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# The negative investor attention impact on bitcoin

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## Abstract

This paper provides an analysis of the negative investor attention impact on bitcoin's performance. By negative investor attention, we mean investor attention preceding a negative event, such as for example, a cyber-attack. Since their creation, the crypto-market has been numerous times the target of various attacks, which lead to important financial losses. Thus, we propose this study, in which we aim to capture the investor's reaction and impact on the bitcoin's performance as a consequence of these negative events happening. We are proxying the negative investor attention by using Google volume searches and splitting the search terms into 'specialist' and 'non-specialist' investors. The results obtained show that our Google searches and implicitly the negative investor attention impact bitcoin's performance. Moreover, the non-specialist-considered keywords seem to drive returns more than the ones of a specialist. This result suggests that the majority of crypto-investors are, in fact, amateur or non-specialists.

**Keywords:** Blockchain, Financial performance, investor attention, bitcoin, cyber-attacks

# 1 Introduction

In this paper, we investigate the relationship between the returns of bitcoin, its price volatility, and Google Trends. Using a set of keywords related to bitcoin, Blockchain technology, or crypto-assets in general, we assess if the investor’s attention can be captured by the Google Search Volume (GSV) and if it impacts bitcoin’s performance. When the crypto-market becomes the target of an attack or other type of significant event that involves financial losses, these scenarios usually attract attention. Under the close scrutiny of the public eye and combined with the negative image set by risky events, crypto-assets prices often become unstable.

Studying negative investor attention in the crypto-market is important as it provides valuable insights into the dynamics and risks associated with market sentiment and investor behavior. Negative attention can indicate concerns, skepticism, or pessimism towards cryptocurrencies, which may have significant implications for market stability, asset valuations, and investor decision-making. Understanding the factors that drive negative investor attention allows researchers and market participants to identify potential vulnerabilities, assess market risks, and develop strategies to address and mitigate them. Ultimately, studying negative investor attention contributes to a comprehensive understanding of the crypto-market and supports the development of informed investment strategies and regulatory frameworks.

With this work, we propose an investigation into the impact suffered by bitcoin’s performance as a result of the negative investor attention triggered by uncertain events such as attacks. The results obtained show that our Google searches and implicitly the negative investor attention impact bitcoin’s performance. Moreover, the non-specialist-considered keywords seem to drive returns more than the ones of a specialist. This result suggests that the majority of crypto-investors are, in fact, amateur or non-specialists.

The contributions made by this study are multiple: (1) first, we show that negative investor attention is captured by the Google searches considered in this study; (2) secondly, we show that bitcoin’s performance is impacted by the negative investor attention; and last but not least (3) the results obtained reveal that the majority of investors present in the crypto-market are in fact non-specialist or amateurs.

This paper is organized as follows. Section 2 presents the theoretical background for this study. In section 3 it is presented the data and methodology used. Section 4 shows the analysis and results obtained. And finally, section 5 presents the discussion of the results and concludes.

## 2 Theoretical background

Despite their relatively short history, crypto-assets have attracted much societal attention, which has been reflected in the large price fluctuations (Hasso et al., 2019). Griffin & Shams (2020) state that given the excessive attention and rapid market capitalization growth, factors which are common in the characterization of financial bubbles, there is no surprise that crypto-assets are subject to price manipulation, misinformation, and speculation. Several studies have identified anomalies in the crypto-assets’ returns (Bariviera, 2017; Chaim & Laurini, 2019; Kristoufek, 2013; Urquhart, 2016), which lead to further questions about the crypto-assets’ nature (Baur et al., 2018; Dyhrberg, 2016; Krückeberg & Scholz, 2019), the investor’s behavior (Benedetti & Kostovetsky, 2021; Hasso et al., 2019; Kallinterakis & Wang, 2019), and financial bubbles (Chaim & Laurini, 2019; Cheah & Fry, 2015; Corbet et al., 2019; Fry & Cheah, 2016; Kyriazis et al., 2020). Compared to other asset classes, crypto-assets seem to be more volatile (Härdle et al., 2020; Urquhart & Zhang, 2019). According to (Lucey et al., 2022), the risky features of crypto-assets make them particularly attractive to ‘amateur’ investors. Hence, the presence of such ‘noise’ traders could be a justification for the high volatility present in the crypto-market and implicitly the significant deviation from the fundamental value (De Long et al., 1990).

