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The ChatGPT effect on AI-themed cryptocurrencies

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Abstract

ChatGPT, an artificial intelligence (AI) chatbot, aims to provide users with comprehensive responses and precise answers to a broad spectrum of inquiries. Since its launch in November 2022, it has drawn considerable attention and millions of users. We analyze the returns of AI-themed crypto assets around the launch and widespread attention towards ChatGPT. Our analysis uncovers significant abnormal returns for AI tokens following ChatGPT's launch, with abnormal returns peaking at 41% over the course of two weeks. Moreover, 90% of tokens exhibit positive abnormal returns. This suggests that the attention towards ChatGPT and AI more generally appears to have spilled over into cryptocurrency markets, resulting in positive price effects for AI-related cryptocurrencies.

Keywords: market efficiency, price discovery, artificial intelligence, ChatGPT

JEL Classification Codes: G10, G14

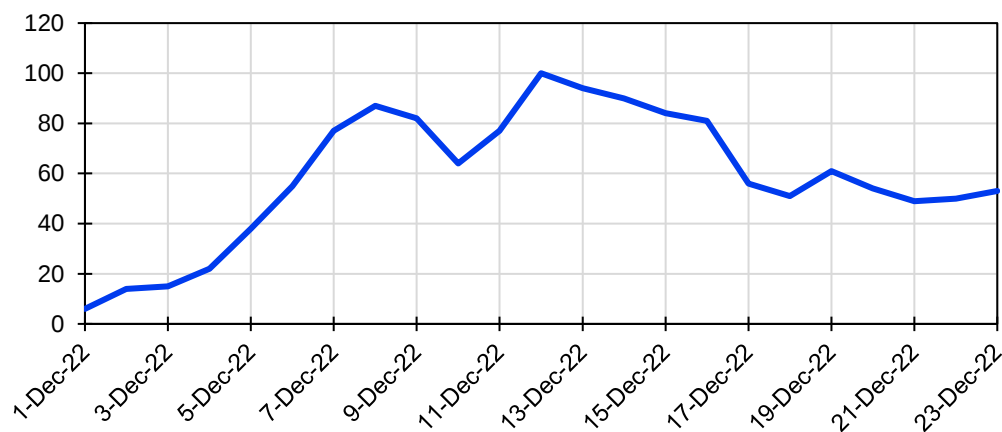
1. Introduction

On November 30, 2022, OpenAI, a US-based organization, unveiled ChatGPT, an artificial intelligence (AI) chatbot model that utilizes reinforcement learning to engage in dynamic interactions with its users, responding to both initial queries and subsequent follow-up questions. The launch of ChatGPT generated significant interest, reflected in the significant public interest reflected in the rapid growth of its user base. In the span of just one week following its release, the model accumulated over one million users, with vibrant exchanges of questions and answers taking place across various social media platforms (Shankland, 2022; Vanian, 2022). Figure 1 illustrates the global Google Trends search results for ChatGPT. It represents a relative scale indicating search volume, where a value of 0 represents no search volume and 100 corresponds to peak search volume.

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Figure 1. "Chatgpt" search results in Google Trends.



ChatGPT, widely covered in media articles, has been perceived as a future competitor for Google (Tyrrell, 2022), signifying a potential catalyst for digital transformation (Brown, 2022). OpenAI's CEO has tempered expectations, emphasizing that ChatGPT, currently in a limited preview stage, should not be depended upon for critical tasks as it is not yet a fully-fledged product (Altman, 2022). Despite these limitations, ChatGPT serves as one promising indication of the ongoing progress in the realm of AI and its evolution.

The emergence and widespread adoption of ChatGPT, coupled with its potential to drive innovative breakthroughs and socioeconomic impact, points to significant opportunities within the AI industry. This is underscored by the widespread dissemination of information about ChatGPT through various social and media channels by a diverse user base. This narrative suggests that AI-centric projects are seen to harbor substantial potential or quality. Theories on market efficiency suggest such perceptions should manifest in the valuation of tradable assets like stocks or cryptocurrencies (Fama, 1970; Lo, 2004). In fact, Wu and Chen (2022) show that ETFs with the name "AI" generate a name premium of approximately 0.4% and Huang and Lee (2023) find positive abnormal returns for AI implementation announcements. Further, Saggi and Ante (2023) identify that AI tokens exhibited higher returns compared to non-AI tokens around the launch of ChatGPT, an effect primarily driven by retail investors. Signaling theory, as proposed by Spence (1973), posits that individuals use quality signals to mitigate information asymmetry. These signals are typically costly and difficult to replicate, publicly accessible, and verifiable (Ante and Fiedler, 2020). In the context of ChatGPT, the posting of chat histories and replies from multiple individuals within one's social network, in combination with media attention surrounding the potential of artificial intelligence, can serve as a valid quality signal that increases the perceived value of assets related to AI. This is due to the tendency for individuals to rely on past experiences with other individuals when making future decisions (Andersen and Baum, 1994) and the importance of obtaining high-quality signals from trustworthy sources within one's network.

