* to Category II to control for excessive influence of the *Wide show* category, the result under category III indicates that the significant effect of *Wide show* disappears, and the positive effect of *Business* emerges again. Taken together, the positive media effect of TV on trading volume observed in the baseline result is likely to be driven mainly by hard news conveyed on business-oriented programmes. Relatively soft news through TV

covering a wide range of news and audience is unlikely to attract investors' attention, which is a different result to the prior literature on the soft news effect on political behaviour for voting (Baum 2002).

Table 10 displays the results from another classification by the summary information content. Both earnings-related (hard) and non-earnings-related (soft) news significantly tend to enhance trading volume; the economic scale of marginal impact is relatively larger for earnings-related information (0.0144 for *TV Earnings I* and 0.0046 for *TV Others I*). In addition, we find that wider defined earnings news count (*TV Earnings II*) has a greater impact on trading than the other types of news (*TV Others II*). Furthermore, absolute price change is positively related to both earnings-related news and other types of news. Specifically, the estimate for *TV Earnings I* is 0.0331 with no statistical significance, and 0.0320 for *TV Others I*. When we expand the definition, the gap becomes greater: 0.0807 for *TV Earnings II* and 0.0226 for *TV Others II*. Taken together, hard information through earnings-related news attracts more attention than relatively soft news, which, overall, is consistent with the results from the TV programme category.

Table 10. Result for TV effect by news content.

	Abn turnover		*Abs price change*	
	(1)	(2)	(3)	(4)
TV Earnings I	0.0144***		0.0331	
	[3.21]		[1.40]	
TV Others I	0.0046***		0.0320***	
	[3.04]		[2.77]	
TV Earnings II		0.0171***		0.0807***
		[4.75]		[3.57]
TV Others II		0.0030**		0.0226**
		[2.02]		[1.97]
Disclosure	0.0556***	0.0553***	0.4743***	0.4722***
	[21.70]	[21.64]	[21.37]	[21.29]
Newspaper	0.0080***	0.0079***	0.0902***	0.0897***
	[7.80]	[7.75]	[9.74]	[9.72]
R^2	0.4862	0.4863	0.1109	0.111
F-value	604.46***	604.73***	134.87***	135.14***
N	209,271	209,271	209,271	209,271

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. *Abn turnover* is abnormal turnover. *Abs price change* is absolute value of excess return (%). *TV* is the number of television broadcasting coverage. *TV Earnings I* is the number of TV sessions that include the word '*kessan*' ('financial result' in English). *TV Others I* is the total TV count minus the earnings-related count (i.e. *TV – TV earnings I*). *TV Earnings II* is the number of TV sessions with more widely defined earnings-related keywords such as sales, profits, etc. *TV Others II* is the number of TV sessions without the widely defined earnings keywords. *Disclosure* is the number of corporate disclosure officially released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper articles. The *t*-statistics are in square brackets. *** and ** indicate statistical significance at 1% and 5%, respectively. To save space, the results of day-of-week dummies, monthly dummies, firm fixed effect and the other control variables are compressed.

Individual investors

Next, we examine the question of whether TV media have a stronger impact on individual investors because the limited attention problem is supposed to be more severe for this class of investors (Barber and Odean 2008). Under no access to detailed transaction data by investor types, we alternatively utilize shareholding ratio of individuals reported in annual securities reports (*Individual*). To consider the non-linear relationship between trading and individual ownership level, we create dummy variables. *Individual Q2* takes 1 if the individual ownership falls into the range from the 1st to 2nd quarters. In the same way, *Individual Q3* and *Q4* are defined. The results in Table 11 demonstrate that the coefficient of interaction between *TV* and *Individual* on trading volume is positive and statistically significant. As predicted, for firms with more individual ownership, TV information tends to stimulate trading more actively. When we include grouping variables by individual ownership, we find that for subsamples with higher individual percentages the coefficient becomes higher and more significant. It is likely that, for pricing, the cross-effect of *TV* and *Individual* is positive, lending support for the prediction that individual investors are more influenced by TV information.

Furthermore, to confirm the ownership effect, we include other ownership items that potentially have the opposite effect against individuals: institutional and foreign ownership. We assume that institutional investors should be less constrained by limited attention and have more information-processing capability than individual investors have.[18] Foreigners are unlikely to be exposed to TV programmes aired in Japan due to the location and language issue. Therefore, we predict that, if exposure to TV media is truly important for investors, the impact of TV on trading is less for firms with more foreign ownership. Fortunately, Japanese firms routinely and

[18]Institutional ownership data are from the Nikkei Corporate Governance Evaluation System and consist of shareholdings by foreign institutions (excluding foreign corporation ownership), trust account ownership and life insurance company special accounts.

