



# **Abnormal returns of corporations adopting Bitcoin as a treasury asset: An event study.**

Erasmus School of Economics

MSc Behavioural Economics: Master Thesis

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Final Version Date: 16 August 2021

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## ABSTRACT

From early 2020 through into 2021, Bitcoin's emergence as a new asset class has garnered serious attention. Despite one of the most tumultuous years in recent memory, dozens of firms begun to announce purchases or acquisitions of bitcoins in lieu of holding fiat currencies. This surge in interest has followed much of the existing literature on Bitcoin being limited to topics such as portfolio construction, volatility and the returns of Bitcoin. However, there is currently no published literature investigating corporate acquisition of Bitcoin and the effects these announcements may have on the shares of firms once made public to the market. This paper is the first event study to investigate the effects of abnormal returns across publicly traded firms, following a market announcement of the purchase or acquisition of Bitcoin as a treasury asset and/or holding.

Event study methodology consistent with that of Fama et al. (1969); Strong (1992) and MacKinlay (1997) will be utilised in order to construct event windows of 20 days on either side of an announcement date (a 41-day event window), and five days either side of an announcement date (an 11-day event window). These test the cumulative abnormal returns (CARs) of 18 different events that occurred across 2020-2021, where firms announced Bitcoin holdings.

The results show positive CARs across both the 41-day and 11-day event windows; however, these findings are insignificant at a 10% significance level. Other variables such as a firm's country of listing, sector, whether an announcement was a surprise to the market, the size of a purchase and the daily value of sentiment indicators are all used as dummy variables to see if they may affect CARs over the 41-day event window. Firms who surprise the market with their announcements see significantly higher CARs than those who made announcements within expected market updates. There is a similar effect for CARs of firms listed outside of the US compared to those listed on US exchanges. These results pave the way for future research in this space, with additional firms announcing holdings throughout the writing of this paper. As additional data becomes available from increased observations, similar studies to this will provide relevant findings for firms actively holding bitcoins on their balance sheets, and especially to those who may be considering acquiring and holding bitcoins.

**Key words:** Bitcoin, event study, abnormal returns

### **A note on nomenclature:**

*“Bitcoin” (with capitalisation), is used to describe the concept of “Bitcoin”, or the decentralised network itself, whereas “bitcoin” (with no capitalisation) refers to the actual unit of account, and the plural “bitcoins” referring to these units being bought, acquired and held or sold.*

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# 1. INTRODUCTION

The past 18 months have seen global financial markets experience turbulence amidst the highest levels of volatility since the 2008-2009 Global Financial Crisis (GFC), with the VIX index (measuring forward-looking volatility of the S&P 500) increasing approximately 500% from mid-January through to 31 March 2020 (Baker et al., 2020). While equities markets marched higher amid record government stimulus, an emerging narrative that garnered serious attention through late 2020 and into 2021 was that of Bitcoin. The increased interest from the public saw Bitcoin-enthusiasts and market commentators both attempting to find a reason to explain why the price had appreciated from March 2020 lows of below US\$5,000 to close the year above US\$28,000, eclipsing the performance of all major indices and gold. From being seen as an inflation hedge, “digital gold” or price appreciation brought about from excessive speculation due to record quantitative easing and stimulus packages, all attempted to explain the rapid price appreciation of a new asset class throughout one of the most tumultuous years in recent memory.

Throughout the economic uncertainty and COVID-19 health pandemic, a movement gained a small amount of traction, surprising proponents and detractors of Bitcoin alike. For the first time, a number of publicly traded firms begun to announce they had acquired bitcoins to place on their balance sheets as part of new treasury strategies. While some firms have historically held bitcoins on their balance sheets due to investments across the blockchain space, via mining bitcoins or previous acquisition, this phenomenon spanned across different industries and multiple countries. Moreover, firms acquiring or buying bitcoins to allocate to their balance sheets were relatively unexpected and saw a pronounced increase in occurrences starting in mid-2020 and continuing into 2021 (Choudhury, 2021).

On January 3, 2009, the open-source project known as “Bitcoin”, created by the anonymous Satoshi Nakamoto, was launched and officially released to the public less than a week later. On the same day, while mining the first bitcoin block, the mysterious creator inserted the following message: *“The Times 03/Jan/2009 Chancellor on brink of second bailout for banks”*, alluding to the uncertain situation that was unfolding across financial markets around the world at the height of the GFC. While initially released as a peer-to-peer electronic cash system (Nakamoto, 2008), each bitcoin had no intrinsic value. Bitcoin’s use case was limited to early adopters sending coins between one another and, importantly, with no central parties involved in these transactions. The subsequent 13 years have seen immense narrative shifts as to what Bitcoin is, with the asset seen as everything from a trustless, digital form of cash (Evans-Pughe, 2012), an alternative to the traditional banking sector (Wonglimpiyarat, 2015), to an alternative to gold and or as an inflation hedge (Selmi et al., 2018).

With most of the existing literature on Bitcoin more centred around features such as portfolio construction, volatility and returns, or looking at the technical or political outcomes that may be of importance, due to the small period of time passing since the events occurring, there is currently an absence of literature regarding these recent firm purchases of bitcoins or investigating the share price returns of firms now holding bitcoins. As such, this paper sets out to deviate from the focus of existing Bitcoin-related literature, delving into the less explored features of Bitcoin as a new corporate investment class, specifically to do with the share performance of firms who have invested in bitcoins as a treasury asset. This paper will contribute to the growing literature on Bitcoin by performing one

of the first event studies investigating the abnormal returns across publicly traded firms that made bitcoin acquisition announcements between March 2020 and May 2021. Its intention is to provide a foundation from which future research can be conducted in the case that this current phenomena of corporate acquisition of bitcoins continues to be a trend in the coming years.

As such, the main research question of this paper is:

**What is the effect on a firm's share price following their announcement of Bitcoin acquisition/purchase over an event period?**

The past 12 months have seen traditional financial companies like VISA and Mastercard, the 236-year-old Bank of New York Mellon, through to recent FinTech competitors PayPal and Square all creating the ability for retail customers to purchase and hold bitcoins on their platforms. This has also continued to more significant institutional offerings from JP Morgan and Morgan Stanley, which opened Bitcoin funds to their clients in early 2021. In addition, Bitcoin has also featured in the investment strategy of New Zealand's national retirement savings program Kiwisaver, with an estimated 5% allocation of funds from the Growth Strategy fund into bitcoins, announced by the fund's chief investment officer in March 2021 (Chawage, 2021). Regardless of these shifting narratives, on April 12, 2021, the market capitalisation of Bitcoin exceeded US\$1 trillion for the first time, making it the fastest asset in history to hit the milestone (Ali, 2021). As of May 31, 2021, Bitcoin represented approximately 42.8% of the US\$1.63 trillion market capitalisation of all 7,500+ cryptocurrencies (CoinGecko, 2021).

Governments and regulators globally have generally allowed Bitcoin to remain a relatively unregulated asset class (Hendrickson & Luther, 2017). According to the United States Commodity Exchange Act (CEA), Bitcoin is recognised as a "commodity", and the US Securities and Exchange Commission (SEC) has no jurisdiction overseeing Bitcoin or other cryptocurrencies as they do not recognise them as securities. However, contrary to this open approach from US regulators, the first half of 2021 saw India, Turkey and China, and a handful of other nations announce sanctions or bans of Bitcoin transactions, mining, the operation of cryptocurrency exchanges, and/or trading (Newsweek, 2021). Alternatively, El Salvador passed legislation in June 2021 as the first country to adopt bitcoins as legal tender (Bitcoin Law, 2021). Effective September 2021, the El Salvadoran government will operate with dual currencies (USD and Bitcoin), ensuring the ability to convert between the two currencies, and assisting local citizens who heavily rely on remittances to and from the United States.

The dichotomy of these approaches creates an interesting predicament with regards to publicly listed companies (overseen by regulators such as the SEC, or their domestic equivalent), who may be allocating portions of their balance sheets into bitcoins. Albeit in its infancy, further instances of companies acquiring bitcoins on their balance sheets will no doubt be of increasing importance to governments and regulators. Publicly traded firms adopting a decentralised asset with little-to-no oversight from existing regulatory bodies enters unknown territory, with the potential to erode both fiscal and monetary controls of governments and central banks, weakening the ability of regulators such as the SEC to serve its role in protecting investors.

Bitcoin's current place as an asset class within global financial markets is unique, due to this aforementioned variance in treatment by various governments and regulators. For example, in

December 2017, The Chicago Mercantile Exchange (CME) received regulatory approval to launch Bitcoin futures in North America, trading slightly less than US\$50 million in notional value on the first day of trading<sup>1</sup>. This paled in comparison to other options available at the time, with unregulated offshore exchanges such as Hong Kong's BitMEX seeing daily volumes of nearly US\$4 billion at this time. This absence of regulation and access to Bitcoin derivatives or financial instruments has subsequently increased over the past three-and-a-half years. With the increased trading volumes via offshore derivatives exchanges such as Binance, Huobi, Okex, Bybit, FTX (which are all incorporated and headquartered in crypto-forward jurisdictions such as Malta, Antigua and Barbuda, Seychelles and Hong Kong), volumes of Bitcoin Futures averaged approximately US\$2 trillion per month across the first 5 months of 2021, compared to approximately US\$80 billion per month in Bitcoin CME Futures (The Block, 2021). CME Futures have a very minor effect on the price discovery of Bitcoin, and even less when compared to the aforementioned spot and derivative exchanges (Alexander & Heck, 2020).

Although there are a multitude of derivatives and other avenues to trade bitcoins across various international jurisdictions, there has been a distinct lack of access to traditional, regulated options, such as Exchange Traded Fund (ETF) products, especially within the United States. Recently Canada approved an ETF that has been available since February 2021, and a Bitcoin ETP (Exchange Traded Product) was launched in early June 2021 in the United Kingdom. Price discovery of asset classes (such as gold, silver and oil) rely on public markets having access to ETFs or ETF-like products (Ivanov, 2011), yet trading volumes of Bitcoin have historically been limited to derivatives and futures, in addition to spot trades on centralised exchanges. Concerns regarding the inconsistent regulation between various jurisdictions globally, inconsistent price stability and the inability to protect Bitcoin from manipulation are among the primary concerns of the SEC as to why they have remained reluctant to approve a Bitcoin ETF (Alexander & Heck, 2020). There are other ways for investors within the US to gain exposure to Bitcoin, such as through the Grayscale Bitcoin Trust (GBTC). The product, available since 2013, now has assets under management (AUM) of over US\$30 billion as of August 2021<sup>2</sup>, demonstrating while there is demand from investors to have access to bitcoin products, there exist other financial products that could make the buying and selling of bitcoins easier for investors.

Bitcoin is also unique in the regard that unlike other assets, they are relatively easy to take delivery of. The ability to digitally transfer bitcoins between wallets, or from an exchange into one's own custody requires little effort when compared to a similar process when attempting to take physical delivery of assets such as silver or gold. Major exchanges in the United States and internationally allow bitcoins to be custodied within their wallets, or to be withdrawn and sent to another wallet, effectively allowing delivery and self-custody. Advocates of self-custodied bitcoin point to historical examples of centralised platforms being hacked or losing coins (Trautman, 2014), such as Japanese exchange MtGox losing nearly 850,000 bitcoins in 2014 (worth approximately US\$30 billion now), and the infamous darknet marketplace Silk Road, which had a total of 170,000 bitcoins seized by the FBI in 2013.

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<sup>1</sup> Reuters, 2017

<sup>2</sup> Grayscale, 2021

Exchanges such as US-based Coinbase provide services to corporations that may wish to use their custodial services, and offset the risks associated with self-custodying large amounts of bitcoins. However, firms that announce the purchasing of bitcoins have multiple options available to them, ranging from purchasing the underlying bitcoins and storing themselves or custodial service, however they may be looking simply for exposure to the asset and use derivative products to achieve this. Amongst the swathe of corporate Bitcoin-related announcements, none have provided evidence of holdings, so could be purchasing either spot bitcoin, or utilising some combination of derivative products. It is more likely to be the former, however, as all transactions on the Bitcoin ledger are publicly viewable, with over 8,000 corporations utilising Coinbase's institutional offering to store their Bitcoin holdings.<sup>3</sup>

Ultimately, with several firms already announcing their intentions to gain increased exposure to Bitcoin as an asset class, there will be increased pressure on regulators to create clear guidelines for institutions to operate within and eliminate some of these grey areas currently present. An interesting question remains unaddressed, however. Will companies in the future begin to provide "proof of reserve" of the bitcoins they have purchased? Firms currently have either stated a purchase of Bitcoin as a dollar value (e.g., US\$500 million of bitcoins), and/or the number of bitcoins they purchased (e.g., 14,000 BTC). However, without the ability for the market to confirm this in absolute terms, there remains the ability for firms to announce they have "bought" bitcoins, without knowing the actual financial instrument used, or if they have acquired actual bitcoins and are storing using a custodial solution or themselves.

Additionally, this problem can be true of custodial providers and exchanges themselves, stating they hold bitcoins on behalf of customers, without proving the Bitcoin address(es) they control. This is of particular importance due to the programmatically finite limit on bitcoins that can exist (no more than 21 million bitcoins will ever be created). In contrast, firms stating they have certain liabilities and assets can be far harder to corroborate evidence as to what is legitimate or not without the use of internal or external auditing. Carter, 2020, makes a case for proof of reserves to become commonplace for exchanges and custodial Bitcoin companies. Due to its relative simplicity in providing evidence of solvency, this could be of even more significance when it comes to firms announcing Bitcoin acquisitions in the future, giving proof of their Bitcoin holdings to regulators and investors alike. This will undoubtedly become of increased significance over the coming years, with implications such as protecting customers from exchange insolvency, avoiding excessive rehypothecation due to the limited supply of bitcoins, and could be extended to assist with highly automated blockchain-based corporate auditing.

Overall, the increase in firms acquiring bitcoins over the past 18 months, in conjunction with a shift in attitudes of nations positioning themselves as pro-Bitcoin or anti-Bitcoin has the potential to affect the share prices of these firms materially, and possibly the economic relations between economies of opposing viewpoints on the asset. These outcomes are pure speculation at this juncture, but will no doubt form the basis of future research and literature. Future research may also look at whether this current trend of firms announcing Bitcoin purchases will continue into the future, with surveys such as the one conducted by Gartner in early 2021 measuring the intentions of private and public

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<sup>3</sup> YahooFinance, 2021



firms over time. In addition, due to the fact this study is being performed within some cases only months after a firm announcing they have acquired bitcoins, it would be useful for future researchers to explore how well the share prices of firms holding bitcoins on their balance sheets perform relative to Bitcoin itself over longer time periods, as some investors may wish to gain exposure to the asset class in jurisdictions where it may be more difficult to simply purchase bitcoins itself.

For the purposes of this paper, the focus will remain on what has occurred over the past 18 months since some firms begun announcing the purchase or acquisition of bitcoins. The following literature review will firstly canvas the background of Bitcoin as an emerging asset class and the narrative that has driven firms to adopt it on an institutional scale, with hypotheses surrounding what may affect the abnormal returns of the shares of these companies following their announcements. The methodology section will outline the steps taken to amalgamate and analyse the share market data and the process by which the event studies were carried out. Following this, the results of the event studies will be detailed. In the final sections of the discussion and conclusion, the findings will be further dissected, with an investigation into the practicalities of what these findings mean and what conclusions can be drawn, with any broader implications for other firms who may be interested in similarly allocating part of their balance sheet(s) into bitcoins.

## 2. LITERATURE REVIEW

### 2.1 – LITERATURE INTRODUCTION

Instances of firms allocating and investing portions of their balance sheets into Bitcoin is a relatively new phenomenon. As such, existing literature in this area of study is virtually non-existent. While a small number of yet to be peer-reviewed papers submitted in late 2020 and early 2021 acknowledge Bitcoin allocations by firms, their primary focus is on the volatility of Bitcoin and other cryptocurrencies in the context of performance during and after COVID-19 (Mazur, 2020; Rubbaniy, 2020), and a time-series analysis between Bitcoin and forward-looking inflation estimates (Blau et al., 2021). More broadly, the bulk of existing literature on Bitcoin that comes from a financial and investing angle (and not from a more technical perspective) usually falls within one of the following four categories: firstly, Bitcoin as a speculative asset class; second, Bitcoin's performance against existing assets and indices; third, Bitcoin as an alternative inflation hedge; and fourth, models or frameworks that attempt to explain the behaviour of Bitcoin price movements.

Bitcoin (and the cryptocurrency market in general) rose to prominence after their 2017 bull run - which culminated in a retail-driven frenzy, ultimately seeing the price of Bitcoin fall nearly 90% within the 12 months following its peak on 17 December 2017<sup>4</sup>. Following this, many papers pointed out the cryptocurrency “bubble” had burst (Vogiazas & Alexiou, 2019, Akyildirim, et al., 2020, Moosa, 2020), similar to those who drew the same conclusion following the 2013 “bubble”, comparing the price action of the early 2000s NASDAQ “dot-com bubble” (Kristoufek, 2013). Following the peak of price action in 2017, other studies attempted to explore possible relationships between the price activity of Bitcoin and other related events, such as the supply/demand shifts following a reduction in block rewards following an anticipated Bitcoin “halving” (Meynkhard, 2019), how mining hashrate may be a leading indicator of broader demand for buying Bitcoin (Fantazzini & Kolodin, 2020) and a possible price floor due to the “production cost” per bitcoin (similar to costs associated with procuring gold from a reserve) due to electricity costs and other fixed costs (Woo, 2019). Additional quantitative models (PlanB@100trillionUSD, 2019, 2020a, 2020b), have attempted to compare the “stock-to-flow” of Bitcoin against various scarce assets; gold, silver and real estate, and analyse if Bitcoin's value could be measured using Fama's Efficient Market Hypothesis (EMH). This is extremely relevant to market participants and investors, as Bitcoin's programmatic supply is known through to the year 2140, with supply halvings roughly every 4 years (or every 210,000 blocks).

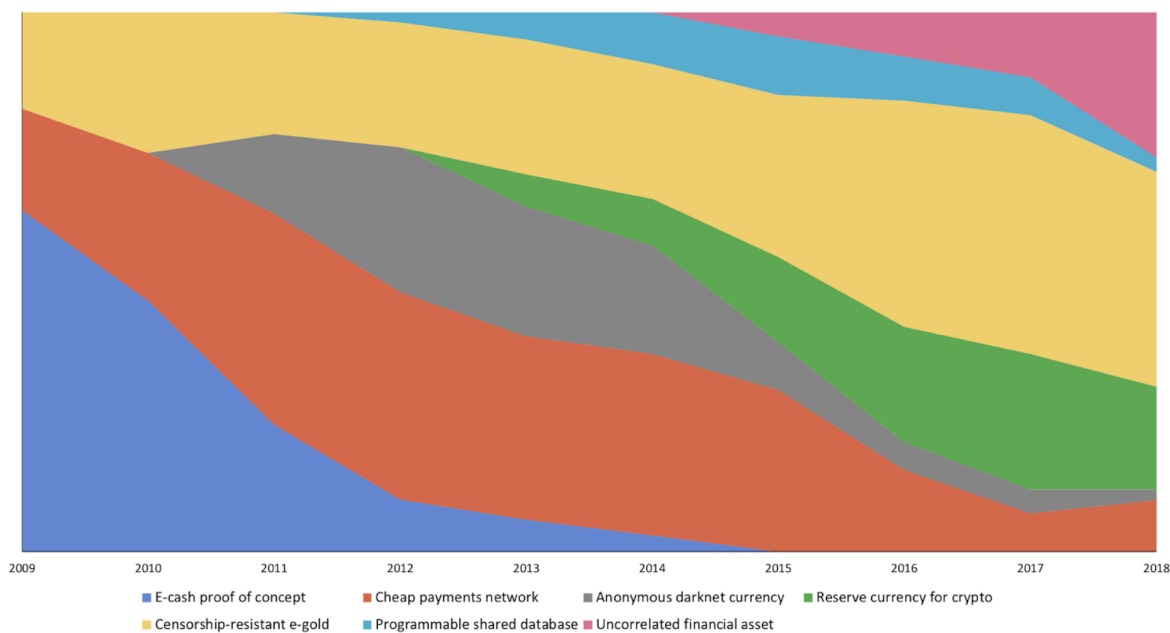
More recent analyses argue that the value of Bitcoin is largely narrative driven, being malleable to the extent that value is driven by the use case of those participating in the network. A research report from the Bank of New York (BNY) Mellon (2021), considers that the valuation of Bitcoin may be “more art than science”, pointing to the various competing models used to value global currencies. This changing of narratives or “visions” of what Bitcoin actually is, has been more

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<sup>4</sup> coinmetrics.io, 2021

extensively explored (Carter, 2018). There have been various distinct narratives that have shifted over the years, from an e-cash and peer-to-peer payments network to a censorship resistant digital gold, a darknet currency, a reserve asset for the entire cryptocurrency space, through to a programmable shared database and an uncorrelated financial asset. This can be seen in Figure 1, with each competing value proposition of Bitcoin varying in dominance over time.

**Figure 1: “Bitcoin’s changing tides” (Carter, 2018)**



Since 2019, proponents of the “uncorrelated financial asset” narrative have also seemingly supported the new narrative of Bitcoin as an “inflation-hedge”. While this may simply be a slight reworking of the same initial thesis, it shares support from some firms (such as MicroStrategy, whose investment thesis references Bitcoin’s potential as a hedge against inflation). Notably, while gold is traditionally seen as an inflation-resistant asset (Ghosh et al., 2004), Bitcoin’s correlation with gold is at the lowest levels since 2018 (Kaiko, 2021). In addition, while gold has underperformed the S&P 500 and other major indices over the past 12 months, portfolios with exposure to Bitcoin ranked higher than those with the same level of exposure to gold (Henriques & Sadorsky, 2018).

Whether Bitcoin can prove itself longer term as an uncorrelated asset class, an inflation hedge, or something else remains to be seen and will likely become more evident over extended periods. However, this notion of time passing to crystallise findings regarding Bitcoin as an asset class usually cites the short history of Bitcoin as a current limitation to extrapolate results more broadly (Bohr & Bashir, 2014 and Briere et al., 2015). While this remains true to the extent that Bitcoin itself has only existed since 2009, from January 2010 onwards, Bitcoin as an asset has been tradeable 24 hours a day, 365 days a year to virtually any market participant with an internet connection. This compares to traditional financial markets (such as the NYSE or NASDAQ),

which are only open between 9:30 am and 4:00 pm Eastern Time, Monday to Friday and closed for weekends and holidays. Thus, even though Bitcoin is viewed through much literature as a newer asset class, it has been tradeable for approximately 95,300 hours since 1 June 2021, while the S&P 500 index (launched on 4 March 1957) has traded roughly 105,100 hours (Spilotro, 2020). With this current trajectory, Bitcoin will equal and eclipse the total trading hours of the S&P 500 index, one of the most prominent indices globally, in late 2022. This observation demonstrates how rapidly the adoption of newer digital assets, such as Bitcoin has become over a relatively short period.

Similarly, trading platforms such as Robinhood have become increasingly central to the investment landscape over the last few years, with the notion of easy to access and “always-on” investing and trading made available and now expected by new entrants to the market especially from millennials. The expeditious pace at which millennial participants have risen to relevance within the traditional investing landscape comes as no surprise, as they now represent the largest living generation in the US and over 40% of the workforce (Frey, 2018). With this demographic rebalancing, shifts in investing habits have also brought about innovations such as micro-investing, fractional ownership, zero commission trading and Decentralised Finance (DeFi) opportunities through Bitcoin and other cryptocurrencies.

While the reasons for investing in Bitcoin are varied, constantly evolving and come with potentially unforeseen risks, it is undoubtedly becoming a more prevalent and legitimised asset class. With ever-increasing demographic changes, shifts in consumer and investor sentiment and risk profiles, interest in decentralised digital assets will be a crucial area for market participants, governments and regulators alike. However, firms’ attitudes toward incorporating Bitcoin will be of equal importance over the coming months and years. In Bank of America’s June survey of Global Fund Managers, over 80% of the 207 fund managers surveyed believe Bitcoin to be a “bubble”, representing relatively sceptical sentiment from surveyed investors.<sup>5</sup> A smaller dataset composed of 77 Chief Financial Officers (CFOs) and senior finance leaders polled in early 2021 displayed a similar view, with approximately 65% of surveyed participants indicating they never anticipate their firm holding bitcoins.

Interestingly, when asked the most important factor driving a firm's attitudes toward Bitcoin adoption, the most common response was what other firms were doing (Gartner, 2021). Basing internal corporate decisions off the attitudes and behaviours represents a dynamic game with incomplete information and plays heavily into the work of Gibbons, 1992, with the game theory associated with treasury decisions potentially relying on decisions from other economic actors. As the event study conducted in this paper focuses on publicly listed firms (due to the ability to measure the effects of bitcoin-related announcements on their share prices), incomplete information will exist as private entities, and other institutions may not necessarily have the regulatory requirements to be as transparent.

