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Twitter/X activity and financial performance: Evidence from European listed companies

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ABSTRACT

Objective: The study aims to investigate the adoption level of Twitter/X for corporate communication in the European context, specifically aspects such as the creation of Twitter accounts, follower number, and tweet frequency. We expand the data analysis framework to provide a comprehensive description of the different types of businesses using Twitter. The article's ultimate goal is to provide insight into their financial characteristics, including profitability, growth options, and leverage.

Research Design & Methods: Using a large novel dataset (nearly 5.5 million tweets) from 41 European stock exchanges, we provide a comprehensive picture of the social media activity of 21 319 listed companies. We applied box plots, data visualisation, and exploratory data analysis to provide a concise visual summary of the data's distribution to compare multiple datasets or identify any potential outliers or skewness.

Findings: Our findings indicate that growth companies are more likely to use Twitter/X for corporate communications. However, the relationship between profitability and Twitter adoption is not clear. The level of Twitter/X adoption for corporate communication in companies listed in Europe is lower than in the Northern American ones.

Implications & Recommendations: Companies should consider adopting social media as part of their communication strategy to enhance their financial performance. Our study contributes to the understanding of social media's role in corporate communication and its potential impact on the financial performance of European listed firms.

Contribution & Value Added: The literature review reveals that the predominant focus of Twitter research has been on samples derived from the US market, whereas studies pertaining to Europe tend to concentrate on specific markets or sectors. To our knowledge, there is no comprehensive research on listed Twitter-using firms in the EU.

Article type: research article

Keywords: stock markets; Twitter; social media; corporate communication; financial performance

JEL codes: G14, G15, G41

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INTRODUCTION

The rise of real-time social networking platforms, exemplified by Twitter, has profoundly transformed the landscape of corporate communication, ushering in a new era of information dissemination (Kim *et al.*, 2022). We have witnessed a remarkable shift in the corporate sphere, with Twitter adoption surging from 15% in 2010 to an impressive 65% of firms in Corporate America by 2017. According to Al Guindy *et al.* (2024), by 2020, the majority of businesses listed in the three major US exchanges, namely 2 518 out of 3 882 firms (65%), were utilising the social media platform Twitter. This transition was catalysed by the Securities and Exchange Commission (SEC), which, recognising the evolving communication landscape, permitted in 2013 that corporations could use social media platforms for dis-

seminating corporate news. This pivotal change came with the stipulation that companies inform investors about the utilization of their social media accounts for such purposes, thus reinforcing the rationale for leveraging these platforms to engage stakeholders. However, social media adoption for corporate communication purposes varies across the world and is largely influenced by regulatory frameworks, linguistic diversity, and cultural landscapes. As far as China is concerned, where different social media platforms prevail, the government has implemented a policy that promotes internet usage while simultaneously exercising strict oversight (Ang *et al.*, 2021). While the USA has progressed towards incorporating social media channels into corporate disclosure frameworks, countries like Australia and Canada promote integrating social media communications with their pre-existing regulations (Hamade *et al.,* 2024). In contrast to the US, the European Union has enacted more stringent rules and procedures governing the dissemination of crucial corporate updates. These regulations are designed to ensure equitable access to precise information through national databases, known as Officially Appointed Mechanisms (OAMs), coupled with directives mandating the public availability of information on the company's website. While European firms are not precluded from sharing news on social media, it can only occur after making the information available via a regulatory information service. Due to differences in regulatory environments concerning disclosure channels in the US and Europe, we aim to analyse the extent of Twitter adoption for corporate communication purposes.

In response to evolving communication dynamics in global corporations, numerous empirical studies have scrutinized information dissemination and disclosure strategies (Blankespoor *et al.*, 2014; Jung *et al.*, 2018; Rakowski *et al.*, 2021). Though distinct, these mechanisms are inherently interlinked, encompassing disclosure (the supply of information) and dissemination (the consumption of information). While extant research predominantly delves into disclosure strategies, the exploration of strategic dissemination has been relatively limited, mainly due to the inherent complexities in isolating dissemination decisions from disclosure decisions (Jung *et al.*, 2018). Disclosure is typically measured by metrics like the number of tweets produced, the frequency of tweeting, and tweet word count, while dissemination is often proxied by metrics such as retweets, followers, and the Google search volume index (SVI). The realm of dissemination extends beyond mere disclosure and reveals how firms actively manage their information environment for effective communication with stakeholders, spanning employees, customers, shareholders, and the broader public. This encompasses a myriad of communication activities, including public relations, marketing, advertising, internal communications, and crisis management. We attempt to examine both disclosure (the supply of information) and dissemination (the consumption of information) in the European context.

Hamade *et al.* (2024) conducted a systematic review to thoroughly examine the literature on corporate communication in social media. They found that 48% of studies focus on the use of social media platforms for corporate communication in the USA, followed by 13% in China and 5% in the UK. To our knowledge, there is no comprehensive research on listed Twitter-using firms in the EU. Research concerning European public companies focuses solely on individual markets and even sectors, as well as marketing-related issues. This issue becomes especially significant for firms that do not receive widespread news coverage through traditional intermediaries like the press, as social media can effectively enhance their communication. This article, uniquely positioned at the intersection of corporate finance and digital communication, investigates Twitter usage by 21 319 companies listed on 41 European stock exchanges, which published nearly 5.5 million tweets between January 2018 and June 2020. Using a large dataset, we aimed to uncover the multifaceted dimensions of social media presence in the European corporate landscape. While the potential of social media for business communication in the United States has garnered substantial attention, the examination of its economic implications remains relatively understudied. The central question driving our research is whether Twitter presence correlates with increased profitability, growth potential and leverage thereby advancing theoretical insights within the domain of business valuation. Our findings affirm the potential of a social media presence in conferring a competitive edge to businesses. We uncovered a positive correlation between Twitter membership, tweet volume, follower count, and profitability. Moreover, our analysis highlights the prevalence of Twitter adoption within specific industries, with technology and consumer goods sectors exhibiting higher utilization rates. Moreover, larger firms tend to amass a larger following on Twitter,

boasting on average 16 times more followers, and even 21 times more followers at the median, compared to the smallest companies in the sample. In the case of EBIT, this relationship is not monotonic, as both companies generating the highest losses and those characterised by the highest operating income publish the most tweets and have the largest number of followers.

To provide a comprehensive understanding of our study, the subsequent sections will provide literature review and hypotheses development (Section 2), examine metrics describing Twitter activity, delineate our data collection process (Section 3), present corporate Twitter activity across different countries and industries, analyse the economic outcomes in the context of company social media presence (Section 4), and conclude with discussions and implications (final section).

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The rate of social media adoption may vary due to regulatory, language, and cultural differences between countries. However, these are not the only reasons for such differences. Financing systems dominated by banks tend to limit transparency and may deter investors from seeking out information (Bhattacharya & Chiesa, 1995), while market-based financing promotes greater disclosure of corporate information (Perotti & von Thadden, 2001). According to agency theory (Jensen & Meckling, 1976), lenders may avoid transparency to protect the value of their claims. We argue that since bank-dominated financing relationships are prevalent in Europe, the level of Twitter/X adoption in publicly traded companies in Europe and those registered in the EU is lower in comparison to those registered in North America.

H1: Among European-listed companies, the level of Twitter/X adoption for corporate communications in European companies is lower than in North American companies.

As this is an exploratory study, we formulated hypotheses to identify the factors associated with activity and stakeholder engagement on Twitter/X. Al Guindy (2021) and Feng and Johansson (2019) suggest that firms with weaker information environments are likely to benefit the most from adopting social media channels. In contrast, Ibrahim *et al.* (2022) highlight firm size as a key factor influencing disclosure, as larger firms face higher agency costs to reduce information asymmetry, prompting greater disclosure. Signalling theory further supports the importance of firm size in disclosure practices (Albarrak *et al.*, 2023). Moreover, Jung *et al.* (2018) show that firms with more analyst coverage are more likely to share earnings on social media. However, smaller firms may be less inclined to adopt social media, relying on conventional channels for information sharing. Based on that, we formulated the following hypothesis:

H2: Larger companies (in terms of capitalization and assets) are more likely to employ Twitter/X for corporate communication purposes.

According to Schiuma *et al.* (2024), the research identifies two principal channels via which corporate disclosure influences company value: one associated with enhanced profitability and the other connected to the capacity of corporate information to diminish the cost of equity capital. Previous research has hinted at a positive association between social media presence and financial performance (Akmese *et al.*, 2016; Al Guindy, 2021; Albarrak *et al.*, 2020; Paniagua & Sapena, 2014; Ravaonorohanta & Sayumwe, 2020). Al Guindy (2021) discovered that firms with higher book-to-market ratios particularly benefit from sharing financial information via Twitter. This aligns with Hasan and Cready's (2019) finding that expanding companies are more likely to share information on Facebook. However, Filip *et al.* (2021) found a negative correlation with growth. These insights are primarily confined to specific sectors or regional contexts. Our study seeks to broaden this perspective by scrutinizing the economic implications of social media presence at the corporate level, across diverse European listed companies. An important question driving our research is whether Twitter presence correlates with increased profitability, thereby advancing theoretical insights within the domain of business valuation. Therefore, we formulated the following hypotheses:

H3: More profitable companies (in terms of (EBIT, ROE and return on assets ratio) are more likely to employ Twitter/X for corporate communication purposes.

H4: Growth companies (in terms of P/BV and P/E ratio) are more likely to employ Twitter/X for corporate communication purposes.

Leverage is also examined as a determinant for using social media channels for corporate communication. Lee *et al*. (2013), Filip *et al.* (2021) and Feng and Johansson (2019) discovered a negative relationship between leverage and the use of Twitter. According to Al Guindy (2021), companies vulnerable to financial risk have stronger motives to use social media channels. Disclosure can affect the cost of capital by reducing monitoring costs for investors (Vitolla *et al.,* 2020). Therefore, we hypothesised:

H5: More indebted companies are more likely to employ Twitter/X for corporate communication purposes.

RESEARCH METHODOLOGY

The burgeoning use of social media platforms, most notably Twitter, has become a prevalent avenue for businesses to engage with their clientele, stakeholders, and the wider public. Twitter provides a real-time conduit through which businesses can disseminate information, express opinions, gather feedback, and gauge the sentiments of their followers. However, the full spectrum of Twitter's impact on business performance remains an ambiguous area. Existing studies have ventured into numerous facets of businesses' Twitter usage, encompassing metrics such as follower counts, tweet frequency and content, and the level of engagement through retweets.

Tweets' frequency and content are one of the most often used metrics to gauge a business's popularity and influence on Twitter. Tweets constitute brief messages posted on Twitter and can encompass a variety of media types, including text, images, videos, links, hashtags, and mentions. The frequency and content of tweets manifest the level of activity and strategic approach adopted by a business on Twitter. Several studies suggest that more frequent tweeting can augment a business's visibility, enhance awareness, generate increased traffic, and yield more leads (Xun & Guo, 2017; Lee *et al.*, 2015). However, a contrasting perspective posits that excessive tweeting can have adverse consequences, potentially vexing or distancing followers, diminishing tweet quality and relevance, and diluting the impact and value of each individual tweet (Pansari & Kumar, 2017). Moreover, the content of tweets can significantly shape follower perceptions and behaviours. Several investigations have probed the influence of various tweet types, including informational, promotional, emotional, or interactive tweets, on follower engagement and satisfaction (Chen & Shen, 2015; Kim *et al.*, 2022).

