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Board diversity and earnings news dissemination on Twitter in the UK

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Abstract

We examine corporate adoption of Twitter by UK firms and provide the first empirical evidence on the association between board diversity, as measured by the proportion of foreign and women directors, and the decision to disseminate news in general and earnings news in particular through Twitter. We measure social media dissemination by tracing Twitter posts (tweets) by UK firms between 2013 and 2015. Utilizing the unique data by Spencer and Stuart on board characteristics, we investigate the relationship between diversity and earnings dissemination in top 150 UK companies between 2013 and 2015. We find that our board diversity measures are positively associated with using Twitter to disseminate earnings at least once, with the frequency of using Twitter to disseminate quarterly earnings, and with the number of tweets disseminating financial information. We also provide evidence that the presence of foreign directors is associated with earlier adoption of Twitter as an information dissemination channel. The results are robust to controlling for firm-level characteristics, other board structure variables, and industry and year-fixed effects. Additionally, we show that firms audited by Big Four auditors are more likely to use Twitter to disseminate earnings information. Our findings show the importance of diverse boards in using Twitter as an alternative or additional information dissemination channel.

Keywords Dissemination · Disclosure · Social media · Twitter

JEL Classification G34 · M10 · M41

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1 Introduction

This paper examines the association between firms' decision to disseminate information to the public through the social media platform Twitter and board diversity in UK listed firms. During the last 20 years, the disclosure landscape has witnessed significant changes. In the late 1990s, several firms began using corporate websites to disseminate information and to publish annual reports and financial statements (Ashbaugh et al. 1999). In the late 2000s, firms started to use social media to distribute both voluntary and mandatory information (Jung et al. 2017).

Compared to traditional disclosure channels, social media allows a firm to directly and quickly reach a large network of stakeholders (Lee et al. 2015). Social media platforms, such as Twitter, are referred to as direct-access information technologies (DAITs) as they allow firms to directly access investors and other stakeholders. Firms can broaden dissemination by using DAITs to distribute hyperlinks in their press releases (Blankespoor et al. 2014). A key advantage of DAITs is that firms have discretion over the information they would like to disseminate to the public. This allows firms to overcome the challenges associated with information dissemination through intermediaries such as press and media, since such traditional communication channels are not controlled by the firm. For example, the business press makes editorial decisions about which firms to cover (Jung et al. 2017). The use of social media allows a firm to bypass information intermediaries and deliver its intended message to a large network of users without interference by media or press. Moreover, social media outlets such as Twitter allow two-way communication between the firm and the public, which changes the dynamics and nature of corporate disclosure and information dissemination (Lee et al. 2015).

This paper explores the determinants of the adoption of social media as a channel of information dissemination by firms. It examines the association between board diversity and corporate use of Twitter as a channel for disclosing or disseminating information. The study builds on two main streams of literature: first, the literature related to the use of social media in disclosure and information dissemination (Blankespoor et al. 2014; Jung et al. 2017; Lee et al. 2015; Mazboudi and Khalil 2017); and second, the literature examining the association between corporate governance (Beekes et al. 2016; Cheng and Courtenay 2006; Eng and Mak 2003) or board characteristics (Ntim and Soobaroyen 2013; Ntim et al. 2013, 2017) and disclosure behavior of firms. Accordingly, this study makes several contributions to the literature by responding to two main limitations in the existing theories. First, research on the link between corporate governance and disclosure has predominantly focused on investigating board characteristics such as board size, board independence, ownership structure and CEO duality rather than on addressing board diversity. The second limitation is that research on social media disclosure has not so far addressed the association between board characteristics and the adoption of social media as a channel for disclosure or information dissemination.

This research focuses on Twitter, which was "created in October 2006 as a free service that allows users to communicate via text-based messages of up to

140 characters, known as Tweets. According to Nielsen Online, Twitter grew to 75 million unique users by the end of 2009, making it both the fastest growing and one of the largest social networks in the US" (Blankespoor et al. 2014, p. 80). Moreover, previous research shows that Twitter has exceeded other social media platforms regarding corporate adoption and dissemination of investor-related announcements such as earnings news, which provides a powerful basis for empirical tests (Jung et al. 2017).

This research's primary focus is to examine whether the adoption of Twitter as a channel for information dissemination and disclosure is associated with board diversity or not. Kang et al. (2007) defined board diversity as variety in composition of directors in observable (e.g., nationality, age, gender and ethnicity) and non-observable (e.g., experience, education and professional occupation) characteristics. Board diversity has been an under-researched area compared to other board characteristics (e.g., board independence, CEO duality and board size) in mainstream corporate governance literature. However, investigation of the effect of board diversity on firm performance and disclosure is an emerging area of research (Ntim et al. 2017). Moreover, gender diversity is important in the UK, and the 2011 Davies report provided recommendations on how gender-diverse boards could be promoted in the UK and the presence of women on boards supported. The report also recommended mandating the FTSE 100 to have 25% female representation on their boards by the end of 2015, while expecting that the percentage would be greater than that. An updated report published in 2015 indicated that the appointment of new female directors had increased to 23.5% in the FTSE 100 compared to 12.5% in 2011 (Davies 2011, 2015).