Table 11. Effect of individual's ownership.

	Abn turnover		*Abs price change*	
	(1)	(2)	(3)	(4)
TV	−0.0066*	0.0024**	−0.029	0.0175
	[−1.93]	[2.13]	[−1.17]	[1.54]
TV × Individual	0.0005***		0.0027**	
	[2.87]		[2.08]	
TV × Individual Q2		0.0001		0.0017
		[0.04]		[0.09]
TV × Individual Q3		0.0056**		0.0156
		[2.38]		[0.92]
TV × Individual Q4		0.0350**		0.2013*
		[2.40]		[1.83]
Disclosure	0.0558***	0.0557***	0.4741***	0.4738***
	[21.87]	[21.84]	[21.50]	[21.48]
Newspaper	0.0080***	0.0081***	0.0901***	0.0906***
	[7.75]	[7.90]	[9.72]	[9.78]
R^2	0.4864	0.4868	0.1108	0.1108
F-value	609.32***	560.43***	137.23***	126.75***
N	209,271	209,271	209,271	209,271

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. *Abn turnover* is abnormal turnover. *Abs price change* is absolute value of excess return (%). *TV* is the number of television broadcasting coverage. *Individual* is the percentage share of individual investor ownership. Individual Q2, Q3 and Q4 is the indicator, taking one if the value is in the second, third and fourth quartile and otherwise zero, respectively. The *t*-statistics are in square brackets. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively. To save space, the results of day-of-week dummies, monthly dummies and firm fixed effect and the other control variables are compressed.

Table 12. Effect of television on market liquidity measures.

	Spread		*Depth*	
	(1)	(2)	(3)	(4)
TV	0.0476***	0.0360**	5.3029	2.3352*
	[3.17]	[2.49]	[1.45]	[1.86]
Disclosure	0.04	0.0521	−4.6717	−4.5231
	[0.86]	[1.12]	[−1.18]	[−1.19]
Newspaper	−0.0074	−0.0321*	4.9409	4.2427
	[−0.41]	[−1.83]	[1.25]	[1.30]
TV(t −1)		0.0394***		12.1389
		[3.61]		[1.14]
Disclosure(t −1)		0.2077***		−4.3693
		[5.08]		[−1.45]
Newspaper(t −1)		0.0730***		4.8942
		[4.32]		[1.24]
Log Turnover(t −1)	−2.0351***	−2.0603***	14.2773*	13.7500*
	[−15.37]	[−15.40]	[1.71]	[1.74]
Log Price	−3.6616	−3.6531	−13.1093	−12.9794
	[−1.07]	[−1.07]	[−0.91]	[−0.90]
Log Mkt cap	−8.5285***	−8.5266***	55.6539	55.01
	[−2.66]	[−2.66]	[1.30]	[1.30]
Constant	247.6362***	247.3484***	−1.2E+03	−1.2E+03
	[4.11]	[4.11]	[−1.25]	[−1.25]
R^2	0.3744	0.3747	0.0126	0.0137
F-value	39.99***	35.59***	7.90***	7.37***
N	199,751	199,751	199,751	199,751

The models are estimated by fixed effect model for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. *Spread* is the daily time-weighted average of (bid−ask)/mid-quote. *Depth* is the amount of shares available at the first best bid and first best ask prices in the limit order book. *TV* is the number of television broadcasting coverage. *Disclosure* is the number of corporate disclosure officially released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper articles. *Turnover* is the turnover rate defined as the trading volume deflated by total number of shares outstanding. *Price* is the closing price level. *Mkt cap* is firm size defined as market capitalization. The *t*-statistics are in square brackets. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively. To save space, the results of day-of-week dummies, monthly dummies and firm fixed effect are compressed.

explicitly disclose foreign ownership ratios in their annual financial statements. The results (not tabulated to save space) show that the cross-effects of *TV x Intuitional* and *TV x Foreigners* on trading volume are negative at an insignificant statistical level, and the effects on price are negative at a moderate significance level. Overall, the greater institutional and foreign ownership is, the weaker the TV media effect is, which lends additional credence to the effect of investor attention through shareholder identity.

