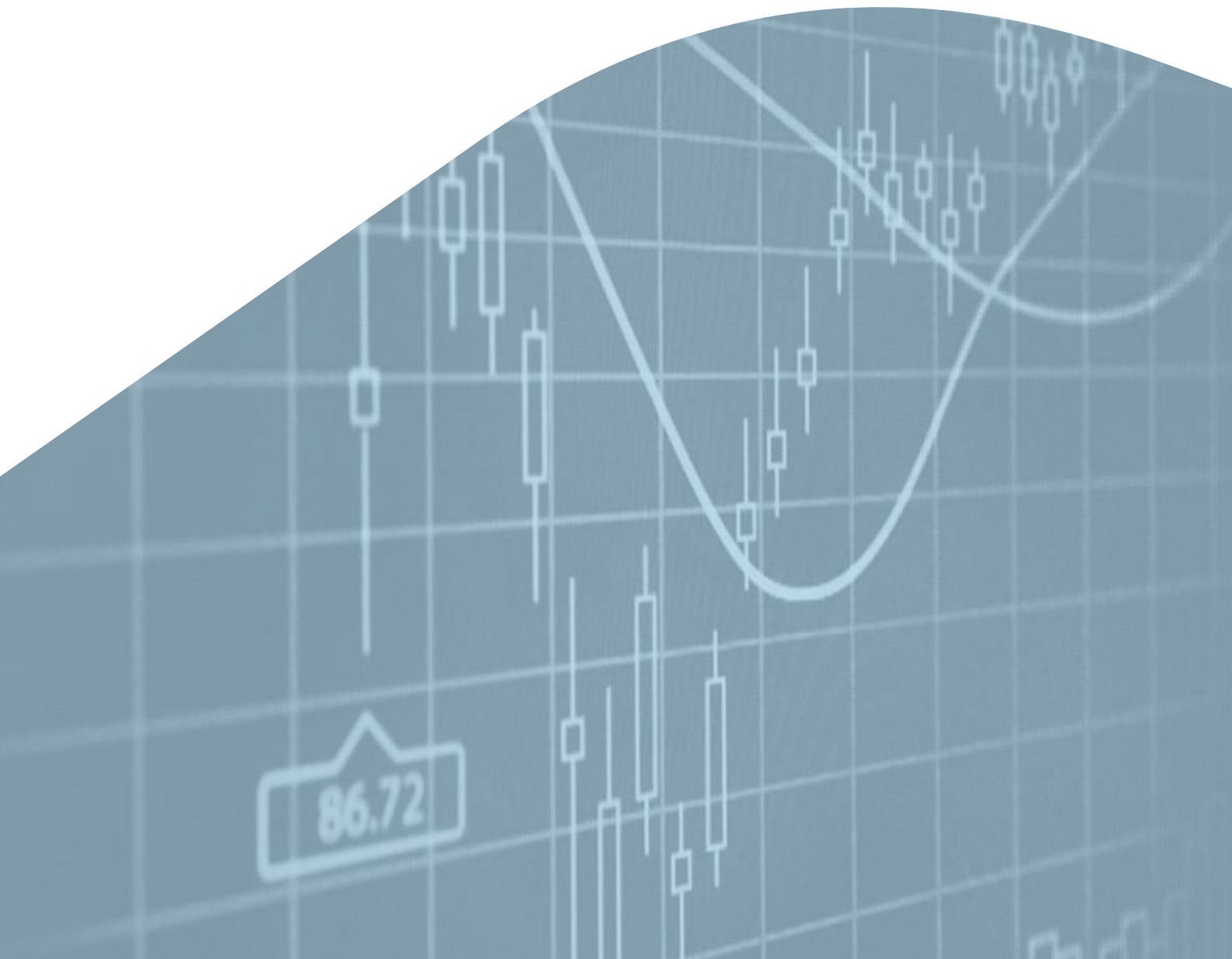ESMA TRV Risk Analysis

Consumer Protection

Social media sentiment: Influence on EU equity prices

ESMA Report on Trends, Risks and Vulnerabilities Risk Analysis

Investor protection

Social media sentiment impact on EU equity prices

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Summary

On social media platforms, investors are nowadays able to share information, opinions and views at a large scale in real time. The quality and validity of information shared by individuals in that way cannot be taken for granted. In this respect, social media posting differs fundamentally from journalism: specialised financial media are held accountable for the accuracy of the information they report.

