

Venture capital: Market observations using social media sentiment analyses

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The present study explores the use of data from social media to observe the venture capital (VC) market. Private markets such as the VC market are characterised by the fact that they are relatively illiquid, so that external influences are slow to be reflected in observable variables such as valuations and transaction volume. Furthermore, relevant information is publicly known in private markets to a limited extent only. Both of these factors hamper the real-time observation of market movements. Given that many market players actively communicate on social media, these constitute an interesting alternative source of information.

In order to examine the potential of social media news for nowcasting global venture capital market sentiment, we have generated sentiment indicators using KI-based natural language processing methods. To enable this, we have used all the English-language communication exchanged on the topic of venture capital on the platform X (formerly Twitter) between October 2022 and April 2023.

The findings suggest that the sentiment indicator so developed allows changes resulting from market-moving events to be tracked and assessed with a high degree of timeliness. Thus, sentiment dropped sharply as a result of the collapse of the Silicon Valley Bank in March 2023 (Figure 1). The further progression of the indicator in the ensuing days traces a rapid recovery of market sentiment after the government intervened to protect customer deposits. Besides, the collapse in sentiment that was measured was significantly steeper than after the collapse of the crypto exchange FTX, which reflects the impact each event had on the real economy. On a monthly

basis, there was a clear upward trend in measured sentiment since November 2022. This is in line with the development of survey-based sentiment indicators among German VC investors.

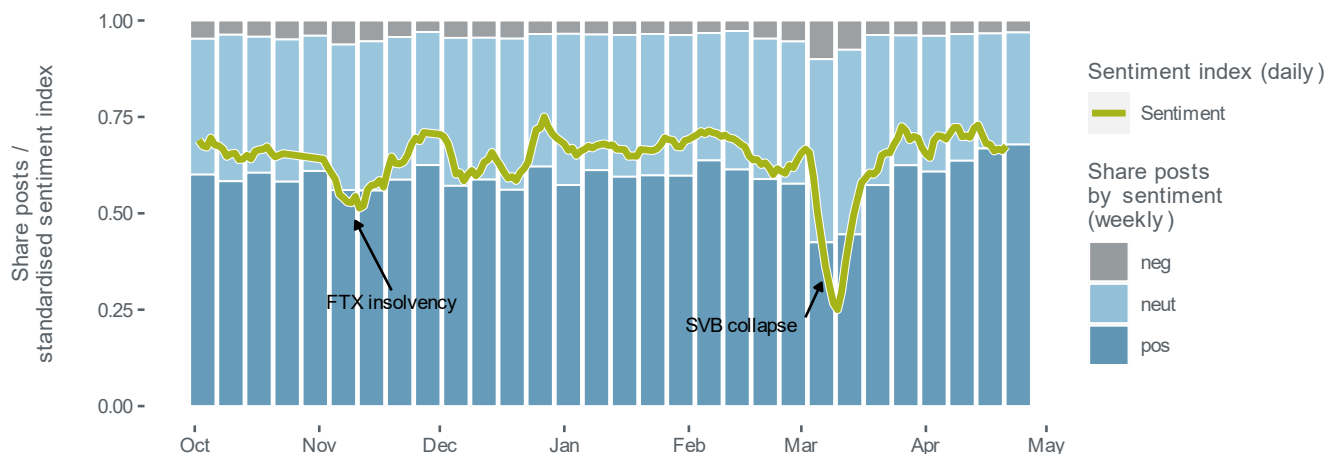
Thus, social media sentiment provides relevant information content for the observation of the VC market. A technological risk in using such sentiment indicators to observe the market lies in the availability of proprietary data from online platforms.

New data sources and analysis methods open up alternative market observation methods

In the past years, new data sources have proven helpful for obtaining information about the state of market players, markets and economies. In private markets such as the venture capital (VC) market, in particular, information is often not publicly known and, given the low liquidity, important market variables such as prices are slow to respond to external influences. Here, alternative data can deliver significant added value as leading indicators. In addition to press articles and Internet search behaviour, social media represent an interesting source of information. First, a large number of market players are represented on social media platforms and share information and opinions there on a broad scale. Second, information on social media platforms is shared with high frequency, thereby allowing timely observation practically at a daily level.