Hence, this study seeks to address the above gaps and contribute to the extant literature. First, using manually collected tweets retrieved from Twitter corporate accounts of the largest 150 companies in the FTSE ranking, and the Spencer and Stuart Board Index covering the period from 2013 to 2015, the results provide evidence for the positive association between board diversity and disclosure through social media channels. Second, the literature on the determinants of corporate use of social media (Jung et al. 2017) is extended. This research provides, therefore, an important extension to the results in the existing literature.

The relationship between board diversity measures, namely gender and nationality, and the adoption of Twitter as a channel for disclosure and information dissemination was expected to be positive. This directional expectation was based on extant theory and empirical evidence existing in the literature. According to prior studies, composition of the board of directors and its diversity can affect the quality of a corporate board's monitoring and provision of resource roles (Carter et al. 2010). Similarly, Murray (1989) argued that heterogeneous groups have the advantage of enhanced capability and greater creativity that can generate long-term benefits for the company. The relationship between board diversity and disclosure has also been discussed by extant theories. Given the various roles played by corporate boards, such as monitoring, provision of resources and development of corporate legitimacy for communication with stakeholders, various theories predict the existence of a positive relationship between board diversity and disclosure in general.

Consistent with this prediction, the results show that board diversity is associated with using Twitter as a channel for disclosure and information dissemination. Results show that the percentage of female directors and foreign directors are positively associated with using Twitter to disseminate earnings information. Several proxies were used to measure the dissemination of earnings news using Twitter to ensure that results are robust to alternative dependent variables. The results also show that companies with more female directors are more likely to adopt a Twitter account earlier than companies with fewer female directors. Results are robust to controlling for firm characteristics, other board structure variables, namely size, independence and average age, and firm and industry fixed effects.

The remainder of the paper is structured as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 presents the research design and descriptive statistics. Sections 4 and 5 provide the empirical results and discussion respectively. Section 6 sets out the conclusions and recommendations for future research.

2 Literature review and hypotheses development

The relationship between diversity of corporate boards and corporate voluntary disclosure has attracted broad attention from scholars. A careful examination of this stream of literature reveals two observable gaps. First, prior studies investigating the association between board diversity and voluntary disclosure mainly focus on voluntary disclosure of non-financial information like corporate social responsibility (CSR), climate change and market risk disclosures (e.g., Al-Yahyee et al. 2017; Ben-Amar et al. 2017; Ntim et al. 2013). Second, the aforementioned types of disclosure are usually communicated through the conventional channels of disclosure or information dissemination. It is well known that CSR or climate change disclosures are included in annual reports or similar standalone reports officially filed by listed firms and often available on company websites. However, to the best of the authors' knowledge, no published studies have investigated whether board diversity could explain variations in corporate behavior towards disclosure and information dissemination using more recent and interactive communication channels like Twitter. We acknowledge that there is a recent working paper (Yang et al. 2016) that investigated a similar relationship. However, there are two main differences that highlight our main contribution compared to that of Yang et al. (2016). First, our sample is based on three consecutive years (2013–2015), thereby allowing us to investigate the aforementioned relationship using a larger sample of firm-year observations. This has implications related to the explanatory power of our models as well as to the persistence of our findings over a greater time span. Second, in this study we also focused on national diversity of board members, which provides evidence about an element of board diversity relatively lacking in existing literature.

Prior research has also investigated the various determinants of corporate voluntary disclosure over a long period of time and in different contexts. Corporate voluntary disclosure has been explained according to various theories, and it has been considered sufficiently complex that no single theory can provide a comprehensive explanation for its determinants and motivations (Branco and Rodrigues 2008; Chen and Roberts 2010; Ntim and Soobaroyen 2013; Ntim et al. 2013, 2017). Theories commonly used to explain motivations behind voluntary disclosure have included agency theory, resource dependence theory and legitimacy theory. These theories have been used to explain how board mechanisms affect whether there is generic voluntary disclosure (Eng and Mak 2003), a specific type of disclosure or a specific type of voluntary disclosure. Examples include corporate governance disclosure (e.g., Elmagrhi et al. 2016), CSR disclosure (e.g., Jizi 2017), climate change disclosure (e.g., Ben-Amar et al. 2017), market risk disclosure (e.g., Al-Yahyee et al. 2017), and forward-looking information disclosure (e.g., Kılıç and Kuzey 2018). Accordingly, we developed our hypotheses according to both extant theory and empirical evidence.