Investor’s attention, associated with the under- and over-reaction of market participants, has been long considered an explanation for security mispricing (Andrei & Hasler, 2015; Baker & Wurgler, 2007; Shiller, 2000). The pioneers of behavioral finance, Tversky & Kahneman (1974), argue that in situations of uncertainty, people tend to ignore the laws of probability and discern events irrationally. In the crypto-market context, this would translate into situations such as investors misinterpreting certain episodes of exponential growth in the crypto-assets prices and choosing to put their capital at risk before considering a scenario such as a financial bubble. With their findings, Lin (2020) confirms Tversky & Kahneman (1974)’s theory, such as crypto-assets performance drives future investors’ attention. This is especially important because investment preferences and selection choices are determined by what news or information catches first the attention of investors (Barber & Odean, 2008). That being said, if, for instance, crypto-assets perform well and that stimulate the investor’s attention, the chances that this attention attracts more ‘amateurs’ creating noise and irrational price fluctuations increases (Lucey et al., 2022). Al Guindy (2021) states that whether an investor’s attention has a positive or negative influence on the crypto-assets prices is still imprecise.

We follow Liu & Tsyvinski (2021) and use Google Search Volume (GSV) as our measure for negative investor attention. In their paper, the negative investor attention measures the change in market attention (online search frequency) coming from risky events associated with the crypto-market. The rationale behind this approach is the following. In this Internet and smart technology era that we live in, our attention is constantly challenged by the overabundance of information available. Google engine accounts for approximately 90% of the total online searches around the world<sup>1</sup> (Smales, 2022). As online searches represent a direct measure of attention (Barber et al., 2008; Lin, 2020; Nasir et al., 2019) and anyone searching for information about a particular crypto-asset will certainly do it online, we believe that GSV is the appropriate proxy for investor attention. In their study, Liu & Tsyvinski (2021) assess if negative investors’ attention impacts bitcoin’s returns. The results show that bitcoin is negatively and significantly driven by the attention proxy.

In this research, we will look only at bitcoin, the leader of the crypto-market. In accordance with the literature, we establish the following hypotheses:

**H1: The returns of bitcoin are negatively impacted by negative investor attention.**

**H2: Bitcoin’s volatility is positively impacted by negative investor attention.**

### 3 Data and methodology

For this study, we are using Google Search Volume (GSV) and bitcoin prices. We retrieved from the Google engine the GSV data, which is afterward used to proxy the negative investor attention. Data spans from April 2013 – April 2022, with a monthly frequency (given the long period studied, Google automatically generated data at the monthly frequency). For bitcoin, we retrieved the financial data from the Thomson Reuters Eikon database. With this data, we compute monthly returns and volatility (standard deviation) for the period April 2013 – April 2022.

We construct proxies for negative investor attention using Google (worldwide) searches for the following phrases ‘cryptocurrency attack’, ‘cryptocurrency hack’, ‘cryptocurrency risk’, ‘bitcoin attack’, ‘bitcoin hack’, ‘bitcoin risk’, ‘bitcoin exploit’, ‘blockchain attack’, ‘blockchain hack’, ‘blockchain risk’, ‘zero-day’. The selec-

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<sup>1</sup>See report about the market share of leading search engines: <https://www.statista.com/statistics/216573/worldwide-market-share-of-search-engines/>

tion of these phrases has been made considering that by negative investor’s attention, we refer to the attention received by the crypto-market when a crypto-asset was the target of a negative event<sup>2</sup>. In our Google search, we work with the term ‘cryptocurrency’ instead of ‘crypto-asset’, simply because out of the scientific and legal world<sup>3</sup>, ‘cryptocurrency’ is the most common word to use when referring to the crypto-market. Furthermore, we consider that the investors interested in the crypto-market could be categorized as specialists in Blockchain technology and non-specialists. This information is relevant, as someone who is a specialist or knowledgeable in Blockchain technology would rather use words such as ‘attack’, ‘exploit’ or ‘zero-day’<sup>4</sup> in searching for information. Therefore, we consider a variety of keywords that aim to capture the attention of both groups.