This is not necessarily the case for social media. The impact of social-media information in securities markets is, therefore, a growing market and public policy concern. Increasing social media interactions and related sentiment among investors influence the collective investor behaviour with potential effects on financial market dynamics. This comes with notable risks for retail investors raising investor protection concerns. It may also involve wider market movements with systemic implications, increasing financial stability concerns.

Against this background, this article investigates the influence specifically of social media activity and sentiment on stock prices. The main findings identify only a transitory effect of social media sentiment on stock excess returns. Positive social media sentiment seems to be correlated with higher returns in the very short-term.

In this sense, information spreading on social media platforms may affect investor trading choices and may amplify daily market movements. However, price overreaction typically does not last more than one day and is only transitory. This points to the risk of investors excessively relying on social media news whose truthfulness and accuracy is difficult to verify.

With this analysis, we cast a first light on the market impact of social-media information in the EU. Other transmission channels and market impacts are likely to exist, and more analytical work and monitoring need to be undertaken to obtain a fuller picture of the risks for individual investors and markets at large.

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[1]   This article was written by Manuel Baierlacher, Lorenzo Danieli, Tania De Renzis, Aira Dominique Gutierrez.

Introduction

Technological development and **digitalisation have radically modified the way information is made accessible and consumed** across industries, including the financial sector. Important changes relate to the significant expansion of social media and their impact on information accessibility and diffusion. At the beginning of 2023, there were 350mln social media users in EU, or 80% of the European Union (EU) population, against 246mln (73%) in the US and 57mln (84%) in the UK. Overall, there were 4.8bn social media users globally (60% of the total global population).[2]

In financial markets, digitalisation has changed both, the demand and supply sides of investing.[3] Social media platforms, financial blogs and online forums have greatly facilitated **social interactions** with notable effects on economic and financial decisions of individuals (Kuchler and Stroebel, 2021).

Moreover, the **emergence of new infrastructures**, such as online broker platforms and trading apps offering low (or zero) fees, have facilitated access to financial products. Investors are now able to share information, views and their own investing and trading behaviour at a large scale in real time and can quickly process transactions on their apps.

Previous research shows the impact of social media on stock market developments. Some studies show that the effect of social media on stock prices developments is higher than that of conventional media, in particular on the daily basis. Chen *et al.* (2014) find that the opinions revealed on social media strongly predict future stock returns and earnings surprises. Their findings point to the usefulness of peer-based advice in financial markets.

Part of the literature focuses on the differences in behaviour between institutional and retail investors. Ben-Rephael *et al.* (2017) find that institutional attention responds more quickly to major news events, leads retail attention, and facilitates permanent price adjustment. The well-documented price drifts following both earnings announcements and analyst recommendations are driven by announcements where institutional investors fail to pay sufficient attention.

Tan and Tas (2020) show that daily firm-specific Twitter sentiment contains information for predicting future stock returns. This predictive power is higher where there is high information asymmetry. The results show the role of social media in diffusing sentiment to investors who may unintentionally cause prices to be less efficient in the short term. Institutional investors can exploit the behaviour of irrational investors as sentiment-driven noise traders who use social media platforms.[4]

This generates **concerns from an investor protection perspective and, potentially, for market manipulation.** The risk of exposure to unverified information is likely higher when relying on social media compared to specialised press and media, which are accountable for the content of the news and information they provide.

This increased access to unverified information may increase the probability of taking a wrong trading decision and, by consequence, incurring financial losses. In this context, the risks of substantial detriment remain high, especially for less-informed investors or investors with limited means, knowledge and experience. The lack of financial skills might lead them to follow (non-professional) influencers' recommendation with the risk to be exposed to manipulative schemes such as, for example, pump and dump.[5] This equates to a high probability of taking the wrong

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[2] Datareportal, Global Social Media Statistics.

[3] European Banking Authority, European Insurance and Occupational Pensions Authority and European Securities and Markets Authority, January 2022, 'Joint European Supervisory Authority response to the European Commission's February 2021 Call for Advice on digital finance and related issues: regulation and supervision of more fragmented or non-integrated value chains, platforms and bundling of various financial services, and risks of groups combining different activities', ESA 2022 01, https://www.esma.europa.eu/sites/default/files/library/esa_2022_01_esa_final_report_on_digital_finance.pdf.

[4] A noise trader is a general term used to describe traders or investors who make decisions regarding buy and sell trades in securities markets without the support of professional advice or advanced fundamental or technical analysis.

[5] A manipulative strategy to boost the price of a stock based on fake recommendations. The issuer of the manipulative scheme already has a position on the stock and takes benefit of the hype he creates. See also: *U.S. authorities charge 8 social media influencers in securities fraud scheme*.

trading decision and incurring in substantial losses.