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<sup>5</sup> Bloomberg, 2021

In addition to the game-theoretic nature of firms acquiring Bitcoin, one could argue that other firms have also taken a partial treasury allocation of the asset due to bandwagon effects. As there remains a lack of consistent reasons why various firms have bought bitcoins (discussed below), two opposing views may describe the behaviour seen thus far. On the one hand, US hedge fund Bill Miller explains the phenomena as Bitcoin becoming “less risky the higher it goes”<sup>6</sup>. This contrasts against the opinion of Nouriel Roubini, Economics Professor from New York University’s Stern School of Business, who stated Bitcoin was “a total speculative play on a bubble that is self-fulfilling”. Although opposed to one another, both acknowledge this heuristic investors are currently displaying, with bandwagon-like behaviour reinforcing opinions on whether to invest in the asset, sharing similar attitudes displayed by the financial executives interviewed by Gartner earlier in 2021.

## **2.2 – BITCOIN INVESTMENT RATIONALES**

After the COVID-19 pandemic, governments and central banks were faced with the difficult task of navigating a global health crisis in addition to deteriorating economic conditions domestically. As a result, many governments combined border closures, lockdowns and monetary stimulus packages to counter the effects of COVID-19. Empirical analysis of the G7 countries demonstrates that combining these policies assisted in cushioning and protecting stock returns (Narayan et al., 2021). However, the evolving nature of the pandemic meant firms’ corporate treasury management was key to remaining resilient through a potentially extended period of downturn. In addition, firms wanting to model for “worst-case scenarios” also had to consider the impacts any large foreign exchange movements may have had on their overall cash positions (EY, 2020), in addition to implications on short-term cash flows.

On 11 August 2020, when announcing a Bitcoin purchase of US\$250 million, NASDAQ-listed Microstrategy, widely reported as the “first” publicly listed company to denominate a significant portion of their balance sheet in Bitcoin, stated; *“Our decision to invest in Bitcoin at this time was driven in part by a confluence of macro factors... the economic and public health crisis precipitated by COVID-19, unprecedented government financial stimulus measures including quantitative easing adopted around the world, and global political and economic uncertainty.”*<sup>7</sup> While anecdotal, this corporate treasury decision was made during this period of instability and uncertainty, and would pave the way for dozens of other firms to similarly allocate part of their balance sheet to Bitcoin. Following this initial announcement, Microstrategy acquired an additional US\$175 million worth of bitcoins in September 2020, taking their total investment to US\$425 million within the span of one month.

This sentiment Microstrategy initially shared as part of their investment thesis, however, was not necessarily shared by other large publicly traded companies who also acquired Bitcoin as part of their corporate treasury management during 2020-2021. In October 2020, the large fintech

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<sup>6</sup> Bloomberg, 2021

<sup>7</sup> Microstrategy, 2020

company Square, allocated US\$50 million to purchase bitcoins, which at the time represented roughly one percent of their assets as at the end of the second quarter 2020<sup>8</sup>. In their announcement to the market, Square stated their purchase was based on a belief that *“cryptocurrency is an instrument of economic empowerment and provides a way for the world to participate in a global monetary system, which aligns with the company’s purpose.”*<sup>9</sup>

Tesla, one of the world’s largest electric vehicle manufacturers, led by CEO Elon Musk, announced in February 2021 they had made a US\$1.5 billion purchase of Bitcoin, and would be accepting bitcoins as a form of payment for their vehicles in North America. Their decision to adopt Bitcoin as a treasury asset was to provide *“...flexibility to further diversify and maximize returns on our cash.”*<sup>10</sup> This thesis for investing in bitcoins as an asset class they believed would appreciate in value turned out to be highly beneficial for the company, as they subsequently sold approximately 10% of their holdings (at the time) within the space of a few months after purchase. At the time their US\$1.5 billion purchase was worth slightly north of double that (US\$3 billion) and saw around US\$300 million worth of bitcoins sold off from their Bitcoin holdings, resulting in a US\$101 million “positive impact” toward their profitability for the first quarter of 2021 (Tesla, 2021).

While Microstrategy, Square and Tesla are the three largest publicly traded companies who have announced Bitcoin holdings on their balance sheets, each also had follow-up announcements after their initial Bitcoin buys. Microstrategy subsequently had three major additional purchases of Bitcoin, while Square announced they had allocated additional capital into Bitcoin in the first quarter of 2021, with an intention of remaining open to additionally allocating to their existing bitcoins. As previously mentioned, Tesla was notably one of first major publicly traded companies to announce they had partially sold some of their holdings. Outspoken Tesla CEO Elon Musk later tweeted that the sale was a liquidity test in order to “confirm bitcoins could be liquidated easily without moving [the] market”<sup>11</sup>. While these three companies are all publicly traded in the US, there are a number of firms currently holding bitcoins on their balance sheets with shares listed on Canadian stock exchanges, with a smaller number of firms from other countries globally (see Appendix 6 for a detailed breakdown of the publicly traded companies holding bitcoins on their balance sheets used for this study).

This lack of definitive rationales as to why firms are either fully or partially adopting Bitcoin as part of their treasury management policies is unsurprising, due to the speed at which they occurred over the past 12-18 months. In the future, however, this may become a larger point of distinction, with an increasing number of investors and firms abstaining from making Bitcoin-related investments due to possible ESG concerns from Bitcoin mining and the volatility of the asset class. Both Microstrategy and Square have also made public detailed analyses on how they acquired their bitcoins, coupled with investment theses, roadmaps, how their Bitcoin

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8 Square Inc., 2020

9 Square Inc., 2020

10 Tesla, 2021

11 Musk, E., 2021 [@elonmusk]

purchases were executed, how their bitcoins will be treated for accounting purposes on their balance sheets and details on how their bitcoins will be custodied and insured in the event of a hack (Microstrategy, 2020; and Square, 2021).

## **2.3 – EVENT STUDIES & ABNORMAL RETURNS**

This paper sets out to analyse the abnormal returns of the shares of firms during the event periods surrounding announcements related to Bitcoin acquisition. There is extensive literature on event studies, especially in the domain of announcement-based abnormal returns. Brown & Warner (1980); and Fama, (1991), also note market efficiencies can be discovered through event studies carried out across longer time horizons, hence both shorter and slightly longer event periods will be utilised for this study. The methodology followed to conduct this study is outlined extensively within Section 3.

By constructing event windows on either side of an announcement date and in a manner to the examples from existing literature, it is expected that firms that announce Bitcoin holdings will outperform the benchmark due to the market looking favourably on such announcements. The primary benchmark of the S&P 500 is used due to its significance as the most referenced index globally (Kenton, 2021). As such the first hypothesis of this paper is:

***Hypothesis 1.*** *Firms that announce they have purchased Bitcoin see positive cumulative abnormal returns (CAR) versus a benchmark (S&P500) over an event window.*

In addition to a firm announcing the purchase or acquisition of bitcoins, the timing of such announcements may also play a role in the abnormal returns of firms over the market. When new information comes as a “surprise” to the market, there is evidence to suggest that the market reprice these shares more strongly compared to firms who may include additional information within a quarterly or annual report (Capstaff et al., 2004). For example, including information about the acquisition of bitcoins within an anticipated report to the market (such as a quarterly market update), the resulting share price action may be more difficult for the market to distinguish and correctly price in, due to the additional exogenous factors such as the market digesting earnings information, growth figures, etc. and less to do with the acquisition of bitcoins. Thus, the second hypothesis is:

***Hypothesis 2.*** *Firms with announcements regarding Bitcoin purchases that come as “unexpected” or “out of cycle” have a higher CAR than those included as part of a quarterly update or other business updates.*

There is currently no precedent and no existing literature exploring if Bitcoin-related announcements are viewed by the market in a positive light, due to the fact that almost all instances have occurred in the second half of 2020 and the first half of 2021. The period across which this study will be investigating is concentrated within a period of approximately six-to-nine months. There are, however, some initial findings that suggest shares of US-listed firms have

may have even outperformed Bitcoin itself since their initial announcements regarding the acquisition of bitcoins as a treasury asset<sup>12</sup>. In addition to this, there may be a possible price premium shares of US-based firms, due to the absence of ETFs currently available to investors. Whether this is also the case in Canada and other countries may be less severe due to the recent introduction of Bitcoin ETFs and ETPs. With this said, the third hypothesis of this paper is:

***Hypothesis 3.*** *US-listed firms experience a higher CAR over an event period compared to firms listed outside of the USA.*

Future research questions and hypotheses within this area that may be of interest could involve larger scale exploration into the jurisdictional arbitrage opportunities that may be present within countries that are yet to approve ETF or ETF-like products that are easily accessible to retail investors.

## **2.4 – DOT-COM BUBBLE vs CRYPTO “BUBBLE”**

The recent announcements by firms purchasing bitcoins could seemingly appear to market participants as the advent of another “bubble” waiting to burst. During the well documented period of Initial Coin Offerings (ICO) that occurred between 2017 and 2018, many observers saw valuations of brand-new cryptocurrencies borne out of exuberance and hype, rather than any fundamentals or genuine use cases (Zetsche et al., 2017). In January 2018, Eastman Kodak launched KODAKOne, a cryptocurrency coin that may have been less about camera manufacturing and more about taking advantage of the sentiment of the market through this period. Regardless, the announcement of the token saw the price of Kodak’s shares on the NYSE rise over 500% within 24 hours. After the announcement, Kodak’s share price saw a substantially decreased relationship with the Dow Jones Industrial Average (DJIA), while simultaneously experiencing an increased relationship with Bitcoin (Corbet et al., 2020). As such, announcements regarding cryptocurrency-related issues may give a reason for concern from both traditional investors and regulators, as any subsequent moves within cryptocurrency markets may ultimately flow back into conventional equity markets.

Jain & Jain (2019), conducted an event study across a list of firms that changed their names to include “blockchain” or “Bitcoin”, finding significant positive returns lasting two months after the announcement, compared to the S&P 500. These returns, however, turn negative five months after the announcement of a name change. This phenomenon is similar in essence to the situation that occurred nearly two decades earlier during the dot-com bubble of the late 1990s and early 2000s, with companies simply creating a website or adding “.com” to their business name. Event studies showed that such announcements ultimately led to positive abnormal returns of the shares of the companies (Cooper et al., 2001).

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<sup>12</sup> Ecoinometrics, 2021 [@ecoinometrics]



However, for the average market participant, the mania of the dot-com bubble may have made it difficult to distinguish genuine investment opportunities from companies with no intention of innovation and simply benefitting from the increased media coverage and attracting additional funds. Further, sceptics and those who thought valuations had run too high began to look for ways to capitalise on the situation once the bubble burst. Ofek & Richardson (2001), notes that while there may have been abundant capital available to those wishing to invest, there was a shortage of available avenues to short sell many technology stocks. Similarly, many investors wanted to short Bitcoin and other cryptocurrencies throughout 2017 but had very few financial instruments to do so. Ironically, the “top” of Bitcoin’s price action in mid-December 2017 came within days of the CME futures opening, which provided the ability for short-selling Bitcoin to market participants in a mainstream way for the first time. While the introduction of the CME futures had a statistically significant adverse effect on the return of bitcoin, overall, it had a neutral effect due to the insignificance of Bitcoin futures returns on the asset’s price over the long run (Hattori & Ishida, 2021).

In order to gauge how extended and “bubbly” the Bitcoin market is at any point in time, many investors and traders look to the Bitcoin “Fear and Greed Index” as a method of simplifying the noise surrounding the price action and online metrics such as social media posts. The index is an open-source, multifactorial market sentiment index, measuring five relevant variables and combining them into a score between 0 and 100 (with 0 indicating “Extreme Fear” and 100 representing “Extreme Greed”). Each variable is weighted according to importance, with the following from most to least weighted; price volatility, market momentum/volume, social media metrics (such as keywords, tweets, hashtags and social media post-counts relating to Bitcoin), Bitcoin’s dominance as a percentage of the total cryptocurrency market capitalisation, and other trends from search engines such as Google. The value of the index is measured against the rolling average of the previous month and quarter. This metric will also form the basis for the fourth hypothesis of this study:

***Hypothesis 4.*** *Firms experience a higher CAR over an event period, when their announcement is released to the market when the Bitcoin “Fear & Greed Index” is >75.*

Evidence suggests that market conditions can influence CAR results during event studies, with bull-markets having significant positive effects and the inverse for bear-markets (Klein & Rosenfeld, 1987). As such, while not perfect, the Fear and Greed Index provides one of the best sentiment-based reference points through which comparisons can be measured between the positive or negative sentiment of the market on Bitcoin in tandem with the date on which a firm announcement was been made. Thus, under Hypothesis 4, it is estimated that firms who announce they have acquired bitcoins during a period where the Fear and Green Index is greater than 75 (representing extreme greed) will have a greater positive effect on their CAR over an event period.

## 2.5 – LARGE vs SMALL PURCHASES

While both Hypothesis 2 and 4 reference timing of announcements in relation to either expectedness or within the broader Bitcoin market cycle, there may also be merit in investigating the relative size of the bitcoins purchased or acquired. While Section 2.2 touched on some details around the size of Bitcoin purchased by Microstrategy, Square and Tesla, Table 1 below indicates the size of each Bitcoin acquisition and its ratio compared to the market capitalisation on the date of announcement.

**Table 1 – Size of Bitcoin Acquisition**

Firm	Ann Date	Market Cap in \$USD	Acquisition Size (BTC) in \$USD	% of Mkt Cap in BTC
<b>MSTR (1)</b>	11-Aug-20	\$ 1,307,000,000.00	\$ 250,000,000.00	19.13%
<b>MSTR (2)</b>	14-Sep-20	\$ 1,381,000,000.00	\$ 175,000,000.00	12.67%
<b>MSTR (3)</b>	21-Dec-20	\$ 2,943,000,000.00	\$ 650,000,000.00	22.09%
<b>MSTR (4)</b>	24-Feb-21	\$ 7,839,000,000.00	\$ 1,026,000,000.00	13.09%
<b>TSLA</b>	8-Feb-21	\$ 828,760,000,000.00	\$ 1,500,000,000.00	0.18%
<b>SQ (1)</b>	8-Oct-20	\$ 82,150,000,000.00	\$ 50,000,000.00	0.06%
<b>SQ (2)</b>	23-Feb-21	\$ 116,650,000,000.00	\$ 170,000,000.00	0.15%
<b>MARA</b>	25-Jan-21	\$ 1,710,000,000.00	\$ 150,000,000.00	8.77%
<b>HUT8</b>	30-Jun-20	\$ 74,310,000.00	\$ 9,420,000.00	12.68%
<b>NEXON</b>	28-Apr-21	\$ 29,230,000,000.00	\$ 100,000,000.00	0.34%
<b>VOYAGER</b>	31-Mar-20	\$ 13,980,000.00	\$ 1,211,296.00	8.66%
<b>RIOT</b>	10-Aug-20	\$ 195,770,000.00	\$ 7,200,000.00	3.68%
<b>MEITU</b>	7-Mar-21	\$ 1,420,000,000.00	\$ 17,900,000.00	1.26%
<b>BITFARMS</b>	4-Feb-21	\$ 257,920,000.00	\$ 7,500,000.00	2.91%
<b>HODL</b>	30-Jun-20	\$ 24,080,000.00	\$ 1,925,000.00	7.99%
<b>HIVE</b>	15-Oct-20	\$ 152,100,000.00	\$ 3,000,000.00	1.97%
<b>DGHI</b>	4-Feb-21	\$ 30,460,000.00	\$ 6,890,000.00	22.62%
<b>DASH</b>	22-Dec-20	\$ 28,090,000.00	\$ 76,584.00	0.27%

For example, MicroStrategy's (MSTR) initial announcement came as a surprise to the market and cryptocurrency pundits, with a quarter-of-a-billion dollars initially allocated. However, their incessant purchasing continued into the new year and grew in size on a US-dollar value each time (apart from their second purchase). These were also sizeable relative to their market capitalisation, averaging 16.75% across their four purchases. In contrast, Tesla's (TSLA) mammoth US\$1.5 billion purchase, eclipsing all other purchases by any other publicly traded firms, was only 0.18% of the total Tesla market capitalisation when purchased in February 2021.

Outside of this, there were Bitcoin mining updates from firms such as Hut 8 (HUT8) and Digihost Technology Inc (DGHI), who both announced retention programs (meaning that they would not

sell all bitcoins mined during a quarter). While not surprising, and something Bitcoin mining firms have done historically, this can be an indicator of anticipated future price appreciation, due to wanting to hold the bitcoins longer and sell at inflated prices. Bitcoin miners face costs denominated primarily in US dollars or local fiat currencies, hence holding onto the bitcoins mined can be speculative in nature. However, it does follow the logic that firms involved in Bitcoin mining may have a desire to allocate at least some portion of their balance sheets in the digital asset.

Based on the above, the fifth and final hypothesis relates to the size of bitcoins purchased or acquired. As can be seen in some instances, firms with multi-billion-dollar market capitalisations have announced Bitcoin purchases in the millions or tens of millions of dollars such as Square (SQ) and Meitu (MEITU).

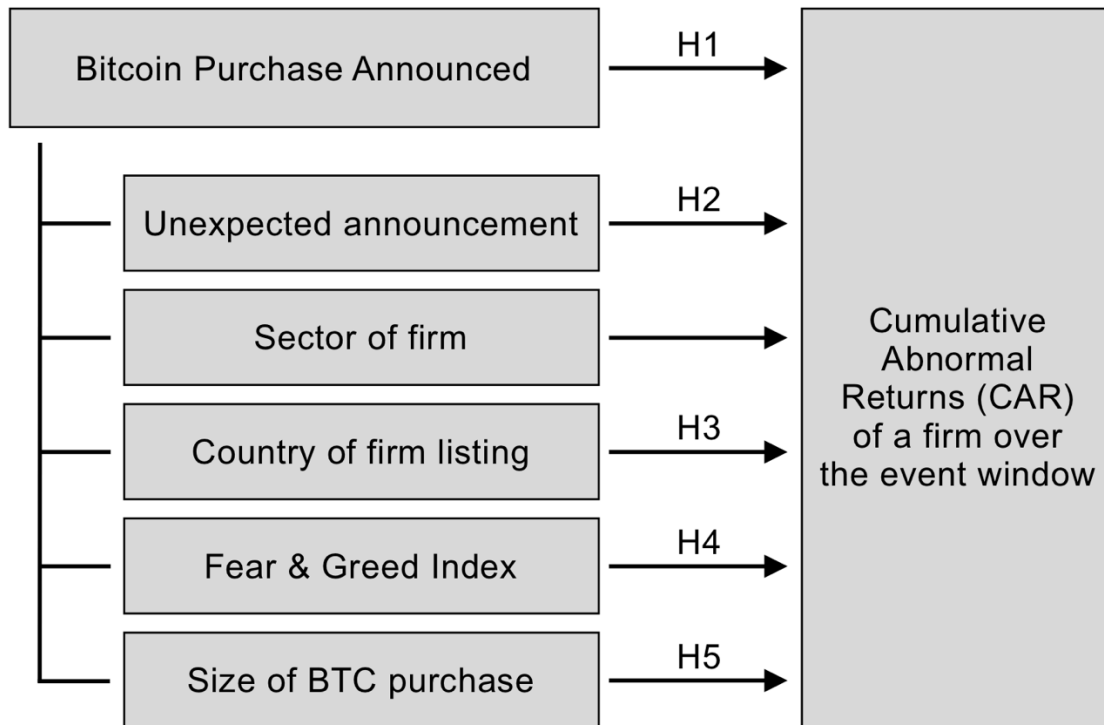
In such instances, one could suggest that an announcement of these purchases has an insufficiently material effect on the share price over an event window, regardless of any associated gains/losses brought about by the underlying value of Bitcoin during this time. Conversely, a firm that uses a more significant amount of their treasury to allocate to Bitcoin may be seen to have made a more material announcement and, as such, would experience a more positive CAR compared to the former examples. Hence, the fifth and final hypothesis of this study is:

***Hypothesis 5.*** *Firms allocating greater than 5% (as a ratio of acquisition amount to total market capitalisation) into Bitcoin have a higher CAR over an event period versus those who allocate smaller amounts.*

## 2.6 – CONCEPTUAL MODEL & REGRESSION

Figure 2 below provides a visual illustration of the above hypotheses 1-5, with the expected outcome of firms experiencing positive cumulative abnormal returns (CARs) over the event period(s) investigated. Further, there may be relevance exploring the effects of the firm's sector on their CAR in addition to these other variables. All variables used in the regression have been turned into dummies due to the small number of observations.

**Figure 2: Conceptual Model**



As per the above conceptual model (Figure 2), the following regression will also form part of the study in order to investigate whether any of these variables may have significance on the CAR of a firm's stock over an event window:

$$CAR_t = \alpha + \beta_{country} + \beta_{sector} + \beta_{expected} + \beta_{size} + \beta_{fear\_greed} + \varepsilon$$

where:

- **Country:** (dummy variable; USA=1, others=0) whether the country of the firm impacts the CAR
- **Sector:** (dummy variable; Technology=1, others=0) whether the sector of the firm impacts the CAR
- **Expected:** (dummy variable; Expected=1, Unexpected=0) if there is an impact on the CAR if the announcement took the market by surprise, or if it was mentioned within an anticipated market update
- **Size:** (dummy variable; Above 5% of market cap=1, lower than 5%=0) whether the size of the purchase or acquisition of Bitcoin, relative to the market cap of the firm impacts the CAR
- **Fear & Greed:** (dummy variable; Above 75=1, below 75=0) whether Bitcoin Fear and Greed Index value being above 75 (Extreme Greed) on the date of announcement impacts the CAR

### **3. DATA & METHODOLOGY**

This study sets out to explore whether the share prices of firms are affected by announcements that the firm has acquired or purchased bitcoins, over an event period, and to what extent various firm-level attributes may contribute to this. In order to test the outlined hypotheses 1-5, an event study methodology and approach has been utilised in order to ascertain firm-level abnormal returns across multiple event windows in order to determine if there may be a link between announcements from firms and abnormal share price returns.

Event studies in general set out to test if efficient markets (Fama et al., 1969) can price information correctly, with evidence to suggest there may be varied forms of market efficiency; weak, semi-strong and strong. This has been a common way for researchers to measure conditions surrounding events such as M&A activity, market-sensitive announcements or information relating to CEOs and board members. To date, there has been little-to-no research that has been conducted in the realm of Bitcoin-related announcements and their possible effects on the share prices of firms that have done this.

While this study will focus on this topic, there is currently a lack of sufficient evidence to suggest that the market would positively or negatively price this information in. Hence this event study sets out to investigate this relatively new phenomena, the types of firms who have so far announced Bitcoin holdings, and how the market will price this information over the short to medium term.

#### **3.1 – DATA**

The data used for this study has been accessed from a range of publicly available databases; Yahoo Finance, YCharts.com, CoinGecko, and The Block, in addition to both the websites of the exchanges on which firms are listed, and the Investor Relations pages of individual firms to reference announcements made. A final list of 14 companies was constructed to include within this study, selected from a more extensive list available from BitcoinTreasuries.net. Each firm selected must have made at least one announcement to the market that they had acquired or purchased bitcoins. Of these 14 firms, seven are listed in Canada, five in the United States and two distributed from the rest of the world (Japan and Hong Kong). In total, between the 14 firms, a total of 18 announcements were made, dated between March 31, 2020, and April 28, 2021. Eight announcements can be defined as a “surprise” to the market (defined as an announcement that was not expected, nor scheduled by the company in the form of a quarterly or annual report), while the remaining 10 announcements had information relating to a purchase or acquisition of bitcoins, but within an anticipated market update (hence counted as an expected announcement). Of the 14 firms, six operate within Financial Services, nine are classified as Technology firms, two within Communication Services and one in Consumer Cyclical (Tesla, as a car manufacturer). Further, six of the firms are involved either directly or indirectly with Bitcoin mining operations.

For the purposes of this study, not all publicly traded firms holding bitcoins have been included; either because they do not meet the aforementioned criteria, or they were not publicly tradable before 2021, making it not possible to conduct an event study of sufficient length including a date range available prior to them holding bitcoins. A full list of both publicly and privately traded entities that are currently known to hold bitcoins on their balance sheet(s) is available at BitcoinTreasuries.net, and this list was used as a source to find firms to include within this study - in conjunction with firm announcements to determine more accurate announcement dates and amounts of Bitcoin acquired. Appendix 5 details the entire list of organisations that are currently known to be holding bitcoins, and the 15 firms which were subsequently selected for this analysis.