To assess the negative investor attention’s impact on bitcoin’s performance, we regress the monthly bitcoin return (volatility) against google search volumes first without lag, and then lagged from one up to three months. Considering that financial markets usually experience instability episodes around uncertain times (negative events) (Acharya et al., 2017; Gray et al., 2007; Maouchi et al., 2021; Palma-Ruiz et al., 2020; Yousaf et al., 2022), we expect that our results will show a decrease (increase) in bitcoin’s returns (volatility) as a response to significant negative investor attention.

Table 1 displays the descriptive statistics of all variables used.

Table 1: Descriptive Statistics of all variables

Panel A		<i>Mean</i>	<i>SD</i>	<i>Sharpe</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>DW</i>
<i>BTC Rt</i>		6.931	29.127	0.238	1.603	7.608	1.483
<i>BTC Volatility</i>		4.747	3.217	1.476	2.534	9.616	0.396

  

Panel B	<i>Mean</i>	<i>SD</i>	<i>Max</i>	<i>Min</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>DW</i>
<i>crypto_attack</i>	18.872	22.185	100.000	0.000	1.596	2.332	0.289
<i>crypto_hack</i>	18.872	22.185	100.000	0.000	1.596	2.332	0.289
<i>crypto_risk</i>	19.110	23.838	100.000	0.000	1.363	0.952	0.105
<i>bitcoin_attack</i>	20.679	16.367	100.000	2.000	1.893	4.748	0.174
<i>bitcoin_hack</i>	20.679	16.367	100.000	2.000	1.893	4.748	0.174
<i>bitcoin_risk</i>	13.688	14.438	100.000	1.000	2.820	11.218	0.180
<i>blockchain_attack</i>	27.037	24.173	100.000	0.000	0.639	-0.249	0.111
<i>blockchain_hack</i>	27.037	24.173	100.000	0.000	0.639	-0.249	0.111
<i>blockchain_risk</i>	37.339	29.698	100.000	0.000	0.197	-1.165	0.080
<i>zero-day</i>	28.721	14.303	100.000	9.000	2.321	7.610	0.261
<i>bitcoin_exploit</i>	16.505	13.398	100.000	0.000	2.662	12.643	0.546

The table summarizes the descriptive statistics of all variables for the sample period. *DW* is the abbreviation for Durbin-Watson test. In panel A we show the statistical properties of bitcoin returns and volatility.

Panel B reports the summary statistics for the proxies used to measure negative investor’s attention: google searches for ‘cryptocurrency attack/hack/risk’, ‘bitcoin attack/hack/risk/exploit’, ‘blockchain attack/hack/risk’ and ‘zero day’. Data spans from April 2013 – April 2022, with a monthly frequency.

## 4 Analysis and results

As the interest of an investor for a particular investment might not be immediate, we perform our tests on different lags. Consequently, we perform the following regressions:

$$Rt_{BTC}(t) = \alpha + \sum_{(j=0)}^3 \beta_j * google\_search(t - j) + \varepsilon. \quad (1)$$

<sup>2</sup>By negative events, we refer to attacks, hacks, and any other similar vulnerability that could have a negative impact on the crypto-assets prices and bring uncertainty in this market.

<sup>3</sup>The Banque de France’s view on bitcoin and other crypto-assets: <https://www.youtube.com/watch?v=Dqaw9-NTd3c>

<sup>4</sup>‘Zero-day’ is a phrase that refers to the recent discovery of a serious security computer-software related vulnerability. As its name suggests, the developers have zero days to fix it before it could be exploited by attackers.

Where  $Rt_{BTC}(t)$  is the monthly return of bitcoin at time t,  $\beta_j$  is the coefficient related to lag j, and  $google\_search(t - j)$  represents the lagged google search trend. Results are reported in table 2.