Another pivotal metric applied to assess the impact of Twitter on business performance is the follower count. Followers represent users who subscribe to receive updates from a specific account, effectively quantifying the scope and outreach of a business's Twitter audience. Nevertheless, it is imperative to acknowledge that follower quantity does not necessarily mirror audience's caliber or loyalty, nor does it encapsulate the interactions and feedback that transpire between a business and its followers. Consequently, some researchers contend that follower count may not be a dependable gauge of business performance on Twitter (Bank *et al.*, 2019; Cole *et al.*, 2015).

A third metric employed to assess the efficacy of Twitter for businesses pertains to the engagement level garnered through retweets. Retweets denote tweets that are re-posted by another user on their own timeline, thereby amplifying the reach and exposure of the original tweet. The engagement level through retweets offers insight into the degree to which a tweet resonates with and influences followers. Certain studies posit that retweets can bolster a business's reputation and credibility, fostering word-of-mouth marketing and referrals (Liu *et al.*, 2015; Zhang *et al.*, 2017). However, it is important to note that retweets do not inherently imply endorsement or agreement with the original tweet, and various motivations, such as humour, sarcasm, or criticism, may underpin retweeting behaviour (Wang *et al.*, 2019).

Table 1 provides an overview of the literature review focusing on metrics that describe Twitter activity.

The main aim of this study is to provide a comprehensive analysis of the social media practices of publicly traded companies in Europe. This area of research has received considerable empirical interest, albeit primarily in relation to North American stock markets, as demonstrated in Table 1. While an array of social media platforms is at the disposal of corporations, including Twitter, Facebook, YouTube, and LinkedIn, recent findings by Best and Caylor (2019) underscore Twitter's prominence as a channel for corporate communication, surpassing the reliance of shareholders to seek

press releases and instead favouring subscription to a company's Twitter feed. Additionally, recent research by Nuseir and Qasim (2021) underscores Twitter's paramount role in financial disclosure and the supplementary dissemination of corporate information. Given the extended timeframe of our study (January 2018 to June 2020), the multitude of local markets (41), and the comprehensive inclusion of more than 21 000 companies in our dataset, our focus narrows down to three principal proxies: Twitter membership (as a disclosure metric), the number of tweets posted by a firm (also as a disclosure metric), and the number of followers (as a dissemination metric). Although our utilization of these three metrics aligns with established practices, a review of prior research in this domain, as presented in Table 1, reveals a more extensive array of proxies. Nonetheless, it is imperative to underscore that our dataset stands as the most expansive in this domain to date.

Table 1. Metrics describing Twitter activity and research samples description

Researcher	Metrics	Country	Number of observations	Research period	Number of companies
Bank *et al.* (2019)	number of followers increase in number of followers number of tweets Twitter membership	BIST 50	128	01/11/2016 – 30/04/2017	28
Blankespoor *et al.* (2014)	number of followers number of tweets (since account inception) date of each firm's first tweet duration between a firm's first and last tweet per firm monthly average retweets percentage replies percentage links	Top IT firms from reputable rankings	4 516	04/03/2007 – 26/09/2009	85
Cole *et al.* (2015)	number of tweets months on twitter	S&P 500	38 275	01/12/2010 – 31/12/2011	215
Al Guindy (2021)	number of tweets number of tweeting days number of words contained in tweets number of retweets	NYSE, AMEX, NASDAQ	16 378	01/01/2006 – 31/12/2018	864
Liu *et al.* (2013, 2015)	official twitter account number of tweets number following	NYSE, NASDAQ	11 034	01/01/2008 – 31/12/2012	293
Prokofieva (2015)	number of tweets number of retweets	ASX 200	3 516	01/08/2013 – 01/01/2014	109
Rakowski *et al.* (2021)	number of tweets increase in number of followers increase in number of tweets	Russel 3000	2 215 535	01/01/2011 – 31/12/2015	1 976
Ranco *et al.* (2015)	financial tweets number of tweets (daily) number of tweets by sentiment type per day sentiment polarity	DJIA30	1 555 770	1/06/2013 – 18/09/2014	30
Zhang *et al.* (2011)	number of tweets per day number of followers per day number of retweets per day positive or negative mood on Twitter	DJIA, NASDAQ, and S&P 500	8 100-43 040/day	30/03/2009 – 07/09/2009	n/a

Source: own study.

The initial phase of our study involved the compilation of a roster of companies listed on European stock exchanges between 2018 and June 2020. To achieve this, we harnessed resources provided by the Federation of European Securities Exchanges, representing 35 exchanges. Subsequently, we expanded our dataset to encompass additional markets, adopting the categorization outlined by the United Nations Statistical Division, covering 44 European countries. The precise tally of stock exchanges across Europe hinges on nuanced definitions and geographical parameters, yet it can be estimated that over 40 stock exchanges operate across the continent. Notably, some countries, such as Germany and Switzerland, host multiple regulated markets, further augmenting the complexity of this landscape. Due to data unavailability within the EquityRT database, we excluded certain exchanges from our research sample, including the Belarusian Currency and Stock Exchange, Montenegro Stock Exchange, and Ukraine Stock Exchange. Consequently, we assembled a dataset encompassing companies listed on 41 stock exchanges.

To eliminate redundancies stemming from cross-listings, where a company's common shares are listed on multiple markets, we assigned companies to specific markets based on the primary code field. Within the EquityRT database, the market exhibiting the highest trading volume was designated as the primary market, a practice underpinned by financial instrument valuation principles applicable to all market participants. Following this phase, our sample encompassed 21 319 companies, which necessitated geographical attribution to the countries where they generated revenues, in adherence to IFRS 8 Operating Segments' requirement for companies to report revenue generation locations. This information was manually sourced from financial reports and populated the 'Business Country' field in the EquityRT database. Ultimately, our dataset comprised companies operating in 33 European countries, including 'other European countries' (encompassing European nations outside the Schengen area, except for Turkey, Bulgaria, Romania, Cyprus, and the UK), along with the USA & Canada, Americas, Australia and Oceania, Africa, and Asia, all listed on 41 stock exchanges.

Given the absence of a dedicated database housing Twitter account details for European-listed companies, we undertook the development of a program to scrape this data from company websites. Consequently, we developed a program for web scraping this data directly from the official websites of the companies. Subsequently, Twitter data was collected exclusively from the official Twitter accounts of the companies, using the Twitter Search API. This ensured that the data originated directly from Twitter's official source, maintaining accuracy and reliability. This method aligns with practices widely adopted in prior studies (*e.g.* Al Guindy, 2021; Ranco *et al.*, 2015; Debreceny *et al*., 2019). Leveraging the entirety of our compiled data, spanning tweets and financial characteristics, we curated an SQL database.

The limitation of our approach is that web scraping relies on the completeness and accuracy of the official websites from which we collected data. Companies that do not maintain their websites or that update their Twitter/X accounts infrequently might have been underrepresented in our dataset. Furthermore, the absence of a centralised European database for corporate social media accounts introduces the possibility that some firms using unofficial Twitter/X accounts or not publicly link them may have been missed. This could lead to selection bias, particularly in smaller firms or firms based in less technologically advanced countries. Moreover, U.S. companies are frequently identified through the use of cashtags, a system that has not been widely adopted in Europe by either investors or companies. Consequently, our efforts to identify European companies active on Twitter via cashtags yielded fewer results compared to data collected from official company websites. Table 2 provides a detailed summary of the sampling process used in this study, covering key aspects such as the number of companies, missing data, and a description of the variables analysed. Both the financial data and Twitter data used in this research correspond to the same period, ensuring consistency and alignment between the two datasets. Of the initial 21 319 observations, after balancing the sample, 7 107 observations remained for the final analysis. While this approach guarantees consistency between the financial and Twitter datasets, it may reduce the representativeness of the sample, particularly for firms in Eastern Europe. Therefore, the results should be interpreted with caution, particularly when generalizing beyond the companies included in the final sample.

Table 2. Number of companies, missing data and detailed description of the variables

Name [description]	Source	Number	% of all companies
All companies analysed	EquityRT	21 319	100.0
Companies active on Twitter			
- with account	Twitter API	7 885	37.0
- tweeting		7 107	33.3
- with followers		7 341	34.4
- all posted tweets		5 443	N/A
		502	
Companies with indicated country	EquityRT	21 319	100.0
Companies with indicated industry	EquityRT	21 098	99.0
Companies with identified financial indicators			
- Debt Ratio: total liabilities/total assets in EUR			
- Total Assets: total assets value of the company at the end of the research period in EUR		19 183	90.0
- Market Capitalization (Mcap): market capitalization of the company at the end of the research period in EUR		19 193	90.0
- Income TTM: income before extraordinary items of the company at the end of the research period in EUR		18 594	87.2
- Return of Assets (ROA): income before extraordinary items/book value of assets of the company at the end of the research period in EUR	EquityRT	18 059	84.7
- Return of Equity (ROE): income before extraordinary items/equity value of the company at the end of the research period in EUR		19 075	89.5
- Price to Book Value Ratio (P/BV): the current market value of a company/book value at the end of the research period in EUR		17 793	83.5
- Price Earnings Ratio (P/E): the relation between the market capitalization and earnings per share (EPS) in EUR		16 542	77.6
		17 142	80.4

Source: own study.

RESULTS AND DISCUSSION

Corporate Twitter Activity Descriptive Statistics

The database underpinning this study encompasses 5 443 502 tweets, posted by 7 107 companies listed on 41 European stock exchanges, deriving their revenue from 47 European countries,[1] as well as the US & Canada, Americas, Australia, Oceania, Africa, and Asia. When examining the composition of our dataset, British (7.58%), German (4.38%), French (4.10%), Polish (3.95%), and Swedish (3.94%) stock markets emerge as the most prominent players. Notably, these statistics exclude non-European countries of residence. Table A1 in the Appendix presents sample distribution and includes Twitter activity by country, focusing on both tweets frequency and the number of followers. A noteworthy trend in our dataset is the steady uptick in the number of tweets and the count of tweeting companies, a phenomenon commencing at the start of 2020 (Figure 1). We may attribute this surge to the global spread of the COVID-19 pandemic, leading to the widespread implementation of remote working solutions and the growing significance of online services. Furthermore, Figure 1 demonstrates that social media activity reached its zenith in the post-holiday season, particularly in October. This observation is not consistent with findings by Hirshleifer *et al.* (2009), who documented an escalation in investor attention on days featuring a flurry of earnings announcements.

[1] The political boundaries of Europe differ depending on the definition of Europe employed by various political organizations. For example, the Council of Europe and the European Court of Human Rights define Europe as 47 countries. The European Higher Education Area covers 48 countries, whereas the definitions of the European Cultural Convention and the European Olympic Committees encompass 50 countries.

On the other hand, companies involved in retail may intensify their marketing and promotional activities before the upcoming Black Friday, Christmas, and the New Year's sales events (Ibrahim & Wang, 2019), while companies in the sports and tourism industries increase their activity on social media to maintain fan engagement after the summer season (Watanabe *et al.*, 2015).