All firms and their dummy variable values used within this study are in Table 2 below:

**Table 2 – Firm-Level Variable Information**

Firm	Country	Sector	Miner	Expected	Fear & Greed	Size
MSTR 1	1	1	0	0	1	1
MSTR 2	1	1	0	0	0	1
MSTR 3	1	1	0	0	1	1
MSTR 4	1	1	0	0	1	1
TSLA	1	0	0	0	1	0
SQ 1	1	1	0	0	0	0
SQ 2	1	1	0	1	1	0
MARA	1	0	0	0	0	1
HUT8	0	0	1	1	0	1
NEXON	0	0	0	1	0	0
VOYAGER	0	1	0	1	0	1
RIOT	1	1	1	1	1	1
MEITU	0	0	0	0	1	0
BITFARMS	0	0	1	1	1	0
HODL	0	0	0	1	0	1
HIVE	0	0	1	1	0	0
DHGI	0	1	1	1	1	1
DASH	0	0	1	1	1	0

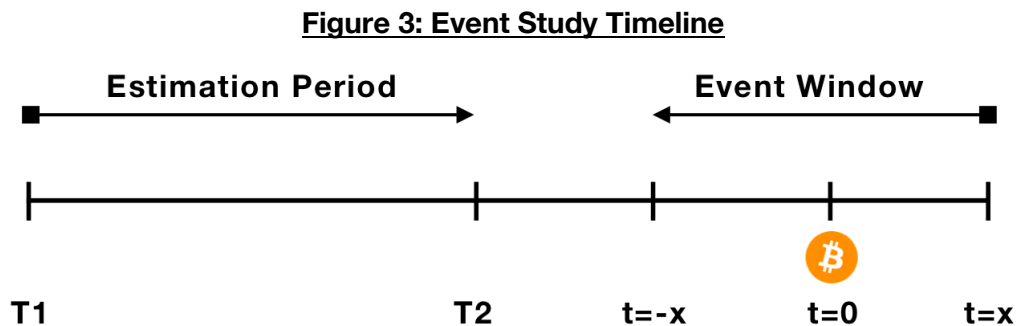
### 3.2 - METHODOLOGY

First, the parameters for the analysis must be set. For the purposes of this study, this has been completed in line with existing literature, using the methodology used in seminal event study literature by Fama et al. (1969); Strong (1992) and MacKinlay (1997), as these papers are still seen as the most consistent and best way in which to conduct an event study.

All dates used for a company's announcement date are confirmed through their official announcements to the market. Thus, in order to determine the event windows to be used for each company, the date of a Bitcoin-related announcement by a firm is seen to be the "event date" ( $t=0$ ).

### 3.3 – ESTIMATION PERIODS & EVENT WINDOWS

Figure 3 outlines the two significant periods of interest when conducting an event study. This is consistent with the methodology outlined and used by both MacKinlay (1997), and Strong (1992). Prior to the date of announcement, an Estimation Period (EP), commencing at  $T1$  and concluding at  $T2$  is used, with the intention of measuring the normal performance of both the market and the shares of the firm without any impact or influence from the announcement of interest. Surrounding the event date is our Event Window (EW), designated by the announcement date at  $t=0$  and with  $x$  days either side.



The time between  $T1$  and  $T2$  in this study is 90 days, allowing for a sufficient measurement of normal returns with no impact from the Bitcoin-related announcement. Estimation period range in previous literature ranges from 100 to 300 trading days (Armitage 1995), although longer estimation periods can lead to estimations that are "out of date". This has led more recent event studies to use periods ranging between 60 to 120 days, thus a 90-day event window sits in the middle of this range.

The event window and estimation period do not overlap; there is a ten-day gap between  $T2$  and the start of the event window ( $t=-x$ ), consistent with MacKinlay (1997). For this analysis there are two event windows, one beginning 20 trading days prior to the announcement (and runs until 20 trading days post the announcement), and a second starting five trading days prior to the announcement (running through until five trading days after the announcement). The former is

intended to capture a potential broader effect of the Bitcoin-related announcement, allowing the market to digest the information, while the latter seeks to capture a more immediate effect the market may put on the announcement.

While many event studies also measure longer term and ongoing abnormal returns, or market over/under-performance of a firm relative to the market, since most of the firms included in this study have only made these Bitcoin-related announcements in the last six or 12 months, there is currently not enough data to support such an analysis.<sup>13</sup>

In order to measure abnormal returns due to firms announcing the purchase or acquisition of bitcoins on their balance sheets, the normal return is calculated within the EP. The normal return is then subtracted from the actual return (the return that occurs within the event window) in order to obtain the abnormal return. The relevant formulas used for this analysis are outlined in Sections 3.4 through to 3.11.

### 3.4 – RETURN CALCULATIONS

The daily return (DR) of each stock is calculated as the difference between closing prices of the current trading day against the previous trading day, including dividends (adjusted close price). The daily returns are also calculated for the market model, which for this study is the S&P 500 index (as the primary benchmark to compare performance against). Although companies included within this study are from different countries and are listed on various indices, in order to maintain consistency, the S&P 500 index was chosen as the benchmark by which all companies will be compared to, due to its significance as the most referenced index globally (Kenton, 2021). This calculation is depicted in the following formula:

$$DR_{it} = \frac{P_{it} + D_{it} - P_{it-1}}{P_{it-1}}$$

where  $DR_{it}$  represents the daily return of firm  $i$  for time  $t$ ,  $P_{it}$  and  $P_{it-1}$  represent today's closing price and yesterday's closing price, respectively and  $D_{it}$  represents any dividends paid during the period, hence use of the adjusted closing price for all firms.

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<sup>13</sup> Over the coming years it may be of interest to other researchers in this area, especially if Bitcoin and other cryptocurrencies become more widely adopted asset classes globally. It would also be prudent to factor in when the announcements were made relative to Bitcoin's four-year supply halving cycles, as well as comparing a firm's share performance compared to that of Bitcoin itself.



### 3.5 – NORMAL RETURNS

Normal returns for this analysis are measured using the market model (Strong, 1992). The time period by which normal return estimations are measured is the Estimation Period (between T1 and T2), for a total length of 90 trading days, with a 10-day gap before the start of the Event Window:

$$NR_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where  $NR_{it}$  and  $R_{mt}$  represent the returns of the firm  $i$  and the market  $m$ , at the period of interest  $t$ .

$\alpha_i$  represents the intercept,  $\beta_i$  represents the slope and  $\varepsilon_{it}$  represents the error term. For the market return<sup>14</sup> of this analysis, the S&P500 has been selected, as has been previously mentioned, due to its popularity as a market index in representing a wide-ranging number of firms across multiple sectors, in addition to its position as one of the leading indices globally.

### 3.6 – ABNORMAL RETURNS

Abnormal returns (AR) are thus calculated as the actual returns during the event window, minus the normal returns (NR, above) during the 90-day estimation period. Hence, the time period used to estimate abnormal returns is the time within the Event Window (between  $t=-x$  and  $t=x$ ), either 20 days or 5 days either side of the firm announcement, for a total of 41 days or 11 days respectively:

$$AR_{it} = DR_{it} - NR_{it}$$

where  $AR_{it}$  represents the abnormal return of firm  $i$  for time  $t$ ,  $DR_{it}$  represents the daily return of the firm  $i$  for time  $t$  (during the event window), and  $NR_{it}$  represents the normal return (or expected return) of the firm  $i$ , for time  $t$  (measured across the 90-day estimation period).

### 3.7 – AVERAGE ABNORMAL RETURNS (AAR)

Average abnormal returns (AAR) are calculated for all firms across both the 41-day and 11-day event windows in order to gauge relative over/underperformance versus the S&P500 as the benchmark index. This indicates an average response on any given day to the Bitcoin-related announcement, after the event date, or possible anticipation in the days leading up to the announcement. Significance testing will allow us to measure if any given day, on average across all firms, is significantly different from zero:

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14 For the purposes of creating the normal returns and market return, the performance of bitcoin was not included in the calculation, due to the relatively immaterial size of most corporate purchases. This, however, is discussed in further length in Section 6

$$AAR_i = \frac{1}{N} \sum_{t=-x}^N AR_{it}$$

### 3.8 – CUMULATIVE ABNORMAL RETURNS (CAR)

Next, cumulative abnormal returns (CAR) are calculated for all firms. In this study, we will have cumulative abnormal returns across both the 41-day and 11-day event windows, with each firm's abnormal returns summed across the windows:

$$CAR_i = \sum_{t=-x}^N AR_{it}$$

### 3.9 – CUMULATIVE AVERAGE ABNORMAL RETURNS

Finally, cumulative average abnormal returns (CAAR) can be derived. This is a measure across all firms within the study, averaging each firm's cumulative abnormal return across both event windows used in this study and dividing by the total number:

$$CAAR = \frac{1}{N} \sum_{t=-x}^N CAR_i$$

### 3.10 – DATA PREPARATION

In order to analyse the data for this study, all stock price data was downloaded from Yahoo Finance. A dataset was created for each estimation period and event window per firm, per announcement, totalling 18 unique events, each with 20-day and 5-day event windows constructed either side of the event date (when the announcement was made to the market) for a total of 36 event windows. This follows the methodology outlined in Section 3.3 above. Once the market returns (based on S&P500 data), intercept, slope, r-squared and standard error for each estimation period have been created, the estimated normal returns, abnormal returns, cumulative abnormal returns and abnormal return t-test were calculated for each event window (41-day and 11-day). Further variables such as the country of the firm, sector, whether the firm is a Bitcoin miner, if the announcement was expected by the market, the Fear and Greed Index value on the date of announcement and the size of the Bitcoin purchase relative to market cap were all coded into the dataset, with this information coming from multiple sources noted at the beginning of this section.

These datasets were subsequently imported into STATA (Release 17), in order to confirm calculations and further estimate for significance and run regressions. Appendix 5 contains all STATA code used for this additional analysis.

## 4. RESULTS

The results of both event windows will be presented, beginning with the longer, 41-day event study results to determine how the market priced firm shares in response to a Bitcoin-related announcement. These will be followed by the results from the shorter, 11-day event study, seeing if there was more of an immediate reaction from the market. Following this, additional regressions and abnormal return comparisons will be presented. Both event windows were tested for multicollinearity, and follow normal distributions, with normality test results found in Appendix 5. Any references to significance within the results were conducted using the following methodology in Section 4.1.

### 4.1 – TESTING FOR SIGNIFICANCE

There are multiple tests across abnormal returns that can be useful to determine if the abnormal returns are significantly different from zero. The following null hypotheses will assist in drawing conclusions on the results presented within this section, uncovering the effects on abnormal returns caused by a firm's Bitcoin-related announcement. For all abnormal returns (AR, AAR, CAR, CAAR), t-tests have been performed in order to determine any significance on a daily, average, or cumulative basis.

The first null hypothesis is intended to determine if an abnormal return is different from zero for each time period  $t$  within the event window(s) for firm  $i$ :

$$H_0: E(AR_{it}) = 0$$

The second null hypothesis more specifically focusses on the average of the abnormal returns, across all firms for each time period  $t$  within the event window(s):

$$H_0: E(AAR_t) = 0$$

The third null hypothesis is intended to determine if the cumulative abnormal return is different from zero for across the entire event window for firm  $i$ :

$$H_0: E(CAR_i) = 0$$

The fourth and final null hypothesis sets out to find if the cumulative abnormal return across, averaged across all firms over the event window (hence CAAR), are different from zero. If so, we may have some evidence to suggest that abnormal returns of firms are affected by announcing Bitcoin holdings to the market:

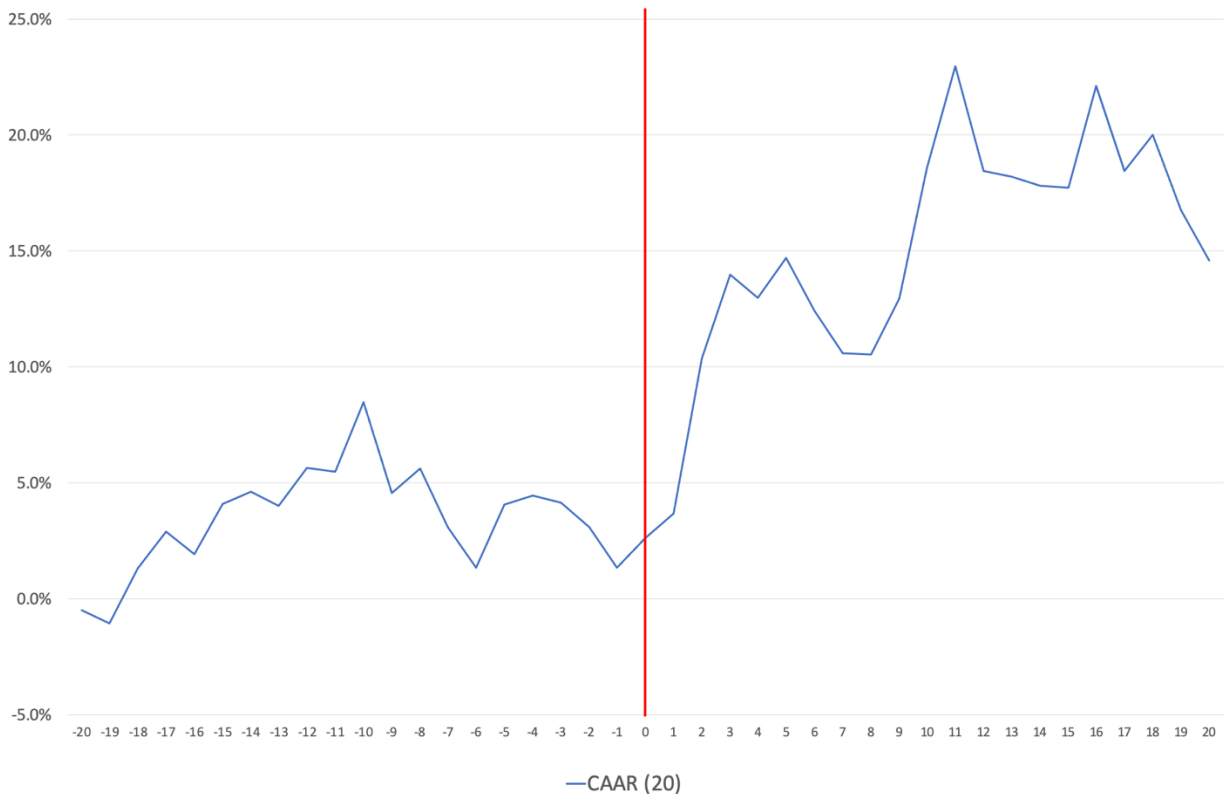
$$H_0: E(CAAR) = 0$$

In general, if there are abnormal returns, average abnormal returns, cumulative abnormal returns or cumulative average abnormal returns, then we will see these fluctuating around zero (MacKinlay, 1997). There may be possible instances of insiders trading on information before the event date, hence we may see abnormal returns in these cases in the days leading into the announcement. Obvious insider trading may see successive days of positive or negative abnormal returns with statistical significance in this period prior to the announcement.

Further to this, as the sample size of events used for this study is low (with only 18 events), several Mann-Whitney U Tests will also be conducted in order to compare differences between the cumulative average abnormal returns of certain attributes of the firms (such as country, if they are a Bitcoin mining firm and if the announcement was expected by the market or not). Results of these are expanded on in Section 4.

## 4.2 – 41 DAY EVENT WINDOW

**Figure 4 – Cumulative Average Abnormal Return (41-Day Event Window)**



The 41-day cumulative average abnormal return is visualised in Figure 4, constructed by the values within Table 4 (below). This represents a daily average of the CARs of each firm (hence, CAAR), with a test for significance as a vector across all 18 daily observations between  $t=-20$  and  $t=20$ .

We see prior to Day 0, or the “event date” a CAR of 1.34%, with the only statistically significant days at  $t=-7$  and  $t=-6$ . These are significant at a 5% level (with an AAR of -2.54%) and 10% (with an AAR of -1.74%) respectively. After the event date ( $t=0$ ) we see five out of the remaining 20 days being significant at either 5% or 10% significance levels. Interestingly, only two out of the five significant days have positive AARs, with the remaining three being statistically significant from zero with a negative return.

Overall, both Figure 4 and Table 4 show a relatively flat period of CAR, ranging around +3% between days  $t=-20$  and the announcement on the event date ( $t=0$ ). Most of the positive return seen across the event window occurs after the event date. The net result across all 18 events is a total cumulative average abnormal return of 14.61%, demonstrating that the market may not have priced in the information regarding acquisition of bitcoins prior to the announcement date, and having a relatively positive reaction to the news following this.

**Table 4 – 41 Day Event Window Abnormal Returns**

Event Day	Average Abnormal Return (AAR)	Test Statistic	Cumulative Average Abnormal Return (CAAR)
-20	-0.50%	0.1958	-0.50%
-19	-0.56%	0.3697	-1.05%
-18	2.37%	0.8821	1.32%
-17	1.58%	1.0757	2.90%
-16	-0.97%	0.5850	1.93%
-15	2.16%	1.1510	4.09%
-14	0.52%	0.3169	4.61%
-13	-0.61%	0.2685	4.00%
-12	1.63%	1.1281	5.64%
-11	-0.16%	0.0536	5.48%
-10	3.00%	1.3701	8.48%
-9	-3.91%	1.4731	4.57%
-8	1.06%	0.4677	5.63%
-7	<b>-2.54%</b>	<b>2.0502**</b>	3.09%
-6	<b>-1.74%</b>	<b>1.8202*</b>	1.34%
-5	2.72%	0.9604	4.06%
-4	0.41%	0.1747	4.47%
-3	-0.32%	0.1643	4.14%
-2	-1.06%	0.7343	3.08%
-1	-1.74%	0.8494	1.34%
0	1.29%	0.8487	2.63%
1	1.05%	0.4783	3.68%
2	6.68%	1.291	10.36%
3	3.63%	1.599	14.00%
4	-1.00%	0.5369	13.00%
5	1.70%	1.0031	14.69%
6	<b>-2.28%</b>	<b>1.9346*</b>	12.42%
7	-1.82%	1.4985	10.60%
8	-0.08%	0.0327	10.53%
9	2.43%	1.1684	12.96%
10	<b>5.64%</b>	<b>1.6713*</b>	18.60%
11	4.37%	0.8524	22.97%
12	<b>-4.50%</b>	<b>2.2193**</b>	18.46%
13	-0.26%	0.2408	18.20%
14	-0.38%	0.1958	17.82%
15	-0.09%	0.0587	17.73%
16	<b>4.38%</b>	<b>2.30123**</b>	22.11%
17	-3.66%	2.2623	18.45%
18	1.57%	0.6175	20.02%
19	<b>-3.26%</b>	<b>1.6565*</b>	16.77%
20	-2.16%	1.1854	14.61%

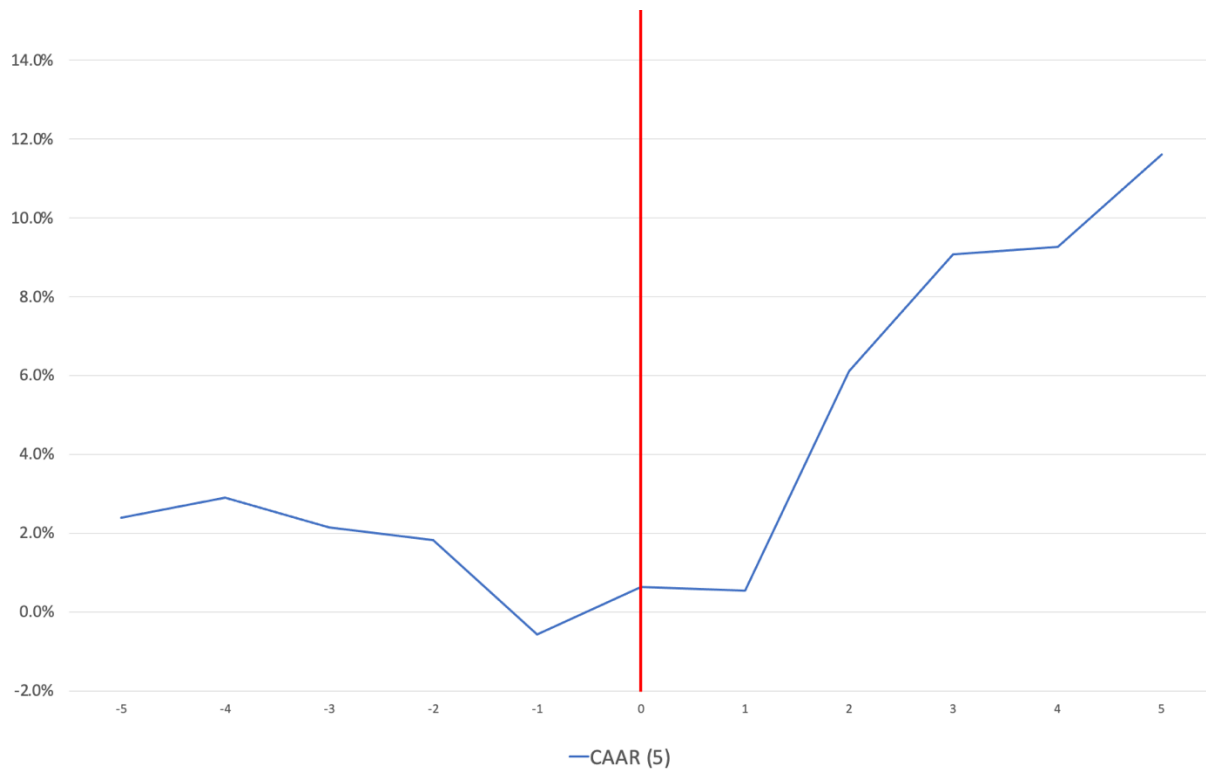
\* denotes significance at 10%

\*\* denotes significance at 5%

\*\*\* denotes significance at 1%

### 4.3 – 11 DAY EVENT WINDOW

**Figure 5 – Cumulative Average Abnormal Return (11-Day Event Window)**



**Table 5 – 11 Day Event Window Abnormal Returns**

Event Day	Average Abnormal Return (AAR)	Test Statistic	Cumulative Average Abnormal Return (CAAR)
-5	2.25%	0.8232	2.25%
-4	0.95%	0.4731	3.20%
-3	-0.45%	0.2293	2.74%
-2	-0.78%	0.6106	1.96%
-1	-2.14%	1.1308	-0.18%
0	1.39%	0.8805	1.21%
1	0.71%	0.3234	1.92%
2	6.15%	1.1929	8.08%
3	3.68%	1.6017	11.76%
4	-1.31%	0.696	10.45%
5	2.01%	1.1760	12.46%

Figure 5 and Table 5 show the findings from the 11-day event window across all 18 events. Running this event study was intended to detect the more immediate reaction from the market compared to the longer, 41-day window. However, we note there are no individual daily AARs that are statistically different from zero. Whilst the net result of the 11-day window is a CAAR of 12.46%, only about 2% less than the 41-day window, much of the significant returns seemingly sit just outside of this smaller window. We see much of this return occur after the announcement date of Day 0, again indicating that from this small sample dataset one could speculate that the market had yet to fully price in this new information until after the announcement.

#### 4.4 – OVERALL CUMULATIVE ABNORMAL RETURNS FOR BOTH EVENT WINDOWS

**Table 6 – Overall Cumulative Abnormal Returns**

Firm	41-Day Window	Test Statistic	11-Day Window	Test Statistic
<b>MSTR (1)</b>	21.87%	1.5633	14.65%	1.19566619
<b>MSTR (2)</b>	23.01%	1.1124	11.44%	0.65826011
<b>MSTR (3)</b>	76.36%	1.5434	15.17%	0.92887247
<b>MSTR (4)</b>	-32.72%	0.5304	-36.55%	1.15516233
<b>TSLA</b>	<b>-45.61%</b>	<b>1.7297*</b>	<b>-18.60%</b>	<b>2.71927595 ***</b>
<b>SQ (1)</b>	-15.68%	0.9005	0.62%	0.0774463
<b>SQ (2)</b>	-15.59%	0.6272	-8.34%	0.64734483
<b>MARA</b>	34.27%	0.3994	-32.60%	1.20983517
<b>HUT8</b>	-33.51%	0.6449	-11.20%	0.47129327
<b>NEXON</b>	<b>-42.09%</b>	<b>2.2352**</b>	-0.77%	0.2492497
<b>VOYAGER</b>	3.63%	0.0429	46.25%	1.12287521
<b>RIOT</b>	-15.54%	0.2929	37.36%	0.90030241
<b>MEITU</b>	38.97%	0.6718	-13.25%	0.84885544
<b>BITFARMS</b>	53.81%	0.6737	20.52%	0.55330944
<b>HODL</b>	30.47%	0.4902	10.73%	0.34478399
<b>HIVE</b>	-1.08%	0.0243	27.08%	1.22341275
<b>DGHI</b>	117.40%	0.7735	147.28%	1.45098627
<b>DASH</b>	64.93%	1.1575	14.43%	0.59043694

Table 6 compares the CARs of each firm across both the 41-day and 11-day event windows, with test statistics indicating significantly different returns from zero. Even with numerous large returns across most firms, there are only three event windows that register significance. This can be explained by both the relatively high betas and heightened expected returns from estimation periods of some firms. Firm betas can be found in Appendix 1, while all daily expected returns, abnormal returns (AR), cumulative abnormal returns (CAR) and test statistics, per day, per event for the 41-day window are contained within Appendix 3.

To start, within the 41-day event window MicroStrategy's (MSTR) first two announcements warranted more than 20% CARs in both instances, its third announcement of purchasing US\$650 million saw a CAR of 76.36% while its fourth announcement came during a peak of



attention on Bitcoin and a pullback of the cryptocurrency markets, hence resulting in an underperformance and a CAR of -32.72%. Notably, the worst performer was Tesla (TSLA), with a CAR of -45.61%, with their Bitcoin purchase coming within days of the all-time-high (ATH) of Tesla (TSLA) shares historically. This return was statistically significant at a 10% level, marking a sharp downturn in share price compared to the market and relative to other firms in this study. Japanese video-game company Nexon (NEXON) saw a -42.09% CAR over the 41-day event window, significant at a 5% level after their US\$100 million Bitcoin purchase. Similarly to Tesla (TSLA), Nexon's (NEXON) announcement came within days of its ATH trading price, with the information of their purchase included within an expected announcement and update that was swiftly rejected by the market. Much of this move was contained to the longer event window, with the 11-day CAR for Nexon coming in almost flat at 0.77%.