Table 2: The impact of negative investor’s attention on bitcoin returns

	Constant	T	T-1	T-2	T-3	$R^2$	<i>google search</i>
<i>Rt BTC</i>	0.019 (0.5)	<b>0.092**</b> ( <b>2.143</b> )	<b>0.126***</b> ( <b>2.824</b> )	<b>0.097**</b> ( <b>2.076</b> )	0.002 (0.053)	23.88	<i>cryptocurrency_attack</i>
	0.043 (1.151)	<b>0.060**</b> ( <b>2.5</b> )	0.027 (1.116)	0.022 (0.884)	0.011 (0.451)	13.86	<i>cryptocurrency_hack</i>
	0.009 (0.241)	<b>0.204***</b> ( <b>3.437</b> )	<b>0.149**</b> ( <b>2.443</b> )	0.062 (0.955)	0.074 (1.152)	28.49	<i>cryptocurrency_risk</i>
	0.041 (1.162)	<b>0.226***</b> ( <b>3.828</b> )	0.057 (0.966)	-0.013 (-0.217)	-0.004 (-0.072)	25.61	<i>bitcoin_attack</i>
	0.039 (1.147)	<b>0.247***</b> ( <b>3.239</b> )	<b>0.145*</b> ( <b>1.836</b> )	<b>0.185**</b> ( <b>2.309</b> )	0.056 (0.724)	22.81	<i>bitcoin_hack</i>
	0.029 (0.803)	<b>0.229***</b> ( <b>3.497</b> )	<b>0.146**</b> ( <b>2.159</b> )	0.026 (0.386)	0.006 (0.09)	26.52	<i>bitcoin_risk</i>
	<b>0.102*</b> ( <b>2.013</b> )	-0.017 (-0.609)	0.000 (0.014)	-0.016 (-0.538)	-0.02 (-0.723)	2.39	<i>bitcoin_exploit</i>
	0.065 (1.582)	-0.055 (-0.519)	<b>0.222**</b> ( <b>2.027</b> )	-0.037 (-0.335)	-0.010 (-0.089)	12.21	<i>blockchain_attack</i>
	0.027 (0.722)	<b>0.361***</b> ( <b>2.735</b> )	<b>0.351**</b> ( <b>2.381</b> )	0.207 (1.406)	0.186 (1.386)	17.97	<i>blockchain_hack</i>
	<b>0.067*</b> ( <b>1.774</b> )	<b>0.161*</b> ( <b>1.784</b> )	-0.067 (-0.752)	0.047 (0.423)	0.007 (0.062)	9.58	<i>blockchain_risk</i>
	<b>0.123***</b> ( <b>3.064</b> )	-0.026 (-0.402)	<b>-0.143**</b> ( <b>-2.041</b> )	-0.112 (-1.592)	-0.105 (-1.624)	12.92	<i>Zero-day</i>

Here we assess the impact of negative investor’s attention, proxied by google search terms such as ‘cryptocurrency attack/hack/risk’, ‘bitcoin attack/hack/risk/exploit’, ‘blockchain attack/hack/risk’ and ‘zero day’ on BTC returns. We regressed bitcoin’s monthly returns against the google search data without lag and lagged from one up to three-month horizons. *Rt* stands for monthly returns. For each regression, we had 50 observations. \*\*\* denotes significance levels based on the respective p-value (\*:10%, \*\*:5%, and \*\*\*:1%). The standard t-statistic value is shown in parentheses.

$$\sigma_{BTC}(t) = \alpha + \sum_{(j=0)}^3 \beta_j * google\_search(t - j) + \varepsilon. \quad (2)$$

Where  $\sigma_{BTC}(t)$  is the monthly volatility of bitcoin at time t,  $\beta_j$  is the coefficient related to lag j, and  $google\_search(t - j)$  represents the lagged google search trend. Results are reported in table 3.

## 5 Discussion and conclusions

In this study, we assess the impact of negative investor attention on bitcoin’s performance. By negative investor attention, we mean investor attention preceding a negative event, such as, for example, cyber-attacks. To assess the negative investor attention, we proxy it with Google (worldwide) searches for several phrases: ‘cryptocurrency attack’, ‘cryptocurrency hack’, ‘cryptocurrency risk’, ‘bitcoin attack’, ‘bitcoin hack’, ‘bitcoin risk’, ‘bitcoin exploit’, ‘blockchain attack’, ‘blockchain hack’, ‘blockchain risk’, ‘zero-day’.