This work aims to examine to what extent there is a "ChatGPT effect" on cryptocurrencies with a focus on AI. We assume that the launch and the subsequent attention to ChatGPT represents a positive quality signal (or narrative) for AI-themed assets, resulting in positive abnormal price effects after or with the launch. For this purpose, we implement an event study methodology (Brown and Warner, 1985; Fama et al., 1969) to test semi-strong market efficiency using a sample of AI-themed crypto assets, for which we calculate AI crypto indices.

The present study adds to the body of literature on the market efficiency of cryptocurrency assets, focusing specifically on how a publicly-perceived "narrative" can influence updated

expectations of a particular set of assets and how these expectations are reflected in market reactions (i.e. spilled-over). Additionally, the findings of this study contribute to the field of signaling theory by examining the potential for the perceived success and potential of a technology, in this case, AI, (Radanliev and De Roure, 2023) to serve as a quality signal for actors in different markets, potentially leading to herding behavior and contagion effects.

In the following, the data and methodology utilized in the study will be outlined in Section 2. The obtained results will then be presented and discussed in Section 3. Finally, the conclusion of the study will be presented in the final section.

2. Data and methods

We rely on the leading market data portal CoinGecko (coingecko.com) as the data source. CoinGecko categorizes crypto asset types and has the category "artificial intelligence", which by December 2022, comprises 15 AI-focused crypto assets. The aforementioned crypto projects pertain to AI, though they exhibit a considerable degree of variance from one another. For example, the three projects with the largest market capitalization comprise an AI-run crowd-sourced hedge fund (Numeraire), a project offering autonomous agent technology for blockchains (Fetch AI) and a platform for AI algorithm monetization (SingularityNET). We exclude five of the assets from our analysis due to a lack of liquidity (i.e., 24-hour trading volumes below \$20,000), resulting in a sample of 10 AI-themed crypto assets, for which we collect daily price data from July 1 until December 14, 2022. We calculate log returns for each asset and calculate an equally weighted AI crypto index (AICI) based on the 10 AI tokens as:

$$AI\ Token\ Index\ Return_t = \frac{1}{N} \sum_i^N Token\ log\ return_{i,t} \quad (1)$$

Since the tokens vary in market capitalization, we also calculate a weighted AI crypto index (WAICI) as:

$$Weighted\ AI\ Token\ Index\ Return_t = \sum_i^N \left(\frac{w_i}{\sum_j^N w_j} \right) Token\ log\ return_{i,t} \quad (2)$$

where $\sum_j^N w_j$ is the sum of the market capitalizations of all N tokens.

Additionally, we collect data on Bitcoin as a reference market for the event study model. Table 1 shows summary statistics on the 10 AI tokens, the AI crypto index and Bitcoin.

The table shows summary statistics for daily logarithmic returns for July 2022 to December 2022. Returns are expressed in percentage points. The AI Crypto Index is an equally weighted portfolio of all AI-themed crypto asset returns.

We use event study methodology to analyze to what extent the launch of ChatGPT on November 30, 2022 has (had) an impact on AI tokens. This methodology, as described by Boehmer et al. (1991), involves comparing historical returns with observed returns in order to determine the extent to which an unexpected event or information results in an abnormal market reaction. The event study approach has gained increasing attention within the realm of cryptocurrency literature, with previous studies examining the effects of events such as positive and negative news (Yue et al., 2021), the launch of central bank digital currencies (Mzoughi et al., 2022) or stablecoins (Ante et al., 2021), fan tokens (Demir et al., 2022) and specific large Bitcoin transfers (Ante and Fiedler, 2021) on the cryptocurrency market. To ensure that any observed abnormal effects are not simply a result of general crypto market volatility, Bitcoin is utilized as a reference market within the market model. This allows for the adjustment of any abnormal effects for possible external influences through changes in the price of Bitcoin (serving as a proxy for the crypto market). This methodology thus allows for the determination of whether the observed abnormal effects are truly caused by the ChatGPT event.