The best performer over the 41-day event window was Digihost Technology Inc (DGHI), with a CAR of 117.40%, however its calculated expected return over the window was 84% meaning the CAR was not statistically significant, albeit incredibly high. Similarly, Digihost (DGHI) was the best performer over the 11-day event window, with an even higher CAR of 147.28%, meaning much of its move was already priced in by the market within the shorter window of time.

Once again, Tesla (TSLA) had a statistically significantly negative return over the shorter event window, registering a CAR of -18.60%, significant at 1%. With a calculated expected return during the window of nearly 20%, it significantly underperformed, again with their announcement coming within days of its ATH trading price. Interestingly, MicroStrategy's (MSTR) third announcement saw much less action during the shorter window with a CAR of 15.17%, compared to the 76.36% CAR across the longer 41-day window.

Other notable results are the large differences some firms experienced between the two event windows. Firstly, Marathon (MARA) had a 11-day CAR of -32.60%, with much of the negative movement coming within a significantly negative daily AR of -19.02% just three days from the event date, followed by another -10.95% AR two days before their announcement. This compares to the CAR of Marathon (MARA) over the longer window of 34.27%. Once again, much of this was due to large moves outside of the shorter window, with a statistically significant 26.30% AR 11 days before the event date and a 38.97% AR 10 days after the announcement, significant at 1%.

Secondly, Voyager's (VOYAGER) 11-day event window had a CAR of 46.25%, while over the longer window had a CAR of only 3.63%. Across the shorter window, again, much of this move came from only three days of statistically significantly positive abnormal returns: 29.12% five days before the announcement, 16.56% one day before the announcement and 14.68% three days after the event date. However, even though these abnormal returns were inside the longer window too, they were mostly erased by two significantly negative days that saw abnormal returns of -21.70% eight days after the announcement (significant at 1%), and -12.71% 17-days after the announcement (significant at 10%).

Third, Neptune Digital Assets (DASH) had an 11-day CAR of 14.43%, while over 41-days its CAR was 64.93%. Just six days' worth of abnormal returns outside of the 11-day window (days -19, -11, 9, 14, 17 and 18) that were all significant between 1% and 10% summed for an AR of 102.89%. Unsurprisingly due to such volatility, nearly half of this was walked back due to equally significantly negative ARs.

Fourth and finally, HIVE Blockchain Technologies (HIVE) had an 11-day CAR of 27.08%, while over the longer window it was -1.08%. Again, this was mostly attributable to statistically significantly negative abnormal returns within the 41-day window, hence eliminating much of the positive AR that could be seen within the shorter event window.

As previously noted, we see much of the positive move come after Day 0 in both event windows. This can be seen in Figure 6 below which provides a visual of both the longer, 41-day window and the shorter, 11-day window relative to one another.

**Figure 6 – CAAR (41-Day vs 11-Day Event Windows)**

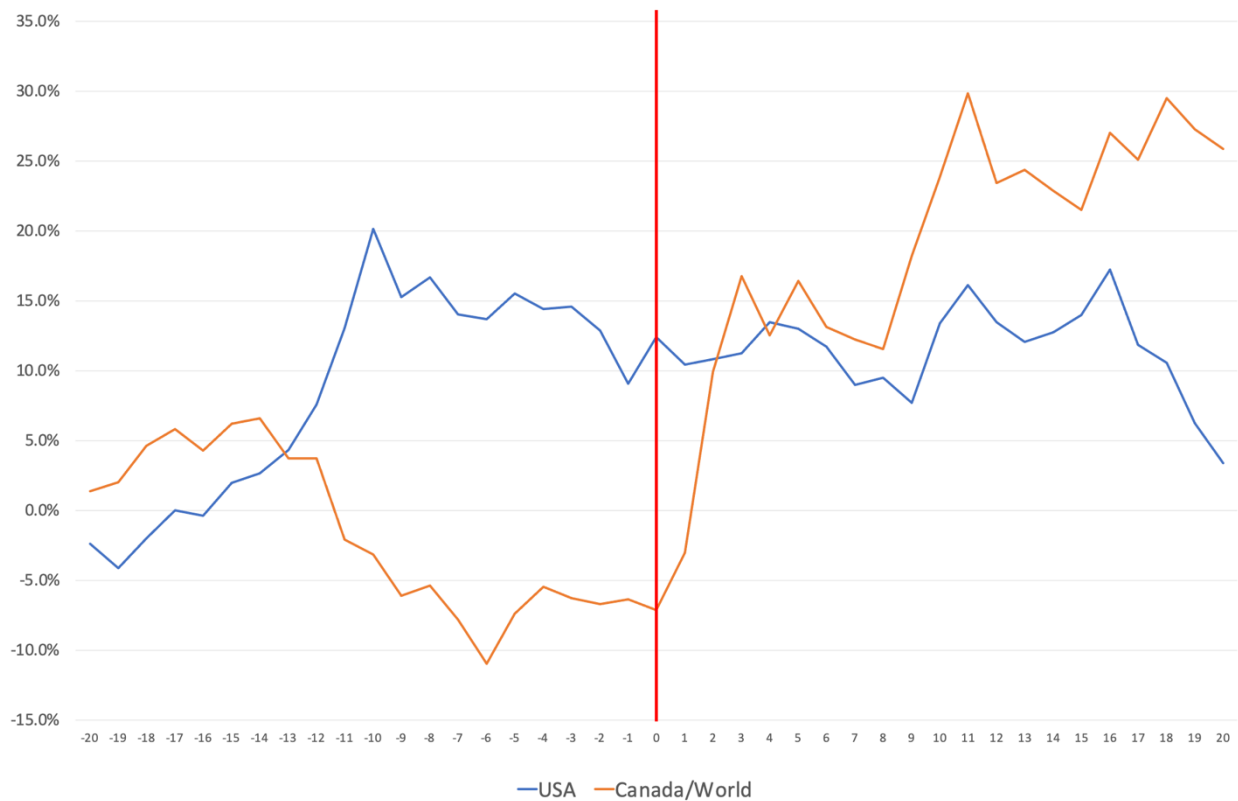


#### 4.5 – MANN-WHITNEY U TESTS

The following figures and results are from running multiple Mann-Whitney U Tests, conducted across the 41-day event window (rather than the 11-day event window), due to having more statistically significant results on a daily basis. Conducting non-parametric Mann-Whitney U Tests provides alternative results across the five variables of interest (in addition to the t-tests performed), as an additional reference point to compare group results due to the small number of overall observations. All STATA outputs referred to within the Section 4.5 can be found in Appendix 5.

##### 4.5.1 – MANN-WHITNEY U TEST #1 (COUNTRY)

**Figure 7: CAAR USA Firms vs Canadian / Rest of World Firms**



A Mann-Whitney U Test was conducted on the 18 events to determine if the country of firm listing leads to a significant difference between cumulative average abnormal returns (CAAR). Each group's CAARs are represented by Figure 7 above. Each group contained 9 events, with one containing all events from USA-listed firms, the other containing all events from firms listed in Canada and the rest of the world. The results show that CAARs between the two groups is not statistically significantly different at a 5% level ( $z = 1.015$ ,  $p = 0.31$ ).

Thus, based on this sample, CAARs between the two groups do not significantly differ from one another across the 41-day event window. However, we can note that anecdotally and based on the findings the events from US-listed firms had a lower CAR compared to those in Canada, Hong-Kong and Japan with US firms seeing a CAAR of 3.37% and those outside the US seeing a CAAR of 25.84% across the 41-day event window.

#### 4.5.2 – MANN-WHITNEY U TEST #2 (SECTOR)

**Figure 8: CAAR Technology Firms vs Non-Technology Firms**

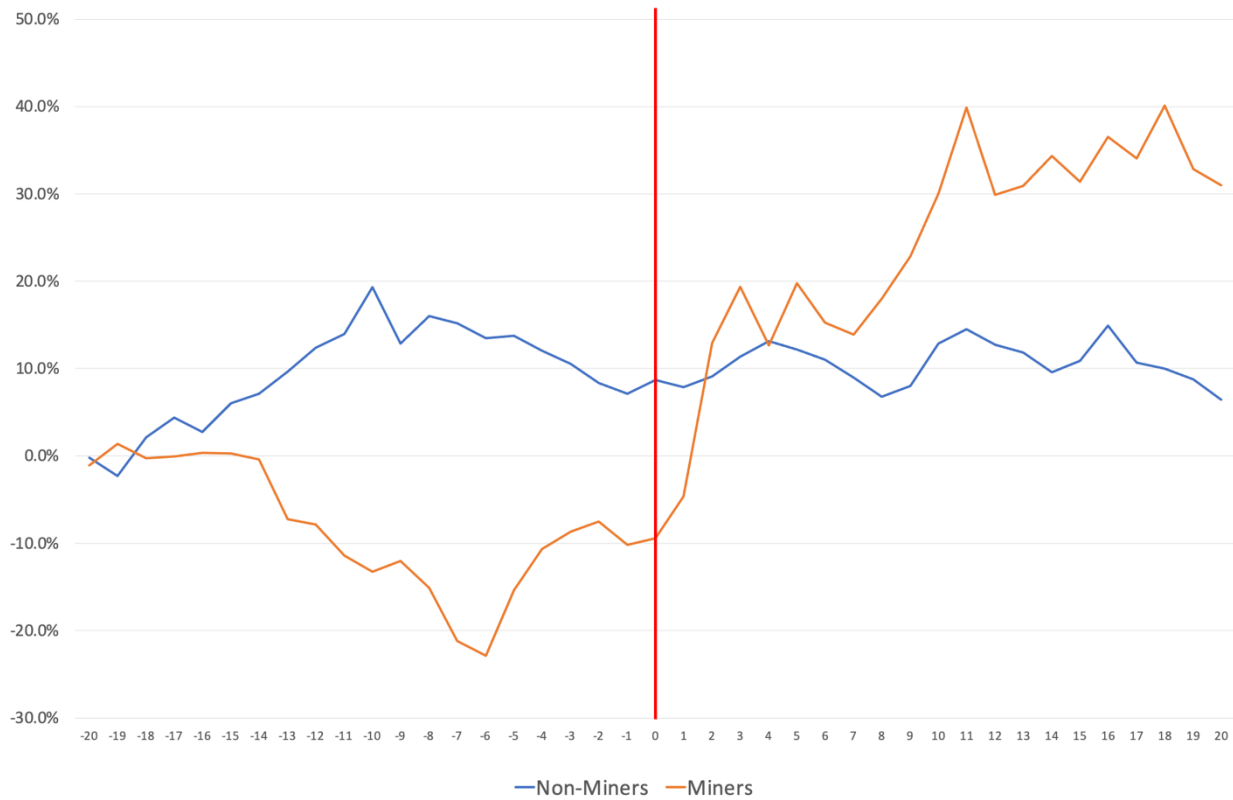


A second Mann-Whitney U Test was conducted on the 18 events to determine if the sector of the firm leads to a significant difference between cumulative average abnormal returns (CAAR). Each group's CAARs are represented by Figure 8 above. Each group contained 9 events, with one containing all events from "Technology" firms, with the other containing all events from firms operating within Financial Services, Communication Services or Consumer Cyclical. The results show that CAARs between the two groups are not statistically significantly different at a 5% level ( $z = -0.132$ ,  $p = 0.897$ ).

It can thus be concluded that based on this sample, CAARs between the two groups do not significantly differ from one another across the 41-day event window, however we can ascertain from the small sample that non-technology firms had higher CARs than those within the technology sector. Technology firms had a lower CAAR of 6.41%, while firms from all other industries had a CAAR of 31.00%.

### 4.5.3 – MANN-WHITNEY U TEST #3 (BITCOIN MINERS)

**Figure 9: CAAR Bitcoin Miners vs Non-Bitcoin Miners**

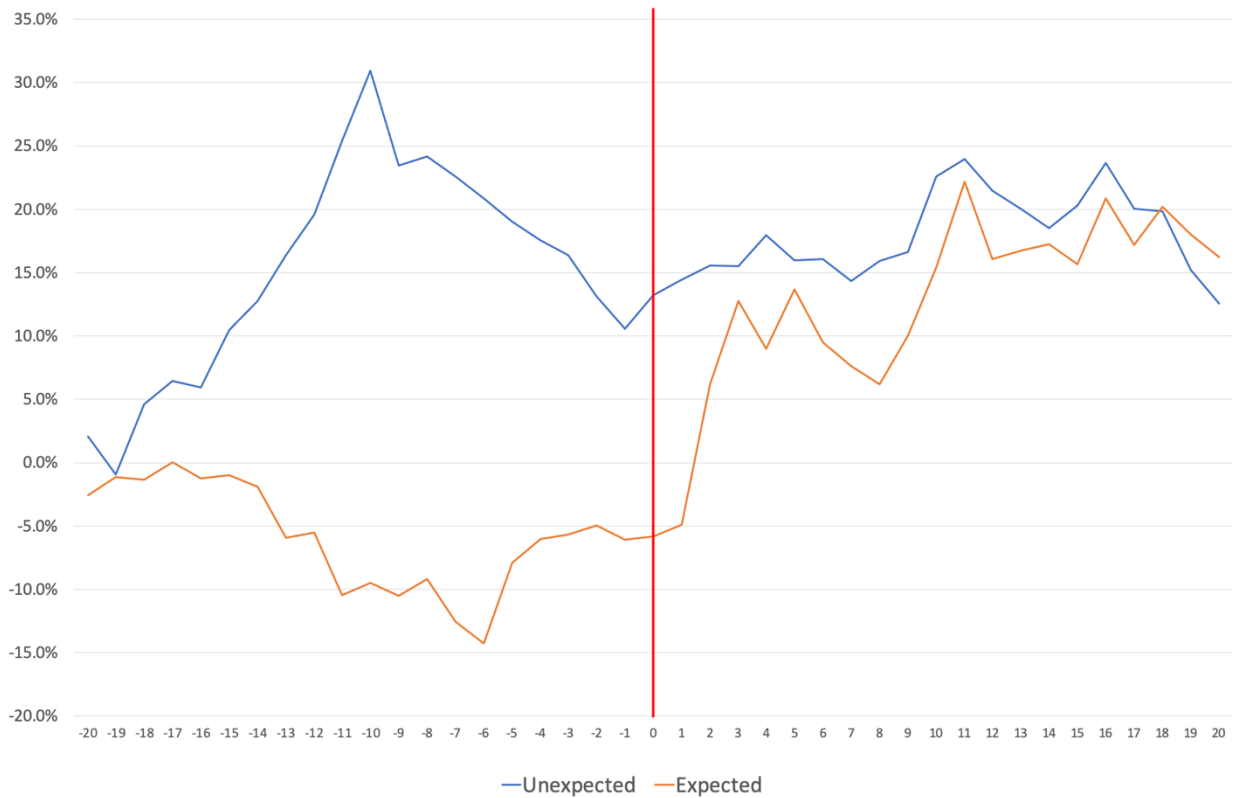


A third Mann-Whitney U Test was conducted on the 18 events to determine if being a Bitcoin miner leads to a significant difference between cumulative average abnormal returns (CAAR), with Figure 9 showing each group's CAARs. One group contained 12 events (those who are not involved directly with the mining of bitcoins), while the other group contained 6 events (firms who are involved in Bitcoin mining). The results show that CAARs between the two groups are not statistically significantly different at a 5% level ( $z = -0.937$ ,  $p = 0.349$ ).

It can thus be concluded that based on this sample, CAARs between the two groups do not significantly differ from one another across the 41-day event window. However, we can see that the firms that are Bitcoin miners did see higher CARs versus firms not involved in Bitcoin mining with CAARs of 6.41% and 31.00% respectively.

#### 4.5.4 – MANN-WHITNEY U TEST #4 (EXPECTED ANNOUNCEMENT)

**Figure 10: CAAR Expected vs Non-Expected Announcements**

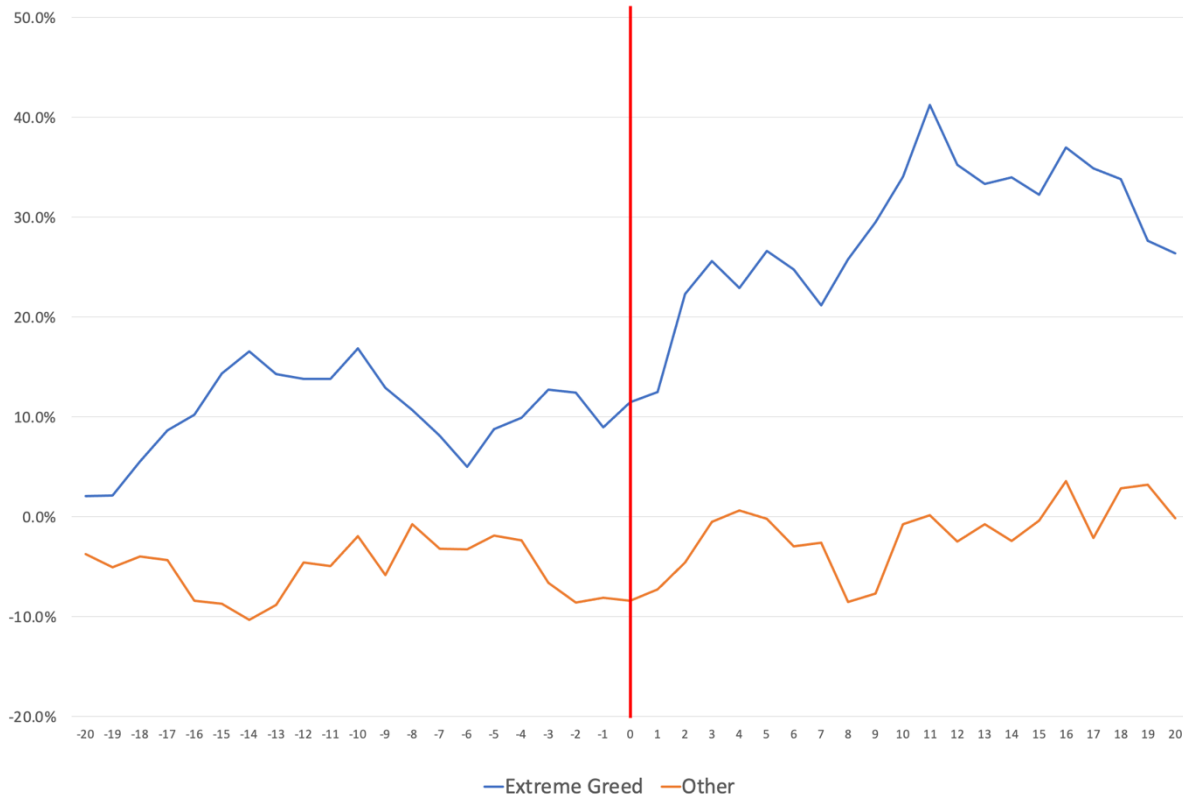


A fourth Mann-Whitney U Test was conducted on the 18 events to determine if unexpectedness of an announcement leads to a significant difference between cumulative average abnormal returns (CAAR). Figure 10 above shows the CAARs of the two groups. One group contained 8 events (those who had unexpected announcements), while the other group contained 10 events (those who had expected announcements and mentioned Bitcoin purchases or acquisitions within these announcements). The results show that CAARs between the two groups are not statistically significantly different at a 5% level ( $z = -0.089$ ,  $p = 0.929$ ).

CAARs between the two groups do not significantly differ from one another across the 41-day event window, however we do see that the CARs on average were quite similar between the two groups. Unexpected announcements seemed to trade exceptionally higher and expected announcements inversely lower leading to the announcement date. Overall, the CAAR for firms who made unexpected announcements was 12.56%, while the CAAR for firms with expected announcements was 16.24%.

#### 4.5.5 – MANN-WHITNEY U TEST #5 (FEAR & GREED INDEX)

**Figure 11: CAAR Fear & Greed Index on Announcement Date**



A fifth Mann-Whitney U Test was conducted on the 18 events to determine if the level of the Bitcoin Fear & Greed Index on the date of announcement leads to a significant difference between cumulative average abnormal returns (CAAR). Each group's CAARs are represented by Figure 11 above. One group contained 8 events (those who on the date of announcement saw the value of the Fear & Greed Index <75), while the other group contained 10 events (those who on the date of announcement saw the value of the Fear & Greed Index >75, or in "Extreme Greed"). The results show that CAARs between the two groups are not statistically significantly different at a 5% level ( $z = -1.155$ ,  $p = 0.248$ ).

It can thus be concluded that based on this sample, CAARs between the two groups do not significantly differ from one another across the 41-day event window. With a p value of under 0.25, this was the closest result to being "significant", albeit statistically quite far, however considering the variable attempting to measure the sentiment of the Bitcoin market on a particular date, with a larger number of observations, this would be an interesting statistic to incorporate into a model or study. Overall, firms who made an announcement on a day that the Fear & Greed Index was above 75 had a CAAR of 26.39%, while those announced when the Index was under 75 had a CAAR of -.012%.

#### 4.5.6 – MANN-WHITNEY U TEST #6 (SIZE OF BITCOIN ACQUIRED vs MARKET CAP)

**Figure 12: CAAR Size of Bitcoin Position vs Market Capitalisation**



A sixth, and final Mann-Whitney U Test was conducted on the 18 events to determine if the size of bitcoins purchased or acquired leads to a significant difference between cumulative average abnormal returns (CAAR). Each group's CAARs are represented by Figure 12 above.

One group contained 8 events (those who acquired less than 5% of their market capitalisation in Bitcoin), while the other group contained 10 events (firms who acquired greater than 5% of their market capitalisation in Bitcoin). The results show that CAARs between the two groups are not statistically significantly different at a 5% level ( $z = -0.80$ ,  $p = 0.424$ ).

It can thus be concluded that based on this sample, CAARs between the two groups do not significantly differ from one another across the 41-day event window. It is interesting to note that those firms who made purchases or acquisitions larger than 5% of their market cap had a CAAR of 22.52%, while those with less than 5% having a CAAR of only 4.71%.



#### 4.6 – REGRESSION ANALYSIS

Table 7 presents the results of a linear, OLS regression, run as per the model outlined in Section 2.6 along with the conceptual model, in order to address both the research question and hypotheses 1-5. In this regression, all explanatory variables have been coded as binary. Robust standard errors are used to control for heteroskedasticity. The dependent variable in the cumulative abnormal returns of all firms over the 41-day event window, regressed against explanatory variables; country of a firm, sector, the firm being a Bitcoin miner, if the announcement was expected, if the Fear & Greed Index was above 75 on the date of announcement, if the size of purchase was above 5% of a firm's market capitalisation at the time of announcement, and the error term.

**Table 7 – OLS Regression 41-Day Event Window**

	(1) CAR
Country	-0.636* (0.297)
Sector	0.212 (0.302)
Miner	0.225 (0.244)
Expected	-0.413* (0.210)
Fear & Greed	0.304 (0.187)
Size	0.229 (0.215)
Constant term	0.217 (0.180)
<i>N</i>	18
<i>R</i> <sup>2</sup>	0.409

Robust standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The relationship between the dependent variable and both “Country” and “Expected” are significant to note. Firstly, we see a significantly negative result for Country (1=US listed firm, 0=otherwise). Similarly, we see a significantly negative relationship for Expected (1=if an announcement was expected by the market). In other words, keeping all else equal, over the 41-day event window the CAR of a firm was lower if it was listed within the US, compared to Canada or the rest of the world, while the CAR of a firm was higher if an announcement surprised the market and was unexpected compared to those included in expected market updates. Both these effects are significant at a 10% significance level.

These results were mixed as one reiterates what may have been expected in Hypothesis 2 (unexpected announcements will have higher CAR versus expected announcements), while the other comes as unexpected relative to Hypothesis 3 (that US-listed firms would experience a higher CAR versus their international counterparts). Further discussion of results on hypotheses will be detailed in Sections 5 and 6.

## 5. DISCUSSION

### 5.1 – ADDRESSING HYPOTHESES

*Hypothesis 1. Firms that announce they have purchased Bitcoin see positive cumulative abnormal returns (CARs) versus a benchmark (S&P500) over an event window.*

Overall, we see the results from both the 41-day and 11-day event windows, on average, point to positive CARs for firms after announcing purchase or acquisition of bitcoins. Hypothesis 1 also overlaps heavily with the main research question relating to the effects of making such an announcement on the performance of a firm's shares. While we cannot definitively conclude this to a degree of significance due to the small sample size, we can see those firms who made announcements at or near the peak of their share price ATH levels severely dragged down the average result. **Hence, the results of this study do not confirm this at a level of significance,** however we do anecdotally experience that on average, firms do have positive CARs over both event windows. Larger scale studies across extended time periods in the future may also allow for this to be concluded more definitively.

*Hypothesis 2. Firms with announcements regarding Bitcoin purchases that come as "unexpected" or "out of cycle" have a higher CAR than those included as part of a quarterly update or other business updates.*

On one hand we found a statistically significant result (at 10%) for unexpected announcements on CARs, however the results of the Mann-Whitney U Test found the difference between expected and unexpected announcements to be not significantly different from one another. While there was evidence to suggest this may be the case, the underlying difference lies in whether returns over the event periods are expected to be normally distributed or not, and which result to lean toward. Due to the small number of observations in this study, **there is inconclusive evidence to suggest this hypothesis is proven or disproven.**

*Hypothesis 3. US-listed firms experience a higher CAR over an event period compared to firms listed outside of the USA.*

The results from both the Mann-Whitney U Test as well as the OLS regression demonstrate that Hypothesis 3 has no evidence to suggest US-listed firms saw higher average CARs versus other firms. In fact, based on the sample this was the opposite, with Canadian firms leading the abnormal returns. **Thus, this hypothesis can be disproven based on the results from this study.** Again, with more instances of firms announcing Bitcoin holdings, we may be able to stand by such a statement with more rigor in future.