The decision about what information should be disclosed through which disclosure channel is usually made by the company's boards and owners (Ntim et al. 2013). According to agency theory, board diversity in terms of gender and nationality would enhance a board's independence and hence lead to better corporate disclosure (Barako and Brown 2008). According to resource dependence theory, a gender and nationality diverse board that has a variety of experiences and backgrounds is predicted to use its different networks to help the company secure its resources (Carter et al. 2003), with the result that the board would aim to enhance corporate voluntary disclosure so that the company can access better resources. According to legitimacy theory, a diverse board helps firms develop their own legitimacy to provide better links with various stakeholders (Ntim et al. 2013, 2017). Diverse boards are expected to set strategies that support increasing corporate voluntary disclosures to indicate to the public that the company's goals are aligned with society (Ntim et al. 2013, 2017). Given the importance of diversity within a board of directors, several studies have investigated the relationship between board diversity and different types of disclosure in different contexts.

First, several studies have investigated the relationship between a board's gender diversity and disclosure. However, results provided by this stream of the literature are rather mixed. Several studies have documented empirical evidence supporting the relationship between gender diversity and disclosure, yet other studies have failed to find a significant relationship between the two constructs. For example, Ben-Amar et al. (2017) and Liao et al. (2015) found a positive association between board gender diversity and climate change disclosures in Canada and the UK respectively. Gender diversity positively affects CSR disclosures, as documented by Cabeza-García et al. (2017) in Spain, Jizi (2017) in the UK, and Ibrahim and Hanefah (2016) in Jordan. Elmagrhi et al. (2016) found a positive relationship with corporate governance disclosure in publicly listed firms in the UK. Board gender diversity positively affects environmental, social and governance (ESG) disclosures (Arayssi et al. 2016; Tamimi and Sebastianelli 2017). Prior studies have also shown that disclosing forward-looking information has a positive association with board diversity (Kılıç and Kuzey 2018). Finally, Rupley et al. (2012) found a positive association between voluntary environmental disclosures and board gender diversity.

On the other hand, some studies have found an insignificant relationship between board gender diversity and different types of corporate disclosures, such as Prado-Lorenzo and Garcia-Sanchez (2010) who used a global sample for climate change disclosures to assess whether this type of disclosure could be influenced by board gender diversity. In addition, Barka and Dardour (2015) found no convincing evidence to suggest that board gender diversity is associated with CSR disclosures in France. More recently, a study by Al-Yahyee et al. (2017) assessed the relationship between market risk disclosures and the presence of female directors on the boards of listed financial companies in the six Gulf Cooperation Council (GCC) countries. They found that female directors have a negative and significant influence on market risk disclosures, which they argued was the result of different cultural aspects in the GCC countries compared to both developed countries and other developing countries in the Arab region.

Second, prior literature has investigated the association between a board's national diversity and different types of disclosure. Extant evidence shows that national diversity exhibits a positive and significant association with several types of disclosure. Although conducted using samples from different countries, several studies have provided similar results regardless of variations in countries' economic and capital market development. For example, CSR disclosure exhibits a positive association with board national diversity in France, Jordan and Bangladesh (Barka and Dardour 2015; Ibrahim and Hanefah 2016; Muttakin et al. 2015). Similarly, corporate governance disclosure is associated with board national diversity in the UK (Elmagrhi et al. 2016). In South Africa, empirical research has revealed that boards with higher national diversity provide better disclosures about black economic empowerment (Ntim and Soobaroyen 2013) and corporate risk disclosures (Ntim et al. 2013). Saggar and Singh (2017) have also documented a positive association between board national diversity and corporate risk disclosure in India. Finally, in a different context, Ntim et al. (2017) found the same relationship between national diversity and disclosures in UK higher education institutions.

This study predicted, therefore, that higher levels of board diversity are associated with the adoption of Twitter as a channel for information dissemination and disclosure. As mentioned earlier, our research is interested in establishing a link between board diversity and the use of social media platforms such as Twitter for corporate information dissemination. It aims, therefore, to provide a better understanding of the role of board diversity in disclosure by considering a different communication channel. Prior studies that have investigated the relationship between board diversity and disclosure relied mainly on conventional channels (e.g., annual reports, financial statements and corporate websites). However, the findings of prior studies generally support the prediction that board gender and national diversity are positively associated with disclosure and information dissemination through Twitter. Hence, this study aimed to test the following two hypotheses:

H_1 Board gender diversity is positively associated with the use of Twitter to disseminate earnings information.