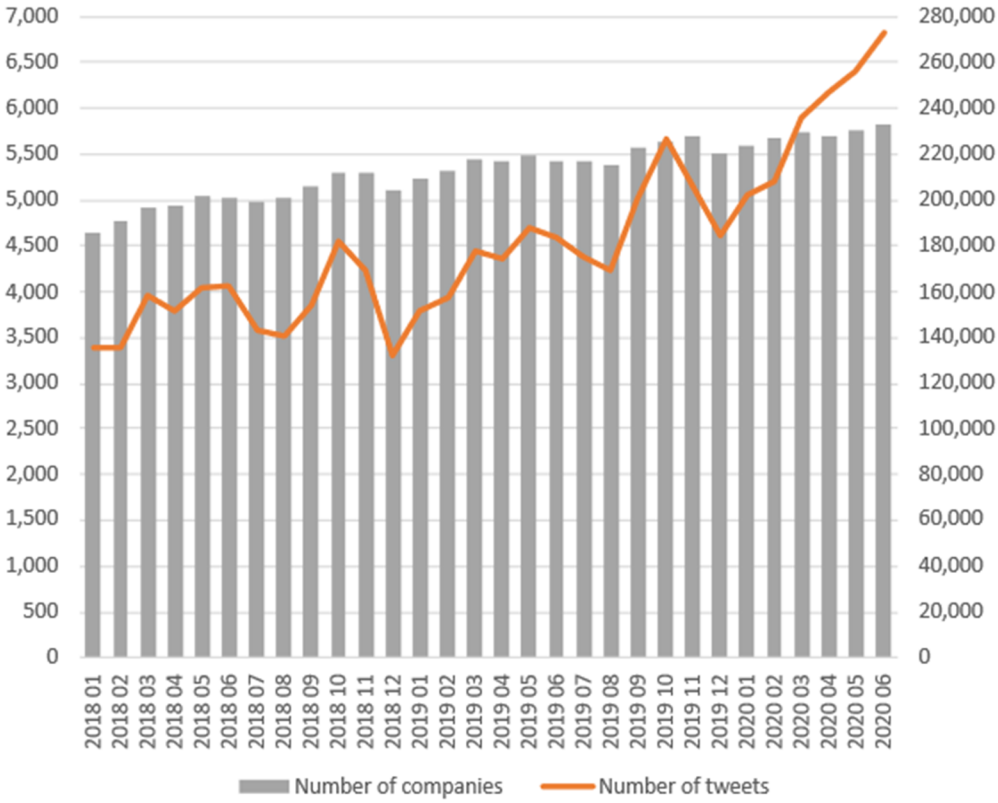

Figure 1. Number of tweets posted and number of companies (in thousands) tweeting between January 2018 and June 2020

Note: The scale on the left represents 'units' and refers to number of companies – total number of companies having a Twitter account; the scale on the right represents 'units' and refers to: the number of tweets – the total number of tweets published by companies active on Twitter.

Source: own elaboration based on Twitter/X data and EquityRT.

Figure 2 provides insights into the share of active Twitter-using companies relative to the total number of listed companies in each market. In our European-focused analysis, countries belonging to the EU Customs Union, Schengen Area, and the UK are presented distinctly, while other companies listed on EU capital markets but generating income elsewhere are grouped into categories such as other European, US & Canada, Americas, Africa, Asia, Australia, and Oceania. This stratification is pivotal in addressing the complexities arising from companies concurrently listed on multiple stock exchanges without dedicated Twitter accounts for each exchange.

Our analysis revealed that the number of companies registered in the US & Canada but quoted in Europe stands at 6 557, with 52% of them possessing a Twitter account, a figure somewhat lower than the report by Kim *et al.* (2022) for S&P 1 500 firms. Within Europe, companies hailing from Ireland (62%), Finland (61%), the United Kingdom (56%), and France (54%) claim the highest proportion of Twitter account holders, while countries like Slovakia, Lithuania, and Bulgaria exhibit figures below 10%. Interestingly, no companies listed in Estonia were found to have a Twitter account or provide a relevant link on their websites. Notably, Eastern European companies, except those in Finland and the Czech Republic, demonstrated markedly lower Twitter account ownership and usage, likely reflecting the comparatively underdeveloped technological landscape in these regions. In contrast, Northern and Western European countries actively utilize social media to establish and nurture lasting business relationships.

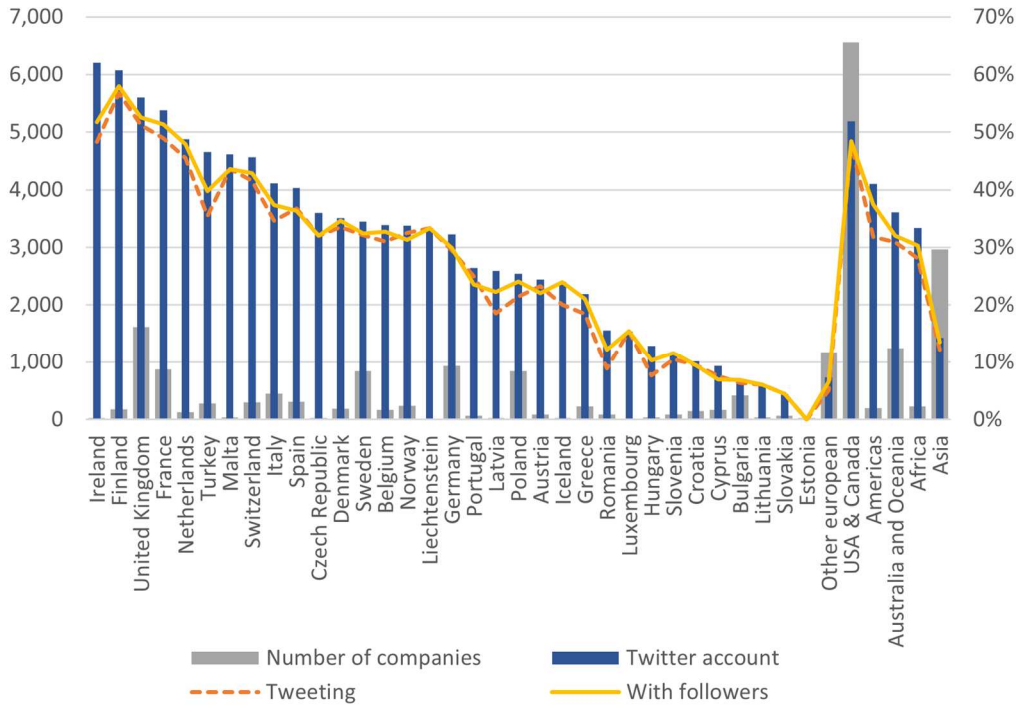

Figure 2. Corporate Twitter activity broken down by countries

Note: The scale on the left represents 'units' and refers to: number of companies – the total number of companies, both having and not having a Twitter account; The scale on the right represents 'percentages' and refers to: (1) Twitter account – number of companies with a Twitter account / total number of companies; (2) Tweeting – number of companies actively tweeting / total number of companies; (3) With followers – number of companies with followers / total number of companies.
Source: own elaboration based on Twitter/X data and EquityRT.

In our examination of Twitter engagement among European public companies, we considered the volume of tweets posted during the research period (Figure 3). We employed box plots, a staple in descriptive statistics, to identify mean values, data set dispersion, and skewness signs. The right-skewed distribution observed in Figure 3 implies a concentration of data toward lower values. Consequently, further analysis leaned toward the median as a more representative metric, as the mean can overestimate less common values. Notably, we observed the highest average activity (median) in the Czech Republic, potentially attributable to the market size and the Czech stock exchange's strategy of welcoming dual listings. However, it is essential to acknowledge that entities like Erste Bank and VIG, among the largest companies listed there, don't consider the Prague Stock Exchange their primary market. Therefore, our sample contained only 25 Czech companies. If we exclude the Czech Republic, Spanish companies emerge as the most active on Twitter, with a median of one thousand posts during the research period, double the figures for Portuguese, German, and Slovenian companies.

Shifting our focus to measure corporate Twitter activity by the number of followers, akin to Bank *et al.* (2019) and Blankespoor *et al.* (2014), we noted that Spain records the highest mean number of followers, while European-listed companies primarily operating in the Americas exhibit the highest median follower count (Figure 4). Within Europe, Luxembourg stands out with the highest median. However, its inclusion is contingent on a small sample size (2 companies) and should be considered separately. Among European companies with their primary revenue generation in Europe, Spain and the Netherlands lead in median followers. This observation resonates with findings by de Oliveira Santini *et al.* (2020), suggesting that Twitter is twice as effective as other social media platforms in enhancing customer engagement, satisfaction, and positive emotions. In this context, the median number of followers for publicly traded European companies underlines the potential benefits of investing more in Twitter as an informational tool for building customer engagement relative to other platforms like Facebook and blogs. Notably, various companies have successfully leveraged Twitter to boost customer engagement and achieve wider dissemination, exemplified by Telepizza in Spain with 34 836

810 followers, and Sport Lisboa E Benfica-Futebol, Futebol Clube Do Porto – Futebol Sad in Portugal, with 1 302 095 and 1 240 223 followers, respectively, among other examples.

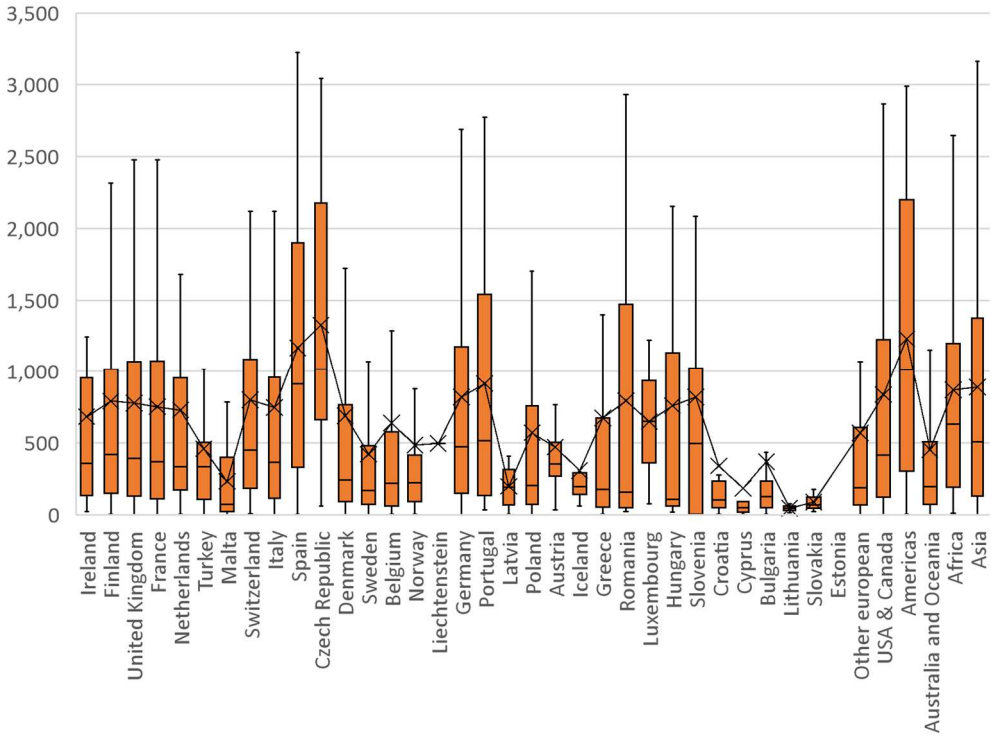

Figure 3. Corporate Twitter activity measured in the number of published tweets over the research period
Note: The median is represented by the line dividing the box into two parts. The mean is marked with an x. The box part of the box plot covers the middle 50% of the values in the data set. Whiskers extend from the top of the box to the largest data point within 1.5 times the interquartile range (IQR) and from the bottom of the box to the smallest data point within 1.5 times the IQR. Data points outside this range are considered outliers and are shown as small filled-in circles. Values outside this range have been omitted.
Source: own elaboration based on Twitter/X data and EquityRT.