Effect on market liquidity

To evaluate what type of information is disseminated by TV programme to investors, we examine the impacts of market liquidity measured by bid–ask spread and depth. Table 12 provides the regression results. An important observation for *Spread* is that the estimated coefficient for *TV* is significantly positive (0.0476) and statistically significant at the conventional level. This finding supports the information asymmetry expansion hypothesis, suggesting that the inflow of information through TV produces a more uncertain environment for liquidity providers, and thus, leads to wider spreads. This finding is in line with our result that hard news is more influential for trading and pricing. As Kim and Verrecchia (1994) argue in the context of earnings releases, the implication of news for true value contains uncertainty; informed investors gain more advantageous status around news releases, and therefore, the required spread becomes wider.

In the models for depth, the estimated coefficients of *TV* are positive and marginally significant. This finding contrasts with our results concerning the risk premium expansion effect of spread. Therefore, we conjecture that depth does not share a common determinant with spread. Instead, we should interpret the improvements in depth associated with TV media as evidence of enhanced investor awareness. In other words, the evidence suggests that the arrival of TV news tends to attract the attention of investors watching the programme, and thereby, increases the quantity of buy and sell orders. Overall, the

Table 13. Return reversal and information flows.

	Rtn(*t* + 1)	*Rtn*(*t* + 1, *t* + 5)	*Rtn*(*t* + 2, *t* + 5)
Rtn(t)	−0.0154*	−0.0570***	−0.0407***
	[−1.71]	[−3.59]	[−3.17]
TV	−0.0005	−0.0169	−0.0166
	[−0.07]	[−0.84]	[−0.98]
TV × *Rtn(t)*	0.0122	0.0329**	0.0251*
	[1.47]	[2.20]	[1.75]
Disclosure	−0.0428**	−0.1004**	−0.0559
	[−2.46]	[−2.39]	[−1.59]
Disclosure × *Rtn(t)*	0.0390***	0.0664***	0.026
	[2.66]	[2.85]	[1.32]
Newspaper	0.0075	0.0472**	0.0389**
	[1.21]	[2.39]	[2.39]
Newspaper × *Rtn(t)*	−0.0034	0.0029	0.0078
	[−0.39]	[0.20]	[0.61]
Log turnover(t − 1)	−0.0057	−0.0088	−0.0029
	[−0.31]	[−0.11]	[−0.04]
Log Mkt cap	−0.0152	−0.0735	−0.0589
	[−1.20]	[−1.27]	[−1.24]
Constant	0.3804	1.9425	1.5793
	[0.94]	[1.04]	[1.03]
R^2	0.0842	0.075	0.0693
F-value	2.38**	4.40***	2.88***
N	208,417	204,995	204,995

The models are estimated by the Fama–MacBeth regression with Newey–West SE estimates with a lag of 5 days, for firm-daily panel data over January 2010–December 2010 for sample firms listed on Tokyo Stock Exchange First Section with more than equal to one television media coverage. *Rtn*(*t* + *s*, *t* + *e*) is the cumulative excess return from day *t* + *s* to *t* + *e*. *TV* is the number of television broadcasting coverage. *Disclosure* is the number of corporate disclosure officially released on Tokyo Stock Exchange. *Newspaper* is the number of newspaper articles. *Turnover* is the turnover rate defined as the trading volume deflated by total number of shares outstanding. *Mkt cap* is firm size defined as market capitalization. The *t*-statistics are in square brackets. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

divergent patterns obtained in our spread and depth regressions differ markedly from prior findings (e.g. Lee, Mucklow, and Ready 1993) in which both measures of liquidity (spread and depth) tend to deteriorate with the increase in information inflows.

Noise trading effect

One interesting question for pricing is to distinguish whether the TV media effect on pricing is driven by noise trading of TV audience. Prior research on the mass media effect uses methodology to run a regression model that predicts future returns by current returns (Peress 2014; Tetlock 2007). Based on that framework, if current price movement is temporarily caused by noise trading unrelated to fundamental value, the price should reverse to former price level thereafter. We hypothesize that if TV media causes noise trading for the short term, return reversal (negative coefficient of current returns *Rtn*(*t*) on future returns *Rtn*(*t* + *s*,*t* + *e*)) should be strengthened by TV information flows (*TV*). Table 13 shows the Fama–MacBeth regression results. As a baseline, we find a pattern where future returns negatively correlates with current returns, consistent with a return reversal. The coefficients of the cross-terms between *TV* and *Rtn*(*t*) are all positive with a significance level for the model on *Rtn*(*t* + 1, *t* + 5) and *Rtn*(*t* + 2, *t* + 5)). This finding is inconsistent with prior studies that argue TV information induces return reversals stemming from noise trading (e.g. Engelberg, Sasseville, and Williams 2012); rather, this is consistent with the notion that TV helps transmit fundamental information to investors.