H_2 Board national diversity is positively associated with the use of Twitter to disseminate earnings information.

3 Research design

3.1 Data and sample

The sample used in the study consists of 308 firm-year observations for 124 unique UK firms over the period from 2013 to 2015. Firm financials required to compute control variables were collected from DataStream, while corporate board data was sourced from Spencer and Stuart UK Board Index, which is available through the Spencer and Stuart website (spencerstuart.com). The Spencer and Stuart Board Index is a comprehensive review of governance practices in the largest 150 companies in the FTSE rankings.

The procedure to populate the database began by identifying companies with corporate governance data available in the 2013, 2014 and 2015 Spencer and Stuart Board Indices. Thereafter, the authors manually searched Twitter to identify the corporate Twitter accounts of those firms. To identify the accounts as the official accounts of the designated firms, the account had to have been verified by Twitter as the official account of the stated firm. Verified accounts have a checked blue sign before the name of the company displayed on the social network. The "Appendix" provides examples of the verification of Twitter accounts.

Next, the website www.allmytweets.net was used to extract all tweets that corresponded to the sample period. Two research assistants (RAs) were hired to classify the tweets (earnings vs. non-earnings) and to construct other variables that will be discussed in the next subsection. To ensure the accuracy of the data and to correct any inconsistencies, the authors manually checked the extracted data and matched it with the classifications performed by the RAs. Finally, firm financial data was collected from DataStream and was matched with the data from both Twitter and the Spencer and Stuart Board Index. The final sample was reduced to 308 firm-year observations (out of 450) due to the unavailability of some data.

3.2 Variables and regression models

Several variables were constructed to capture the adoption of Twitter as a channel for information dissemination. There were two reasons for this. First, capturing different dimensions of Twitter usage served as a natural robustness test of the main hypotheses. Second, it provided a better understanding of the relationship between the main variables of interest and Twitter adoption for corporate dissemination in general. The first two variables measured Twitter usage for earnings announcements. Following Jung et al. (2017), Twitter usage for earnings announcement was measured using *EARNINGS-ONCE* and *QUARTERLY_EARNINGS*. *EARNINGS-ONCE* is an indicator variable that receives the value of 1 (zero otherwise) if the Twitter account was used to disseminate earnings news in any quarter in the year. On the other hand, *QUARTERLY_EARNINGS* is an indicator variable that receives the value of 1 (zero otherwise) if the firm announced its earnings every quarter on Twitter.

In addition to the decision to disseminate earnings on Twitter at least once or quarterly, the authors sought to assess the relationship between board diversity and the number of earnings tweets in general. Two key issues were addressed by this. First, the continuous variable *NO-OF-EARNINGS* represents the total number of tweets related to earnings announcements, follow-ups on earlier earnings tweets, or commentaries from top management personnel on such earlier tweets. Therefore, it helped ensure that results were not biased by employing dichotomous variables as the main dependent variables. Second, *EARNINGS-ONCE* and *QUARTERLY_EARNINGS* measure whether firms announced earnings at least once in the year or were committed to announcing earnings news on Twitter each quarter. The authors were also interested in assessing how the main variables of interest are associated with the frequency of disseminating earnings information on Twitter. Finally, the authors investigated the relationship between board diversity and the time of adopting Twitter as a channel for information dissemination by the sampled companies. *AGE-OF-ACCOUNT* corresponds to the age of the account in days by the end of 2015 and was set to zero if the company adopted a Twitter account after 2015.

The main independent variables of interest are *FOREIGN-DIRECTORS* and *WOMEN-ON-BOARD*. Those variables were designed to represent the diversity of the board. They were calculated as the percentage of foreign and female directors on the board.

To avoid biased results, a set of control variables related to board structure and firm characteristics was considered. Board structure is represented by *BOARD-SIZE* and *BOARD-INDPENDENCE*. *BOARD-SIZE* measures the total number of directors on the board, and *BOARD-INDPENDENCE* measures the percentage of independent directors on the board. Both variables were controlled, since prior studies found evidence that they can drive a firm's performance. For example, Jensen (1993) argued that large boards are less effective. On the other hand, evidence on board independence shows that it is an indicator of better monitoring by the board than by managers (Harris and Raviv 2008).

The control variables related to firm characteristics are defined as follows. *FINANCIAL-FIRM* is an indicator variable that receives the value of 1 for banks and financial services firms and zero otherwise. This variable was controlled because banks in general are highly regulated (Lobo 2017) and therefore tend to disclose more information in general. This will likely affect their information dissemination on social media as well.[1] Other control variables were *ROA*, *LOSS*, *LEVERAGE*, *LOG-OF-ASSETS* and *BIG 4*. These variables were included in the model to ensure the results were not biased due to the omission of one or more correlated variables, especially given that earlier evidence on voluntary disclosure suggests that such firm characteristics could influence firms' disclosure behavior. Therefore, and because there is no regulation that requires firms to disseminate information using social media platforms, control variables were selected and informed by this stream of literature. Additionally, to ensure that results are not affected by fixed firm effects, results of each regression model are reported twice. Results are reported using default standard errors and standard errors clustered by firm. All variables are defined and described in Table 1.