Table 1. AI-themed crypto asset returns

Ticker	Name	Mean	SD	Median	Min	Max
Panel A: AI-themed tokens						
ALI	Artificial Liquid Intelligence	-0.37	8.44	-0.80	-26.31	50.23
DBC	DeepBrain Chain	0.31	6.01	-0.32	-15.63	35.34
MOOV	dotmoovs	-0.67	4.76	-0.76	-26.85	17.53
EFX	Effect Network	0.04	5.08	0.02	-18.37	22.88
FET	Fetch.ai	0.12	5.99	-0.10	-25.90	30.56
MAN	Matrix AI Network	0.62	7.91	0.15	-24.38	47.84
NMR	Numeraire	-0.24	6.44	-0.42	-26.19	39.56
ORAI	Oraichain	-0.06	5.69	-0.70	-16.99	42.26
AGIX	SingularityNET	0.21	7.46	-0.08	-24.02	42.36
VXV	Vectorspace AI	-0.26	5.33	-0.34	-20.36	23.37
Panel B: AI Crypto Indices						
AICI	AI Crypto Index	-0.03	3.75	-0.15	-19.56	22.21
WAICI	Weighted AI Crypto Index	0.06	4.89	-0.12	-23.32	19.85
Panel C: Bitcoin						
BTC	Bitcoin	0.05	3.06	0.16	-10.20	15.49

In the market model, the return $R_{i,t}$ of an event i in the period t is calculated as

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}, \quad (2)$$

with α_i indicating the observed return, $R_{m,t}$ being the log return of the reference market Bitcoin, β_i representing the regression coefficient measuring the sensitivity of AI token returns on the reference market, and $\varepsilon_{i,t}$ being the error term. Expected returns are calculated by a time series regression over the estimation period of $t = -115$ to -15 (i.e., 100 days). Accordingly, the abnormal return (AR) for a given time period can be calculated by comparing the observed return of a specific event within an event window to the expected return and the market return. This can be expressed mathematically as follows:

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i R_{m,t}) \quad (3)$$

The cumulative abnormal return over a specific time period t_1 to t_2 is then calculated as:

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t}. \quad (4)$$

To assess the significance of CARs, we rely on a parametric t-test and the nonparametric Wilcoxon sign rank test (Wilcoxon, 1945).

3. Results and discussion

Table 2 illustrates the correlation between AI-themed tokens, the AI indices, and Bitcoin. It is notable that there are relatively high and positive correlations between AI-themed tokens, reaching up to 0.55. However, it is interesting to note that these tokens appear to be independent from Bitcoin, as the correlations are approximately zero. Despite the commonly observed strong correlation between cryptocurrencies and Bitcoin (Smales, 2020), the discovery of unique dynamics exhibited by AI tokens during the analyzed time frame is surprising. It can be inferred that AI tokens are not primarily impacted by the cryptocurrency market, but rather by external factors, one of which is being analyzed in this study.

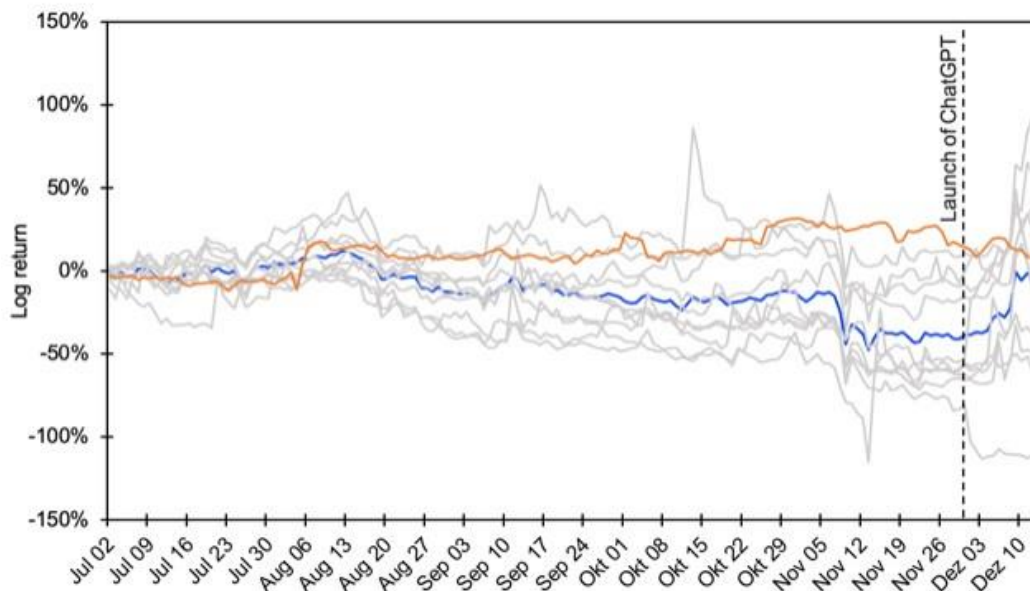
The table 2 shows Spearman rank correlations for daily logarithmic returns between July 01 and December 13, 2022. Significant correlations at the 5% level are highlighted in bold.