Our findings show that Google searches have a significant impact on bitcoin’s returns, which first of all proves that negative investor attention is captured by GSV. Furthermore, we observe that for most of the keywords used, the effect is persistent, impacting bitcoin’s returns for up to two months. Although, the relationship between bitcoin’s returns and investors’ negative attention seems to be the strongest for lag = 0, which indicates that the reaction of investors’ attention might not impact returns in the long run. At the same time, our non-specialist-considered keywords seem to drive returns more than the ones of a Blockchain specialist. This result suggests that the majority of crypto-investors are, in fact, amateur or non-specialists in the crypto-market. This evidence is in line with the existing literature (Hasso et al., 2019; Lucey et al.,

Table 3: The impact of negative investor’s attention on bitcoin volatility

	Constant	T	T-1	T-2	T-3	R <sup>2</sup>	google search
<i>BTC volatility</i>	<b>0.044***</b> (12.525)	0.004 (1.04)	0.000 (0.081)	-0.003 (-0.763)	0.004 (0.918)	5.46	<i>cryptocurrency_attack</i>
	<b>0.046***</b> (13.905)	0.001 (0.235)	-0.002 (-0.718)	0.001 (0.527)	-0.003 (-1.254)	5.69	<i>cryptocurrency_hack</i>
	<b>0.047***</b> (12.757)	0.004 (0.659)	-0.003 (-0.428)	-0.003 (-0.447)	-0.005 (-0.802)	3.01	<i>cryptocurrency_risk</i>
	<b>0.048***</b> (15.22)	0.000 (0.065)	<b>-0.010*</b> (-1.938)	-0.001 (-0.192)	<b>-0.011**</b> (-2.103)	14.70	<i>bitcoin_attack</i>
	<b>0.046***</b> (14.199)	0.004 (0.503)	-0.003 (-0.45)	-0.005 (-0.684)	-0.004 (-0.519)	2.57	<i>bitcoin_hack</i>
	<b>0.048***</b> (15.217)	0.009 (1.491)	<b>-0.015**</b> (-2.501)	-0.002 (-0.38)	<b>-0.011**</b> (-1.92)	20.8	<i>bitcoin_risk</i>
	<b>0.048***</b> (11.547)	0.002 (0.99)	-0.002 (-0.862)	-0.004 (-1.577)	-0.001 (-0.28)	9.42	<i>bitcoin_exploit</i>
	<b>0.046***</b> (12.332)	0.005 (0.505)	-0.003 (-0.352)	-0.002 (-0.216)	-0.009 (-0.298)	1.26	<i>blockchain_attack</i>
	<b>0.046***</b> (13.282)	0.003 (0.212)	0.002 (0.143)	-0.008 (-0.58)	-0.009 (-0.731)	2.02	<i>blockchain_hack</i>
	<b>0.046***</b> (13.994)	-0.008 (-0.964)	-0.006 (-0.769)	0.003 (0.27)	0.002 (0.246)	3.93	<i>blockchain_risk</i>
	<b>0.043***</b> (12.069)	0.003 (0.548)	0.007 (1.149)	0.006 (1.033)	0.003 (0.534)	3.60	<i>Zero-day</i>

Here we assess the impact of negative investor’s attention, proxied by google search terms such as ‘cryptocurrency attack/hack/risk’, ‘bitcoin attack/hack/risk/exploit’, ‘blockchain attack/hack/risk’ and ‘zero-day’ on BTC volatility. We regressed bitcoin’s monthly volatility against the google search data without lag and lagged from one up to three-month horizons. For each regression, we had 50 observations. \*\*\* denotes significance levels based on the respective p-value (\*:10%, \*\*:5%, and \*\*\*:1%). The standard t-statistic value is shown in parentheses.

2022). As most of our (significant) results show a positive impact on the returns, contradictory to our initial assumptions (H1), we deduce that, in general, negative investor attention increases bitcoin’s returns.

When assessing if the negative investor attention impacts bitcoin’s volatility, we have interesting results. With only ‘bitcoin attack’ and ‘bitcoin risk’ searches being significant, our findings show that negative investor attention coming from both specialist<sup>5</sup> and non-specialist<sup>6</sup> investors, has little impact on bitcoin’s volatility. Additionally, we found that negative investor attention tends to decrease the volatility in the coming months. This surprising result contradicts our initial assumptions (H2). While there could be many reasons behind this weak impact on volatility, we think of two possible explanations: 1) The increased investor attention attracts more participants and contributes to higher trading volumes. Consequently, the influx of participants could increase market liquidity, making it easier to buy and sell bitcoin. This increased liquidity can help absorb sudden price shocks and dampen volatility, resulting in a negative impact of investor attention on bitcoin’s volatility. 2) Another idea to explain the weak impact of negative investor attention on bitcoin volatility is the volatility persistence. If bitcoin’s volatility exhibits persistence, it means that the impact of investor attention may be overshadowed by other factors that contribute to the persistence of volatility, such as market uncertainty, liquidity conditions, or external shocks. In Appendix A, we have performed a quick check to test for volatility persistence. Our results confirm the presence of volatility persistence for bitcoin, which means that even if public attention attracts more participants to the market, if the underlying factors driving volatility persistence remain dominant, the impact of negative investor attention on volatility will be limited. To fully understand the complex dynamics that shape bitcoin’s volatility, further analysis should be done on this issue.