[1] Jung et al. (2017) reported that the number of financial firms that use social media to disseminate information is higher than in other industries.

Table 1 Variable definitions

	Variable	Description	Data source
Twitter	Earnings once	An indicator variable that receives the value of 1 (zero otherwise) if the Twitter account was used to disseminate earnings news in any quarter in the year	Historical Tweets are retrieved from allmytweets.com. Next, we analyze the tweets to classify them as earnings or non-earnings Tweets to construct our Twitter variables
	Quarterly earnings	is an indicator variable that receives the value of 1 (zero otherwise) if the firm announces its earnings every quarter on Twitter	
	No of earnings' Tweets	The total number of Tweets related to earnings announcements, follow up on earlier earnings Tweets or commentaries from top management personnel on such earlier Tweets	
	Age of Twitter account	The age of the account in days by the end of 2015 and is set to zero if the company adopted a Twitter account after 2015	
Board diversity	Foreign directors	The percentage of foreign directors on the board	Spencer & Stuart UK Board Index
	Women directors	The percentage of female directors on the board	Spencer & Stuart UK Board Index
Board control variables	Board independence	The percentage of independent board members	Spencer & Stuart UK Board Index
	Board Size	The number of people sitting on the board of directors of the firm	Spencer & Stuart UK Board Index
Firm-level control variables	Financial firm	An indicator variable that receives the value of 1 for banks and financial services firms and 0 otherwise	DataStream
	ROA	Return on assets	DataStream
	Big 4	Big4 measures audit quality by audit firm size, is an indicator variable equal to 1 if the auditor is a Big 4 audit firm and 0 otherwise.	DataStream
	Leverage	Long-term debt and is calculated as the ratio of total long-term debt to the book value of total assets	DataStream
	Loss	An indicator variable that receives the value of one if the firm has a negative net income	DataStream
	Ln of total assets	Natural logarithm of Total Assets	DataStream

Table 1 explains the main variables used in the empirical analysis, and how they were measured. Source: Historical tweets were retrieved from allmytweets.com. Board diversity and control variables were retrieved from Spencer & Stuart UK Board Index database. Firm-level control variables were retrieved from DataStream

Table 2 Descriptive statistics

Variable	N	Mean	SD	Min	Max
Earnings once	308	0.523	0.500	0.000	1.000
Quarterly earnings	308	0.104	0.306	0.000	1.000
No of earnings' Tweets	308	2.769	4.956	0.000	38.000
Age of Twitter account	308	480.633	365.317	0.000	1087.000
Board independence	308	59.641	10.759	33.333	85.714
Board Size	308	10.481	2.463	6.000	20.000
Foreign directors	308	28.389	23.062	0.000	92.307
Women directors	308	21.431	9.133	0.000	57.143
Financial firm	308	0.140	0.347	0.000	1.000
ROA	308	0.079	0.178	−0.208	2.174
Big 4	308	0.877	0.329	0.000	1.000
Leverage	308	763,664.000	13,400,000.000	0.000	235,000,000.000
Loss	308	0.107	0.310	0.000	1.000
Ln of total assets	308	15.989	1.790	10.402	21.246

This table provides descriptive statistics for the variables used in our regressions analysis. All variables are defined as described in Table 1

Tests were employed using ordinary least squares (OLS) and binary logistic regressions. Binary logistic regressions were run when the dependent variable was one of the dichotomous variables (*EARNINGS-ONCE* or *QUARTERLY_EARNINGS*). On the other hand, when the dependent variable was a continuous variable (*NO-OF-EARNINGS* or *AGE-OF-ACCOUNT*) OLS regressions were run. The main regression specification is represented by the following equation:

$$\begin{aligned} Twitter = {} & \beta 0 + \beta 1 * FOREIGN\text{-}DIRECTORS + \beta 2 * WOMEN\text{-}ON\text{-}BOARD \\ & + \beta 3 * BOARD\text{-}SIZE + \beta 4 * BOARD\text{-}INDPENDENCE \\ & + \beta 5 * FINANCIAL\text{-}FIRM + \beta 6 * ROA + \beta 7 * LOSS \\ & + \beta 8 * LEVERAGE + \beta 9 * LOG\text{-}OF\text{-}ASSETS + \beta 10 * BIG4 + \varepsilon it \end{aligned} \tag{1}$$

where *Twitter* equals *EARNINGS-ONCE*, *QUARTERLY_EARNINGS*, *NO-OF-EARNINGS* or *AGE-OF-ACCOUNT*.