Moreover, considering the large number of users and the amount of information circulated, this could also result in collective interdependent behaviour. This behaviour is mainly based on emotions and in-group psychology rather than advice based on economic fundamentals (e.g., herding behaviour). Eventually, this may have implications at a more systemic level increasing financial stability concerns.

The most recently observed example of this is the **Gamestop** frenzy, in January 2021, characterised by extreme price volatility and substantial retail investors' trading. Some retail investors were caught up in the hype surrounding the stock, making impulsive and uninformed decisions without fully understanding the risks involved. This reveals significant **investor protection** issues.[6]

So far, we have **not observed similar events affecting the EU retail market**. However, 80% of the EU population makes use of social media. This is a massive proportion, with a higher concentration among younger generations.

For example, in France, among investors with less than three years of financial experience, social media is the most commonly cited source of information for 18–24-year-olds (41% of those belonging to this age group). In addition, the type of sources consulted seems to correlate with the level of financial knowledge.[7]

A better understanding of the link between news on social media and developments in financial markets is, therefore, fundamental for individual investors. Information on social media, can also have wider implications in the **secondary markets** through price disruptions and increased speculation.

In light of this, **ESMA issued statements on 17 February 2021 and 21 October 2021, highlighting the social media underlying risks for retail investors,** the potential for market

abuse and the crucial roles of investor awareness and financial education.[8]

Against this background, this article aims to shed some light on social media activity in the **EU and investigates how social media interactions and sentiment relate to stock returns**.

We are aware of the limitations related to the scarcity of relevant data, especially at a more granular level (e.g., type of investor, if institutional or retail, intra-day trading and sentiment). To the best of our knowledge, however, this is the first attempt looking across several social media sources, time and countries in the EU.[9] In doing so, it raises awareness on emerging vulnerabilities for investors, and it brings some interesting results on the topic paving the way to further research.

Our **results show a significant correlation between social media interactions and stock excess returns at the very short term**, suggesting that information spreading on social media platforms influences investor trading choices and may amplify short-term financial market movements. These effects, however, do not last longer than one day and show no subsequent relationship. These dynamics therefore raise significant investor protection and orderly market concerns.

The article first provides a description of the data used. It continues by presenting the methodology developed to investigate the relation between social media sentiment and stock excess returns. It concludes by presenting the main results of the analysis.

Social media sentiment analysis

Data and sample

Our sample covers the STOXX 600 constituents for the period from **January 2019 to June 2023**.

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[6] ESMA has recently published a Warning to raise awareness to social media users and influencers about the requirements regarding investment recommendations under the Market Abuse Regulation framework and the possible market abuse which could occur on social media.

[7] Autorité des Marchés Financiers, November 2023, 'An OECD study for the AMF profiles new French retail investors'.

[8] ESMA, February 2021, "Statement: Episodes of very high volatility in trading of certain stocks"; ESMA, October 2021, "ESMA's statement on Investment Recommendations on Social Media"

[9] This article is based on data from Stockpulse. Details on the data can be found on Stockpulse website.

We used social media data from the Stockpulse database. This database includes **mentions of listed stocks, indices or crypto assets** on several social media platforms like X (formerly known as Twitter), Instagram or Reddit and forum posts on finance blogs (e.g., Seekingalpha.com or Finanzen.net). [10] For our analysis, we downloaded the daily number of positive, negative and total (including neutral) mentions of constituents of the STOXX 600, focusing on the European stock market.

Starting from the beginning of 2021, there is a clear **increase in social media activity** (Chart 1), with frequent peaks and drops. This is mostly linked to the increased attention of users towards individual stocks, which during the peaks account for 75% of the total messages.

Chart 1 shows that there is a **lack of a clear and consistent relation over time** between the overall price of the STOXX 600 and the total number of positive and negative messages relating to the single constituents of the index.

Chart 1
Social media mentions of STOXX 600 constituents
High volatility in total message flow
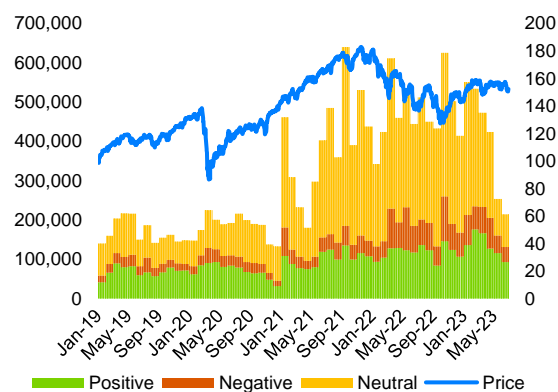
Note: STOXX 600 daily price index (100 = 01/01/2019) and social media messages mentioning constituents of the STOXX 600 Index, classified by sentiment type. "Neutral" messages are defined as the number of "Total" messages minus "Positive" and "Negative".
Sources: Stockpulse, Refinitiv Eikon, ESMA.