Our analysis delves into sectoral affiliation (Figure 5), revealing that the Medical Care sector comprises the largest representation, with 2 324 companies. Nevertheless, the computer software & services sector stands out, boasting 1 484 companies, of which 858 (59%) maintain active Twitter accounts, generating 894 668 tweets. This surge in activity aligns with the sector's pronounced growth in the global economy during the research period, underpinned by a surge in IT sector performance. Importantly, this period also coincided with the onset of the COVID-19 pandemic and subsequent economic disruptions, which did not adversely affect IT sector companies, as highlighted by Gartner's report (2020) of average annual growth in the global IT market from 2012 to 2019. Furthermore, 2020 marked the beginning of the COVID-19 lockdowns and the resulting economic disruptions. The IT sector companies were one of the few that did not experience adverse effects of that situation. Al Guindy (2021) draws similar conclusions. Computer software & services and communication services tend to tweet more, whereas industries such as steelworks and mining are less active. Customer services stands out against the others where the number of Twitter-active companies in this sector and the average number of tweets posted are below average for the entire population. The lowest level of activity in terms of the number of accounts they have, the published tweets, and the number of followers exhibited by companies involved in real estate and textile & apparel. Companies that operate in these industries should use social networking sites for marketing purposes.

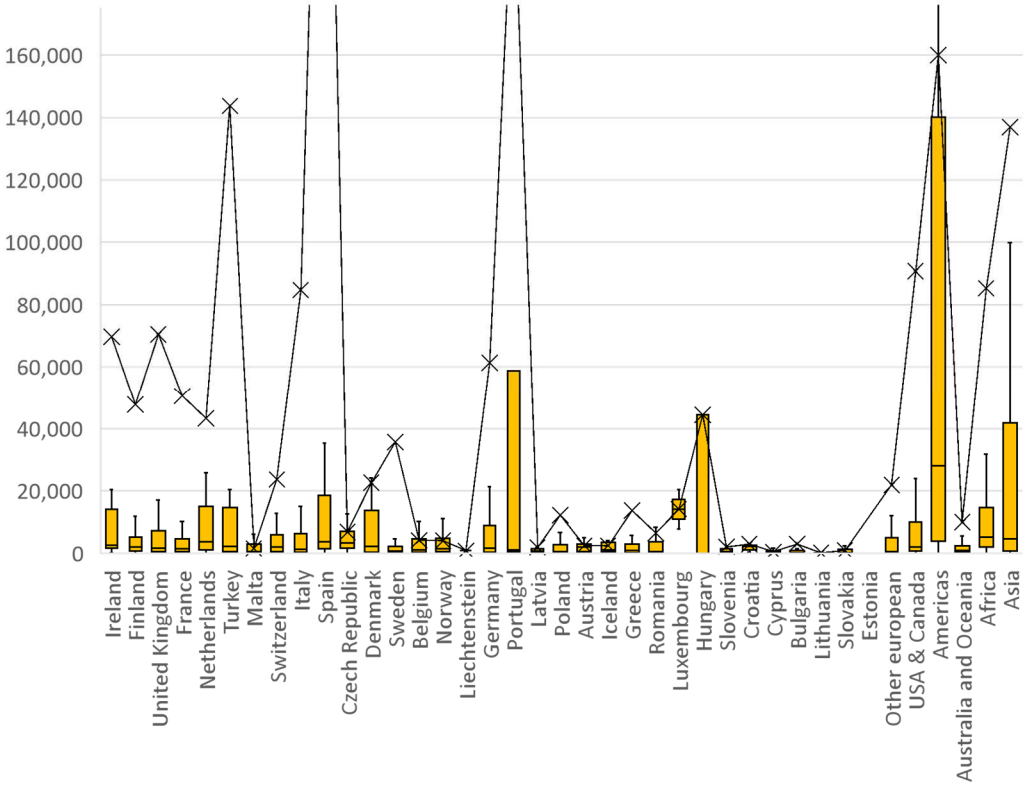

Figure 4. Corporate Twitter activity measured in the number of followers at the end of the research period

Note: Values outside the chart area: mean for Spain = 344k, mean for Portugal = 221k, upper whisker for Americas = 300k.

Source: own elaboration based on Twitter/X data and EquityRT.

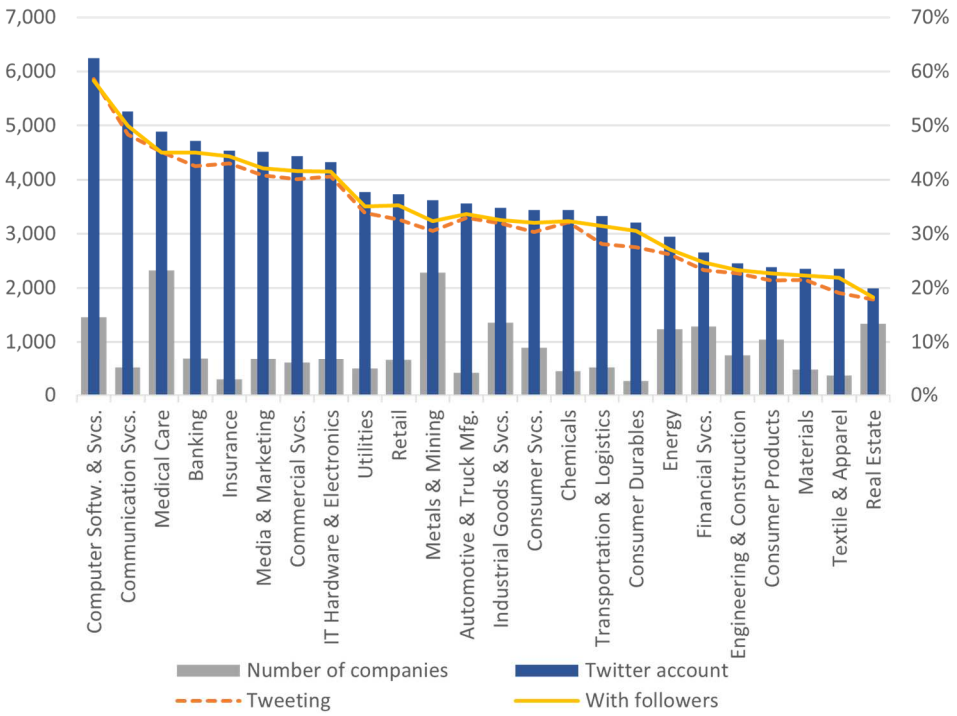

Figure 5. Corporate Twitter activity broken down by sectors

Note: The scale on the left represents 'units' and refers to: the number of companies – total number of companies, both having and not having a Twitter account; The scale on the right represents 'percentages' and refers to (1) Twitter account – number of companies with a Twitter account / total number of companies; (2) Tweeting – number of companies actively tweeting / total number of companies; (3) With followers – number of companies with followers / total number of companies.

Source: own elaboration based on Twitter/X data and EquityRT.

According to Li *et al.* (2013), companies engage in social media because this form of electronic word of mouth is approximately twenty times more effective than marketing events and thirty times more effective than media appearances, which is linked to firm profits and shareholder value. This finding is not restricted to any industry but we can generalize it across industries (Pansari & Kumar, 2017). However, intangible features characterize service environments, which are more varied than manufacturing contexts (Zeithaml *et al.*, 1985). Consequently, to develop customer relationships and engage clients, companies that provide services must disclose more details. It also refers to consumer electronics industry, retail banking, and insurance (Pansari & Kumar, 2017). Our results (Figure 6) support conclusions drawn mainly on US datasets. In our sample, the most active sectors on Twitter were retail, banking, insurance, and consumer services, while metals & mining, industrial goods & services, and energy were inactive. However, Twitter activity in consumer durables appears to be very low, which is surprising given that, according to Gallup, fully-engaged shoppers in the consumer electronics industry make 44% more visits per year to their preferred retailer than actively disengaged shoppers, which translates to customer value and subsequently affects firm value. We also discovered that medical care sector's Twitter activity decreased significantly during the pandemic period.

In the next cross-sectional analysis (Figure 7), we explored the number of followers as a proxy for customer engagement. Customer engagement is known to significantly impact firm performance. In our sample, the most popular sectors on Twitter in terms of followers were retail, banking, insurance, and consumer services, while metals and mining, materials, and medical care garnered fewer followers. Notably, transportation & logistics and textile & apparel stood out, as they host fewer Twitter-active companies, with below-average numbers of tweets posted, yet their messages draw substantial followers. We may attribute this phenomenon to the nature of information disseminated by these companies. Entities in these sectors appear to utilize social networking sites primarily for marketing purposes. Forbes (2018) reports that 40% of consumers follow their 'favourite' brands on social media, with 25% of those followers making purchases from these brands.

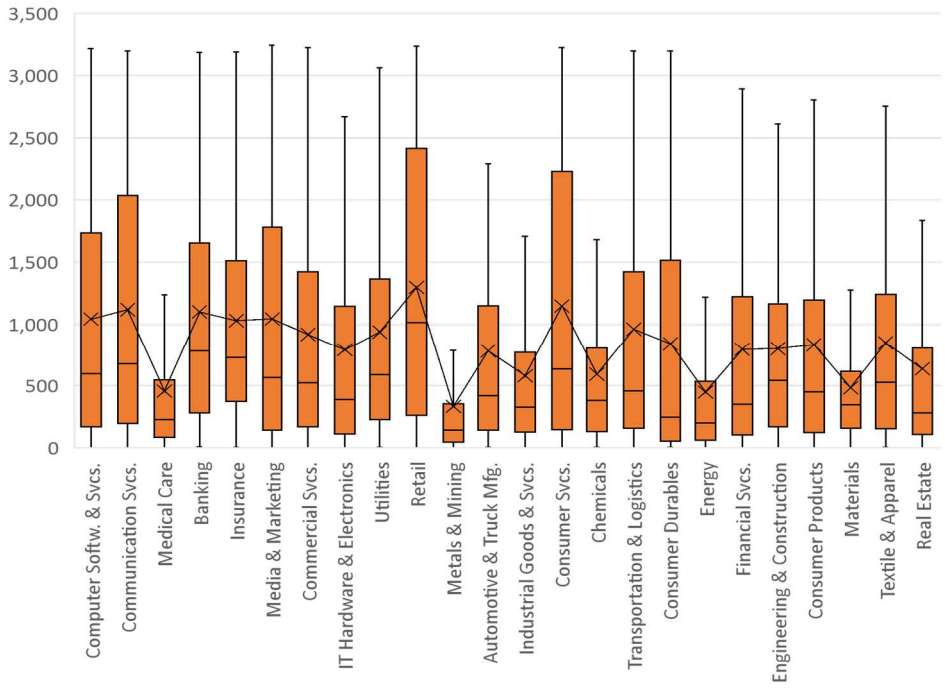

Figure 6. Corporate Twitter activity measured in the number of published tweets over the research period broken down by sectors

Note: The median is represented by the line dividing the box into two parts. We marked the mean with an x. The box part of the box plot covers the middle 50% of the values in the data set. Whiskers extend from the top of the box to the largest data point within 1.5 times the interquartile range (IQR) and from the bottom of the box to the smallest data point within 1.5 times the IQR. Data points outside this range are considered outliers and are shown as small filled-in circles. Values outside this range have been omitted.