*Hypothesis 4. Firms experience a higher CAR over an event period, when their announcement is released to the market when the Bitcoin “Fear & Greed Index” is >75.*

Based on the results from the regression and Mann-Whitney U Test, there is insufficient evidence to suggest Hypothesis 4 to be true. However, this may be one of the more promising metrics by which to measure abnormal performance by under a larger sample size study in future. This could also possibly provide more merit to the open-source nature of the project and lead more researchers to integrate such data into future studies. **While disproven with the results from this study**, it may be worth pursuing a similar angle in future research and incorporate models utilising daily sentiment of the Bitcoin market.

*Hypothesis 5. Firms allocating greater than 5% (as a ratio of acquisition amount to total market capitalisation) into Bitcoin have a higher CAR over an event period versus those who allocate smaller amounts.*

Once again, **the results from both the linear regression and Mann-Whitney U Test point to hypothesis 5 being disproven**. However, there may be a more nuanced approach to be taken, with construction of categorical variables with tighter boundaries (rather than simply above/below 5%) or using other financial metrics to benchmark against (such as allocation size vs total assets, etc).

## 5.2 – IMPLICATIONS OF FINDINGS

This paper has found evidence to suggest that there may be a positive market reaction to firms who allocate part of their balance sheet in bitcoins. As is the nature of such an initial and small-scale study, there will be much opportunity as time passes to see how firms performed not only relative to the market but also to Bitcoin itself. This will allow for various other metrics such as Bitcoin's halving cycle, network hash rate and levels of retail adoption to be measured against firm price action, with many more topics of research that will become investigable over the coming years.

There is much needed in the way of consideration on the part of regulators and stock exchanges around the levels at which firms can possibly invest in digital assets such as Bitcoin. With no central authority and computer code dictating the operation of the network, implications surrounding oversight and volatility will be of primary concern. Longer term, if the game-theoretic nature of the Bitcoin network adoption plays out and more firms begin to allocate parts of their treasuries into bitcoins, it will undoubtedly create headaches for central banks and governments as dollars, euros, yen, francs and so-on leave the current monetary system. This may be a small and unnoticeable sum of money now, but with the entire cryptocurrency market growing from non-existence to just north of US\$2 trillion in the space of 13 years, it would be naïve to assume there would be no further growth of the market or future disruption to the established financial system. Bitcoin's dominance against all other cryptocurrencies will additionally be an important factor to consider, with its size relative to the total cryptocurrency market capitalisation falling from historical highs of 90% until 2017 to levels sub-50% throughout most of 2021. With the creation of new cryptocurrencies every week, it would be of importance to firms purchasing bitcoins to monitor such a metric, historically, however, there is evidence to suggest that the market capitalisations of all cryptocurrencies broadly experience price increases at similar times or co-bubbling (Bouri et al., 2019). During and after periods of price appreciation, Bitcoin has come out ever dominant, yet this effect appears to be weakening after each cycle.

Finally, and on a different tangent, will be the views of the market on the environmental and social governance (ESG) narratives surrounding Bitcoin. With the Bitcoin network relying on Proof of Work (POW), requiring specialised machines to algorithmically hash to “mine” the next block, many detractors have pointed to the network consuming as much energy as small countries. The Cambridge Centre for Alternative Finance (CCAF) currently estimates that Bitcoin consumes approximated 80-Terawatt hours per year, or just shy of 0.4% of global consumption on an annual basis<sup>15</sup>. The importance of Bitcoin's energy use into the future will be the energy mix of mining operators, with a shift from coal-powered to increasingly hydro, solar and wind (Carter, 2021). This will be an increasingly important statistic for users of the network and regulators to watch, as other cryptocurrencies experiment with “Proof of Stake” (POS) solutions that may consume less energy but may become less decentralised. For firms holding bitcoins on their balance sheets, this may loom as a future headwind if additional taxes and limitations are placed on Bitcoin miners.

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<sup>15</sup> Cambridge Bitcoin Energy Consumption Index, 2021

### **5.3 – LIMITATIONS**

The first major limitation of this study is the low number of firms ( $n=14$ ) and number of events ( $n=18$ ) used. While this may be limiting now, in the future there will be additional data and additional firms that will be able to include within datasets and studies. Additionally, the inability to construct longer term post-announcement windows months and years later limits the forward-looking nature usually associated with event studies. Further with Microstrategy (MSTR) and Square Inc (SQ) contributing four and two announcements respectively, one-third of the dataset is from only two firms. This lack of diversity within the current available data will again be less of a limitation in the coming years.

Secondly, only using the S&P500 as the model benchmark for all firms when models may usually include capital asset pricing models (CAPM) formulas or multiple indices. Over such a small dataset and due to the recent nature of the occurrences, this may not have added much additional value beyond these initial findings intended to discover any immediate trends that would warrant further investigation in the future.

Finally, while controlling for Bitcoin's performance was not done within this study, again due to the small nature of most firm investments and the relatively short event windows, this would be a powerful metric in future research by which construction of normal and abnormal return estimations for firms could be weighted by their underlying holdings of bitcoins in conjunction with the market return. This would potentially also form the basis for the above-mentioned post-announcement event windows in future.

## 6. CONCLUSION

There remains a high level of interest now and no doubt into the future surrounding Bitcoin as an emerging asset class, and what role it may play within the portfolios of many around the globe in the years to come. With Bitcoin being a disinflationary asset, and having a programmatically finite supply, the demand for holding it from a retail perspective and an institutional perspective has thus far only increased over the past 13 years. Legalisation and introduction of Bitcoin as legal tender in certain jurisdictions, while others may outright ban trading, holding or exchanging bitcoins may mean that the next decade of adoption is defined by regulatory outcomes between nations.

This research was intended to provide an initial discovery on the effects on a firm's share price after announcing a Bitcoin purchase. The results of this study are interesting and provide a framework and possible variables of interest that future researchers can follow. However, there also remains an inability to draw a direct conclusion between the findings and some of the hypotheses, or conclusive remarks at degrees of significance. Further, since the adoption of Bitcoin as a network and as an asset remains relatively new, the future of research within this domain may remain lacklustre (without some significant level of institutional adoption in the short-to-medium term).

This area of research remains relatively underexplored, however, there is reason to believe that following a year where several firms have paved the way for institutional adoption of Bitcoin, there may be additional firms following suit in the months and years to come. Future studies would do well to not only incorporate the available data, but to also consider and focus on the implications of a world where numerous companies are holding decentralised assets on their balance sheets, potentially out of the control and influence from any centralised third-party. This has consequences not only for shareholders, but for policymakers, governments, central-banks and regulators alike.

To conclude, this paper set out to investigate the phenomena surrounding very recent happenings that took many by surprise only 12 months ago. The rate of change, and the speed at which firms navigate into the future will undoubtedly make for future additions to concepts analysed within this paper, coupled with new outlooks and happenings that have not been covered yet. This will only add to the incredibly useful body of work and research surrounding Bitcoin that expands ever greater, every day. Understanding the relationship between traditional financial markets and the decentralised world of finance and commerce remains an exciting frontier, to which this paper has contributed.

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## 8. APPENDICIES

### APPENDIX 1 – FIRM-LEVEL BETA'S (SLOPE) OVER ESTIMATION PERIOD(S)

<b>Firm</b>	<b>41-Day Window</b>	<b>11-Day Window</b>
<b>MSTR (1)</b>	0.73229592	0.80176995
<b>MSTR (2)</b>	0.80096159	0.8885497
<b>MSTR (3)</b>	1.1758303	1.26334598
<b>MSTR (4)</b>	1.18426433	0.84670554
<b>TSLA</b>	1.91891911	2.11450161
<b>SQ (1)</b>	1.35835857	1.27585166
<b>SQ (2)</b>	1.29173475	1.19925109
<b>MARA</b>	2.75837516	2.4519709
<b>HUT8</b>	-0.8141647	-0.7946758
<b>NEXON</b>	0.70566134	0.91993033
<b>VOYAGER</b>	1.44388075	0.14162172
<b>RIOT</b>	1.4951325	1.65016594
<b>MEITU</b>	0.45306651	0.83247491
<b>BITFARMS</b>	1.12858139	1.58895415
<b>HODL</b>	-0.956155	-0.9377531
<b>HIVE</b>	-0.8568911	-0.2425291
<b>DGHI</b>	-0.6450821	-0.7047435
<b>DASH</b>	-0.3886098	-0.5053425

**APPENDIX 2 – PERCENTAGE OF MARKET CAPITALISATION (\$US) PURCHASED IN BITCOIN & FEAR/GREED INDEX ON DATE OF ANNOUNCEMENT**

<b>Firm</b>	<b>Ann Date</b>	<b>Fear &amp; Greed</b>	<b>Market Cap in \$USD</b>	<b>Acquisition Size (BTC) in \$USD</b>	<b>% of Mkt Cap in BTC</b>
<b>MSTR (1)</b>	11-Aug-20	84	\$ 1,307,000,000.00	\$ 250,000,000.00	19.13%
<b>MSTR (2)</b>	14-Sep-20	39	\$ 1,381,000,000.00	\$ 175,000,000.00	12.67%
<b>MSTR (3)</b>	21-Dec-20	92	\$ 2,943,000,000.00	\$ 650,000,000.00	22.09%
<b>MSTR (4)</b>	24-Feb-21	76	\$ 7,839,000,000.00	\$ 1,026,000,000.00	13.09%
<b>TSLA</b>	8-Feb-21	83	\$ 828,760,000,000.00	\$ 1,500,000,000.00	0.18%
<b>SQ (1)</b>	8-Oct-20	46	\$ 82,150,000,000.00	\$ 50,000,000.00	0.06%
<b>SQ (2)</b>	23-Feb-21	94	\$ 116,650,000,000.00	\$ 170,000,000.00	0.15%
<b>MARA</b>	25-Jan-21	74	\$ 1,710,000,000.00	\$ 150,000,000.00	8.77%
<b>HUT8</b>	30-Jun-20	44	\$ 74,310,000.00	\$ 9,420,000.00	12.68%
<b>NEXON</b>	28-Apr-21	59	\$ 29,230,000,000.00	\$ 100,000,000.00	0.34%
<b>VOYAGER</b>	31-Mar-20	12	\$ 13,980,000.00	\$ 1,211,296.00	8.66%
<b>RIOT</b>	10-Aug-20	78	\$ 195,770,000.00	\$ 7,200,000.00	3.68%
<b>MEITU</b>	7-Mar-21	76	\$ 1,420,000,000.00	\$ 17,900,000.00	1.26%
<b>BITFARMS</b>	4-Feb-21	80	\$ 257,920,000.00	\$ 7,500,000.00	2.91%
<b>HODL</b>	30-Jun-20	44	\$ 24,080,000.00	\$ 1,925,000.00	7.99%
<b>HIVE</b>	15-Oct-20	56	\$ 152,100,000.00	\$ 3,000,000.00	1.97%
<b>DGHI</b>	4-Feb-21	80	\$ 30,460,000.00	\$ 6,890,000.00	22.62%
<b>DASH</b>	22-Dec-20	88	\$ 28,090,000.00	\$ 76,584.00	0.27%

**APPENDIX 3 – ABNORMAL RETURNS vs EXPECTED RETURNS & CUMULATIVE ABNORMAL RETURNS OVER 41-DAY EVENT PERIOD**

Firm	Days	Date	Expected Return	AR	CAR	T Stat
MSTR (1)	-20	14/7/20	0.00786149	-0.03%	-0.03%	0.01220963
MSTR (1)	-19	15/7/20	0.00509929	2.74%	2.70%	0.96128872
MSTR (1)	-18	16/7/20	-0.0040402	-1.25%	1.46%	0.438072
MSTR (1)	-17	17/7/20	0.00049458	-0.15%	1.31%	0.05291469
MSTR (1)	-16	20/7/20	0.00428971	1.40%	2.71%	0.49304195
MSTR (1)	-15	21/7/20	-7.038E-05	0.45%	3.16%	0.15683268
MSTR (1)	-14	22/7/20	0.00253975	-0.11%	3.04%	0.03984665
MSTR (1)	-13	23/7/20	-0.0103659	-0.16%	2.88%	0.05604426
MSTR (1)	-12	24/7/20	-0.0063446	-1.71%	1.17%	0.60085318
MSTR (1)	-11	27/7/20	0.00371175	0.24%	1.41%	0.08280751
MSTR (1)	-10	28/7/20	-0.0062729	0.75%	2.16%	0.26491466
MSTR (1)	-9	29/7/20	0.00737785	3.45%	5.61%	1.20982077
MSTR (1)	-8	30/7/20	-0.0042411	-0.06%	5.55%	0.01985741
MSTR (1)	-7	31/7/20	0.0041582	1.03%	6.59%	0.36264418
MSTR (1)	-6	3/8/20	0.00346274	-0.56%	6.03%	0.19517691
MSTR (1)	-5	4/8/20	0.00120014	-0.39%	5.63%	0.138627
MSTR (1)	-4	5/8/20	0.00291976	0.22%	5.85%	0.07682662
MSTR (1)	-3	6/8/20	0.00326668	-0.81%	5.04%	0.28455617
MSTR (1)	-2	7/8/20	-0.0011026	0.14%	5.19%	0.05008168
MSTR (1)	-1	10/8/20	0.00056027	0.13%	5.32%	0.04576043
MSTR (1)	0	11/8/20	-0.0076733	<b>9.88% ***</b>	15.20%	<b>3.4691376</b>
MSTR (1)	1	12/8/20	0.00858146	0.74%	15.94%	0.25823469
MSTR (1)	2	13/8/20	-0.0029522	0.27%	16.20%	0.09337531
MSTR (1)	3	14/8/20	-0.0016067	<b>7.19% **</b>	23.39%	<b>2.52354398</b>
MSTR (1)	4	17/8/20	0.00069783	-1.97%	21.42%	0.69233346
MSTR (1)	5	18/8/20	-4.639E-05	-0.48%	20.94%	0.16917924
MSTR (1)	6	19/8/20	-0.0046776	-0.56%	20.38%	0.19627508
MSTR (1)	7	20/8/20	0.00065169	1.68%	22.06%	0.58906694
MSTR (1)	8	21/8/20	0.00096933	0.56%	22.61%	0.19487215
MSTR (1)	9	24/8/20	0.00579207	1.83%	24.44%	0.64344724
MSTR (1)	10	25/8/20	0.00093404	-1.18%	23.26%	0.41547027
MSTR (1)	11	26/8/20	0.0057133	-1.18%	22.08%	0.41547903
MSTR (1)	12	27/8/20	-2.719E-05	0.32%	22.39%	0.11149496
MSTR (1)	13	28/8/20	0.00310177	-0.06%	22.34%	0.02023609
MSTR (1)	14	31/8/20	-0.0042812	-1.24%	21.10%	0.43514879
MSTR (1)	15	1/9/20	0.00526879	2.51%	23.60%	0.87940483
MSTR (1)	16	2/9/20	0.00896355	-0.10%	23.50%	0.03631132
MSTR (1)	17	3/9/20	-0.0268299	-1.13%	22.37%	0.39673623
MSTR (1)	18	4/9/20	-0.0076075	-0.69%	21.68%	0.24141623
MSTR (1)	19	8/9/20	-0.0216369	-0.21%	21.47%	0.07243443
MSTR (1)	20	9/9/20	0.01283258	0.40%	<b>21.87%</b>	0.13869739
MSTR (2)	-20	14/8/20	-0.0012657	<b>7.16% ***</b>	7.16%	<b>3.92369537</b>
MSTR (2)	-19	17/8/20	0.00125486	-2.03%	5.13%	1.11213633
MSTR (2)	-18	18/8/20	0.00044085	-0.53%	4.60%	0.29101573
MSTR (2)	-17	19/8/20	-0.0046246	-0.56%	4.03%	0.30953469
MSTR (2)	-16	20/8/20	0.00120439	1.62%	5.66%	0.8899601
MSTR (2)	-15	21/8/20	0.00155181	0.50%	6.15%	0.27249882



Firm	Days	Date	Expected Return	AR	CAR	T Stat
MSTR (2)	-14	24/8/20	0.00682676	1.73%	7.88%	0.94848603
MSTR (2)	-13	25/8/20	0.00151322	-1.24%	6.64%	0.68082314
MSTR (2)	-12	26/8/20	0.00674061	-1.29%	5.35%	0.70540948
MSTR (2)	-11	27/8/20	0.00046185	0.27%	5.62%	0.14736696
MSTR (2)	-10	28/8/20	0.0038842	-0.14%	5.49%	0.0745166
MSTR (2)	-9	31/8/20	-0.0041911	-1.25%	4.24%	0.6847513
MSTR (2)	-8	1/9/20	0.00625442	2.41%	6.64%	1.31979966
MSTR (2)	-7	2/9/20	0.01029563	-0.24%	6.41%	0.12976848
MSTR (2)	-6	3/9/20	-0.0288541	-0.93%	5.48%	0.50880726
MSTR (2)	-5	4/9/20	-0.0078292	-0.67%	4.81%	0.36499197
MSTR (2)	-4	8/9/20	-0.0231742	-0.05%	4.76%	0.02886866
MSTR (2)	-3	9/9/20	0.01452745	0.23%	4.99%	0.12374498
MSTR (2)	-2	10/9/20	-0.0151972	0.51%	5.49%	0.27778981
MSTR (2)	-1	11/9/20	-0.0008818	1.10%	6.59%	0.60170056
MSTR (2)	0	14/9/20	0.00926023	0.13%	6.72%	0.07113671
MSTR (2)	1	15/9/20	0.00275717	<b>8.93% ***</b>	15.65%	<b>4.89686089</b>
MSTR (2)	2	16/9/20	-0.0044683	<b>12.71% ***</b>	28.39%	<b>6.9868622</b>
MSTR (2)	3	17/9/20	-0.0083341	<b>-5.60% ***</b>	22.77%	<b>3.08252332</b>
MSTR (2)	4	18/9/20	-0.0105108	-1.41%	21.37%	0.77093919
MSTR (2)	5	21/9/20	-0.0102039	<b>-3.64% **</b>	17.73%	<b>1.99332102</b>
MSTR (2)	6	22/9/20	0.00686785	0.69%	18.42%	0.37657179
MSTR (2)	7	23/9/20	-0.0198646	-1.88%	16.53%	1.03298226
MSTR (2)	8	24/9/20	0.00084537	-1.58%	14.95%	0.86728951
MSTR (2)	9	25/9/20	0.01165952	-1.12%	13.83%	0.61304026
MSTR (2)	10	28/9/20	0.01201401	2.45%	16.28%	1.34122548
MSTR (2)	11	29/9/20	-0.0056516	-0.60%	15.68%	0.33089833
MSTR (2)	12	30/9/20	0.00478328	0.10%	15.78%	0.05640649
MSTR (2)	13	1/10/20	0.00385265	-1.45%	14.33%	0.79395308
MSTR (2)	14	2/10/20	-0.0088942	-0.79%	13.54%	0.43256633
MSTR (2)	15	5/10/20	0.01291391	-0.10%	13.45%	0.05292746
MSTR (2)	16	6/10/20	-0.0126759	2.50%	15.95%	1.37208171
MSTR (2)	17	7/10/20	0.01265256	0.77%	16.72%	0.42086028
MSTR (2)	18	8/10/20	0.00580893	<b>6.51% ***</b>	23.22%	<b>3.5676514</b>
MSTR (2)	19	9/10/20	0.00586316	-0.10%	23.12%	0.05726474
MSTR (2)	20	12/10/20	0.01159612	-0.11%	<b>23.01%</b>	<b>0.05998782</b>
MSTR (3)	-20	20/11/20	-0.0046211	2.77%	2.77%	1.01052251
MSTR (3)	-19	23/11/20	0.01047903	-1.66%	1.11%	0.60509128
MSTR (3)	-18	24/11/20	0.02237773	<b>9.75% ***</b>	10.86%	<b>3.56416223</b>
MSTR (3)	-17	25/11/20	0.00161794	<b>9.16% ***</b>	20.02%	<b>3.34665567</b>
MSTR (3)	-16	27/11/20	0.00670539	-0.30%	19.72%	0.11118323
MSTR (3)	-15	30/11/20	-0.0017749	<b>26.5% ***</b>	46.25%	<b>9.69909109</b>
MSTR (3)	-14	1/12/20	0.01629105	<b>-7.1% ***</b>	39.15%	<b>2.59659818</b>
MSTR (3)	-13	2/12/20	0.00590433	-1.42%	37.73%	0.51806831
MSTR (3)	-12	3/12/20	0.00311017	2.89%	40.62%	1.05554346
MSTR (3)	-11	4/12/20	0.01356359	-2.44%	38.18%	0.89244764
MSTR (3)	-10	7/12/20	0.00101433	2.40%	40.58%	0.87880108
MSTR (3)	-9	8/12/20	0.00687143	<b>-14.6% ***</b>	25.99%	<b>5.33481845</b>
MSTR (3)	-8	9/12/20	-0.0071151	-0.41%	25.58%	0.14905418
MSTR (3)	-7	10/12/20	0.00304605	1.13%	26.71%	0.41475533

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MSTR (3)	-6	11/12/20	0.00205189	-1.72%	24.99%	0.63009921
MSTR (3)	-5	14/12/20	-0.0018337	-2.05%	22.94%	0.7497448
MSTR (3)	-4	15/12/20	0.01932719	0.31%	23.24%	0.11210667
MSTR (3)	-3	16/12/20	0.00527597	4.14%	27.38%	1.51177093
MSTR (3)	-2	17/12/20	0.01000587	-1.44%	25.94%	0.52694621
MSTR (3)	-1	18/12/20	-0.0012642	1.27%	27.21%	0.46344806
MSTR (3)	0	21/12/20	-0.0007736	<b>5.52% **</b>	32.73%	<b>2.01814133</b>
MSTR (3)	1	22/12/20	0.00144889	4.23%	36.96%	1.54649727
MSTR (3)	2	23/12/20	0.00448738	1.26%	38.23%	0.46218737
MSTR (3)	3	24/12/20	0.00800515	<b>-5.12% *</b>	33.10%	<b>1.87174217</b>
MSTR (3)	4	28/12/20	0.013532	<b>13.34% ***</b>	46.44%	<b>4.87386568</b>
MSTR (3)	5	29/12/20	0.00118749	-1.18%	45.26%	0.43157111
MSTR (3)	6	30/12/20	0.00510837	<b>6.02% **</b>	51.28%	<b>2.19930678</b>
MSTR (3)	7	31/12/20	0.00940481	-1.30%	49.97%	0.47678034
MSTR (3)	8	4/1/21	-0.0125771	<b>10.70% ***</b>	60.67%	<b>3.90869416</b>
MSTR (3)	9	5/1/21	0.01152903	-0.35%	60.32%	0.12826241
MSTR (3)	10	6/1/21	0.01046049	<b>11.07% ***</b>	71.38%	<b>4.04449457</b>
MSTR (3)	11	7/1/21	0.02090056	<b>9.40% ***</b>	80.78%	<b>3.43411842</b>
MSTR (3)	12	8/1/21	0.01013024	-1.78%	79.00%	0.650575
MSTR (3)	13	11/1/21	-0.0044954	<b>-6.35% **</b>	72.65%	<b>2.32071732</b>
MSTR (3)	14	12/1/21	0.00367895	3.42%	76.07%	1.24848721
MSTR (3)	15	13/1/21	0.00659714	0.32%	76.38%	0.11566247
MSTR (3)	16	14/1/21	-0.000687	<b>21.59% ***</b>	97.97%	<b>7.88940231</b>
MSTR (3)	17	15/1/21	-0.0051443	<b>-7.87% ***</b>	90.10%	<b>2.87754958</b>
MSTR (3)	18	19/1/21	0.01266333	1.18%	91.28%	0.431144
MSTR (3)	19	20/1/21	0.0197026	<b>-8.96% ***</b>	82.32%	<b>3.27424998</b>
MSTR (3)	20	21/1/21	0.0045027	<b>-5.96% **</b>	<b>76.36%</b>	<b>2.17887118</b>
MSTR (4)	-20	26/1/21	0.01266155	-3.30%	-3.30%	0.6542164
MSTR (4)	-19	27/1/21	-0.0144339	-2.08%	-5.38%	0.41210764
MSTR (4)	-18	28/1/21	0.02469506	4.62%	-0.76%	0.9160955
MSTR (4)	-17	29/1/21	-0.0091984	7.65%	6.89%	1.51768293
MSTR (4)	-16	1/2/21	0.03422279	-0.63%	6.27%	0.12455704
MSTR (4)	-15	2/2/21	0.03125584	5.28%	11.55%	1.04807481
MSTR (4)	-14	3/2/21	0.01544132	6.20%	17.75%	1.22980598
MSTR (4)	-13	4/2/21	0.02797007	0.50%	18.24%	0.09819398
MSTR (4)	-12	5/2/21	0.01917125	3.36%	21.60%	0.66675759
MSTR (4)	-11	8/2/21	0.02306277	<b>26.85% ***</b>	48.45%	<b>5.32628932</b>
MSTR (4)	-10	9/2/21	0.01372156	<b>20.91% ***</b>	69.36%	<b>4.14762197</b>
MSTR (4)	-9	10/2/21	0.01399425	<b>-24.85% ***</b>	44.52%	<b>4.92872907</b>
MSTR (4)	-8	11/2/21	0.01642273	2.00%	46.51%	0.39606756
MSTR (4)	-7	12/2/21	0.02036012	0.38%	46.89%	0.07478771
MSTR (4)	-6	16/2/21	0.01348448	<b>-9.02% *</b>	37.87%	<b>1.78859186</b>
MSTR (4)	-5	17/2/21	0.01478199	-2.86%	35.01%	0.56742221
MSTR (4)	-4	18/2/21	0.00946983	-2.44%	32.58%	0.4831575
MSTR (4)	-3	19/2/21	0.01241879	2.63%	35.21%	0.52208996
MSTR (4)	-2	22/2/21	0.00540095	<b>-9.64% *</b>	25.57%	<b>1.9127634</b>
MSTR (4)	-1	23/2/21	0.01594829	<b>-22.69% ***</b>	2.88%	<b>4.50051692</b>
MSTR (4)	0	24/2/21	0.02755996	<b>15.54% ***</b>	18.42%	<b>3.08248376</b>
MSTR (4)	1	25/2/21	-0.0140256	<b>-9.12% *</b>	9.29%	<b>1.81007408</b>