Particularly in times of rapid and profound economic changes, this provides an advantage over conventional sources of information such as survey-based indicators or transaction

Figure 1: Social media sentiment for venture capital market observation



Source: KfW Research

data, which are available only in irregular intervals or with a delay.¹

In the past years, text-based sentiment indicators have increasingly found their way into business applications such as algorithmic trading, online marketing and economic and financial market research. The relevance of sentiment indicators for forecasting real market developments has been corroborated by a broad set of literature. One exemplary channel is the uncertainty of market players, which is reflected in sentiment indicators and can lead to higher risk premiums and the deferment of investment decisions.²

Moreover, VC investors and start-ups themselves are using social media more intensively to communicate with stakeholders or to obtain information. The data shared on social media can thus also have an immediate effect on market activity. Existing studies examine the interaction between information on Twitter/X, investment decisions and investment success, for example.³ Not least, conversations on Twitter are being discussed as a catalyst for the run on the Silicon Valley Bank (SVB) in March 2023.⁴ This illustrates the effects which information sharing on social media can have on the real economy.

Sentiment analyses for nowcasting venture capital market sentiment

In order to assess the potential for using social media sentiment analyses to make observations on the global VC market sentiment, all tweets on the topic of 'venture capital' uploaded to the platform X (formerly Twitter) between 8 October 2022 and 28 April 2023 were read out.⁵ In total, the dataset thus obtained comprised 266,083 individual English-language posts.

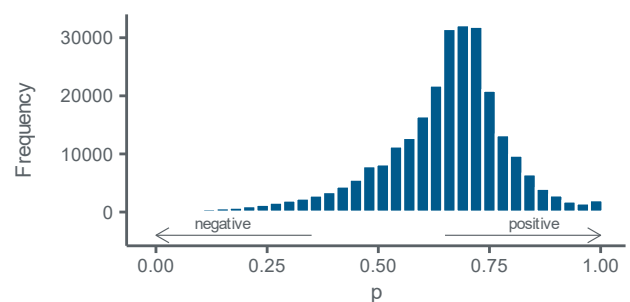
For our analysis, we used all posts in English language because i) annotated training data for sentiment analyses with tweets in English were already abundantly available, ii) the English-language forum is significantly larger than the quantity of German-language tweets and, therefore, provides more information for data-intensive machine learning (ML) models, iii) many investors and start-ups domiciled in Germany communicate in English on the platform and iv) the English-language VC market (especially the US market) is by far the most important market internationally. Not least, the fact that an estimated 40 and 29% of the funds in the German VC market came from US investors⁶ in 2021 and 2022, respectively, highlights the importance of English-language players for the development of the market in Germany.

As we have limited ourselves to English-language posts and have not distinguished posts by regional origin for the present study, our analysis mainly covers broad trends that apply to the global market and does not focus on developments taking place exclusively in the German market. Thus, economic or political developments in Germany could influence market sentiment irrespective of events taking place in the global VC market. Furthermore, differences in the significance of individual technological fields in regional VC markets could cause the dynamic of market sentiment to diverge from the global average at particular points in time. A relevant distinction of regional trends could be made using, for example, information on the location of the user profiles and could therefore be examined in future studies.

For our sentiment analysis, we trained a model on the basis of a previously annotated dataset of 1.6 million tweets.⁷ With the ML-model trained on the basis of these data, we assigned a probability (p between 0 and 1) to each tweet posted on the topic of 'venture capital'⁸ that this tweet has a positive connotation. (We used the word2vec algorithm for feature extraction based on neuronal networks and a lasso model to classify the posts). Figure 2 shows the distribution of p across all posts, illustrating that the communication on the topic of venture capital on the platform has a positive connotation in general. Our model classifies significantly more posts with a high value for p . Next, we divide all posts into negative ($p < 0.35$), neutral ($0.35 < p < 0.65$) and positive ($p > 0.65$) tweets to enable a better presentation and interpretation. Again, it is clear that the majority of tweets posted on the topic across the overall period of observation transmits positive sentiment (58.5% of the posts in the total dataset) and only a small portion of posts is to be classified as carrying a negative connotation (4.6%). The likeliest explanation for the generally positive sentiment expressed in the posts is that many market participants (start-ups as well as venture capitalists) use social media to communicate with potential investors. Therefore, their communication is not purely factual and undistorted but pursues a business objective. For market observations, however, what is crucial is not so much the overall level of sentiment on the topic but rather the variations in the market players' sentiment over time.