Source: own elaboration based on Twitter/X data and EquityRT.

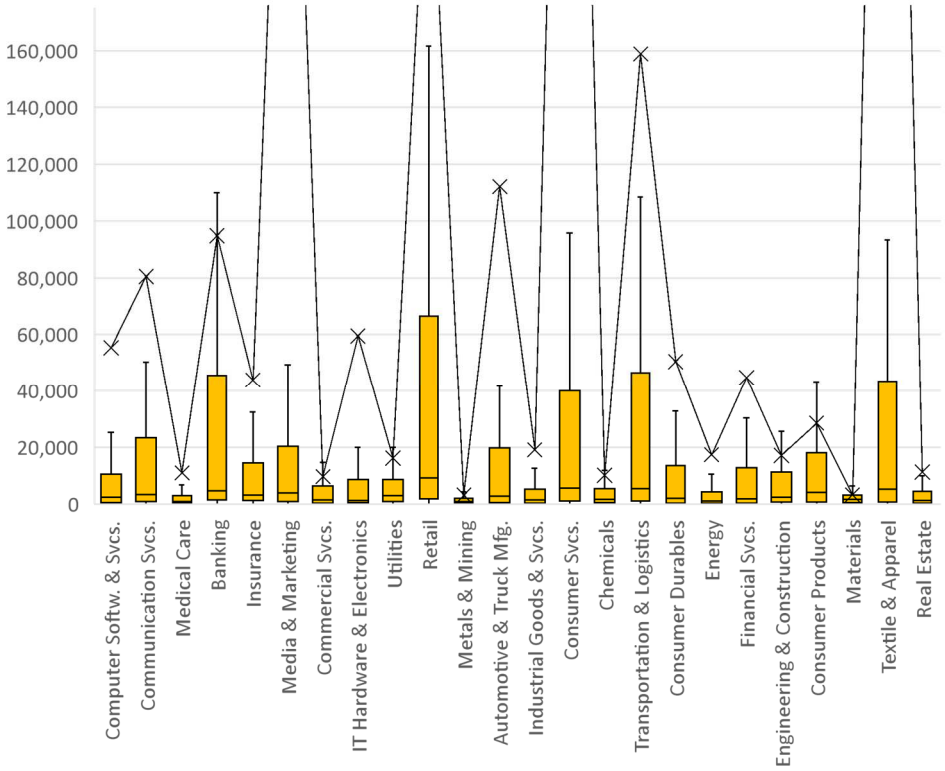

Figure 7. Corporate Twitter activity measured in the number followers at the end of the research period broken down by sectors

Note: Means outside the chart area: media & marketing = 349k, retail = 249k, consumer svcs. = 481k, textile & apparel = 511k.
Source: own elaboration based on Twitter/X data and EquityRT.

Financial Characteristics of Tweeting European Listed Companies

This section delves into financial characteristics of European-listed companies active on Twitter, focusing on firm size (capitalization, total assets), profitability (EBIT, return on equity ratio and return on assets ratio), firm value (P/BV and P/E ratio), and leverage (debt ratio). Table A2 in the Appendix presents the sample distribution and provides data on Twitter activity, focusing on the number of tweets and followers, categorized by different quintiles of selected variables.

Figure 8 presents the share of companies engaged in Twitter activity, divided into individual quintiles based on various financial metrics. The findings regarding firm size indicate the existence of a relationship between having an account on Twitter/X and the size of the company. While a significant number of larger firms, particularly in terms of capitalization and total assets, have embraced Twitter for corporate communications, a substantial proportion of smaller companies have not. Notably, nearly 85% and 70% of small companies have not adopted Twitter, as measured by capitalization and total assets, respectively.

Regarding P/E ratios, approximately 50% of companies with both the highest and lowest ratios have Twitter accounts. The third quintile stands out as the least active in adopting Twitter. In terms of expected return on equity, nearly 50% of companies with the highest ratios have embraced Twitter, whereas only 30% of companies in the first quintile of P/E ratios have done the same (Figure 9).

The relationship between profitability and Twitter adoption is not straightforward, as companies with both high and low profitability, measured by ROA and ROE ratios, exhibit Twitter activity. However, when profits are measured by EBIT, more than 50% of companies in the lowest quintile of earnings generated from its core business activities have a Twitter account and are actively tweeting. Interestingly, companies with higher levels of indebtedness are more likely to have adopted Twitter.

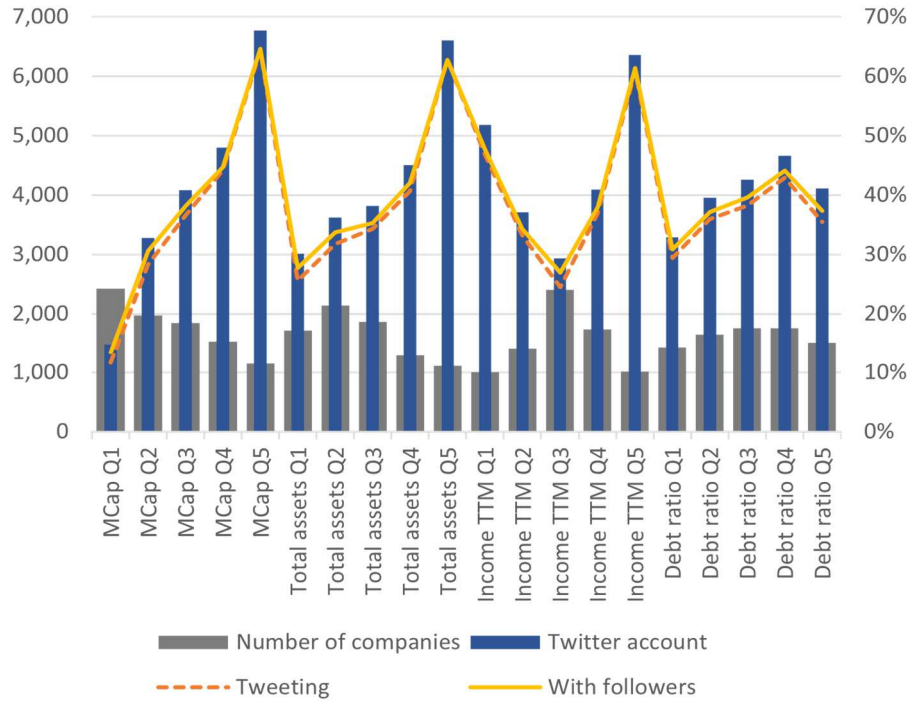

Figure 8. Activity on Twitter, measured in the number of companies and published tweets, in quintiles based on market capitalization, total assets, EBIT (Income TTM), and debt-to-equity ratio

Note: The scale on the left represents 'units' and refers to: number of companies – total number of companies, both having and not having a Twitter account; The scale on the right represents 'percentages' and refers to: (1) Twitter account – number of companies with a Twitter account / total number of companies; (2) Tweeting – number of companies actively tweeting / total number of companies; (3) With followers – number of companies with followers / total number of companies.
Source: own elaboration based on Twitter/X data and EquityRT.

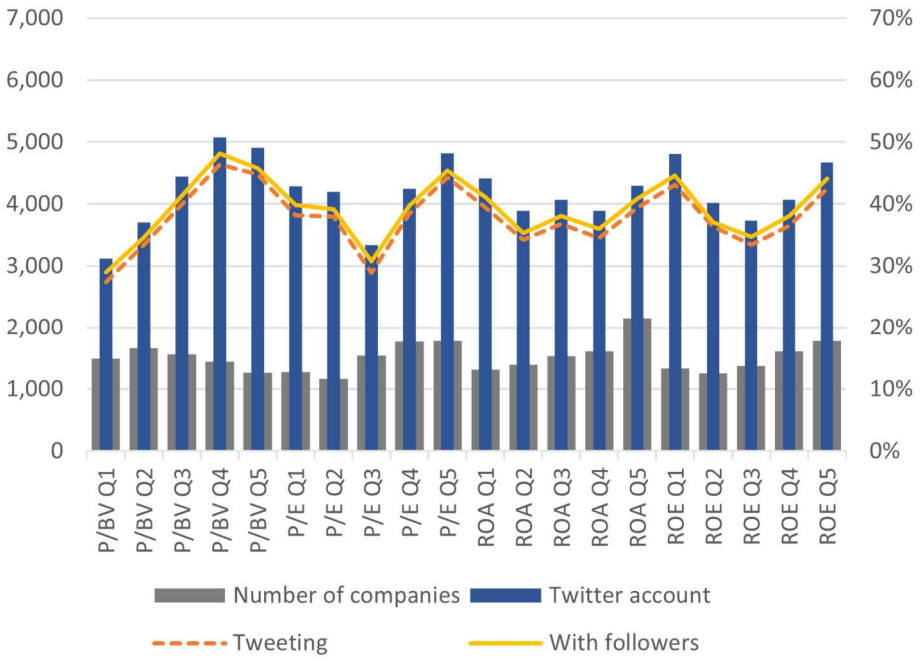

Figure 9. Activity on Twitter, measured in the number of companies and published tweets in quintiles based on P/BV, P/E, ROA, and ROE

Note: The scale on the left represents 'units' and refers to: number of companies – total number of companies, both having and not having a Twitter account; The scale on the right represents 'percentages' and refers to: (1) Twitter account – number of companies with a Twitter account / total number of companies; (2) Tweeting – number of companies actively tweeting / total number of companies; (3) With followers – number of companies with followers / total number of companies.
Source: own elaboration based on Twitter/X data and EquityRT.

Subsequently, we analysed corporate Twitter activity based on the number of published tweets (Figure 10) and the number of followers (Figure 11) for each financial measure. As indicated by market capitalization, larger companies tweet significantly more, with the largest entities tweeting approximately eight times more than the smallest ones. Notably, the largest companies are significantly more efficient in terms of followers, with an average of 16 times more followers and up to 21 times more followers at the median, than the smallest companies in the sample. A similar pattern emerges when analyzing disclosure and dissemination relative to total asset size quintiles. However, it is essential to note that larger companies extensively covered by analysts and those with high levels of institutional ownership might not always benefit from Twitter activity. Smaller companies with fewer analyst followers and institutional holdings are more likely to gain from tweeting financial information as a substitute information source (Al Guindy, 2021).

Interestingly, companies with higher levels of debt exhibit greater activity both in terms of the quantity of published information and the number of followers. However, in the case of EBIT, this relationship is not monotonic, as both companies generating the highest losses and those characterized by the highest operating income publish the most tweets and have the largest number of followers. It is important to focus on medians due to outliers and skewness in the distributions, especially concerning the number of followers.