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MSTR (4)	2	26/2/21	0.00840799	1.73%	11.02%	0.34295966
MSTR (4)	3	1/3/21	0.04321684	-0.05%	10.97%	0.01058247
MSTR (4)	4	2/3/21	0.00526913	-4.86%	6.11%	0.96500407
MSTR (4)	5	3/3/21	-0.0011763	-2.14%	3.96%	0.42535356
MSTR (4)	6	4/3/21	-0.000145	<b>-11.73% **</b>	-7.77%	<b>2.32665013</b>
MSTR (4)	7	5/3/21	0.03629656	-7.57%	-15.33%	1.50102101
MSTR (4)	8	8/3/21	0.00861396	-0.22%	-15.56%	0.04454318
MSTR (4)	9	9/3/21	0.03141841	<b>11.57% **</b>	-3.99%	<b>2.29421154</b>
MSTR (4)	10	10/3/21	0.02188161	3.48%	-0.52%	0.68968314
MSTR (4)	11	11/3/21	0.02651757	3.59%	3.07%	0.71157737
MSTR (4)	12	12/3/21	0.01610507	-4.07%	-1.00%	0.80692407
MSTR (4)	13	15/3/21	0.02157253	-4.07%	-5.07%	0.80722225
MSTR (4)	14	16/3/21	0.01301649	-7.12%	-12.18%	1.4117957
MSTR (4)	15	17/3/21	0.01854824	4.59%	-7.59%	0.91109568
MSTR (4)	16	18/3/21	-0.0027205	-4.78%	-12.37%	0.94793825
MSTR (4)	17	19/3/21	0.01231887	4.91%	-7.46%	0.97477196
MSTR (4)	18	22/3/21	0.02396636	<b>-9.15% *</b>	-16.61%	<b>1.81519372</b>
MSTR (4)	19	23/3/21	0.00518908	-7.05%	-23.66%	1.39929499
MSTR (4)	20	24/3/21	0.00848989	<b>-9.07% *</b>	<b>-32.72%</b>	<b>1.7982498</b>
TSLA	-20	8/1/21	0.01750317	6.09%	6.09%	1.30717872
TSLA	-19	11/1/21	-0.0063653	-7.18%	-1.09%	1.54219035
TSLA	-18	12/1/21	0.00697487	4.02%	2.92%	0.86239761
TSLA	-17	13/1/21	0.01173727	-0.59%	2.33%	0.12634784
TSLA	-16	14/1/21	-0.0001503	-1.09%	1.25%	0.23317005
TSLA	-15	15/1/21	-0.0074244	-1.49%	-0.24%	0.3192084
TSLA	-14	19/1/21	0.0216371	0.06%	-0.18%	0.01336212
TSLA	-13	20/1/21	0.03312497	-2.61%	-2.79%	0.56105696
TSLA	-12	21/1/21	0.00831921	-1.47%	-4.26%	0.31637129
TSLA	-11	22/1/21	-0.0002222	0.22%	-4.05%	0.04668319
TSLA	-10	25/1/21	0.01413763	2.62%	-1.43%	0.56258289
TSLA	-9	26/1/21	0.00357439	-0.10%	-1.52%	0.02091568
TSLA	-8	27/1/21	-0.0403296	1.89%	0.37%	0.40553666
TSLA	-7	28/1/21	0.02307285	-5.63%	-5.27%	1.2088523
TSLA	-6	29/1/21	-0.0318462	-1.83%	-7.10%	0.39295964
TSLA	-5	1/2/21	0.03851109	1.98%	-5.12%	0.42522111
TSLA	-4	2/2/21	0.0337036	0.56%	-4.56%	0.11949568
TSLA	-3	3/2/21	0.00807858	-2.88%	-7.44%	0.61853158
TSLA	-2	4/2/21	0.0283795	-3.39%	-10.83%	0.72718297
TSLA	-1	5/2/21	0.01412237	-1.15%	-11.98%	0.24656255
TSLA	0	8/2/21	0.02042798	-0.73%	-12.71%	0.15664108
TSLA	1	9/2/21	0.00529197	-2.15%	-14.85%	0.46062968
TSLA	2	10/2/21	0.00573382	-5.83%	-20.68%	1.2510488
TSLA	3	11/2/21	0.00966881	-0.12%	-20.80%	0.02511451
TSLA	4	12/2/21	0.01604875	-1.06%	-21.85%	0.22653111
TSLA	5	16/2/21	0.00490783	-2.93%	-24.78%	0.62872459
TSLA	6	17/2/21	0.00701025	-0.46%	-25.24%	0.09844052
TSLA	7	18/2/21	-0.0015973	-1.19%	-26.43%	0.25534949
TSLA	8	19/2/21	0.00318104	-1.09%	-27.52%	0.23402347
TSLA	9	22/2/21	-0.0081903	<b>-7.73% *</b>	-35.25%	<b>1.65937324</b>

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TSLA	10	23/2/21	0.00890005	-3.08%	-38.33%	0.66147721
TSLA	11	24/2/21	0.02771499	3.41%	-34.93%	0.73135821
TSLA	12	25/2/21	-0.039668	-4.09%	-39.02%	0.87838382
TSLA	13	26/2/21	-0.0033178	-0.65%	-39.67%	0.140212
TSLA	14	1/3/21	0.05308457	1.05%	-38.63%	0.22469661
TSLA	15	2/3/21	-0.0084039	-3.61%	-42.24%	0.77537407
TSLA	16	3/3/21	-0.0188477	-2.96%	-45.20%	0.63483058
TSLA	17	4/3/21	-0.0171767	-3.14%	-48.34%	0.67495882
TSLA	18	5/3/21	0.04187132	<b>-7.97% *</b>	-56.31%	<b>1.71008035</b>
TSLA	19	8/3/21	-0.0029841	-5.55%	-61.85%	1.19053528
TSLA	20	9/3/21	0.03396701	<b>16.24%***</b>	<b>-45.61%</b>	<b>3.48678367</b>
SQ (1)	-20	9/9/20	0.03504085	0.16%	0.16%	0.05168272
SQ (1)	-19	10/9/20	-0.0153694	-0.64%	-0.48%	0.20421495
SQ (1)	-18	11/9/20	0.0089082	-3.46%	-3.94%	1.10230066
SQ (1)	-17	14/9/20	0.02610812	2.45%	-1.49%	0.77981186
SQ (1)	-16	15/9/20	0.01507953	<b>5.49% *</b>	4.00%	<b>1.7494678</b>
SQ (1)	-15	16/9/20	0.00282573	-2.52%	1.48%	0.80213571
SQ (1)	-14	17/9/20	-0.0037303	-3.21%	-1.73%	1.023106
SQ (1)	-13	18/9/20	-0.0074217	0.31%	-1.42%	0.09872013
SQ (1)	-12	21/9/20	-0.0069013	4.90%	3.49%	1.563606
SQ (1)	-11	22/9/20	0.02205086	0.75%	4.24%	0.24005238
SQ (1)	-10	23/9/20	-0.0232849	-1.53%	2.71%	0.48716457
SQ (1)	-9	24/9/20	0.01183727	0.63%	3.35%	0.20234587
SQ (1)	-8	25/9/20	0.03017711	0.53%	3.88%	0.17035723
SQ (1)	-7	28/9/20	0.03077828	-1.15%	2.73%	0.3668136
SQ (1)	-6	29/9/20	0.00081903	2.44%	5.17%	0.77720085
SQ (1)	-5	30/9/20	0.01851562	-3.22%	1.94%	1.02765587
SQ (1)	-4	1/10/20	0.01693736	1.96%	3.90%	0.62514691
SQ (1)	-3	2/10/20	-0.0046801	1.13%	5.04%	0.3611922
SQ (1)	-2	5/10/20	0.03230443	3.44%	8.47%	1.09619918
SQ (1)	-1	6/10/20	-0.0110935	-1.97%	6.50%	0.62972609
SQ (1)	0	7/10/20	0.03186121	-0.43%	6.07%	0.13576456
SQ (1)	1	8/10/20	0.02025503	-0.18%	5.89%	0.05831999
SQ (1)	2	9/10/20	0.02034699	0.03%	5.92%	0.00805011
SQ (1)	3	12/10/20	0.03006958	-4.13%	1.78%	1.31807316
SQ (1)	4	13/10/20	-0.0006482	2.93%	4.71%	0.93334074
SQ (1)	5	14/10/20	-0.0003184	-1.53%	3.18%	0.48873028
SQ (1)	6	15/10/20	0.0065378	-0.06%	3.12%	0.01968948
SQ (1)	7	16/10/20	0.00739598	-1.93%	1.18%	0.61624222
SQ (1)	8	19/10/20	-0.0124351	1.57%	2.75%	0.50089304
SQ (1)	9	20/10/20	0.01365798	-2.02%	0.74%	0.64358382
SQ (1)	10	21/10/20	0.00564547	-4.83%	-4.09%	1.53967203
SQ (1)	11	22/10/20	0.01566758	-2.63%	-6.72%	0.83850489
SQ (1)	12	23/10/20	0.01282861	-0.81%	-7.53%	0.25681316
SQ (1)	13	26/10/20	-0.0168855	-2.20%	-9.73%	0.70262719
SQ (1)	14	27/10/20	0.00353383	0.31%	-9.42%	0.09940886
SQ (1)	15	28/10/20	-0.0382107	1.55%	-7.87%	0.4931222
SQ (1)	16	29/10/20	0.02202242	-0.57%	-8.44%	0.18136708
SQ (1)	17	30/10/20	-0.005944	<b>-8.22% ***</b>	-16.67%	<b>2.62256197</b>

Firm	Days	Date	Expected Return	AR	CAR	T Stat
SQ (1)	18	2/11/20	0.02344178	-2.12%	-18.78%	0.67542491
SQ (1)	19	3/11/20	0.03219966	-1.30%	-20.09%	0.41459946
SQ (1)	20	4/11/20	0.03857507	4.41%	<b>-15.68%</b>	1.40619621
SQ (2)	-20	25/1/21	0.0091993	-3.72%	-3.72%	1.11011055
SQ (2)	-19	26/1/21	0.00208858	-3.66%	-7.38%	1.09140681
SQ (2)	-18	27/1/21	-0.0274657	-0.46%	-7.84%	0.13768444
SQ (2)	-17	28/1/21	0.01521411	<b>7.10% **</b>	-0.74%	<b>2.118237</b>
SQ (2)	-16	29/1/21	-0.0217551	0.38%	-0.36%	0.11320655
SQ (2)	-15	1/2/21	0.02560648	0.21%	-0.15%	0.0621903
SQ (2)	-14	2/2/21	0.02237028	0.33%	0.17%	0.09751072
SQ (2)	-13	3/2/21	0.00512061	-0.38%	-0.20%	0.11217853
SQ (2)	-12	4/2/21	0.01878633	2.41%	2.21%	0.71984087
SQ (2)	-11	5/2/21	0.00918903	0.20%	2.41%	0.05970762
SQ (2)	-10	8/2/21	0.0134337	<b>6.81% **</b>	9.22%	<b>2.03128535</b>
SQ (2)	-9	9/2/21	0.00324478	-1.04%	8.18%	0.30921943
SQ (2)	-8	10/2/21	0.00354222	-0.60%	7.58%	0.17855867
SQ (2)	-7	11/2/21	0.00619108	2.66%	10.24%	0.7934735
SQ (2)	-6	12/2/21	0.01048579	1.52%	11.76%	0.4524455
SQ (2)	-5	16/2/21	0.00298619	0.90%	12.66%	0.26868328
SQ (2)	-4	17/2/21	0.00440145	-2.28%	10.38%	0.68063029
SQ (2)	-3	18/2/21	-0.0013928	0.11%	10.48%	0.03165372
SQ (2)	-2	19/2/21	0.00182379	1.93%	12.41%	0.57584743
SQ (2)	-1	22/2/21	-0.0058309	-2.49%	9.93%	0.74213302
SQ (2)	0	23/2/21	0.00567358	-4.85%	5.07%	1.44847098
SQ (2)	1	24/2/21	0.018339	<b>-9.34% ***</b>	-4.27%	<b>2.7886519</b>
SQ (2)	2	25/2/21	-0.0270204	-1.60%	-5.87%	0.47756389
SQ (2)	3	26/2/21	-0.002551	1.54%	-4.33%	0.45984971
SQ (2)	4	1/3/21	0.03541672	1.23%	-3.10%	0.36627327
SQ (2)	5	2/3/21	-0.0059747	5.24%	2.14%	1.56527676
SQ (2)	6	3/3/21	-0.013005	<b>-5.84% *</b>	-3.70%	<b>1.74193191</b>
SQ (2)	7	4/3/21	-0.0118801	<b>-5.55% *</b>	-9.25%	<b>1.65758985</b>
SQ (2)	8	5/3/21	0.02786844	-3.69%	-12.94%	1.10091032
SQ (2)	9	8/3/21	-0.0023263	<b>-6.50% *</b>	-19.44%	<b>1.9396043</b>
SQ (2)	10	9/3/21	0.0225476	<b>9.25% ***</b>	-10.19%	<b>2.75993</b>
SQ (2)	11	10/3/21	0.01214535	-0.49%	-10.68%	0.14502589
SQ (2)	12	11/3/21	0.01720202	4.89%	-5.79%	1.45975186
SQ (2)	13	12/3/21	0.00584459	-0.42%	-6.21%	0.12627685
SQ (2)	14	15/3/21	0.01180822	2.59%	-3.62%	0.77179688
SQ (2)	15	16/3/21	0.00247573	-3.38%	-7.00%	1.00879234
SQ (2)	16	17/3/21	0.00850948	0.43%	-6.58%	0.1274345
SQ (2)	17	18/3/21	-0.0146894	<b>-7.53% **</b>	-14.10%	<b>2.2461195</b>
SQ (2)	18	19/3/21	0.0017148	0.07%	-14.03%	0.02067195
SQ (2)	19	22/3/21	0.01441929	-0.87%	-14.90%	0.25910518
SQ (2)	20	23/3/21	-0.006062	-0.69%	<b>-15.59%</b>	0.20578336
MARA	-20	23/12/20	0.01689192	<b>-24.31% *</b>	-24.31%	<b>1.73024492</b>
MARA	-19	24/12/20	0.02514426	-1.50%	-25.81%	0.10654107
MARA	-18	28/12/20	0.03810967	8.37%	-17.44%	0.59564499
MARA	-17	29/12/20	0.00915073	-4.92%	-22.35%	0.34983946
MARA	-16	30/12/20	0.0183487	-9.32%	-31.67%	0.6632163

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MARA	-15	31/12/20	0.02842771	-6.89%	-38.56%	0.49018716
MARA	-14	4/1/21	-0.0231396	7.77%	-30.78%	0.5533096
MARA	-13	5/1/21	0.03341092	20.09%	-10.69%	1.43009625
MARA	-12	6/1/21	0.03090422	21.71%	11.02%	1.54505157
MARA	-11	7/1/21	0.05539554	<b>26.30% *</b>	37.32%	<b>1.8719574</b>
MARA	-10	8/1/21	0.03012949	15.01%	52.33%	1.06838589
MARA	-9	11/1/21	-0.0041806	-11.06%	41.26%	0.78746899
MARA	-8	12/1/21	0.01499544	10.44%	51.71%	0.7433672
MARA	-7	13/1/21	0.02184122	-14.23%	37.48%	1.01284755
MARA	-6	14/1/21	0.00475327	5.79%	43.26%	0.4117971
MARA	-5	15/1/21	-0.0057029	-7.82%	35.44%	0.55643266
MARA	-4	19/1/21	0.03607186	-3.79%	31.66%	0.26946368
MARA	-3	20/1/21	0.05258524	-19.04%	12.62%	1.35515658
MARA	-2	21/1/21	0.01692787	-10.57%	2.05%	0.75210382
MARA	-1	22/1/21	0.00464992	3.75%	5.80%	0.26685141
MARA	0	25/1/21	0.02529164	-2.97%	2.84%	0.21113352
MARA	1	26/1/21	0.01010737	1.07%	3.91%	0.07650718
MARA	2	27/1/21	-0.053003	0.19%	4.10%	0.01372113
MARA	3	28/1/21	0.03813569	8.93%	13.04%	0.63591589
MARA	4	29/1/21	-0.0408085	8.30%	21.34%	0.59090703
MARA	5	1/2/21	0.06032759	-6.03%	15.31%	0.42939285
MARA	6	2/2/21	0.053417	4.30%	19.61%	0.30616738
MARA	7	3/2/21	0.01658199	2.43%	22.04%	0.17306733
MARA	8	4/2/21	0.04576381	-8.25%	13.79%	0.58734604
MARA	9	5/2/21	0.0252697	-3.76%	10.03%	0.2672717
MARA	10	8/2/21	0.03433379	<b>38.97% ***</b>	49.01%	<b>2.77400226</b>
MARA	11	9/2/21	0.01257633	15.95%	64.96%	1.13560653
MARA	12	10/2/21	0.01321148	-10.84%	54.12%	0.77191045
MARA	13	11/2/21	0.01886787	7.70%	61.81%	0.5479647
MARA	14	12/2/21	0.02803881	0.39%	62.20%	0.02769014
MARA	15	16/2/21	0.01202415	12.06%	74.26%	0.85825925
MARA	16	17/2/21	0.01504629	8.46%	82.72%	0.60205961
MARA	17	18/2/21	0.00267326	-14.71%	68.01%	1.04730305
MARA	18	19/2/21	0.00954195	4.63%	72.64%	0.32982623
MARA	19	22/2/21	-0.0068039	-13.56%	59.08%	0.96485911
MARA	20	23/2/21	0.01776281	<b>-24.82% *</b>	<b>34.27%</b>	<b>1.76631776</b>
HUT8	-20	2/6/20	-0.0053323	5.45%	5.45%	0.45257137
HUT8	-19	3/6/20	0.00764124	-6.49%	-1.04%	0.53908215
HUT8	-18	4/6/20	-0.0153637	1.54%	0.49%	0.12755119
HUT8	-17	5/6/20	-0.0043385	-1.22%	-0.73%	0.10158566
HUT8	-16	8/6/20	0.01157377	-3.40%	-4.13%	0.28265202
HUT8	-15	9/6/20	0.01004577	-4.45%	-8.59%	0.36968208
HUT8	-14	10/6/20	0.05243863	-11.79%	-20.38%	0.97894547
HUT8	-13	11/6/20	-0.0042474	-16.14%	-36.51%	1.33961424
HUT8	-12	12/6/20	-0.0020978	7.08%	-29.43%	0.58779255
HUT8	-11	15/6/20	-0.0101681	3.87%	-25.56%	0.32162094
HUT8	-10	16/6/20	0.00888464	-4.36%	-29.92%	0.36203032
HUT8	-9	17/6/20	0.00518944	3.08%	-26.84%	0.25555471
HUT8	-8	18/6/20	0.01015568	-7.96%	-34.80%	0.66085147

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HUT8	-7	19/6/20	0.00027969	-0.03%	-34.83%	0.00232206
HUT8	-6	22/6/20	0.00175476	-0.92%	-35.75%	0.07652454
HUT8	-5	23/6/20	0.02627109	-7.14%	-42.89%	0.59263894
HUT8	-4	24/6/20	-0.0032255	-2.83%	-45.72%	0.2347058
HUT8	-3	25/6/20	0.02484047	-13.05%	-58.77%	1.08369109
HUT8	-2	26/6/20	-0.0064634	-5.72%	-64.49%	0.47465783
HUT8	-1	29/6/20	-0.0049264	-4.36%	-68.85%	0.36211683
HUT8	0	30/6/20	-0.0002002	7.16%	-61.69%	0.59467256
HUT8	1	2/7/20	0.00101936	4.66%	-57.03%	0.38687716
HUT8	2	3/7/20	-0.0070658	2.52%	-54.50%	0.20960955
HUT8	3	6/7/20	0.01390005	-2.28%	-56.79%	0.18952645
HUT8	4	7/7/20	-0.0007246	0.07%	-56.71%	0.00601536
HUT8	5	8/7/20	0.01013783	12.50%	-44.21%	1.03774527
HUT8	6	9/7/20	-0.0028103	-10.04%	-54.25%	0.83323839
HUT8	7	10/7/20	0.01255274	-1.26%	-55.50%	0.10421461
HUT8	8	13/7/20	-0.0050481	6.70%	-48.81%	0.55620163
HUT8	9	14/7/20	-0.001977	1.03%	-47.77%	0.08559822
HUT8	10	15/7/20	0.0081842	-2.47%	-50.25%	0.20517181
HUT8	11	16/7/20	0.00314246	-4.52%	-54.76%	0.37491859
HUT8	12	17/7/20	-0.001077	-4.28%	-59.04%	0.35518787
HUT8	13	20/7/20	0.00377057	3.29%	-55.75%	0.2733619
HUT8	14	21/7/20	0.00086863	-3.63%	-59.37%	0.30109261
HUT8	15	22/7/20	0.01521713	-3.36%	-62.73%	0.27866761
HUT8	16	23/7/20	0.01074628	5.47%	-57.26%	0.45391361
HUT8	17	24/7/20	-0.0004344	-5.22%	-62.48%	0.43334844
HUT8	18	27/7/20	0.01066654	<b>34.12% ***</b>	-28.36%	<b>2.83256851</b>
HUT8	19	28/7/20	-0.0045104	-5.03%	-33.39%	0.41746625
HUT8	20	29/7/20	0.00840759	-0.12%	<b>-33.51%</b>	0.00964055
NEXON	-20	30/3/21	-0.0004835	1.18%	1.18%	0.43165013
NEXON	-19	31/3/21	0.00424886	0.83%	2.00%	0.30436633
NEXON	-18	1/4/21	0.00900903	-0.76%	1.24%	0.2803983
NEXON	-17	5/4/21	0.01151703	0.77%	2.01%	0.2833454
NEXON	-16	6/4/21	0.00097184	-1.85%	0.16%	0.67926343
NEXON	-15	7/4/21	0.00220519	-2.96%	-2.80%	1.08875708
NEXON	-14	8/4/21	0.00473821	1.78%	-1.02%	0.65489847
NEXON	-13	9/4/21	0.00651886	-1.48%	-2.50%	0.54344946
NEXON	-12	12/4/21	0.00164585	-1.00%	-3.50%	0.3669877
NEXON	-11	13/4/21	0.0034799	0.21%	-3.28%	0.07824774
NEXON	-10	14/4/21	-0.0010213	1.08%	-2.21%	0.3961349
NEXON	-9	15/4/21	0.00896912	-0.34%	-2.55%	0.12651723
NEXON	-8	16/4/21	0.00374717	-0.79%	-3.34%	0.28901573
NEXON	-7	19/4/21	-0.0020784	0.21%	-3.13%	0.07634433
NEXON	-6	20/4/21	-0.0037779	-1.14%	-4.27%	0.41855001
NEXON	-5	21/4/21	0.0080656	-0.39%	-4.65%	0.14193101
NEXON	-4	22/4/21	-0.0050563	1.90%	-2.75%	0.69804053
NEXON	-3	23/4/21	0.00903963	-1.18%	-3.93%	0.43310242
NEXON	-2	26/4/21	0.00286173	-0.29%	-4.22%	0.1051189
NEXON	-1	27/4/21	0.00123652	-0.54%	-4.76%	0.19741673
NEXON	0	28/4/21	0.00118573	-0.12%	-4.88%	0.04355488