Figure 2: Most posts on the topic of 'venture capital' have a positive connotation

Distribution of the probability (p) of positive sentiment across all posts



Source: KfW Research

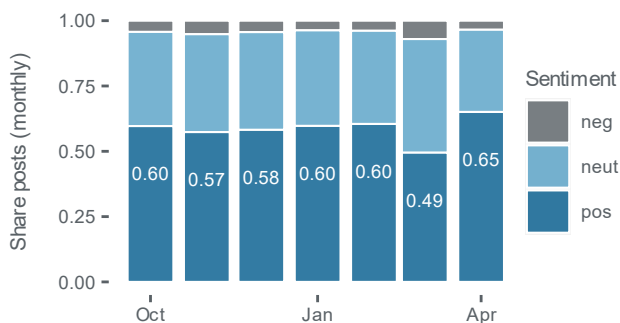
Venture capital sentiment over time

Figure 1 illustrates the key findings of our sentiment analysis. The bars show the share of posts with positive, negative and neutral connotations per week. They demonstrate that fluctuations in market sentiment occur on a weekly basis across the entire period of observation. However, the shares of negative, neutral and positive posts tweeted in the first week (calendar week 40, 2022) and the last week (calendar week 17, 2023) of the period of observation diverged only minimally at a rate of less than 10 percentage points each. One explanation for the fact that market sentiment did not exhibit a pronounced trend on a weekly basis is that economic conditions that were important for the VC market were steady during the period of observation. Thus, the start of the interest rate turnaround or the escalation of geopolitical conflicts in Europe were established already before the start of the period of observation. The fact that the sentiment indicators do not show a stronger trend is also attributable to the short period of observation of just under seven months. It can therefore be assumed that

more significant variations in market sentiment become visible only over longer periods of time.

However, the analysis on a weekly basis does suggest that even relatively minor variations in the shares of positive and negative posts can have informative value for the development of market sentiment. If we look at the corresponding shares on a monthly basis (Figure 3), we can see that the share of positive news, for example, increased successively since November 2022 (with the exception of an outlier in March 2023). This positive sentiment trend is in line with the findings for survey-based sentiment indicators for Germany during the same period. The German Venture Capital Barometer showed that sentiment in the German VC market brightened from the fourth quarter of 2022 to the second quarter of 2023.⁹

Figure 3: Share of positive posts per month increased over time



Source: KfW Research

Market observations in real time

In addition to observing the share of positive and negative communication, the sentiment measured via social media can be condensed into an aggregate index. We used the average of the probability p calculated in the model across all posts as an aggregate sentiment indicator. Thus, higher indicator values stand for more positive sentiment. As the current analysis provides the great advantage of enabling real-time market observation, we calculated the indicator on a daily basis. We used the seven-day moving average to smooth the indicator over time. In order to make the variation in the indicator thus obtained more visible for the graphical representation, we standardised its values by setting its minimum at 0.25 and its maximum at 0.75. The line chart in Figure 1 represents the aggregate sentiment indicator calculated in this way. It illustrates different highs and lows in the measured sentiment. During the observation period, there were mainly two downward spikes in the sentiment indicator that were associated with drastic market events.

Two shocks that moved the market: FTX insolvency and Silicon Valley Bank collapse

The first event was the insolvency of the crypto exchange FTX in November 2022. In the previous year, cryptocurrencies and marketplaces were a major trending topic that accounted for a high share of global VC investment.¹⁰ The platform FTX was a market leader in this technological field in terms of transactions under management and users. The collapse of the crypto exchange was triggered by a report released on 2 November 2022. It questioned the stability of the exchange

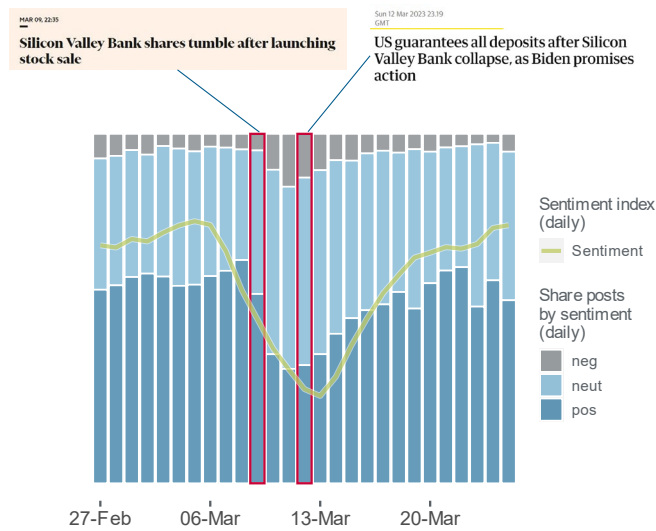
and its proprietary cryptocurrency because a hedge fund that belonged to the FTX Group held a major proportion of the propriety cryptocurrency in its own books. As a consequence, customers liquidated deposits on a large scale and the value of the FTX cryptocurrency fell rapidly. FTX filed for insolvency on 11 November. It later became clear that customer deposits of the crypto exchange were misappropriated by the hedge fund for investments. The FTX case resulted in fluctuations in the price of other cryptocurrencies and created uncertainty, for example regarding stronger regulation. The daily sentiment index in Figure 1 traces these developments. It dropped to a low on 14 November 2022. The sentiment index then recovered significantly until the end of the month but remained very volatile until the beginning of the year 2023.