Data on prices, turnover, market capitalisation and implied volatility of the STOXX 600 constituents are from Refinitiv Eikon. From roughly 640,000 initial observations, the sample boils down to approximately 300,000

observations covering 580 stocks across four years and a half.

This was the result of a combination of three factors:

- the price information for 20 ISINs was not available;

- cumulated social media messages over the weekend until Mondays;

- the social media information for each and every ISIN was not available for every day of our timeframe. As a result, we end up with an unbalanced panel dataset.

Chart 2 shows the share of positive to negative social media messages of the STOXX 600 constituents and the price movements of the overall STOXX 600 index. As already observed in Chart 1, there is no clear evidence of price drops coinciding with peaks of negative social media messages consistently along the entire sample period.

This lack of alignment may be related to the fact that while the *Sentiment* refers to each single constituent of the STOXX 600, the price represents the overall index and therefore accounts for all the index constituents.

Chart 2
STOXX 600 sentiment and price index
Movements not closely aligned
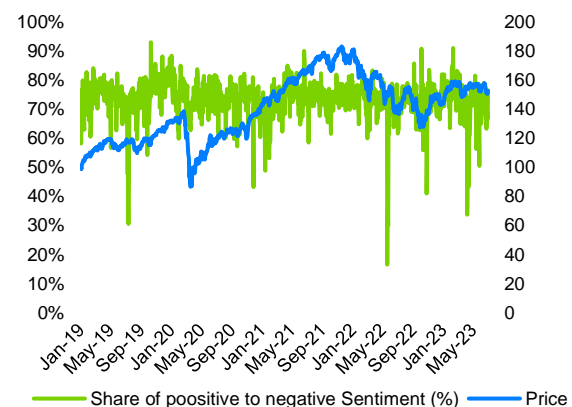
Note: Daily STOXX 600 price index (100 = 01/01/2019) and share of positive to negative total daily messages on the constituents of STOXX 600 across social media platforms.
Sources: Stockpulse, Refinitiv Eikon, ESMA.

As shown in Chart 1, the total number of social

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is calculated by Stockpulse using NLP techniques specifically adjusted to the language used in the social media context The Stockpulse Method: NLP – Stockpulse

media **messages was highly variable and increasing** in 2021. During this year, some specific stocks among the STOXX 600 constituents received substantial *Attention* compared to the previous period under analysis. This explains the large increase in the total number of messages. Also, this increase in *Attention*, does not provide information on the direction of the sentiment: posted messages can be either positive, negative or neutral.

In order to have a better picture of these dynamics, we distinguish two clusters looking at the daily sentiment among the top-10% and the bottom-90% most frequently mentioned stocks (Chart 3). While we observe overall positive sentiment across clusters, the **stocks mentioned more frequently show a more negative sentiment** compared to the stocks receiving less attention.

Chart 3
Sentiment by *Attention* buckets (top 10%/bottom 90%)
Lower sentiment for most mentioned-stocks
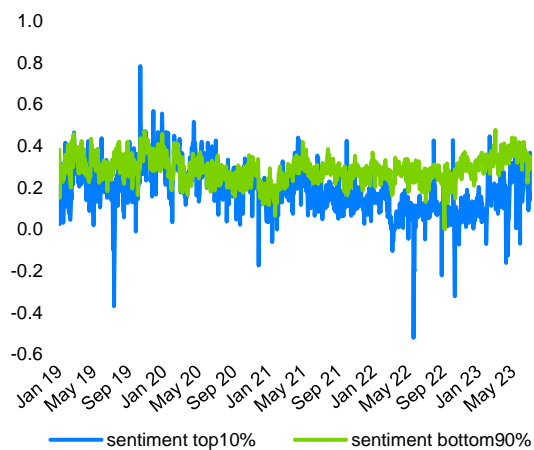
Note: Daily sentiment of top-10% and bottom-90% most mentioned STOXX 600 constituents, in %.
Sources: Stockpulse, ESMA

Methodology

To understand the impact of social media coverage on individual stocks, rather than the market at large, we investigate the relation

between **social media interactions and the excess returns** of the constituents of the STOXX 600.