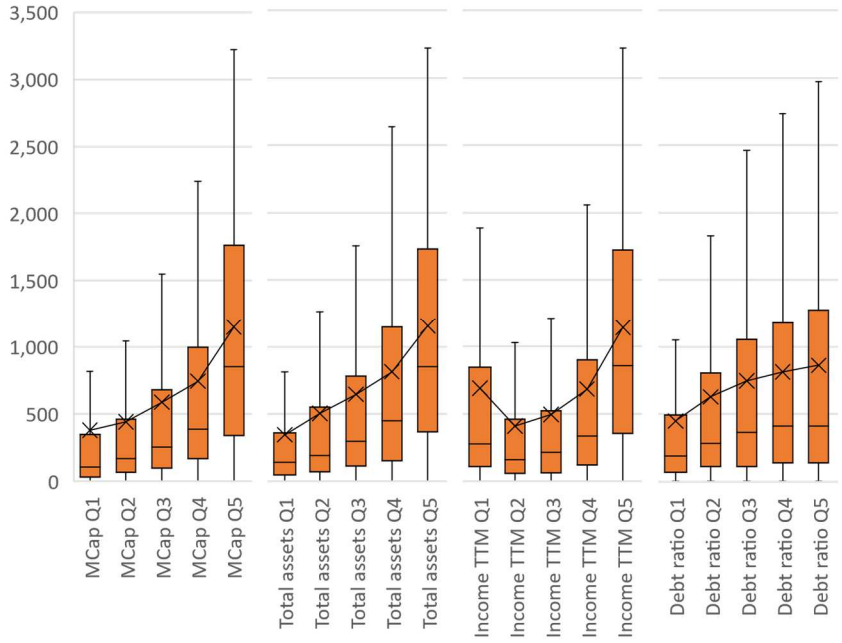

Figure 10. Activity on Twitter, measured in the number of published tweets, in quintiles based on market capitalization, total assets, EBIT, and debt-to-equity ratio

Note: The line dividing the box into two parts represents the median. We marked the mean with an x. The box part of the box plot covers the middle 50% of the values in the data set. Whiskers extend from the top of the box to the largest data point within 1.5 times the interquartile range (IQR) and from the bottom of the box to the smallest data point within 1.5 times the IQR. Data points outside this range are considered outliers and are shown as small filled-in circles. Values outside this range have been omitted.
Source: own elaboration based on Twitter/X data and EquityRT.

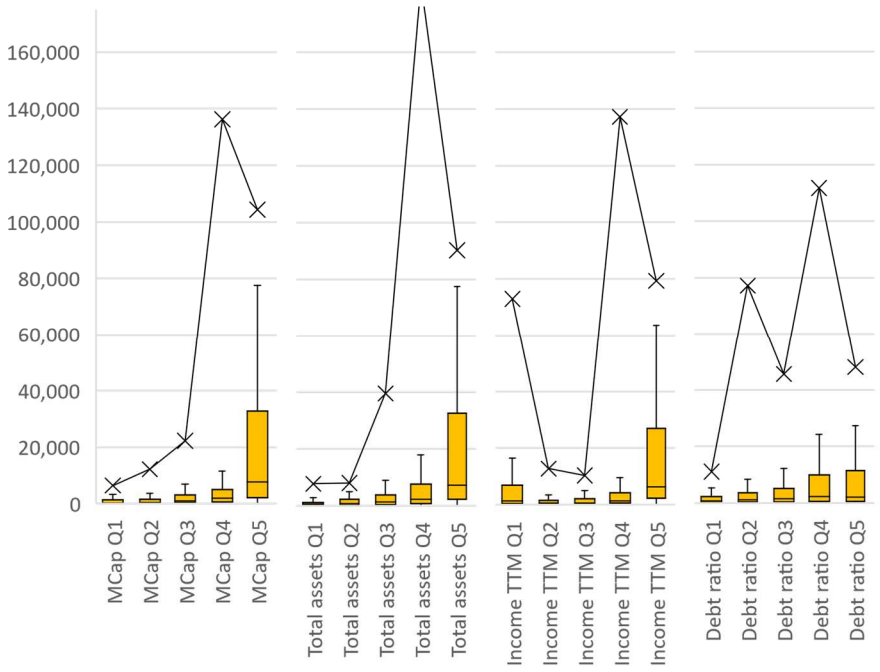

Figure 11. Activity on Twitter measured in the number of followers, in quintiles based on market capitalization, total assets, EBIT, and debt-to-equity ratio

Note: The line dividing the box into two parts represents the median. We marked the mean with and x. The box part of the box plot covers the middle 50% of the values in the data set. Whiskers extend from the top of the box to the largest data point within 1.5 times the interquartile range (IQR) and from the bottom of the box to the smallest data point within 1.5 times the IQR. Data points outside this range are considered outliers and are shown as small filled-in circles. Values outside this range have been omitted. Mean outside the chart area for Total assets Q4 = 184k.

Source: own elaboration based on Twitter/X data and EquityRT.

Figures 12 and 13 present descriptive statistics for P/BV, P/E, ROA, and ROE measures. In the case of P/BV ratios, the mean values of published tweets showed minor differences across individual quintiles, though a decreasing trend is evident. Similarly, median tweet volumes showed subtle changes in the quantity of published tweets depending on quintile placement. Companies with higher long-term growth potential tend to publish fewer tweets compared to those with book values higher than market values. This pattern holds true for follower counts as well.

For the P/E ratio, both the average and median of tweets increase, peaking in the fifth quintile for the average and the fourth quintile for the median. Companies valued at a premium due to anticipated profit potential tend to publish more tweets. As investor expectations for future earnings growth rise, follower counts also significantly increase.

Companies incurring losses tend to tweet less than profitable counterparts, especially concerning ROA and ROE metrics. Conversely, entities with high profitability, particularly those in the fifth quintile, exhibit lower levels of Twitter activity than those generating lower returns. The third quintile showcases the highest average and median values for both ROE and ROA, with similar patterns observed for follower counts.

These findings underscore the nuanced relationship between financial characteristics and Twitter activity among European-listed companies, highlighting the influence of size, profitability, and valuation metrics on social media engagement.

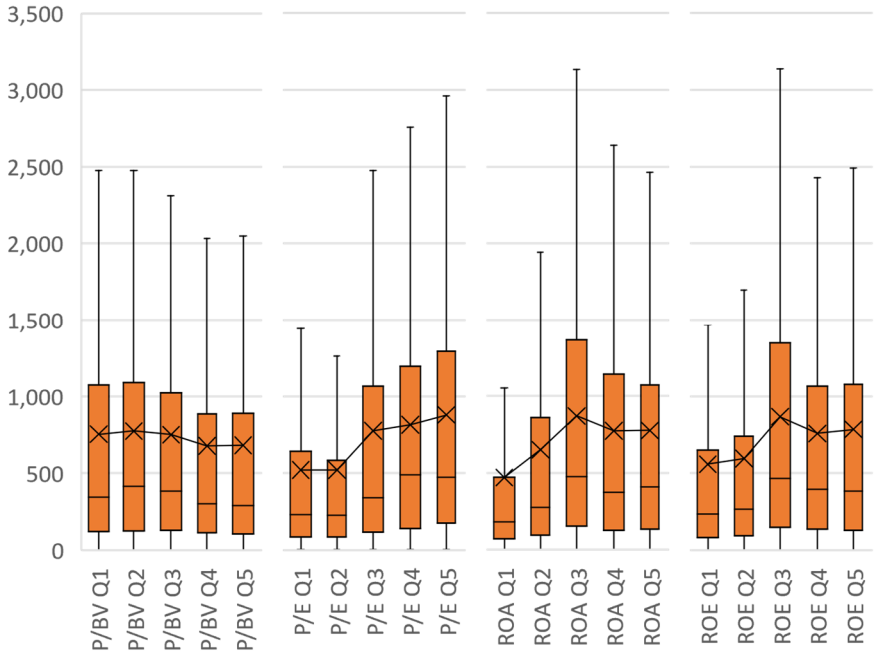

Figure 12. Activity on Twitter, measured in the number of published tweets, in quintiles based on P/BV, P/E, ROA, and ROE

Note: The line dividing the box into two parts represents the median. We marked the mean with and x. The box part of the box plot covers the middle 50% of the values in the data set. Whiskers extend from the top of the box to the largest data point within 1.5 times the interquartile range (IQR) and from the bottom of the box to the smallest data point within 1.5 times the IQR. Data points outside this range are considered outliers and are shown as small filled-in circles. Values outside this range have been omitted.
Source: own elaboration based on Twitter/X data and EquityRT.

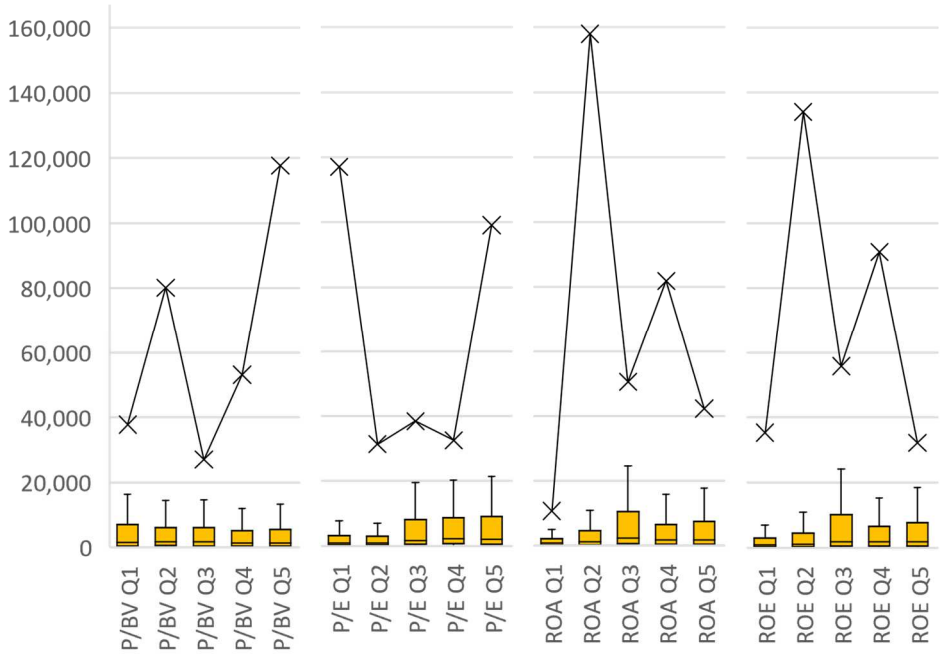

Figure 13. Activity on Twitter measured in the number of followers in quintiles based on P/BV, P/E, ROA, and ROE

Note: The line dividing the box into two parts represents the median. We marked the mean with and x. The box part of the box plot covers the middle 50% of the values in the data set. Whiskers extend from the top of the box to the largest data point within 1.5 times the interquartile range (IQR) and from the bottom of the box to the smallest data point within 1.5 times the IQR. Data points outside this range are considered outliers and are shown as small filled-in circles. Values outside this range have been omitted.
Source: own elaboration based on Twitter/X data and EquityRT.