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NEXON	1	29/4/21	0.00588562	-0.59%	-5.46%	0.21619468
NEXON	2	30/4/21	-0.003248	0.74%	-4.72%	0.27193445
NEXON	3	3/5/21	0.00291054	-0.29%	-5.02%	0.10691199
NEXON	4	4/5/21	-0.0029649	0.30%	-4.72%	0.10890776
NEXON	5	5/5/21	0.0016093	-0.16%	-4.88%	0.05911388
NEXON	6	6/5/21	0.00702368	<b>-4.98% *</b>	-9.86%	<b>1.82863732</b>
NEXON	7	7/5/21	0.00652437	-1.23%	-11.09%	0.45137308
NEXON	8	10/5/21	-0.0055991	1.14%	-9.95%	0.41861417
NEXON	9	11/5/21	-0.0049093	-2.54%	-12.48%	0.93117588
NEXON	10	12/5/21	-0.0136033	-1.91%	-14.39%	0.70108591
NEXON	11	13/5/21	0.00986531	<b>-15.33% ***</b>	-29.72%	<b>5.63247642</b>
NEXON	12	14/5/21	0.01222425	-0.61%	-30.34%	0.22504979
NEXON	13	17/5/21	-0.000407	<b>-4.67% *</b>	-35.00%	<b>1.71364658</b>
NEXON	14	18/5/21	-0.0046912	1.74%	-33.26%	0.63955095
NEXON	15	19/5/21	-0.0004615	3.19%	-30.07%	1.17036299
NEXON	16	20/5/21	0.00898006	<b>-6.02% **</b>	-36.09%	<b>2.21122892</b>
NEXON	17	21/5/21	0.00081082	0.11%	-35.99%	0.0395511
NEXON	18	24/5/21	0.00858228	-2.67%	-38.65%	0.97959478
NEXON	19	25/5/21	-0.0001771	-1.67%	-40.32%	0.61369497
NEXON	20	26/5/21	0.00278898	-1.76%	<b>-42.09%</b>	0.64727263
VOYAGER	-20	3/3/20	0.05639539	<b>-16.39% **</b>	-16.39%	<b>2.19800763</b>
VOYAGER	-19	4/3/20	-0.0474756	2.13%	-14.26%	0.28585675
VOYAGER	-18	5/3/20	0.05455662	10.29%	-3.97%	1.37949123
VOYAGER	-17	6/3/20	-0.0541309	3.23%	-0.74%	0.43294482
VOYAGER	-16	9/3/20	-0.0300027	<b>-14.35% *</b>	-15.09%	<b>1.92368736</b>
VOYAGER	-15	10/3/20	-0.1188929	7.56%	-7.54%	1.01303979
VOYAGER	-14	11/3/20	0.0685794	-5.46%	-12.99%	0.73173659
VOYAGER	-13	12/3/20	-0.0765206	9.17%	-3.82%	1.22966853
VOYAGER	-12	13/3/20	-0.1442804	6.43%	2.61%	0.86179647
VOYAGER	-11	16/3/20	0.11729836	<b>-14.03% *</b>	-11.42%	<b>1.88070615</b>
VOYAGER	-10	17/3/20	-0.1641288	11.77%	0.35%	1.57826122
VOYAGER	-9	18/3/20	0.07182417	<b>-31.65% ***</b>	-31.30%	<b>4.24313827</b>
VOYAGER	-8	19/3/20	-0.0792417	<b>33.96% ***</b>	2.66%	<b>4.55312513</b>
VOYAGER	-7	20/3/20	-0.0030656	1.85%	4.51%	0.24764784
VOYAGER	-6	23/3/20	-0.0683567	-6.96%	-2.45%	0.93277048
VOYAGER	-5	24/3/20	-0.0430513	<b>32.31% ***</b>	29.86%	<b>4.33109297</b>
VOYAGER	-4	25/3/20	0.12468637	<b>-21.84% ***</b>	8.01%	<b>2.92853889</b>
VOYAGER	-3	26/3/20	0.01548136	-7.13%	0.88%	0.95648911
VOYAGER	-2	27/3/20	0.07817409	<b>-12.86% *</b>	-11.98%	<b>1.72379419</b>
VOYAGER	-1	30/3/20	-0.049141	<b>20.30% ***</b>	8.32%	<b>2.72141353</b>
VOYAGER	0	31/3/20	0.0407572	2.59%	10.91%	0.34736375
VOYAGER	1	1/4/20	-0.0276553	-9.70%	1.21%	1.30089366
VOYAGER	2	2/4/20	-0.0711156	7.11%	8.32%	0.95343467
VOYAGER	3	3/4/20	0.02718416	11.53%	19.85%	1.5453376
VOYAGER	4	6/4/20	-0.0270039	2.70%	22.55%	0.36203648
VOYAGER	5	7/4/20	0.09084599	-0.77%	21.77%	0.10351402
VOYAGER	6	8/4/20	-0.0046617	-2.02%	19.76%	0.27015808
VOYAGER	7	9/4/20	0.04233492	-4.23%	15.53%	0.56757698
VOYAGER	8	13/4/20	0.01583823	<b>-21.70% ***</b>	-6.18%	<b>2.90957216</b>



Firm	Days	Date	Expected Return	AR	CAR	T Stat
VOYAGER	9	14/4/20	-0.0193168	3.41%	-2.76%	0.45759734
VOYAGER	10	15/4/20	0.03645029	-8.86%	-11.63%	1.18838219
VOYAGER	11	16/4/20	-0.0368136	3.68%	-7.95%	0.49355313
VOYAGER	12	17/4/20	0.00083199	4.27%	-3.68%	0.57220008
VOYAGER	13	20/4/20	0.03287297	5.57%	1.89%	0.74659828
VOYAGER	14	21/4/20	-0.031572	-8.71%	-6.82%	1.16736073
VOYAGER	15	22/4/20	-0.049975	<b>13.65% *</b>	6.83%	<b>1.83021213</b>
VOYAGER	16	23/4/20	0.02591266	3.60%	10.44%	0.48310495
VOYAGER	17	24/4/20	-0.0062377	<b>-12.71% *</b>	-2.27%	<b>1.70394972</b>
VOYAGER	18	27/4/20	0.01399213	6.29%	4.02%	0.84370445
VOYAGER	19	28/4/20	0.01468452	4.17%	8.20%	0.55965533
VOYAGER	20	29/4/20	<b>-0.0127735</b>	<b>-4.57%</b>	<b>3.63%</b>	<b>0.61285219</b>
RIOT	-20	13/7/20	-0.0028684	-6.15%	-6.15%	0.74035011
RIOT	-19	14/7/20	0.02945372	0.27%	-5.89%	0.03197314
RIOT	-18	15/7/20	0.0238141	-1.94%	-7.82%	0.23314089
RIOT	-17	16/7/20	0.005154	-2.29%	-10.11%	0.27506911
RIOT	-16	17/7/20	0.01441264	-0.99%	-11.10%	0.11925827
RIOT	-15	20/7/20	0.02216119	-0.87%	-11.97%	0.1048163
RIOT	-14	21/7/20	0.01325918	0.44%	-11.53%	0.05344087
RIOT	-13	22/7/20	0.0185883	-0.12%	-11.64%	0.01440747
RIOT	-12	23/7/20	-0.0077613	-1.36%	-13.01%	0.16377003
RIOT	-11	24/7/20	0.00044899	-3.10%	-16.11%	0.373329
RIOT	-10	27/7/20	0.02098116	<b>16.82% **</b>	0.71%	<b>2.02461848</b>
RIOT	-9	28/7/20	0.00059542	4.86%	5.58%	0.58553463
RIOT	-8	29/7/20	0.02846627	-3.57%	2.01%	0.42953668
RIOT	-7	30/7/20	0.00474376	-7.75%	-5.74%	0.93247202
RIOT	-6	31/7/20	0.02189268	1.34%	-4.40%	0.16130504
RIOT	-5	3/8/20	0.02047275	<b>30.53% ***</b>	26.13%	<b>3.67452916</b>
RIOT	-4	4/8/20	0.01585319	-4.44%	21.69%	0.53471233
RIOT	-3	5/8/20	0.01936415	<b>16.00% *</b>	37.69%	<b>1.92639655</b>
RIOT	-2	6/8/20	0.02007246	3.98%	41.67%	0.47878271
RIOT	-1	7/8/20	0.01115169	-12.41%	29.26%	1.49363092
RIOT	0	10/8/20	0.01454678	8.09%	37.36%	0.97427332
RIOT	1	11/8/20	-0.0022637	-12.12%	25.23%	1.45908754
RIOT	2	12/8/20	0.03092369	-5.30%	19.93%	0.63820748
RIOT	3	13/8/20	0.00737533	1.24%	21.17%	0.1492354
RIOT	4	14/8/20	0.01012252	3.70%	24.87%	0.44497229
RIOT	5	17/8/20	0.01482764	8.31%	33.17%	0.99969448
RIOT	6	18/8/20	0.01330816	-3.98%	29.19%	0.47921929
RIOT	7	19/8/20	0.00385265	-9.05%	20.14%	1.08912909
RIOT	8	20/8/20	0.01473343	6.66%	26.80%	0.80123136
RIOT	9	21/8/20	0.01538194	-8.18%	18.62%	0.98455295
RIOT	10	24/8/20	0.02522856	-5.07%	13.55%	0.61062943
RIOT	11	25/8/20	0.01530991	-2.91%	10.64%	0.3500667
RIOT	12	26/8/20	0.02506774	-7.26%	3.38%	0.87328599
RIOT	13	27/8/20	0.01334735	-5.44%	-2.06%	0.65481696
RIOT	14	28/8/20	0.01973576	7.81%	5.76%	0.9403262
RIOT	15	31/8/20	0.00466184	-2.97%	2.78%	0.35785987
RIOT	16	1/9/20	0.02416017	4.73%	7.51%	0.56894116

Firm	Days	Date	Expected Return	AR	CAR	T Stat
RIOT	17	2/9/20	0.03170378	-11.70%	-4.19%	1.40870515
RIOT	18	3/9/20	-0.0413758	-3.73%	-7.93%	0.44945569
RIOT	19	4/9/20	-0.0021294	-1.37%	-9.30%	0.16481953
RIOT	20	8/9/20	-0.0307733	-6.25%	-15.54%	0.75196504
MEITU	-20	5/2/21	0.00194636	27.95% ***	27.95%	11.1565501
MEITU	-19	8/2/21	0.00333345	-11.71% ***	16.24%	4.67319405
MEITU	-18	9/2/21	3.8759E-06	23.01% ***	39.25%	9.18537319
MEITU	-17	10/2/21	0.00010107	1.79%	41.04%	0.71398148
MEITU	-16	11/2/21	0.00096668	-1.51%	39.53%	0.60285607
MEITU	-15	12/2/21	0.00237012	14.46% ***	53.99%	5.77201298
MEITU	-14	16/2/21	-8.063E-05	13.13% ***	67.12%	5.24294416
MEITU	-13	17/2/21	0.00038186	13.50% ***	80.62%	5.388524
MEITU	-12	18/2/21	-0.0015116	-3.01%	77.60%	1.2023848
MEITU	-11	19/2/21	-0.0004605	-5.73% **	71.87%	2.28865075
MEITU	-10	22/2/21	-0.0029619	4.30% *	76.17%	1.7151134
MEITU	-9	23/2/21	0.00079757	-12.13% ***	64.04%	4.84291915
MEITU	-8	24/2/21	0.00493643	-10.99% ***	53.05%	4.38710512
MEITU	-7	25/2/21	-0.0098863	6.20% **	59.25%	2.47528863
MEITU	-6	26/2/21	-0.0018901	-8.17% ***	51.08%	3.26165401
MEITU	-5	1/3/21	0.01051715	0.64%	51.71%	0.25449046
MEITU	-4	2/3/21	-0.0030089	-8.67% ***	43.05%	3.46089741
MEITU	-3	3/3/21	-0.0053063	5.28% **	48.32%	2.10593303
MEITU	-2	4/3/21	-0.0049387	-5.08% **	43.24%	2.02843925
MEITU	-1	5/3/21	0.0080505	-0.81%	42.43%	0.32138964
MEITU	0	8/3/21	-0.0018167	-6.09% **	36.34%	2.43178975
MEITU	1	9/3/21	0.00631173	6.46% **	42.80%	2.57712301
MEITU	2	10/3/21	0.00291244	-1.39%	41.40%	0.55658273
MEITU	3	11/3/21	0.00456488	-1.57%	39.83%	0.62746145
MEITU	4	12/3/21	0.00085345	4.43% *	44.26%	1.76690842
MEITU	5	15/3/21	0.00280227	1.88%	46.14%	0.74974829
MEITU	6	16/3/21	-0.0002474	2.49%	48.63%	0.99386412
MEITU	7	17/3/21	0.00172429	-3.95%	44.67%	1.57790514
MEITU	8	18/3/21	-0.0058567	10.94% ***	55.62%	4.36855997
MEITU	9	19/3/21	-0.0004961	7.49% ***	63.11%	2.99132444
MEITU	10	22/3/21	0.00365553	0.54%	63.65%	0.21480352
MEITU	11	23/3/21	-0.0030374	-17.01% ***	46.64%	6.79056019
MEITU	12	24/3/21	-0.0018609	1.27%	47.91%	0.50665537
MEITU	13	25/3/21	0.00265961	-4.19% *	43.71%	1.6745292
MEITU	14	26/3/21	0.00708737	-8.14% ***	35.57%	3.25109732
MEITU	15	29/3/21	7.1753E-05	-3.22%	32.35%	1.28548997
MEITU	16	30/3/21	-0.0008349	2.99%	35.34%	1.19288341
MEITU	17	31/3/21	0.00199594	0.20%	35.54%	0.08129346
MEITU	18	1/4/21	0.00484341	5.94% **	41.48%	2.3718935
MEITU	19	5/4/21	0.00634367	-0.26%	41.23%	0.10260237
MEITU	20	6/4/21	3.5662E-05	-2.26%	38.97%	0.90191355
BITFARMS	-20	6/1/21	0.02208524	8.79%	8.79%	0.96827465
BITFARMS	-19	7/1/21	0.0321058	11.79%	20.58%	1.2992357
BITFARMS	-18	8/1/21	0.02176826	27.48% ***	48.05%	3.0282418
BITFARMS	-17	11/1/21	0.00773038	-13.30%	34.75%	1.46578616

Firm	Days	Date	Expected Return	AR	CAR	T Stat
BITFARMS	-16	12/1/21	0.01557621	<b>19.60% **</b>	54.35%	<b>2.15995633</b>
BITFARMS	-15	13/1/21	0.01837714	-1.84%	52.52%	0.20252259
BITFARMS	-14	14/1/21	0.01138566	<b>16.47% *</b>	68.99%	<b>1.81542398</b>
BITFARMS	-13	15/1/21	0.00710754	-14.72%	54.27%	1.62229579
BITFARMS	-12	19/1/21	0.02419957	-6.49%	47.77%	0.71556872
BITFARMS	-11	20/1/21	0.03095597	<b>-17.03% *</b>	30.74%	<b>1.87721334</b>
BITFARMS	-10	21/1/21	0.01636686	<b>-17.26% *</b>	13.48%	<b>1.90217553</b>
BITFARMS	-9	22/1/21	0.01134337	2.68%	16.16%	0.29525974
BITFARMS	-8	25/1/21	0.01978887	-9.33%	6.83%	1.0277389
BITFARMS	-7	26/1/21	0.01357627	-11.93%	-5.10%	1.31476273
BITFARMS	-6	27/1/21	-0.0122452	-6.16%	-11.26%	0.67936572
BITFARMS	-5	28/1/21	0.02504398	9.20%	-2.06%	1.01362224
BITFARMS	-4	29/1/21	-0.0072558	<b>28.34% ***</b>	26.28%	<b>3.12367797</b>
BITFARMS	-3	1/2/21	0.03412373	-7.82%	18.47%	0.86128003
BITFARMS	-2	2/2/21	0.03129628	6.94%	25.41%	0.76488181
BITFARMS	-1	3/2/21	0.01622534	6.60%	32.01%	0.72782994
BITFARMS	0	4/2/21	0.028165	-7.80%	24.21%	0.85923936
BITFARMS	1	5/2/21	0.0197799	1.13%	25.34%	0.1240295
BITFARMS	2	8/2/21	0.02348844	5.01%	30.35%	0.55201114
BITFARMS	3	9/2/21	0.01458644	10.38%	40.73%	1.1438423
BITFARMS	4	10/2/21	0.01484631	-9.84%	30.89%	1.0845324
BITFARMS	5	11/2/21	0.01716061	-1.17%	29.72%	0.12882221
BITFARMS	6	12/2/21	0.02091287	2.90%	32.61%	0.31921787
BITFARMS	7	16/2/21	0.01436052	6.54%	39.15%	0.72070482
BITFARMS	8	17/2/21	0.01559702	<b>22.44% **</b>	61.59%	<b>2.473</b>
BITFARMS	9	18/2/21	0.01053463	<b>19.18% **</b>	80.78%	<b>2.11404486</b>
BITFARMS	10	19/2/21	0.01334493	11.53%	92.30%	1.27014637
BITFARMS	11	22/2/21	0.00665706	0.82%	93.13%	0.09080687
BITFARMS	12	23/2/21	0.01670847	<b>-24.22% ***</b>	68.91%	<b>2.66904725</b>
BITFARMS	13	24/2/21	0.02777418	3.03%	71.94%	0.33381023
BITFARMS	14	25/2/21	-0.0118561	-9.26%	62.68%	1.02009533
BITFARMS	15	26/2/21	0.00952272	-2.44%	60.24%	0.26907661
BITFARMS	16	1/3/21	0.04269489	7.61%	67.85%	0.83860046
BITFARMS	17	2/3/21	0.00653144	3.21%	71.06%	0.35351742
BITFARMS	18	3/3/21	0.00038906	0.61%	71.67%	0.06740616
BITFARMS	19	4/3/21	0.00137188	-14.34%	57.33%	1.58015113
BITFARMS	20	5/3/21	0.03609999	-3.52%	<b>53.81%</b>	0.38834664
HODL	-20	2/6/20	0.00199737	-0.20%	-0.20%	0.01433436
HODL	-19	3/6/20	-0.0028103	0.28%	0.08%	0.02016842
HODL	-18	4/6/20	0.01242582	-1.24%	-1.16%	0.08917549
HODL	-17	5/6/20	-0.0145911	1.46%	0.30%	0.10471514
HODL	-16	8/6/20	-0.0016432	0.16%	0.46%	0.01179263
HODL	-15	9/6/20	0.01704417	-1.70%	-1.24%	0.12231974
HODL	-14	10/6/20	0.01524969	-1.52%	-2.77%	0.10944137
HODL	-13	11/6/20	0.06503587	-6.50%	-9.27%	0.46673838
HODL	-12	12/6/20	-0.0015362	0.15%	-9.12%	0.01102485
HODL	-11	15/6/20	0.00098825	-14.38%	-23.50%	1.03232525
HODL	-10	16/6/20	-0.0084895	0.85%	-22.65%	0.06092574
HODL	-9	17/6/20	0.01388606	15.28%	-7.37%	1.09644994

Firm	Days	Date	Expected Return	AR	CAR	T Stat
HODL	-8	18/6/20	0.00954642	-0.95%	-8.33%	0.06851111
HODL	-7	19/6/20	0.01537878	-1.54%	-9.87%	0.11036779
HODL	-6	22/6/20	0.00378041	-0.38%	-10.25%	0.02713063
HODL	-5	23/6/20	0.00551273	-14.84%	-25.08%	1.06479576
HODL	-4	24/6/20	0.0343047	13.24%	-11.85%	0.9499129
HODL	-3	25/6/20	-0.0003361	0.03%	-11.81%	0.00241236
HODL	-2	26/6/20	0.03262458	11.02%	-0.79%	0.79109836
HODL	-1	29/6/20	-0.0041387	-12.09%	-12.88%	0.86737691
HODL	0	30/6/20	-0.0023336	0.23%	-12.64%	0.01674759
HODL	1	1/7/20	0.00321677	-0.32%	-12.96%	0.02308556
HODL	2	2/7/20	0.00464908	-0.46%	-13.43%	0.03336472
HODL	3	6/7/20	-0.0048462	14.77%	1.34%	1.06001211
HODL	4	7/7/20	0.01977616	-1.98%	-0.64%	0.1419262
HODL	5	8/7/20	0.00260102	-0.26%	-0.90%	0.01866658
HODL	6	9/7/20	0.0153578	-1.54%	-2.43%	0.11021727
HODL	7	10/7/20	0.0001515	-0.02%	-2.45%	0.00108726
HODL	8	13/7/20	0.01819388	-14.32%	-16.77%	1.02764954
HODL	9	14/7/20	-0.0024765	14.53%	-2.23%	1.04300588
HODL	10	15/7/20	0.0011301	12.39%	10.15%	0.88896851
HODL	11	16/7/20	0.01306346	20.92%	31.07%	1.50105516
HODL	12	17/7/20	0.00714245	-9.81%	21.26%	0.70367965
HODL	13	20/7/20	0.00218715	-0.22%	21.05%	0.0156964
HODL	14	21/7/20	0.0078801	-10.79%	10.26%	0.77421562
HODL	15	22/7/20	0.00447206	-11.56%	-1.30%	0.82949775
HODL	16	23/7/20	0.02132294	22.87%	21.57%	1.64113079
HODL	17	24/7/20	0.01607237	-1.61%	19.96%	0.11534544
HODL	18	27/7/20	0.0029418	-10.29%	9.67%	0.73877525
HODL	19	28/7/20	0.01597872	20.62%	30.29%	1.48013339
HODL	20	29/7/20	-0.001845	0.18%	<b>30.47%</b>	0.01324099
HIVE	-20	17/9/20	0.0166647	-2.89%	-2.89%	0.46658281
HIVE	-19	18/9/20	0.01899334	-3.13%	-6.02%	0.5066646
HIVE	-18	21/9/20	0.01866502	-5.62%	-11.64%	0.90803187
HIVE	-17	22/9/20	0.0004012	-3.94%	-15.57%	0.63637763
HIVE	-16	23/9/20	0.02900028	<b>-11.01% *</b>	-26.58%	<b>1.77970885</b>
HIVE	-15	24/9/20	0.00684422	8.14%	-18.44%	1.31586686
HIVE	-14	25/9/20	-0.0047251	-2.23%	-20.67%	0.36056047
HIVE	-13	28/9/20	-0.0051043	7.45%	-13.22%	1.20524554
HIVE	-12	29/9/20	0.01379484	-3.98%	-17.19%	0.64295164
HIVE	-11	30/9/20	0.00263133	-5.60%	-22.79%	0.90479255
HIVE	-10	1/10/20	0.00362694	1.05%	-21.74%	0.16906978
HIVE	-9	2/10/20	0.01726385	-5.89%	-27.64%	0.95274216
HIVE	-8	5/10/20	-0.006067	3.51%	-24.13%	0.56670214
HIVE	-7	6/10/20	0.02130961	-4.95%	-29.08%	0.79993138
HIVE	-6	7/10/20	-0.0057875	2.03%	-27.05%	0.32787443
HIVE	-5	8/10/20	0.00153405	<b>12.70% **</b>	-14.35%	<b>2.05384026</b>
HIVE	-4	9/10/20	0.00147605	7.45%	-6.90%	1.20402604
HIVE	-3	12/10/20	-0.0046572	5.17%	-1.73%	0.83610459
HIVE	-2	13/10/20	0.01472039	-1.47%	-3.20%	0.2379876
HIVE	-1	14/10/20	0.01451236	-2.57%	-5.78%	0.4162785