The second event that moved the market was the collapse of SVB in March 2023. To illustrate the development, Figure 4 shows the daily share of positive, neutral and negative posts and the progression of the aggregate sentiment index around this event. SVB was regarded as one of the most important banks for the US VC ecosystem. On Wednesday, 8 March 2023, SVB announced its intention to raise fresh capital by selling shares. The background was that SVB was struggling with losses on the assets side as a result of the interest rate pivot as customers were withdrawing deposits. The following day, the bank's stock price plummeted and major VC investors advised their portfolio companies to withdraw their deposits from the bank. That day already saw a sharp drop in the number of posts expressing positive sentiment compared with the previous day.

After SVB failed to raise new capital, the US Federal Deposit Insurance Corporation FDIC took control of the bank on 10 March 2023 and shut it down. Over the weekend, great uncertainty remained over the availability of the deposits of many customers. Accordingly, on Saturday, 11 March, the share of positive posts fell to its lowest level of the entire period of observation, while the share of negative posts peaked. On the evening of Sunday, 12 March, the Fed finally announced a federal guarantee for all deposits (previously, only deposit up to USD 250,000 were insured by the FDIC). As a response to the federal deposit insurance coverage, the market sentiment measured via social media also increased immediately and recovered significantly in the course of the following week.

The progression of the sentiment indicators over the following days and weeks allows the conclusion that the uncertainty subsided quickly and lastingly after the government intervened and sentiment among market actors normalised swiftly. Already two weeks after the federal deposit guarantee, the sentiment index returned to a level seen in the days preceding the SVB collapse. This indicates that the SVB insolvency had no immediate, lasting effect on activity in the VC market after the deposits were covered by federal insurance.

Figure 4: Market sentiment measured daily followed the events around the collapse of Silicon Valley Bank



Source: KfW Research

An analysis of the sentiment index against the background of the two shocks that occurred during the period of observation highlights two characteristics of the social media sentiment analysis for VC market observation. First, the rapid and sharp drop of the sentiment indicator after the SVB collapse and the ensuing quick recovery after the federal deposit guarantee was announced show that external influences that were important for market actors were reflected directly in the market sentiment measured via social media. The high frequency and the volume with which the information was generated on social media enable market observations to be made almost in real time. This is an advantage over conventional sources of information such as transaction data or survey-based indicators in situations when events that are of relevance to the market occur in rapid succession. Alternative signals from the market provide a particularly interesting supplement here.

The change in the sentiment index over time thus provides valuable information for the real-time observation of the situation around important events that move the market.

Second, the local low points on the sentiment index around the insolvency of the crypto exchange FTX and the SVB collapse were clearly on different levels. The significantly sharper drop of the indicator following the SVB collapse is in line with the larger impact this shock had on the real economy. While the collapse of FTX is likely to have negatively affected mainly the technology field of crypto marketplaces and currencies, the insolvency of SVB threatened the business activity of many actors across the broad VC market in the short term.

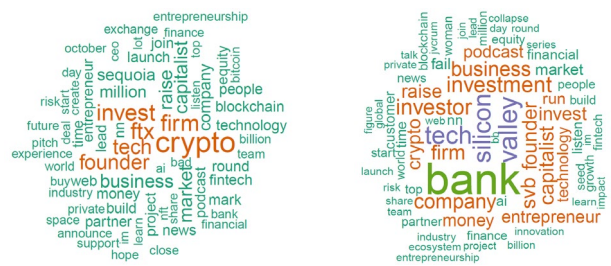
The level of the measured market sentiment thus reflects real market conditions. A comparison of the sentiment indicator at different points in time allows conclusions to be drawn about the importance which market actors give to particular events and prevailing conditions.