To measure social media interactions, we employ two main variables: *Sentiment and Attention*. We measure *Sentiment* by the difference between the number of positive and negative messages over the total number of messages.[11] This continuous metric takes values from -1, if all messages are negative, to 1, if all messages are positive.

We measure *Attention* as a binary variable equal to 1 if the stock belongs to the cohort of stocks that are frequently mentioned on social media (for each day, we rank every stock *i* according to the total number of messages on that day; whenever a stock is ranked above the 90th percentile, it is classified as 'frequently mentioned') and 0 otherwise.

We also introduce an interaction variable between *Sentiment* and *Attention.* This is done on the assumption that the effect of sentiment on excess returns is different for most popular stocks is different than for those with less attention. It represents the additional (or reduced) effect of sentiment on excess returns of most mentioned stocks.

To examine the extent to which average social media sentiment and attention are associated with higher or lower returns, we regress (panel with fixed effects) the daily excess return of each stock on the *Sentiment* variable, how often a stock is mentioned and the interaction between these two variables.[12]

We also include a set of stock level characteristics as control variables that previous research (Tetlock, 2011; Tan and Tas, 2020) has shown to play a role in explaining stock market returns. This includes cumulative excess stock returns over the five days preceding the day under analysis, market illiquidity measured by the

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[11] This follows the methodology of the ECB statistics paper series on social media sentiment and consumer confidence, ECB (2014).

[12] Daily excess returns are defined as the difference between the daily returns on the index constituent and the daily return of the STOXX 600 equity index. Daily returns are calculated as price percentage change from t-1 to t. We perform this analysis at different points in time to test

the persistence of the social media effect. We lag sentiment and attention variables by k days, were k equals 0, 1, 5, or 10. In other words, same day analysis will be t-0, one day analysis t-1, five-days analysis t-5 and ten days analysis t-10. This can be expressed as the following formula: *Daily excess returns$_{i,t}$ = β_0 + β_1 sentiment$_{i,t-k}$ + β_2 attention$_{i,t-k}$ + β_3 sentiment$_{i,t-k}$ × attention$_{i,t-k}$ + δcontrols + α_i + $u_{i,t}$*

mean of the Amihud illiquidity indicator [13] and volatility through the VSTOXX volatility index averaged over the preceding five days, and the company size measured by market capitalisation. We introduce firm-level fixed effects, to account for unobservable firm-specific characteristics that might have an effect on excess return.[14]

Performing the analysis at different points in time aims to check the role of social media sentiment and attention over time, the same day (*t*) and one, five and ten days later (*t-1*, *t-5*, *t-10*, respectively). For the same-day analysis (*t*) and the analysis from *t-2* to *t-5*, we use daily social media data from 5pm of day *t-1* to 5pm of day *t*. For our one-day window analysis we use daily data from 5am of day *t-1* to 5am of day *t*.

While the 5pm data closely aligns with trading hours, the 5am dataset allows us to measure the social media activity and *Sentiment* shortly before markets open. This enables us to verify if social media sentiment holds information about stock prices for the following trading day.

Following previous analyses showing that social media effects lead to initial price momentum followed by reversion towards fundamentals (Pedersen, 2023; Daas *et al.*, 2014; Subrahmanyam, 2005), we expect the correlation between our variables measuring social media interactions and excess stock returns to dissipate over time.

Findings

We find that overall, the correlation between excess returns, social media sentiment and increased social media interest in specific stocks is significant on the same day and on the following day. As expected, over time the correlation between social media interactions and stock prices seems to decrease.[15]

Table 1
Sentiment and excess return analysis
Significant relation in the very short term

	(1)	(2)	(3)	(4)
	[t]	[t-1]	[t-5]	[t-10]
Sentiment	0.2***	0.1***	0	0
Attention	-0.2***	-0.1*	0	-0
Sentiment × Attention	0.7***	0.1	-0.1*	0
Controls	Yes	Yes	Yes	Yes
N	295,985	230,258	171,057	173,369

Note: Stars indicate statistical significance of the coefficient using the p-value (p), namely* p<0.1, ** p<0.05, *** p<0.01. Results still remain robust when: a) excluding the four stocks that were responsible for 75% of total messages at the peak of this metric in October 2021 and b) including time fixed effects and random fixed effects.
Source: ESMA

Positive social media *Sentiment* is correlated with higher returns only in the short-term (on the same and following day). Moreover, the magnitude of the coefficient decreases from t to t-1 (Columns 1 and 2, Table 1). Conversely, when considering *Sentiment* at day t and returns in the following five and ten days, social media explanatory variables lose predictive power (Table 1).