3.3 Descriptive statistics

In Table 2, descriptive statistics are provided for the variables of interest. Of the firms in the sample, 52% used Twitter at least once a year to disseminate earnings news at the end of a quarter. However, only 10% of the sampled firms were committed to adopting Twitter as an information channel to disseminate quarterly earnings news. The mean *NO-OF-EARNINGS* is 2.769. This reflects the low commitment by the sampled firms to disclose earnings announcements quarterly. The average *AGE-OF-ACCOUNT* was around 480 calendar days by the end of 2015. The average percentages of foreign and female directors were 28% and 21% respectively. Table 2 also shows that the proxies for female and foreign directors exhibit considerable variation as the minimum value for both is zero while the maximum is 57% and 92% respectively. The presence of companies in the FTSE 150 with up to 57% female board members supports the Davies 2011 report expectations that female representation by the end of 2015 could significantly exceed the mandated 25%. This research used the FTSE 150 rather than the FTSE 100, which explains why some companies had no female representation. Moreover, due to the small sample size, data for 2013 through 2015 was pooled, and thus companies might have had no female representation in 2013 but female board members later on in the period under study. The average percentage of independent directors was 60% and the average board size was 10.5 members. Of the sampled firms, 14% belonged to the financial services industry and 88% were audited by one of the Big Four audit firms.

Table 3 presents the correlations between the main variables of interest. As Table 3 shows, except for the correlations between the set of dependent variables, the correlation coefficients are averagely low and hence should not pose a multicollinearity problem, with a variance inflation factor below 2.0 in an OLS regression. The correlation matrix shows that the percentage of women directors and the percentage of foreign directors exhibit a positive and significant correlation coefficient with the main dependent variables except for *AGE-OF-ACCOUNT*. Results of the correlation analysis provide preliminary support for the hypotheses that board gender and national diversity measures are associated with adopting Twitter as a channel for corporate information dissemination.

4 Empirical results

Table 4 presents the results of the regressions of *Twitter* variables on the independent variables of interest. It shows the results of eight regression models. Models (1), (3), (5) and (7) are estimated using default standard errors, while models (2), (4), (6) and (8) are estimated using standard errors clustered by firm. *EARNINGS-ONCE* is the dependent variable in models (1) and (2), *QUARTERLY_EARNINGS* is the dependent variable in models (3) and (4), *NO-OF-EARNINGS* is the dependent variable in models (5) and (6) and *AGE-OF-ACCOUNT* is the dependent variable in models (7) and (8).

Results of models (1) and (2) show that the percentage of both women and foreign directors is positively and significantly associated with *EARNINGS-ONCE.* This finding suggests that board diversity as measured by nationality and gender diversity is a significant explanatory variable related to the probability of adopting Twitter as an information dissemination channel to communicate earnings news. Similarly, as the results for models (3) and (4) show, board diversity measures are also positively and significantly associated with the likelihood that the firm is committed to using

Table 3 Correlation matrix

	Earnings once	Quarterly earnings	No of earnings' Tweets	Age of Twitter account	Board independence	Board size	Foreign directors	Women directors	Financial firm	ROE	ROA	Big 4	Leverage	Loss	Ln of total assets
Earnings at least once	1														
Quarterly earnings	0.3254*	1													
No of earnings' Tweets	0.5335*	0.6051*	1												
Age of Twitter account	0.3365*	0.3074*	0.3282*	1											
Board independence	0.1815*	0.1624*	0.1099	0.0492	1										
Board size	0.036	0.1238*	0.0347	−0.005	0.2554*	1									
Foreign directors	0.1566*	0.2130*	0.1552*	0.0825	0.4827*	0.4024*	1								
Women directors	0.1305*	0.1207*	0.1139*	0.0674	0.2052*	−0.032	−0.003	1							
Financial firm	0.0473	0.0163	−0.057	0.0861	0.0822	0.2375*	−0.102	−0.041	1						
ROA	−0.046	−0.013	−0.044	0.0441	0.0218	−0.004	−0.023	0.1009	−0.016	0.7511*	1				
Big 4	0.1159*	0.063	0.0883	0.0698	−0.024	0.0291	−0.073	−0.059	−0.02	0.0103	−0.039	1			

Table 3 (continued)