Finally, the plausibility of the analysis can be checked through a simple evaluation of the contents of the posts. Figure 5 is a

simple word cloud composed of the keywords with the greatest relative frequency in the weeks after the FTX and SVB insolvencies. The word clouds show that in the week after the FTX insolvency, 'crypto' and 'FTX' were among the most frequently used terms, while in the week of the SVB collapse the terms 'bank', 'silicon', 'valley' and 'SVB' were among the most frequent. This illustrates that the measured change in sentiment substantively correlates with these two events.

Figure 5: Content of communication on social media reflects events that move the market

Word clouds of the most frequent keywords



Week after FTX insolvency

Week after SVB collapse

Source: KfW Research

Methodological limitations

When interpreting the findings, however, various distorting effects need to be taken into account. It can be assumed that the communication of individual actors on social media are driven by interests and strategic considerations. Thus, a portion of the public comments of investors and start-ups around the SVB collapse may have been posted with the intent of influencing political decision-making processes with a particular description of the situation and bringing about a government bailout. Furthermore, the data on the communication posted on social media platforms contains information that is not related to market-specific developments. This is illustrated by, for example, the rise of the aggregate sentiment indicator to its maximum level during the period of observation approaching 31 December (New Year's Eve) (Figure 1).¹¹ Not least, the availability of data from proprietary platforms can be subject to restrictions. Since the middle of the year 2023, access to data from the platform X has been subject to restrictions and is no longer free of charge. And in alternative methods for collecting data from online sources, through web scraping, occurring changes in the structure of the underlying Internet pages can also make data collection difficult.

Conclusion

The present analysis clearly demonstrates that social media-based sentiment indexes can be a valuable supplement to existing indicators on the venture capital market. Advantages consist primarily in the possibility of making real-time analyses, broad data coverage and the comparatively low analytical effort.

Future empirical studies of the forecasting power for real market variables will require longer time series. Substantive analyses of data beyond sentiment analyses also present an interesting opportunity for further studies. Thus, methods such as named entity recognition and topic modelling could enable

technological trends and important actors to be identified and their relevance in the VC market to be examined. A further option for future studies would be to examine regional differences in the measured sentiment.

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¹ Furthermore, survey-based indicators are often based on a low number of individuals and therefore subject to sampling problems (cf. Ludvigson, S. C. (2004). Consumer confidence and consumer spending. *The Journal of Economic Perspectives*, 18(2), 29–50).

² Shapiro, A. H., Sudhof, M., and Wilson, D. J. (2020). Measuring News Sentiment. *Journal of Econometrics* 228(2), 221–243; Bloom, N. (2014). Fluctuations in uncertainty. *Journal of Economic Perspectives*, 28(2), 153-176.

³ Tumasjan, A., Braun, R., and Stolz, B. (2021). Twitter sentiment as a weak signal in venture capital financing. *Journal of Business Venturing*, 36(2), 106062; Jin, F., Wu, A. and Hitt, L. (2017). Social is the new financial: How startup social media activity influences funding outcomes. *Academy of Management Proceedings*, Vol. 1, p. 13329.

⁴ Cookson, J. A., Fox, C., Gil-Bazo, J., Imbet, J. F., and Schiller, C. (2023). Social media as a bank run catalyst. Available at SSRN 4422754.

⁵ This was done using the API provided by the platform. The free, unpaid access to the Twitter API was terminated in the course of 2023 after the ownership of the platform changed.

⁶ Viète, S. and Metzger, G. (2023). [KfW Venture Capital-Dashboard Q3 2023](#). KfW Research.

⁷ The corpus of annotated tweets and a brief description of the methodology are available here: Bryl, S. (2017). [Twitter sentiment analysis with Machine Learning in R using doc2vec approach](#) (part 1).

⁸ The individual posts were assigned to the topic of 'venture capital' by the platform itself. Cf. X Help Center: [Topics on X](#).

⁹ Metzger, G. (2023). [German Venture Capital Barometer 3rd quarter 2023. German VC market](#): Business sentiment continues to recover. KfW Research.

¹⁰ Pitchbook (2022). Emerging Tech Research. Crypto Report Q3 2022. VC trends and emerging opportunities.

¹¹ Purely seasonal effects could be removed by adding longer time series.