Table 2. Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) ALI												
(2) DBC	0.19											
(3) MOOV	0.24	0.11										
(4) EFX	0.11	0.05	0.24									
(5) FET	0.38	0.36	0.35	0.33								
(6) MAN	0.19	0.17	0.06	0.12	0.40							
(7) NMR	0.26	0.20	0.33	0.34	0.51	0.31						
(8) ORAI	0.34	0.22	0.45	0.42	0.55	0.31	0.46					
(9) AGIX	0.29	0.13	0.33	0.21	0.42	0.31	0.37	0.40				
(10) VXV	0.18	0.08	0.29	0.18	0.35	0.24	0.31	0.27	0.25			
(11) AICI	0.56	0.40	0.44	0.42	0.72	0.54	0.65	0.64	0.63	0.47		
(12) WAICI	0.48	0.35	0.37	0.32	0.72	0.41	0.77	0.54	0.70	0.43	0.89	
(13) BTC	0.04	-0.03	0.02	-0.02	-0.05	-0.07	0.07	0.00	-0.07	-0.08	-0.02	-0.06

In Figure 2, we present the cumulative log returns of AI themed tokens, the equally weighted AI crypto index and Bitcoin. It is evident that the introduction of ChatGPT resulted in an increase in returns for the majority of AI-centric tokens and the AI cryptocurrency index, while Bitcoin experienced a decrease in value following the event. This serves as preliminary evidence of the positive impact of the launch of ChatGPT. Since the two indices are highly correlated ($r=0.89$), we focus on the equally weighted index for the following analyses.

Figure 2. Cumulative log returns of AI themed tokens, the AI crypto index and Bitcoin before and after the launch of ChatGPT



Note: The blue line shows log returns of the equally weighted AI crypto index, the orange line visualizes Bitcoin and the ten individual AI tokens are shown in grey.

Table 3 presents the abnormal returns following the launch of ChatGPT for various event windows. The mean β over the market model regression is approximately 0.04, indicating that for every 1% change in Bitcoin returns, the returns of AI tokens change by 0.04%, explaining

0.4% of the variability in AI token returns. Accordingly, it can be concluded that the abnormal returns constitute distinct effects that are not driven by broader market phenomena. On the launch day, the statistically significant average abnormal return was 2.71% with 90% of AI-themed tokens experiencing a positive return. There was a strong reaction to the platform's launch on days 8 and 9, with abnormal returns of 5.6% and 22.59%, respectively, likely due to increasing popularity and usage of the platform as well as a better understanding of future prospects. The potential explanation for this result can be gleaned from the Google Trends results depicted in Figure 1, which demonstrate a gradual increase in awareness of ChatGPT over the first nine days before reaching a temporary peak. In examining the CARs, there were significant positive returns of 18.26% and 41.68% in the one week and two-week periods, respectively, with 90% of tokens exhibiting positive abnormal returns in both periods.

The table 3 shows average abnormal returns (ARs) per day as well as cumulative abnormal returns (CARs) for intervals of one and two weeks for the ten AI-themed tokens around the launch of ChatGPT. The column *z-test* relates to the Wilcoxon sign rank test and the column *positives* indicates the share of AI tokens with positive abnormal returns in the particular event window.