Robustness check

To minimize the likelihood that our basic findings are spurious, we conduct analyses to check robustness.[19] As for the information variables, we define TV media coverage as the logarithm of the number of TV (log *TV*) to consider a possible decline of marginal impact of information flow count.[20] We construct log variable versions of the disclosure and press media data in the same manner, as log *Disclosure* and log *Newspaper*, respectively. The results again indicate support for the positive mass media effect on trading volume and price change. Then, we take another functional form of binary conversion of *TV* and construct *TV1*, defined as taking 1 if *TV* = 1, otherwise 0; *TV2*, defined as taking 1 if *TV* = 2; and as well *TV3, TV4. TV5* takes 1 if *TV* ≥ 5, otherwise 0. The results show that all five binary variables have statistically significant and positive coefficients on trading volume and price change. An observed trend is that the marginal impact of one unit of TV (estimated coefficient divided by *TV*) is decreasing.

For the trading activity variable, we estimate abnormal trading volume and abnormal return based on a standard market model. For volume, log (Turnover) = $a + b$ (Market Turnover) + u is estimated by OLS and the residuals are used as abnormal trading volume. Similarly, the residuals for daily return are estimated. The results remain qualitatively similar to the baseline results. More TV information is significantly associated with larger abnormal trading and

[19]The results are not tabulated here, and they are available upon request.
[20]More exactly, one is added before log-transformation because log(0) is undefined.

larger price change, lending support for the investor attention effect.

For the liquidity measure, we alternatively calculate the effective spread as an estimate of the cost of a round-trip transaction, which is defined as the difference between the transaction price P_j and the midquote M_j, scaled by the midquote at trade. The effective spread for the jth transaction, $ESPR_t$, is $Q_j(P_j - M_j)/M_j$, where $Q_j = 1$ if the jth transaction is buyer-initiated and $Q_j = -1$ if the jth transaction is seller-initiated.[21] We construct the effective spread for each day and firm as the trading share average of $ESPR_j$. The main results are qualitatively unchanged from those obtained earlier in that the signs of the estimated coefficients are identical, and the sizes of the estimated coefficients are approximately the same. We thereby confirm that our primary evidence concerning the liquidity-deteriorating effect of risk premium expansion through TV coverage is robust. For depth, the number of best quotes increases only from the first to the fifth quotes. We define *Depth5* similarly to *Depth*. Once again, expanding quotes wider has no material effect on the estimated results. We are able to confirm that the overall pattern of results is the same as the primary outcome obtained earlier. Predictably, the sizes of the estimated slopes of the regression equation are four to five times larger than for *Depth*.

V. Conclusion

This study conducted empirical analysis to examine the determinants of trading activities in terms of mass media effects. In particular, we employed TV programme data along with corporate disclosure and newspaper coverage to test the investor attention hypothesis. The first and most important finding is that more TV information increases trading volume, in accordance with the argument that TV media coverage attracts investor attention and leads to active trading. In addition, stock price is changed significantly by greater TV programme coverage, indicating that information aired on TV has the effect of shifting equilibrium price even after controlling for other major information providers (e.g. corporate disclosure and newspaper media). We find no evidence for return reversal around TV information arrivals. This is interpreted as evidence that investor trading stimulated by TV information flows is unlikely to be overreaction.

Further, detailed investigations into TV contents reveal that information type appears to be important for the investor attention. Soft news that entails more entertainments has a less impact on trading activities, while traders are more responsive to hard information, which is conveyed by business-oriented TV programmes broadcast and contained in earnings-related news.

For market liquidity measures, increased TV coverage of a firm significantly widens the bid–ask spread. This supports the information risk premium expansion hypothesis that the inflow of news through TV provides an additional advantage to informed investors in interpreting information content. Finally, we provided evidence that the effects of TV on trading activities vary with shareholders' identities. The media effect is significantly greater for stocks with more individual and less institutional shareholdings, suggesting that individuals are more influenced by TV media information due to the limited attention.

The insights we obtained in this study can be extended for other types of media in a broader way. Reflecting rapid growth of the Internet media, an increasing body of literature has explored investor attention through the Internet on financial markets over recent years. For example, several studies argue that social network services are useful for corporations to communicate with customers and investors (Blankespoor, Miller, and White 2014; Lee, Hutton, and Shu 2015). For future works, our finding on the comparison between hard and soft information could help understand better what type of information circulated through the Internet the investors utilize.

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[21]Note that identifying whether a transaction is seller- or buyer-initiated is straightforward in our study because the TSE is a pure order-driven market, and thus, we do not need to rely on the method proposed by Lee and Ready (1991).

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