	Earnings once	Quarterly earnings	No of earnings' Tweets	Age of Twitter account	Board independence	Board size	Foreign directors	Women directors	Financial firm	ROE	ROA	Big 4	Leverage	Loss	Ln of total assets
Leverage	−0.06	−0.019	−0.032	0.0716	0.051	0.0585	0.1778*	−0.038	−0.023	−0.006	−0.023	0.0214	1		
Loss	0.0368	−0.049	0.0671	−0.009	−0.053	0.0006	−0.093	0.0122	−0.018	−0.1401*	−0.2299*	0.0023	−0.02	1	
Ln of total assets	0.1055	0.1744*	0.0867	−0.003	0.4799*	0.5337*	0.3817*	0.0469	0.4102*	0.0507	0.0383	0.0303	0.0291	−0.08	1

This table presents Pearson's correlation coefficients for our main variables of interest. *, ** and *** indicate significance at the 1, 5 and 10% levels, respectively. All variables are defined in Table 1

Table 4 Results

	1		2		3		4		5		6		7		8	
	Binary logistic		Binary logistic		Binary logistic		Binary logistic		OLS		OLS		OLS		OLS	
Twitter=	Earnings once		Earnings once		Quarterly earnings		Quarterly earnings		No of earnings' Tweets		No of earning's Tweets		Age of account		Age of account	
Variable	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig
Foreign directors	0.017**	0.012	0.017**	0.043	0.025**	0.019	0.012**	0.042	0.037**	0.021	0.037*	0.064	2.556**	0.030	2.556*	0.100
Women directors	0.030**	0.036	0.030*	0.074	0.044**	0.034	0.029	0.125	0.062*	0.051	0.062**	0.022	3.156	0.183	3.156	0.283
Board independence	0.020	0.156	0.020	0.232	0.000	0.999	0.027	0.999	−0.003	0.939	−0.003	0.957	0.343	0.889	0.343	0.926
Board size	−0.064	0.286	−0.064	0.423	−0.008	0.927	0.104	0.936	−0.115	0.415	−0.115	0.468	−7.770	0.458	−7.770	0.605
Financial firm	0.549	0.175	0.549	0.391	−0.060	0.930	0.827	0.942	−0.746	0.427	−0.746	0.375	178.954**	0.011	178.954*	0.079
ROA	−0.490	0.496	−0.490	0.551	−1.128	0.617	1.013	0.265	−0.992	0.541	−0.992	0.386	111.976	0.354	111.976	0.418
Big 4	0.945**	0.012	0.945***	0.010	1.058	0.173	0.734	0.149	1.592*	0.064	1.592**	0.024	106.684*	0.095	106.684*	0.056
Leverage	0.000***	0.985	0.000***	0.000	0.000	0.991	0.000***	0.000	0.000	0.300	0.000***	0.000	0.000	0.340	0.000***	0.001
Loss	0.336	0.408	0.336	0.387	−0.623	0.464	0.744	0.402	1.221	0.192	1.221	0.254	14.679	0.833	14.679	0.789
Ln of total assets	−0.020	0.835	−0.020	0.890	0.213	0.198	0.220	0.334	0.217	0.332	0.217	0.221	−24.289	0.145	−24.289	0.375
N	308		308		308		308		308		308		308		308	
Clustered errors	No		By Firm		No		By Firm		No		By Firm		No		By Firm	
Pseudo R2	0.068		0.068		0.120		0.120									
Adjusted R2									0.033		0.065		0.015		0.047	

This table presents the findings of our regression models described in Eqs. (1). Where *Twitter* is measured by *Earnings-once* in columns (1) and (2), *quarterly-earnings* in columns (3) and (4), *no of earnings' Tweets* in columns (5) and (6) and *age of account* in columns (7) and (8). To control for firm fixed effects, standard errors are clustered by firm in columns (2), (4), (6) and (8). *, *, *** indicate significance at the 1, 5 and 10%, respectively. All variables are defined in Table 1

Twitter for announcing earnings news every quarter (*QUARTERLY_EARNINGS)*. However, it is worth mentioning that the coefficient of women directors is not significant when standard errors are clustered by firm.

Results of models (5) and (6) show that both measures of diversity are associated with the number of earnings tweets. Finally, results of models (7) and (8) show that board diversity is not associated with *AGE-OF-ACCOUNT.*

Taken together, the results suggest that both variables of diversity—board gender diversity measured by percentage of women on board and national diversity proxied by the percentage of foreign directors—are positively associated with the likelihood that a company adopts Twitter as a channel to disseminate earnings information.[2] Furthermore, both dimensions of board diversity are proven to be significant explanatory variables for the dependent variable measuring the commitment of firms to use Twitter to disseminate earnings information every quarter. Finally, results show that gender and nationality diverse boards are associated with the frequency with which Twitter is used to disseminate earnings information.