CONCLUSIONS

This article aimed to explore the extent to which Twitter has been adopted for corporate communication purposes in the European context and to determine whether the profitability of European listed firms is linked to their use of Twitter. Using a large, novel dataset comprising nearly 5.5 million tweets from 41 European stock exchanges, we provided a comprehensive overview of the social media activity of 21 319 listed companies. Noteworthy, the rules and procedures governing corporate communication in the European Union are more strict in the European Union compared to the United States. Companies may post their news on social media, but only after it has first made it available via a regulatory information service. As a result, we confirmed our first hypothesis (H1) that the level of Twitter/X adoption for corporate communication in companies listed in Europe is lower than in the North American ones. This is especially visible in the case of companies listed on the stock exchanges of Eastern Europe, most likely reflecting the comparatively underdeveloped technological landscape in these regions.

Larger companies (H2) are more likely to have a Twitter/X account and engage in more activity. This is because they have more resources, such as marketing budgets and public relations teams, and that their customers come from a variety of geographical regions and industries, making social media an effective tool for reaching this diverse audience.

The relationship between profitability and Twitter adoption (H3) is not clear, as companies with both high and low returns on assets and equity (ROA and ROE ratios) engage in Twitter activity. However, when profits are measured by EBIT (Income TTM), more than half of companies in the lowest quintile of earnings from core business activities have a Twitter account and actively tweet. Interestingly, in the case of EBIT, the relationship between profitability and activity, as measured by the quantity of published information and the number of followers, is not monotonic, as both companies generating the highest losses and those with the highest operating income publish the most tweets and have the greatest number of followers.

Growth companies (in terms of P/BV and P/E ratio) are more likely to use Twitter/X for corporate communications (H4). However, roughly half of the companies with the lowest ratios have Twitter accounts. The third quintile is the least active in adopting Twitter. For the P/E ratio, both the average and median number of tweets rise, peaking in the fifth quintile for the average and the fourth for the median. Companies that are valued at a premium due to their anticipated profit potential tend to tweet more. As investors' expectations for future earnings growth rise, so do follower counts.

Interestingly, companies with higher levels of debt (H5) are more likely to have adopted Twitter and exhibit greater activity, both in terms of published information and number of followers. We also found that the use of Twitter is more prevalent in certain industries, such as technology and consumer goods, and that larger firms tend to have more Twitter followers.

The implications of our research suggest that companies should consider adopting social media as part of their communication strategy to enhance their financial performance. Our study contributes to the understanding of social media's role in corporate communication and its potential impact on the financial performance of European listed firms.

For European companies, while the use of Twitter is not mandatory, several stock exchanges and regulatory bodies actively encourage adopting social media platforms to enhance market transparency and improve communication with investors.

Firstly, growth-oriented companies, particularly those with high P/BV and P/E ratios, should implement a media strategy focused on regularly informing the market about their activities and progress. Investors are more interested in firms that consistently share information on Twitter, as demonstrated by a substantial number of followers. Secondly, companies with higher levels of debt are advised to leverage social media platforms like Twitter to increase transparency and build trust with investors and financial institutions. Enhanced media activity can be a tool for fostering confidence among stakeholders, especially for firms seeking external financing. Lastly, regarding the relationship between Twitter usage and financial performance measured by EBIT, companies should consider tailoring their social media strategies based on their operational profitability. While the

correlation is not entirely clear—both high and low EBIT companies show increased activity on Twitter. Profit-generating firms might enhance their social media presence to maintain stakeholder engagement and attract new investors. Conversely, companies with lower operational profits can use Twitter to boost visibility and create a competitive advantage.

With the advent of social media as a means for companies to convey information to investors, this article shows that firms can attain tangible benefits. Notably, 'marginalized' firms that have historically been overlooked by traditional media are the most likely to benefit from the democratizing influence of social media.

This study is subject to limitations. First, the relatively short study period, dictated by the availability of archival Twitter data[2], means that our results may be specific to the time frame or sample used. Consequently, further research covering a longer period is needed to build confidence in the generalizability of the findings. Second, web scraping relies on the completeness and accuracy of the official websites from which data was collected. Companies that do not maintain their websites or that update their Twitter/X accounts infrequently may have been underrepresented in our dataset. Moreover, the absence of a centralized European database for corporate social media accounts introduces the possibility that some firms using unofficial Twitter/X accounts or not publicly linking them may have been missed. This could lead to selection bias, particularly among smaller firms or those based in less technologically advanced countries.

Some observations were excluded from the final analysis due to incomplete financial data for some companies. This ensures consistency between the financial and Twitter datasets but may reduce sample representativeness, especially for Eastern European firms. Thus, the results should be interpreted carefully, especially when generalizing beyond the final sample companies.

Our analysis was also limited to Twitter/X as a social media platform and did not explore the role of other platforms, such as LinkedIn or Facebook, which may also play a critical role in corporate communication strategies. Furthermore, the study is constrained by regulatory differences between regions, particularly between the European Union and the United States, which might affect the generalizability of the results. Additionally, we did not consider the impact of industry-specific practices and corporate strategies on social media adoption and usage patterns.

Another limitation is that we did not analyse the topics in the companies' tweets, as our analysis was strictly quantitative. Lower levels of Twitter activity might be attributed to a company's communication strategy, where social media is used selectively, for example, only for operational updates or marketing purposes. This suggests that a company's overall Twitter engagement may not fully reflect its investor communication efforts. Consequently, future research could expand on this by incorporating qualitative analysis of tweet content to provide deeper insights into the nature of corporate social media activity.

While this study primarily focuses on a descriptive analysis of Twitter/X activity among European firms, future research could investigate potential causal mechanisms. One possible explanation is that firms active on Twitter/X may leverage social media for more transparent and frequent communication, which can reduce information asymmetry and potentially lower the cost of equity (Vitolla *et al.,* 2020). Moreover, firms that use Twitter to engage with customers and investors might experience enhanced brand loyalty and customer satisfaction (de Oliveira Santini *et al.,* 2020), which could translate into better financial performance in the long run. However, establishing a direct causal relationship between Twitter/X activity and financial outcomes requires further empirical investigation, as such relationships might be industry-specific and time-dependent (Bank *et al.,* 2019). Future studies could use time-lagged models to assess the long-term effects of social media engagement on profitability, growth, and leverage.

Finally, further studies could investigate the role of regulatory environments in shaping disclosure and dissemination strategies. More detailed research on Twitter's potential to substitute for traditional communication channels would also be beneficial. Examining how companies' Twitter activity

[2] As stated in Twitter's developer documentation, the API provides access to only the most recent 5 000 followers and up to the latest 3 200 tweets from a user.

evolves and how these changes correlate with shifts in business fundamentals could provide valuable insights into the relationship between social media presence and corporate performance.

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Appendix

Table A1. Twitter activity in number of tweets and followers

	N	Tweets					Followers				
		N	Mean	Q1	Median	Q3	N	Mean	Q1	Median	Q3
Country	21 319	7 107 (33.3%)					7 341 (34.4%)				
Ireland	29	14 (48.3%)	683	133	360	954	15 (51.7%)	69 715	1 710	2 551	14 204
Finland	176	100 (56.8%)	792	151	420	1 017	102 (58.0%)	47 770	708	1 961	5 168
United Kingdom	1 616	828 (51.2%)	778	130	392	1 070	849 (52.5%)	70 459	562	1 634	7 194
France	875	428 (48.9%)	752	112	368	1 075	449 (51.3%)	50 617	496	1 520	4 639
Netherlands	123	56 (45.5%)	729	171	336	957	59 (48.0%)	43 345	1 122	3 621	15 065
Turkey	279	99 (35.5%)	460	109	334	504	111 (39.8%)	143 757	457	2 203	14 596
Malta	39	17 (43.6%)	232	24	74	402	17 (43.6%)	1 575	167	571	3 019
Switzerland	296	123 (41.6%)	800	184	452	1 088	127 (42.9%)	23 671	588	2 059	5 993
Italy	447	155 (34.7%)	747	115	364	958	167 (37.4%)	84 751	351	1 221	6 280
Spain	305	112 (36.7%)	1 168	329	912	1 900	111 (36.4%)	343 811	1 447	3 674	18 629
Czech Republic	25	8 (32.0%)	1 328	664	1 016	2 176	8 (32.0%)	6 880	1 569	3 401	7 064
Denmark	185	62 (33.5%)	690	93	242	768	64 (34.6%)	22 687	291	2 212	13 810
Sweden	840	270 (32.1%)	422	75	169	481	272 (32.4%)	35 671	260	671	2 126
Belgium	171	53 (31.0%)	639	61	221	578	56 (32.7%)	4 185	356	1 171	4 641
Norway	243	79 (32.5%)	485	91	222	416	76 (31.3%)	4 091	557	1 439	4 777
Liechtenstein	3	1 (33.3%)	497	497	497	497	1 (33.3%)	824	824	824	824

	N	Tweets					Followers				
		N	Mean	Q1	Median	Q3	N	Mean	Q1	Median	Q3
Germany	933	275 (29.5%)	821	150	472	1 175	279 (29.9%)	61 346	357	1 616	8 881
Portugal	68	17 (25.0%)	914	134	514	1 542	16 (23.5%)	220 832	510	1 078	58 758
Latvia	27	5 (18.5%)	197	70	192	314	6 (22.2%)	1 909	376	636	1 542
Poland	843	181 (21.5%)	572	71	203	757	203 (24.1%)	12 294	92	506	2 822
Austria	86	20 (23.3%)	471	268	353	506	19 (22.1%)	2 530	547	2 056	2 892
Iceland	25	5 (20.0%)	307	142	195	293	6 (24.0%)	2 458	539	1 015	3 425
Greece	233	43 (18.5%)	675	55	178	673	49 (21.0%)	13 751	153	948	2 999
Romania	90	8 (8.9%)	795	49	159	1 470	11 (12.2%)	6 534	155	550	3 707
Luxembourg	13	2 (15.4%)	649	363	649	936	2 (15.4%)	14 181	11 015	14 181	17 347
Hungary	39	3 (7.7%)	760	63	109	1 131	4 (10.3%)	44 483	20	45	44 508
Slovenia	86	9 (10.5%)	821	3	496	1 025	10 (11.6%)	2 116	302	530	1 520
Croatia	148	14 (9.5%)	340	51	103	234	14 (9.5%)	2 928	1 067	2 229	2 509
Cyprus	172	13 (7.6%)	184	20	50	92	12 (7.0%)	458	28	104	747
Bulgaria	422	27 (6.4%)	370	50	127	236	29 (6.9%)	3 046	95	197	977
Lithuania	33	2 (6.1%)	47	31	47	62	2 (6.1%)	151	92	151	209
Slovakia	68	3 (4.4%)	88	44	67	122	3 (4.4%)	897	142	197	1 303
Estonia	22	0 (0.0%)					0 (0.0%)				
Other European	1 173	59 (5.0%)	569	67	189	610	77 (6.6%)	21 961	68	546	5 023
USA & Canada	6 557	3 144 (47.9%)	837	124	418	1 224	3 175 (48.4%)	90 757	631	2 098	9 939
Americas	195	62 (31.8%)	1 230	303	1 012	2 201	73 (37.4%)	159 979	3 967	28 085	140 138
Australia and Oceania	1 240	383 (30.9%)	453	73	197	508	397 (32.0%)	9 991	354	858	2 458
Africa	231	65 (28.1%)	871	193	631	1 198	70 (30.3%)	85 307	1 997	5 228	14 699
Asia	2 963	362 (12.2%)	889	130	509	1 376	400 (13.5%)	136 967	774	4 644	41 799
Industry	21 098	7 088 (33.6%)					7 320 (34.7%)				
Computer Softw. & Svcs.	1 464	858 (58.6%)	1 043	171	600	1 737	853 (58.3%)	55 334	564	2 317	10 472
Communication Svcs.	519	251 (48.4%)	1 118	198	677	2 038	259 (49.9%)	80 509	851	3 407	23 429
Medical Care	2 324	1 048 (45.1%)	457	85	228	547	1 046 (45.0%)	11 043	392	983	2 986
Banking	697	296 (42.5%)	1 100	282	782	1 654	314 (45.1%)	94 936	1 406	4 605	45 461
Insurance	291	125 (43.0%)	1 030	375	729	1 512	129 (44.3%)	43 906	1 293	3 173	14 516
Media & Marketing	689	281 (40.8%)	1 044	144	565	1 781	290 (42.1%)	348 981	984	3 917	20 346
Commercial Svcs.	609	244 (40.1%)	918	169	523	1 424	253 (41.5%)	9 680	394	1 456	6 412
IT Hardware & Electron-ics	680	276 (40.6%)	792	113	391	1 147	282 (41.5%)	59 550	444	1 263	8 636
Utilities	499	169 (33.9%)	938	226	588	1 364	175 (35.1%)	16 210	961	3 044	8 598
Retail	656	214 (32.6%)	1 298	264	1 013	2 416	231 (35.2%)	249 058	1 801	9 290	66 599
Metals & Mining	2 281	696 (30.5%)	334	45	144	355	738 (32.4%)	3 211	349	850	1 991