In our sample and for the period considered, we can observe that the most-mentioned stocks (blue line in Chart 3) receive mostly messages containing deteriorating sentiment and with few strong negative spikes, compared to those stocks that are mentioned less (green line in Chart 3). The purpose of the *Attention* variable is precisely to capture this effect.

The negative sign of the *Attention* coefficient suggests that elevated news flows mainly consist of a larger share of negative rather than positive messages.[16] In this sense, increased social media activity is correlated with lower excess returns.

We interact the *Sentiment* and the *Attention* variables to check the relation between the *Sentiment* and returns for the most mentioned

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[13] The Amihud illiquidity indicator is a metric used to assess the level of illiquidity of a stock. It is calculated as the ratio of the absolute value of the stock daily return to its average daily trading volume. In other words, it represents the average price movement of a stock traded in a single day relative to the average trading volume on that day. A low reading of the Amihud illiquidity indicator suggests that the security is more liquid, as a higher trading volume relative to price change indicates that the price is not sensitive to individual transactions.

[14] Please note that positive and negative firm events (e.g. earnings announcements, mergers and acquisitions, etc.) are also captured by the *Sentiment* and *Attention* variables.

[15] To note that following t-1, *Sentiment* results to be not significant also at intervals shorter than t-5 (e.g., t-2, t-3, t-4).

[16] As the *Attention* subsample shows a higher share of negative messages on average, we interpret the negative value of the *Attention* variable as an intercept accounting for the difference in sentiment within these two groups.

stocks (*Attention=1*). Results show that the interaction term is positive. On average, for those stocks receiving the most attention, a deterioration in social media sentiment seems to be associated with a decline of the same day stock excess returns. On the same day, the effect of a deterioration in *Sentiment* for trending stocks is associated with a decrease in excess returns for the stocks that have been receiving less attention on the social networks (Column 1, Table 1).

Conclusion

The development of social media has radically changed the scale and speed of information sharing and social interaction. The immediacy, ease and convenience with which information spreads through social media compared to more traditional channels has made it an appealing tool, including in the financial markets. However, this new means of communication may also lead to notable risks, potentially causing substantial detriment to both investor protection and financial stability.

It is important to note that specialised financial media are held accountable for the **accuracy of the information** they report. This is not necessarily the case for social media.

The amount of information exchanged through social media and the speed of its circulation generate great challenges to verifying its accuracy and truthfulness.

This may **expose individual investors to misinformation or fraud**, and thus to the risk of incurring significant losses especially given the increasing use of digital trading platforms and the overall limited financial knowledge and means.

Moreover – even if this is outside the scope of this analysis – this risk could spill over into far-reaching implications in terms of **price dislocation and market efficiency increasing financial stability concerns**.

In this context, it is relevant to start analysing the implications of social media interactions on financial markets. The scope for such an analysis, however, is large and entails several aspects that are crucial to fully understanding these dynamics. This, therefore, requires further and more accurate research that is currently impeded due to the limitation on data availability and accuracy.

This article provides the first empirical evidence on the relation between social media interactions and excess returns in equity markets in the EU. The main findings, consistent with previous research mostly focused on the US equity markets, show the **existence of a relevant and significant link between social media interaction and sentiment on stock market excess returns mostly in the very short-term**.

On average, for those stocks receiving the highest attention on social media, a deterioration in social media sentiment seems to be associated with a decline in same day stock excess returns. However, based on the sample analysed, these **excess returns are only transitory**, do not last beyond a few days and are reported without taking transaction costs into account. We do **not observe any evidence of a link between social media activity and excess returns in the longer-term**.

It thus does not appear as convenient for retail investors to predict and plan investment strategies based on social media advice. As shown in the article, elevated social media activity does not necessarily lead to financial gains.

Potential implications may be related to the risk of investors excessively relying on information spreading on social media, whose truthfulness and accuracy are difficult to verify.

Going forward, and when a larger set and more accurate data are available, we will continue to monitor developments in this area, and analyse major factors impacting the relation between social media and financial markets.

With this analysis, we cast a first light on the market impact of social-media information in the EU. **Other transmission channels and market impacts are likely to exist, and more analytical work and monitoring need to be undertaken** to obtain a fuller picture of the risks for individual investors and markets at large.

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