5 Discussion

Results are in line with and complement prior findings investigating the role of board diversity in explaining firm disclosure practices. In other words, results support our hypotheses. The first hypothesis on the positive association between board gender diversity and the use of Twitter to disseminate earnings information is supported by our results and by studies that have investigated the association between board diversity and various types of disclosure, including climate change disclosures (Ben-Amar et al. 2017; Liao et al. 2015), CSR disclosures (Cabeza-García et al. 2017; Jizi 2017; Ibrahim and Hanefah 2016), corporate governance disclosure (Elmagrhi et al. 2016), ESG disclosures (Arayssi et al. 2016; Tamimi and Sebastianelli 2017), forward-looking information (Kılıç and Kuzey 2018), and environmental disclosures (Rupley et al. 2012).

Our second hypothesis on the positive association between board nationality diversity and the use of Twitter to disseminate earnings information is supported by our results and resembles the findings of studies on CSR disclosure (Barka and Dardour 2015; Ibrahim and Hanefah 2016; Muttakin et al. 2015), corporate governance disclosure (Elmagrhi et al. 2016), corporate risk disclosures (Ntim et al. 2013; Saggar and Singh 2017), and disclosures about black economic empowerment (Ntim and Soobaroyen 2013).

The significant positive association found between each of the two board diversity variables—gender and nationality—and dissemination of earnings information using Twitter is supported by the theoretical framework addressed earlier in the manuscript. In line with agency theory, having more female and foreign board

[2] In an additional (non-tabulated) test, we checked whether observations from technology-related industries were biasing our findings. We found that our results are not sensitive to the inclusion or exclusion of firm-year observations from such industries.

members helped increase board independence and thus enhance disclosure in FTSE 150 companies. Moreover, since the board is responsible for setting strategies, a diverse board would have helped set a policy for social media, and specifically Twitter, disclosure. Also, according to resource dependence theory, a board with diverse backgrounds would aim to enhance corporate disclosure, using social media as a means to do so, in order to have access to better resources. Finally, the earlier discussion highlights the importance of having a gender and nationality diverse board of directors, since the outcome of such diversity would positively affect various stakeholders.

6 Conclusion and recommendations for future research

This paper has had two objectives: first, it aimed to assess how Twitter is used by UK firms to disseminate earnings news; second, it has examined the relationship between the decision to disseminate earnings news through Twitter and two board diversity constructs, namely gender and nationality. Meeting the aforementioned objectives implies that this paper contributes to the literature on social media disclosure generally and on the relationship between social media disclosure and board characteristics in particular. The top 150 FTSE companies in the UK comprised the sample for this research. However, the final sample included observations for 124 companies for the period from 2013 to 2015, yielding 308 firm-year observations. Tweets were manually extracted from companies' corporate Twitter accounts and board characteristics were sourced from the Spencer and Stuart UK Board Index. Several models were run for robustness and they all confirmed that a positive association exists between using Twitter as a channel for disclosure and information dissemination and board diversity.

The study has several limitations. First, it relies on a sample of top UK firms. Therefore, the investigation of the relationship between board diversity and using Twitter as a channel for disclosure and information dissemination in smaller firms or in a different institutional setting may provide different results. For example, several studies have provided evidence that board diversity is positively associated with firm performance (Carter et al. 2003). However, investigating the same relationship in the context of UK SMEs, Shehata et al. (2017) documented a negative significant relationship between board diversity and firm performance. It is recommended, therefore, that more research be conducted to provide answers on how the aforementioned relationship is sensitive to differences in firms' size, institutional setting, ownership structure and other variables that could influence the functionality of the board of directors. Moreover, future research could extend the results of this study by investigating the role of board members' technological expertise and whether this can influence the investigated relationship between corporate governance and social media disclosure. The need for technology expertise on boards has been strongly advocated in recent times, especially with the risk of cybercrime and issues regarding cyber security. It is unlikely that board diversity alone is a sufficient response to such challenges.

Second, the sample size is relatively small. Although our results show a significant and positive association between board diversity and adoption of Twitter as a channel to disseminate information, future studies could benefit from investigating similar phenomena using larger sample sizes. Increasing the sample size could have at least two benefits. First, it can increase the explanatory power of regression models. Second, larger sample sizes would allow researchers to examine the relationship across various subsamples and clusters, thereby providing more in-depth explanations about other variables that might influence the relationship between board diversity and the use of Twitter as a channel for disclosure and information dissemination. In this context, cross-country studies could provide useful insights on how institutional factors, legal environment, technological advancement, economic development, culture and other country-specific variables affect the investigated relationship.

Finally, qualitative research is also recommended since this would help delve deeper into the associations through in-depth explanations of the phenomena that support the quantitative analysis.

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Appendix: Verification of official corporate Twitter accounts

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