Table 3. Abnormal returns after the launch of ChatGPT

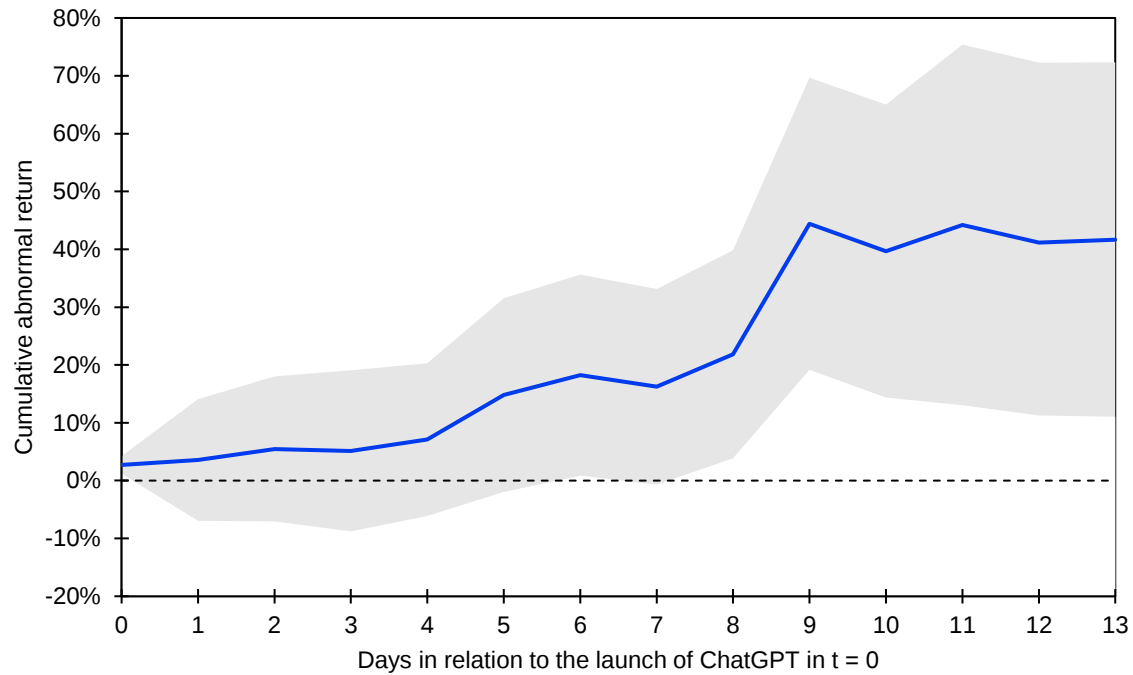
Event window	(C)AR	SE	t-test	z-test	positives
t = 0	2.71%	0.67%	4.03***	2.70***	90%
t = 1	0.86%	4.54%	0.19	-0.87	30%
t = 2	1.89%	1.12%	1.69	1.58	70%
t = 3	-0.33%	1.79%	-0.19	-0.05	50%
t = 4	1.96%	1.03%	1.90*	1.38	80%
t = 5	7.69%	3.87%	1.99*	2.40**	90%
t = 6	3.47%	3.63%	0.96	0.66	50%
t = 7	-2.04%	3.21%	-0.63	-0.76	30%
t = 8	5.60%	1.41%	3.97***	2.80***	100%
t = 9	22.59%	4.99%	4.53***	2.80***	100%
t = 10	-4.73%	3.50%	-1.35	-1.27	30%
t = 11	4.53%	4.60%	0.98	1.27	70%
t = 12	-2.46%	2.33%	-1.06	-0.97	40%
t = 13	-0.07%	1.66%	-0.04	-0.26	40%
t = 0 to 6 (one week)	18.26%	7.68%	2.38**	2.19**	90%
t = 0 to 13 (two weeks)	41.68%	13.54%	3.08**	2.50**	90%

*, **, *** indicates significance at the 10%, 5% and 1% level.

Figures 4 and 5 present the CARs of an equally weighted AI crypto index and individual AI tokens, respectively, over a two-week period following the launch of ChatGPT. The index saw an increase of over 40% in CARs up to day 9. The individual tokens displayed a similar pattern, with one exception experiencing a decline in price during the same time frame. Overall, the launch and popularity of ChatGPT appeared to serve as a positive signal for AI-themed tokens.