Studying investor attention’s impact on bitcoin performance has important implications in investment decision processes. Therefore, we believe that our results may be of interest to investors interested in the crypto-market. Among its many interesting features and innovative advantages, Blockchain technology and

<sup>5</sup>In this study, we consider that searches for ‘bitcoin attack’ are made by specialist investors.

<sup>6</sup>In this study, we consider that searches for ‘bitcoin risk’ are made by non-specialist investors.

the crypto-market are mostly famous thanks to their highly volatile prices (Baur & Dimpfl, 2021; Dyrberg, 2016; Yi et al., 2018). The high volatility in this market might be associated with the investors' behavior, as already shown in the literature (Nie et al., 2020). Our findings bring new evidence that could help to understand this market better. At the same time, we think that supporting Blockchain literacy among investors would greatly improve the performance and reputation of the crypto-market as a whole.

A limitation of this study represents the fact that we have investigated the impact of negative investor attention only on bitcoin's performance, leaving out other important cryptocurrencies from this market. Therefore, as future work, it would be interesting to include other cryptocurrencies and study the negative investor attention's impact on the crypto-market as a whole.

## A Appendix - Additional tests

In section 4, we tested if negative investors' attention impacts bitcoin returns and volatility. Our results show that investors' attention impacts bitcoin returns and has little to almost no effect on the volatility. One explanation for this result could be the presence of volatility persistence. To complement our initial results and provide further answers, we decided to perform some additional tests and check the presence of volatility persistence in this market. Volatility persistence could potentially explain why negative investor attention has a weak impact on bitcoin volatility. Volatility persistence refers to the tendency of volatility to persist over time. If bitcoin's volatility exhibits persistence, it means that the impact of negative investor attention may be overshadowed by other factors that contribute to the persistence of volatility, such as market uncertainty, liquidity conditions, or external shocks. We follow the study of (Chou, 1988), and test the presence of volatility persistence with the Garch model:

$$h(t) = \omega + \alpha\epsilon_{t-1}^2 + \beta h(t-1), \quad (3)$$

$h(t)$  is the conditional variance at time  $t$ ,  $\epsilon_{t-1}$  is the error term (or innovation) at time  $t-1$ , and  $h(t-1)$  is the conditional variance at time  $t-1$ .  $\omega$ ,  $\alpha$ , and  $\beta$  are parameters to be estimated. The parameters  $\alpha$  and  $\beta$  play key roles in determining the persistence of volatility.  $\alpha$  measures the impact of a shock in the previous period's error (or "news") on the current period's variance.  $\beta$  measures the impact of the previous period's variance on the current period's variance.

Results are reported in Table 4. As we can observe, the sum of  $\alpha$  and  $\beta$  is close to 1. This means that shocks to the variance have a very persistent effect, confirming our initial intuition. These results show that even if public attention increases and attracts more participants to the crypto-market, if the underlying factors driving volatility persistence remain dominant, the impact of negative investor attention on volatility will be limited. In such cases, short-term increases in attention might have only a temporary or minimal impact on the overall volatility of bitcoin.

Table 4: Volatility persistence test - GARCH(1,1)

Parameters	Estimate	Std. Error	t value	p-value
mu	0.003361	0.00081	4.1489	3.30E-05
omega	0.00008	0.000013	6.2351	0.00E+00
alpha	0.13074	0.014098	9.2736	0.00E+00
beta	0.857727	0.013009	65.9332	0.00E+00

*Here, we assess the volatility persistence for bitcoin. We applied the GARCH model to bitcoin returns. All the results obtained are positive and highly significant at a 99% confidence level. .*

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