	N	Tweets					Followers				
		N	Mean	Q1	Median	Q3	N	Mean	Q1	Median	Q3
Automotive & Truck Mfg.	410	135 (32.9%)	783	143	419	1 148	138 (33.7%)	112 241	505	2 788	19 882
Industrial Goods & Svcs.	1 363	436 (32.0%)	581	125	328	772	444 (32.6%)	19 183	404	1 461	5 269
Consumer Svcs.	894	271 (30.3%)	1 148	145	635	2 229	286 (32.0%)	481 355	1 050	5 701	39 994
Chemicals	439	141 (32.1%)	594	129	380	804	142 (32.3%)	10 160	584	1 638	5 432
Transportation & logis-tics	519	146 (28.1%)	961	159	459	1 422	163 (31.4%)	158 886	1 136	5 502	46 418
Consumer durables	262	72 (27.5%)	841	53	247	1 516	80 (30.5%)	50 403	335	2 117	13 476
Energy	1 237	324 (26.2%)	449	61	201	536	336 (27.2%)	17 404	285	1 080	4 381
Financial svcs.	1 286	299 (23.3%)	796	103	352	1 222	317 (24.7%)	44 799	323	1 932	12 801
Engineering & construc-tion	755	171 (22.6%)	803	170	542	1 165	176 (23.3%)	17 143	629	2 499	11 328
Consumer products	1 048	224 (21.4%)	832	124	451	1 197	238 (22.7%)	28 573	800	4 117	18 064
Materials	475	102 (21.5%)	484	158	346	616	106 (22.3%)	3 230	471	1 747	3 163
Textile & apparel	361	69 (19.1%)	848	155	529	1 243	79 (21.9%)	510 953	676	5 225	43 542
Real estate	1 340	240 (17.9%)	638	108	282	805	245 (18.3%)	11 274	385	1 337	4 404

Source: own study.

Table A2. Twitter activity in quintiles of selected variables

		Tweets					Followers				
		N	Mean	Q1	Median	Q3	N	Mean	Q1	Median	Q3
P/BV	7 407	2 817 (38.0%)					2 920 (39.4%)				
P/BV Q1 (0.0 – 0.7)	1 491	408 (27.4%)	753	120	346	1 074	432 (29.0%)	37 762	341	1 601	6 986
P/BV Q2 (0.7 – 1.3)	1 657	554 (33.4%)	774	124	415	1 089	574 (34.6%)	80 175	529	1 762	6 110
P/BV Q3 (1.3 – 2.5)	1 556	621 (39.9%)	750	127	385	1 021	643 (41.3%)	27 003	425	1 648	6 135
P/BV Q4 (2.5 – 6.4)	1 442	669 (46.4%)	677	112	302	885	694 (48.1%)	53 159	406	1 386	5 100
P/BV Q5 (6.4 – 16 250 000.0)	1 261	565 (44.8%)	682	105	290	888	577 (45.8%)	117 749	420	1 277	5 605
P/E	7 522	2 840 (37.8%)					2 947 (39.2%)				
P/E Q1 (-9 026 951 – -11)	1 272	485 (38.1%)	521	84	230	640	507 (39.9%)	117 049	285	948	3 241
P/E Q2 (-11 – -1)	1 163	442 (38.0%)	521	84	226	581	456 (39.2%)	31 359	266	895	2 981
P/E Q3 (-1 – 8)	1 544	446 (28.9%)	775	117	339	1 064	475 (30.8%)	38 448	437	1 733	8 137
P/E Q4 (8 – 21)	1 764	679 (38.5%)	815	142	490	1 194	702 (39.8%)	32 540	657	2 279	8 781
P/E Q5 (21 – 589 347)	1 779	788 (44.3%)	878	174	474	1 290	807 (45.4%)	99 079	605	2 022	9 009
ROA	8 001	2 962 (37.0%)					3 073 (38.4%)				
ROA Q1 (-1 280 064 – -88)	1 309	517 (39.5%)	471	71	184	471	538 (41.1%)	10 739	275	804	2 187
ROA Q2 (-88 – -10)	1 390	476 (34.2%)	651	96	278	859	491 (35.3%)	157 968	321	1 246	4 641
ROA Q3 (-10 – 6)	1 535	565 (36.8%)	870	155	476	1 366	584 (38.0%)	50 530	628	2 322	10 605
ROA Q4 (6 – 26)	1 613	557 (34.5%)	773	129	376	1 144	580 (36.0%)	81 884	454	1 809	6 633
ROA Q5 (26 – 778 365)	2154	847 (39.3%)	777	136	410	1 072	880 (40.9%)	42 305	544	1 741	7 446
ROE	7 343	2 830 (38.5%)					2 932 (39.9%)				

		Tweets					Followers				
		N	Mean	Q1	Median	Q3	N	Mean	Q1	Median	Q3
ROE Q1 (-680.81 – -0.11)	1 332	574 (43.1%)	559	82	236	651	594 (44.6%)	35 341	302	924	3 003
ROE Q2 (-0.11 – 0.00)	1 249	454 (36.3%)	595	96	265	739	463 (37.1%)	134 078	326	1 153	4 564
ROE Q3 (0.00 – 0.03)	1 375	459 (33.4%)	867	149	467	1 348	478 (34.8%)	55 792	476	1 874	10 201
ROE Q4 (0.03 – 0.09)	1 610	588 (36.5%)	758	138	396	1 068	613 (38.1%)	91 110	608	1 838	6 505
ROE Q5 (0.09 – 714.55)	1 777	755 (42.5%)	785	128	383	1 079	784 (44.1%)	32 282	534	1 850	7 718
MCap	8 920	2 931 (32.9%)					3 059 (34.3%)				
MCap Q1 (0 – 7 795)	2 419	281 (11.6%)	379	34	106	350	325 (13.4%)	6 446	68	359	1 508
MCap Q2 (7 797 – 44 132)	1 977	560 (28.3%)	442	67	168	462	604 (30.6%)	12 258	149	496	1 591
MCap Q3 (44 158 – 216 755)	1 843	674 (36.6%)	589	100	257	681	703 (38.1%)	22 224	378	1 049	3 061
MCap Q4 (216 852 – 1 385 252)	1 531	677 (44.2%)	745	168	386	998	684 (44.7%)	136 226	697	1 947	5 079
MCap Q5 (1 385 489 – 31 956 050 635)	1 150	739 (64.3%)	1 150	343	853	1 763	743 (64.6%)	104 337	2 140	7 700	32 797
Total assets	8 110	2 977 (36.7%)					3 089 (38.1%)				
Total assets Q1 (0 – 11 986)	1 715	439 (25.6%)	346	50	143	361	476 (27.8%)	7 715	118	436	1 165
Total assets Q2 (11 995 – 85 468)	2 137	678 (31.7%)	504	71	194	551	720 (33.7%)	7 912	233	743	2 152
Total assets Q3 (85 593 – 489 982)	1 862	639 (34.3%)	646	115	296	780	656 (35.2%)	39 529	416	1 231	3 848
Total assets Q4 (490 058 – 2 914 242)	1 283	522 (40.7%)	813	152	451	1 148	539 (42.0%)	184 151	766	2 221	7 646
Total assets Q5 (2 915 335 – 4 179 806 612)	1 113	699 (62.8%)	1 154	368	852	1 729	698 (62.7%)	90 296	2 329	7 224	32 621
Income TTM	7 561	2 783 (36.8%)					2 888 (38.2%)				
Income TTM Q1 (-10 879 938 422 – -4 895 766)	1 001	469 (46.9%)	689	111	276	847	478 (47.8%)	72 945	498	1 461	6 966
Income TTM Q2 (-4 888 751 – -315 490)	1 409	468 (33.2%)	410	58	162	460	483 (34.3%)	12 774	192	587	1 563
Income TTM Q3 (-314 821 – 7 056 869)	2 404	589 (24.5%)	495	62	215	524	647 (26.9%)	10 376	161	608	2 088
Income TTM Q4 (7 065 272 – 96 364 076)	1 734	640 (36.9%)	684	122	334	901	658 (37.9%)	137 148	542	1 466	4 187
Income TTM Q5 (96 371 269 – 59 143 674 872)	1 013	617 (60.9%)	1 142	355	857	1 722	622 (61.4%)	79 326	2 264	6 263	26 936
Debt ratio	8 110	2 977 (36.7%)					3 089 (38.1%)				
Debt ratio Q1 (0.0 – 0.3)	1 438	423 (29.4%)	449	70	191	495	444 (30.9%)	11 084	229	719	2 289
Debt ratio Q2 (0.3 – 0.5)	1 649	593 (36.0%)	628	113	284	805	612 (37.1%)	77 242	407	1 205	3 660
Debt ratio Q3 (0.5 – 0.6)	1 760	673 (38.2%)	747	112	364	1 055	696 (39.5%)	45 662	438	1 565	5 193
Debt ratio Q4 (0.6 – 0.8)	1 754	753 (42.9%)	812	138	410	1 179	774 (44.1%)	111 754	513	2 280	10 002
Debt ratio Q5 (0.8 – 14 073.1)	1 509	535 (35.5%)	861	140	411	1 276	563 (37.3%)	48 158	542	2 056	11 482

Source: own study.

Authors

The contribution share of authors is equal and amounted to 25% for each of them.
KBK – conceptualization, analysis and interpretation, writing – original draft , CG – critical review, writing – review & editing , JC – methodology, formal analysis, visualization , RG – data curation, data analysis, writing – review & editing.

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Use of Artificial Intelligence

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