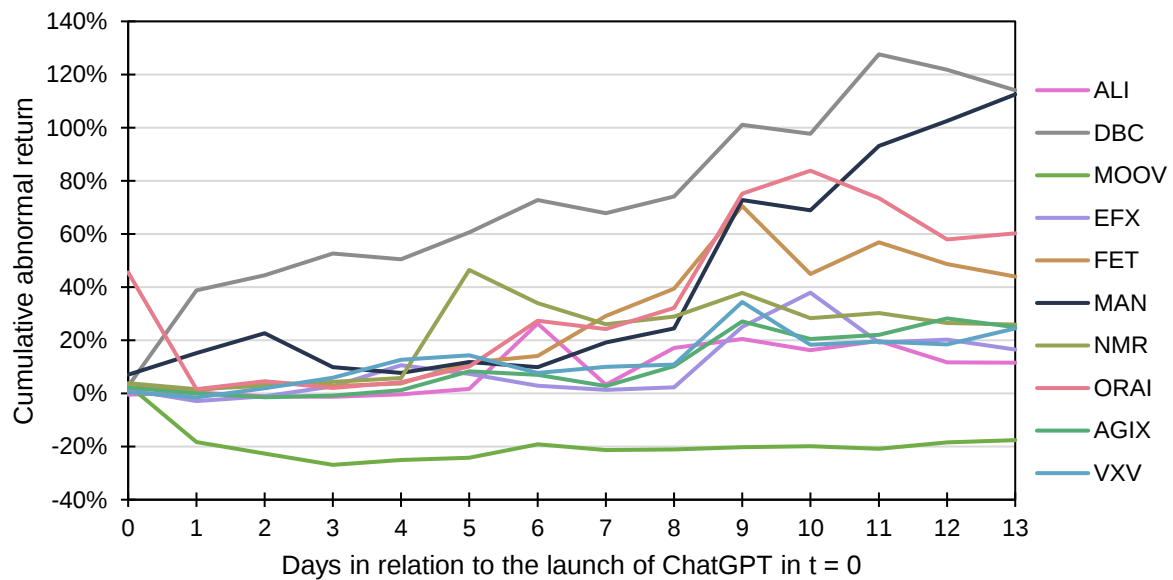
The findings suggest that, in accordance with the notion of transference (Andersen and Baum, 1994), cryptocurrency investors rely on their (social) networks and media for (re-)assessing new information concerning AI and AI tokens, leading to abnormal price effects. As predicted by cognitive balance theory (Heider, 2013), investors attempt to achieve a balance between public sentiment and their personal beliefs, in this case regarding ChatGPT, AI, and AI tokens. A favorable view of ChatGPT and the potential of AI translates to a corresponding perception of AI tokens, resulting in the transfer of attitudes from the investor's network onto the investable asset (Ohanian, 1991). This demonstrates the influence that social networks and

Figure 3. Cumulative abnormal returns of an equally weighted AI crypto index over the span of two weeks after the launch of ChatGPT



Note: The blue line shows mean cumulative abnormal returns and the grey bar indicates 95% intervals.

Figure 4. Cumulative abnormal returns of AI tokens over the span of two weeks after the launch of ChatGPT



media hold over financial markets. In accordance with signaling theory (Spence, 1973), the positive sentiment towards ChatGPT and AI serve as quality signals to the market, which are immediately reflected in prices. This finding aligns with the signaling theory-related findings of Ante (2023) of how social media influencers and their activity represent relevant quality signals for the cryptocurrency market, or rather investors and the study of Feinstein and

Werbach (2021), who identified that regulatory events can serve as quality signals affecting cryptocurrency markets and trading. The market will only react as long as the signal (i.e., the sentiment) holds value. If, hypothetically, the market loses confidence in ChatGPT and the sentiment shifts to negative, this shift should also be reflected in prices. If the quality of the signals becomes too low, for example, due to a limited number of people posting to ChatGPT, investors may no longer interpret this as a quality signal and instead disregard it. From this perspective, the “ChatGPT Effect” is simply an uncritical aspect of market efficiency.

4. Conclusion

This paper explores the impact of the launch of ChatGPT in November 2022 on the returns of AI-themed crypto assets and AI crypto indices based on those tokens. By using an event study methodology, we identify significant positive abnormal returns on the day of the launch and also on days 8 and 9 after the launch, which likely relates to the fact that the worldwide attention for ChatGPT only reached its interim peak at this time. The CAR of the AI crypto index is up to 41% over the course of two weeks and 90% of tokens exhibiting positive abnormal returns. This suggests that the positive coverage of ChatGPT has spilled over to other AI-related markets and in this case AI-focused crypto assets. Accordingly, we identify a “ChatGPT effect”, i.e., a positive signal of quality that the cryptocurrency market picked up.

An implication of our study is the finding that crypto asset markets are highly fragmented. While there was virtually no relevant attention for AI tokens before the launch of ChatGPT, they may represent an (at least temporarily) independent submarket, which is surprisingly even quasi uncorrelated to Bitcoin in the time frame considered in this study. This results in the practical implication that investors should closely follow the developments related to specific themed tokens as their dynamics can be different from the rest of the cryptocurrency market.

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