Firm	Days	Date	Expected Return	AR	CAR	T Stat
HIVE	0	15/10/20	0.01018727	-8.97%	-14.75%	1.45072808
HIVE	1	16/10/20	0.00964591	5.21%	-9.54%	0.84202864
HIVE	2	19/10/20	0.02215592	-1.05%	-10.59%	0.17020867
HIVE	3	20/10/20	0.00569566	9.78%	-0.82%	1.58038733
HIVE	4	21/10/20	0.01075018	-2.12%	-2.94%	0.34220897
HIVE	5	22/10/20	0.00442795	-6.76%	-9.69%	1.09267478
HIVE	6	23/10/20	0.00621885	-8.49%	-18.18%	1.37212
HIVE	7	26/10/20	0.02496338	<b>10.92% *</b>	-7.26%	<b>1.76518409</b>
HIVE	8	27/10/20	0.01208227	<b>-10.89% *</b>	-18.15%	<b>1.75990553</b>
HIVE	9	28/10/20	0.03841589	-2.65%	-20.80%	0.42861111
HIVE	10	29/10/20	0.00041913	<b>19.96% ***</b>	-0.84%	<b>3.22666633</b>
HIVE	11	30/10/20	0.01806115	<b>-10.63% *</b>	-11.47%	<b>1.71851718</b>
HIVE	12	2/11/20	-0.0004762	1.12%	-10.35%	0.1815404
HIVE	13	3/11/20	-0.006001	5.92%	-4.43%	0.95697684
HIVE	14	4/11/20	-0.0100227	8.07%	3.64%	1.30517609
HIVE	15	5/11/20	-0.0075836	0.76%	4.40%	0.12260525
HIVE	16	6/11/20	0.00932396	-4.71%	-0.30%	0.76082595
HIVE	17	9/11/20	-0.0016392	-3.76%	-4.06%	0.60750628
HIVE	18	10/11/20	0.01038479	3.04%	-1.02%	0.49199306
HIVE	19	11/11/20	0.00276273	-0.28%	-1.29%	0.04466569
HIVE	20	12/11/20	0.01744086	0.22%	<b>-1.08%</b>	0.03503415
DGHI	-20	7/1/21	0.01716303	-4.60%	-4.60%	0.39123385
DGHI	-19	8/1/21	0.01143541	-4.11%	-8.71%	0.34981556
DGHI	-18	11/1/21	0.01734421	<b>-25.20% **</b>	-33.92%	<b>2.14317713</b>
DGHI	-17	12/1/21	0.02536808	14.80%	-19.12%	1.25820567
DGHI	-16	13/1/21	0.02088351	-2.09%	-21.21%	0.17758051
DGHI	-15	14/1/21	0.01928253	-1.93%	-23.14%	0.1639668
DGHI	-14	15/1/21	0.02327877	-6.87%	-30.01%	0.58446592
DGHI	-13	18/1/21	0.02572409	-18.05%	-48.06%	1.53474203
DGHI	-12	19/1/21	0.01595451	1.22%	-46.84%	0.10386465
DGHI	-11	20/1/21	0.01209264	-13.54%	-60.38%	1.15119102
DGHI	-10	21/1/21	0.02043158	4.21%	-56.17%	0.357724
DGHI	-9	22/1/21	0.02330294	2.08%	-54.09%	0.17699548
DGHI	-8	25/1/21	0.0184756	-1.85%	-55.94%	0.1571052
DGHI	-7	26/1/21	0.02202664	-5.02%	-60.96%	0.42683305
DGHI	-6	27/1/21	0.03678584	-6.58%	-67.53%	0.55927911
DGHI	-5	28/1/21	0.01547185	-0.05%	-67.59%	0.00464694
DGHI	-4	29/1/21	0.03393398	-0.45%	-68.04%	0.03845417
DGHI	-3	1/2/21	0.01028199	-2.46%	-70.50%	0.20890867
DGHI	-2	2/2/21	0.01189812	3.16%	-67.34%	0.26853812
DGHI	-1	3/2/21	0.02051247	-3.44%	-70.78%	0.29252804
DGHI	0	4/2/21	0.01368792	5.67%	-65.11%	0.48243633
DGHI	1	5/2/21	0.01848073	<b>29.73% **</b>	-35.37%	<b>2.52813095</b>
DGHI	2	8/2/21	0.01636098	<b>92.36% ***</b>	56.99%	<b>7.85405905</b>
DGHI	3	9/2/21	0.02144924	<b>30.33% ***</b>	87.32%	<b>2.57901762</b>
DGHI	4	10/2/21	0.02130071	<b>-24.31% **</b>	63.01%	<b>2.06709311</b>
DGHI	5	11/2/21	0.01997789	<b>22.50% *</b>	85.51%	<b>1.91344988</b>
DGHI	6	12/2/21	0.01783314	-7.41%	78.11%	0.62974412
DGHI	7	16/2/21	0.02157838	-9.39%	68.71%	0.79862786

Firm	Days	Date	Expected Return	AR	CAR	T Stat
DGHI	8	17/2/21	0.02087161	-1.17%	67.54%	0.09946667
DGHI	9	18/2/21	0.02376521	-1.47%	66.08%	0.12478123
DGHI	10	19/2/21	0.02215888	<b>35.17% ***</b>	101.25%	<b>2.99076837</b>
DGHI	11	22/2/21	0.02598157	<b>82.65% ***</b>	183.90%	<b>7.02785668</b>
DGHI	12	23/2/21	0.02023632	<b>-25.92% **</b>	157.98%	<b>2.20385971</b>
DGHI	13	24/2/21	0.01391131	6.52%	164.49%	0.5540675
DGHI	14	25/2/21	0.03656343	-6.03%	158.47%	0.51250182
DGHI	15	26/2/21	0.0243436	-9.28%	149.19%	0.78891246
DGHI	16	1/3/21	0.00538283	10.84%	160.03%	0.92143748
DGHI	17	2/3/21	0.02605337	-9.84%	150.19%	0.83668045
DGHI	18	3/3/21	0.02956428	-13.28%	136.91%	1.12903952
DGHI	19	4/3/21	0.02900251	-17.99%	118.92%	1.52973917
DGHI	20	5/3/21	0.00915238	-1.52%	<b>117.40%</b>	0.12905147
DASH	-20	24/9/20	-0.0023708	-6.91%	-6.91%	1.04942783
DASH	-19	25/9/20	-0.0076176	<b>16.15% **</b>	9.24%	<b>2.4536643</b>
DASH	-18	28/9/20	-0.0077896	-5.89%	3.35%	0.89471814
DASH	-17	29/9/20	0.00078138	7.06%	10.42%	1.07358144
DASH	-16	30/9/20	-0.0042814	0.43%	10.85%	0.0650618
DASH	-15	1/10/20	-0.0038299	0.38%	11.23%	0.05820032
DASH	-14	2/10/20	0.00235461	-0.24%	10.99%	0.03578158
DASH	-13	5/10/20	-0.0082262	0.82%	11.82%	0.12500864
DASH	-12	6/10/20	0.00418941	-0.42%	11.40%	0.06366385
DASH	-11	7/10/20	-0.0080994	<b>14.14% **</b>	25.54%	<b>2.14926539</b>
DASH	-10	8/10/20	-0.004779	<b>-11.29% *</b>	14.25%	<b>1.71518521</b>
DASH	-9	9/10/20	-0.0048053	0.48%	14.73%	0.07302368
DASH	-8	12/10/20	-0.0075868	0.76%	15.49%	0.11529261
DASH	-7	13/10/20	0.00120112	-6.79%	8.71%	1.03134455
DASH	-6	14/10/20	0.00110678	-0.11%	8.60%	0.01681907
DASH	-5	15/10/20	-0.0008547	0.09%	8.68%	0.01298826
DASH	-4	16/10/20	-0.0011002	0.11%	8.79%	0.01671919
DASH	-3	19/10/20	0.00457322	<b>13.83% **</b>	22.62%	<b>2.10141462</b>
DASH	-2	20/10/20	-0.0028917	0.29%	22.91%	0.04394323
DASH	-1	21/10/20	-0.0005994	0.06%	22.97%	0.00910883
DASH	0	22/10/20	-0.0034666	0.35%	23.31%	0.05267993
DASH	1	23/10/20	-0.0026544	0.27%	23.58%	0.04033755
DASH	2	26/10/20	0.00584644	<b>11.92% *</b>	35.50%	<b>1.81070247</b>
DASH	3	27/10/20	4.7061E-06	<b>-11.11% *</b>	24.38%	<b>1.68855789</b>
DASH	4	28/10/20	0.0119473	-7.44%	16.94%	1.13132933
DASH	5	29/10/20	-0.0052847	7.20%	24.13%	1.09339945
DASH	6	30/10/20	0.0027162	-0.27%	23.86%	0.04127635
DASH	7	2/11/20	-0.0056907	-5.68%	18.18%	0.86329532
DASH	8	3/11/20	-0.0081962	0.82%	19.00%	0.12455313
DASH	9	4/11/20	-0.0100202	<b>21.00% ***</b>	40.00%	<b>3.19154569</b>
DASH	10	5/11/20	-0.008914	<b>-15.78% **</b>	24.23%	<b>2.39726944</b>
DASH	11	6/11/20	-0.0012462	-6.54%	17.69%	0.99415385
DASH	12	9/11/20	-0.0062182	0.62%	18.31%	0.09449343
DASH	13	10/11/20	-0.0007651	-7.07%	11.24%	1.07382853
DASH	14	11/11/20	-0.0042218	<b>23.50% ***</b>	34.74%	<b>3.57101249</b>
DASH	15	12/11/20	0.00243489	-0.24%	34.50%	0.03700147

Firm	Days	Date	Expected Return	AR	CAR	T Stat
DASH	16	13/11/20	-0.0067151	6.92%	41.42%	1.05181926
DASH	17	16/11/20	-0.0061858	<b>12.38% *</b>	53.80%	<b>1.88181098</b>
DASH	18	17/11/20	0.00075505	<b>15.71% **</b>	69.52%	<b>2.38795397</b>
DASH	19	18/11/20	0.00334185	-4.88%	64.64%	0.74152846
DASH	20	19/11/20	-0.0029711	0.30%	<b>64.93%</b>	0.04515047

## APPENDIX 4 – STATA CODE

### **\*open document**

```
import excel "/Users/liamthomson/Desktop/CAR ALL 20.xlsx"
```

### **\*rename\***

```
rename A window  
rename B dif  
rename C firm  
rename D id  
rename E pred_ret  
rename F ab_ret  
rename G cum_ab_ret  
rename H country  
rename I sector  
rename J miner  
rename K expected  
rename L fear_greed  
rename M size  
rename N date
```

### **\*Cumulative Abnormal Returns\***

```
sort id date  
by id: egen ar_sd = sd(ab_ret)  
gen test =(1/sqrt(41)) * (cum_ab_ret /ar_sd)  
list id cum_ab_ret test if dif==20  
*Export to Excel*  
export excel firm id cum_ab_ret test using "CAR20stata.xlsx" if dif==20, firstrow(variables) replace
```

### **\*\*Test across all events\***

```
reg cum_ab_ret if dif==20, robust
```

### **\*Average Abnormal Return\***

```
sort dif  
by dif: egen ar_sd_t = sd(ab_ret) if dif>=-20 & dif<=20  
by dif: egen AAR = mean(ab_ret)
```

### **sort id date**

```
gen AAR_ttest = sqrt(18) * (AAR/ar_sd_t) if dif>=-20 & dif<=20  
export excel dif AAR AAR_ttest using "AARt20" if dif>=-20 & dif<=20 & id==1, firstrow(variables) replace
```

### **\*Cumulative Average Abnormal Return\***

```
export excel firm id date pred_ret ab_ret using "returns20" if dif>=-20 & dif<=20, firstrow(variables) replace  
egen CAAR = mean(cum_ab_ret) if dif==20  
reg cum_ab_ret if dif>=-20 & dif<=20, robust
```



**\*open document**

```
import excel "/Users/liamthomson/Desktop/cumreturns20.xlsx"
```

**\*rename variables\***

```
rename A firm  
rename B id  
rename C cum_ab_ret  
rename D country  
rename E sector  
rename F miner  
rename G expected  
rename H fear_greed  
rename I size
```

**\*Wilcoxon: Country\***

```
ranksum cum_ab_ret, by(country) exact porder
```

**\*Wilcoxon: Sector\***

```
ranksum cum_ab_ret, by(sector) exact porder
```

**\*Wilcoxon: Miner\***

```
ranksum cum_ab_ret, by(miner) exact porder
```

**\*Wilcoxon: Expected\***

```
ranksum cum_ab_ret, by(expected) exact porder
```

**\*Wilcoxon: F&G\***

```
ranksum cum_ab_ret, by(fear_greed) exact porder
```

**\*Wilcoxon: Size\***

```
ranksum cum_ab_ret, by(size) exact porder
```

**\*Ttests\***

**\*ttest: Country\***

```
ttest cum_ab_ret, by(country)
```

**\*ttest: Sector\***

```
ttest cum_ab_ret, by(sector)
```

**\*ttest: Miner\***

```
ttest cum_ab_ret, by(miner)
```

**\*ttest: Expected\***

```
ttest cum_ab_ret, by(expected)
```

**\*ttest: F&G\***

```
ttest cum_ab_ret, by(fear_greed)
```

**\*ttest: Size\***

```
ttest cum_ab_ret, by(size)
```

**\*regression\***

```
reg cum_ab_ret country sector miner expected fear_greed size, robust
```

**\*test for multicollinearity\***

```
vif
```

**\*test for normality\***

```
reg cum_ab_ret country sector miner expected fear_greed size  
predict r, resid  
kdensity r, normal // for graph  
swilk r
```

## APPENDIX 5.1- MANN-WHITNEY U TEST RESULTS

### MANN-WHITNEY U TEST (COUNTRY)

```
. ranksum cum_ab_ret, by(country) porder exact
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

country	Obs	Rank sum	Expected
0	9	97	85.5
1	9	74	85.5
Combined	18	171	171

Unadjusted variance      **128.25**

Adjustment for ties      **0.00**

---

Adjusted variance      **128.25**

H0: cum\_ab~t(country==0) = cum\_ab~t(country==1)

z = **1.015**

Prob > |z| = **0.3099**

Exact prob = **0.3401**

### MANN-WHITNEY U TEST (SECTOR)

```
. ranksum cum_ab_ret, by(sector) porder exact
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

sector	Obs	Rank sum	Expected
0	9	84	85.5
1	9	87	85.5
Combined	18	171	171

Unadjusted variance      **128.25**

Adjustment for ties      **0.00**

---

Adjusted variance      **128.25**

H0: cum\_ab~t(sector==0) = cum\_ab~t(sector==1)

z = **-0.132**

Prob > |z| = **0.8946**

Exact prob = **0.9314**

### **MANN-WHITNEY U TEST (MINER)**

```
. ranksum cum_ab_ret, by(miner) porder exact
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

miner	Obs	Rank sum	Expected
0	12	104	114
1	6	67	57
Combined	18	171	171

Unadjusted variance      **114.00**

Adjustment for ties      **0.00**

---

Adjusted variance      **114.00**

H0: cum\_ab~t(miner==0) = cum\_ab~t(miner==1)

z = **-0.937**

Prob > |z| = **0.3490**

Exact prob = **0.3845**

### **MANN-WHITNEY U TEST (EXPECTED)**

```
. ranksum cum_ab_ret, by(expected) porder exact
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

expected	Obs	Rank sum	Expected
0	8	75	76
1	10	96	95
Combined	18	171	171

Unadjusted variance      **126.67**

Adjustment for ties      **0.00**

---

Adjusted variance      **126.67**

H0: cum\_ab~t(expected==0) = cum\_ab~t(expected==1)

z = **-0.089**

Prob > |z| = **0.9292**

Exact prob = **0.9654**

### **MANN-WHITNEY U TEST (FEAR & GREED)**

```
. ranksum cum_ab_ret, by(fear_greed) porder exact
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

fear_greed	Obs	Rank sum	Expected
0	8	63	76
1	10	108	95
Combined	18	171	171

Unadjusted variance      **126.67**

Adjustment for ties      **0.00**

---

Adjusted variance      **126.67**

H0: cum\_ab~t(fear\_g~d==0) = cum\_ab~t(fear\_g~d==1)

z = **-1.155**

Prob > |z| = **0.2481**

Exact prob = **0.2743**

### **MANN-WHITNEY U TEST (SIZE)**

```
. ranksum cum_ab_ret, by(size) porder exact
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

size	Obs	Rank sum	Expected
0	8	67	76
1	10	104	95
Combined	18	171	171

Unadjusted variance      **126.67**

Adjustment for ties      **0.00**

---

Adjusted variance      **126.67**

H0: cum\_ab~t(size==0) = cum\_ab~t(size==1)

z = **-0.800**

Prob > |z| = **0.4239**

Exact prob = **0.4598**

## APPENDIX 5.2 – MULTICOLLINEARITY (VIF RESULTS)

. vif

Variable	VIF	1/VIF
country	2.69	0.371948
expected	2.68	0.373801
sector	2.00	0.499651
miner	1.98	0.505650
size	1.38	0.723070
fear_greed	1.33	0.751243
Mean VIF	2.01	

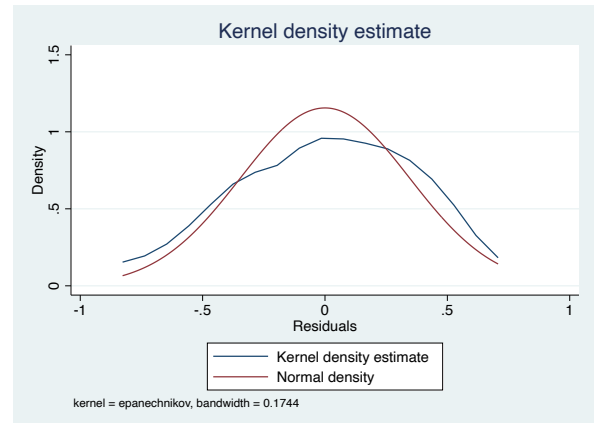
## APPENDIX 5.3 – NORMALITY (SHAPIRO-WILK W TEST)

### 41-DAY EVENT WINDOW:

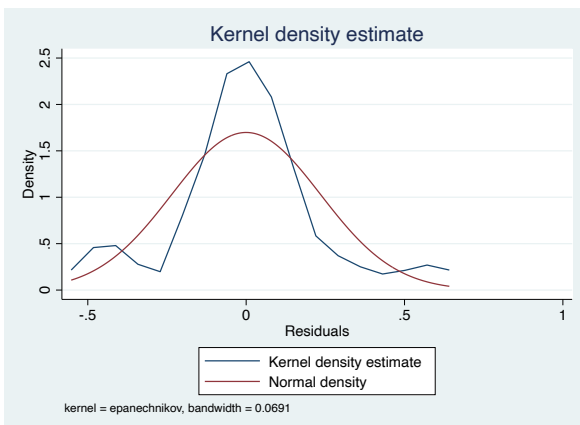
. swilk r

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	18	0.96514	0.766	-0.533	0.70286



### 11-DAY EVENT WINDOW:



. swilk r

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	18	0.93612	1.404	0.679	0.24842

## APPENDIX 5.4 – TTESTs

### COUNTRY:

```
. ttest cum_ab_ret, by(country)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	9	.2583667	.1676732	.5030196	-.1282884	.6450217
1	9	.0337444	.1279748	.3839243	-.2613659	.3288548
Combined	18	.1460556	.1058804	.4492124	-.0773325	.3694436
diff		.2246222	.2109309		-.2225313	.6717757

```
diff = mean(0) - mean(1)                                t = 1.0649
H0: diff = 0                                           Degrees of freedom = 16

Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 0.8486          Pr(|T| > |t|) = 0.3027          Pr(T > t) = 0.1514
```

### SECTOR:

```
. ttest cum_ab_ret, by(sector)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	9	.1112889	.1423717	.4271152	-.2170209	.4395987
1	9	.1808222	.1645399	.4936198	-.1986076	.560252
Combined	18	.1460556	.1058804	.4492124	-.0773325	.3694436
diff		-.0695333	.2175847		-.5307923	.3917256

```
diff = mean(0) - mean(1)                                t = -0.3196
H0: diff = 0                                           Degrees of freedom = 16

Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(T < t) = 0.3767          Pr(|T| > |t|) = 0.7534          Pr(T > t) = 0.6233
```

**MINER:**

```
. ttest cum_ab_ret, by(miner)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	12	.064075	.1079842	.3740682	-.1735966	.3017466
1	6	.3100167	.234472	.5743368	-.2927129	.9127462
Combined	18	.1460556	.1058804	.4492124	-.0773325	.3694436
diff		-.2459417	.223205		-.7191152	.2272319

diff = mean(0) - mean(1) t = -1.1019  
H0: diff = 0 Degrees of freedom = 16

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0  
Pr(T < t) = 0.1434 Pr(|T| > |t|) = 0.2868 Pr(T > t) = 0.8566

**EXPECTED:**

```
. ttest cum_ab_ret, by(expected)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	8	.1255875	.1443375	.4082481	-.2157165	.4668915
1	10	.16243	.1583864	.5008617	-.1958649	.5207249
Combined	18	.1460556	.1058804	.4492124	-.0773325	.3694436
diff		-.0368425	.2194448		-.5020447	.4283597

diff = mean(0) - mean(1) t = -0.1679  
H0: diff = 0 Degrees of freedom = 16

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0  
Pr(T < t) = 0.4344 Pr(|T| > |t|) = 0.8688 Pr(T > t) = 0.5656

**FEAR & GREED:**

```
. ttest cum_ab_ret, by(fear_greed)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	8	-.001225	.1016549	.2875236	-.2416008	.2391508
1	10	.26388	.1679753	.5311846	-.1161065	.6438665
Combined	18	.1460556	.1058804	.4492124	-.0773325	.3694436
diff		-.265105	.2093999		-.7090129	.1788029

diff = mean(0) - mean(1) t = -1.2660  
H0: diff = 0 Degrees of freedom = 16

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0  
Pr(T < t) = 0.1118 Pr(|T| > |t|) = 0.2236 Pr(T > t) = 0.8882

**SIZE:**

```
. ttest cum_ab_ret, by(size)
```

Two-sample t test with equal variances

Group	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	
0	8	.047075	.1511546	.4275297	-.3103488	.4044988
1	10	.22524	.1494401	.472571	-.1128169	.5632969
Combined	18	.1460556	.1058804	.4492124	-.0773325	.3694436
diff		-.178165	.2150742		-.634102	.277772

diff = mean(0) - mean(1) t = -0.8284  
H0: diff = 0 Degrees of freedom = 16

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0  
Pr(T < t) = 0.2098 Pr(|T| > |t|) = 0.4196 Pr(T > t) = 0.7902



## APPENDIX 6 – LIST OF PUBLICLY KNOWN COMPANIES HOLDING BITCOIN ON BALANCE SHEET

Firm	Symbol	Country	Market Cap	% BTC	Cost Basis USD	Today's Value	NgU	Bitcoin
MaicroStrategy	NADQ:MSTR	US	\$7,096,156,704	70%	√\$2,740,000,000	\$4,958,304,473	1.8X	฿ 105,084
Tesla, Inc.	NADQ:TSLA	US	\$757,554,688,042	0.30%	√\$1,500,000,000	\$2,038,357,440	1.36X	฿ 43,200
Square inc.	NADQ:SQ	US	\$123,143,848,908	0.30%	√\$220,000,000	\$378,747,573	1.7X	฿ 8,027
Marathon	NADQ:MARA	US	\$3,275,969,643	8%	√\$161,539,500	\$255,962,961	1.6X	฿ 5,425
Coinbase	NADQ:COIN	US	\$54,512,973,625	0%	? \$255,962,961	\$255,962,961	1X	฿ 4,487
Hut 8 Mining	NADQ:HUT	CA	\$1,176,542,000	17%	√\$39,303,111	\$194,540,457	4.9X	฿ 4,123
Galaxy Digital	TSE:GLXY	CA	\$7,850,016,000	2%	? \$188,736,800	\$188,736,800	1X	฿ 4,000
Bitcoin Group	ADE.DE	DE	-	-	? \$188,736,800	\$188,736,800		฿ 4,000
NEXON Co.	TYO:3659	US	-	-	√\$100,000,000	\$81,015,271	0.8X	฿ 1,717
Bitfarms Ltd	NASDAQ:BITF	CA	\$1,414,922,000	5.60%	? \$16,817,350	\$79,175,088	4.7X	฿ 1,678
Riot	NADQ:RIOT	US	\$3,013,222,538	2.50%	√\$9,930,000	\$73,843,273	7.4X	฿ 1,565
Argo	OTCPK:ARBKF	US	\$492,563,667	12.10%	? \$59,829,566	\$59,829,566		฿ 1,268
Voyager	CSE:VYGR	CA	\$112,289,495	52%	√\$7,927,182	\$58,461,224	7.4X	฿ 1,239
Seetee AS	AKER:NO	NO	-	-	√\$58,599,450	\$55,205,514	0.9X	฿ 1,170
Meitu	SEHK:1357	HK	-	-	√\$49,500,000	\$44,395,586	0.9X	฿ 941
Coin Citadel	OTCMKTS:CCTL	US	-	-	√\$184,390	\$24,205,495	131X	฿ 513
Bit Digital	NADQ:BTBT	US	\$655,714,191	3.50%	? \$23,049,482	\$23,049,482	1X	฿ 489
Cypherpunk	CSE:HODL	CA	\$22,365,374	76%	? \$5,637,663	\$16,976,875	3X	฿ 360
Hive Blockchain	CVE:HIVE	CA	\$1,458,703,000	1%	? \$15,098,944	\$15,098,944	1X	฿ 320
BIGG	CNSX:BIGG	CA	\$265,693,138	5%	√\$2,690,387	\$14,155,260	5.3X	฿ 300
ABT AG	ABT:GR	DE	-	-	√\$2,117,978	\$11,977,426	5.7X	฿ 254
DMG	TSX-V:DMGI	CA	\$223,093,300	5%	? \$10,380,524	\$10,380,524		฿ 220
DigitalX	ASX:DCC	AU	\$42,901,190	24%	√\$874,835	\$10,144,603	12X	฿ 215
Incrementum	INDPGUS:LE	LI	\$15,000,000		√\$5,600,000	\$9,295,287	2X	฿ 197
Digihost	TSXV:DGHI.V	CA	-	-	√\$6,890,000	\$8,667,738	1.3X	฿ 184
Fortress	TSXV:FORT	CA	-	-	? \$7,700,461	\$7,700,461		฿ 163
CleanSpark Inc	NASDA:CLSK	US	\$482,973,751	1%	? \$6,747,341	\$6,747,341	1X	฿ 143
Banxa Holdings	OTC:BNXAF	CA	\$132,805,600	5%	? \$6,417,051	\$6,417,051		฿ 136
Brooker Group's	SET:BROOK	TH	-	-	? \$6,599,916	\$5,771,373	1X	฿ 122
Neptune	TSX-V:NDA	CA	-	-	? \$4,718,420	\$4,718,420		฿ 100
Mode Global s	LON:MODE	UK	-	-	√\$975,089	\$4,005,759	4X	฿ 85
BTCS Inc.	OTCQB:BTCS	US	-	-	? \$3,705,564	\$3,705,564		฿ 79
FRMO Corp.	OTCMKTS:FRMO	US	\$458,173,100	0.60%	? \$2,965,055	\$2,965,055	1X	฿ 63
QwD FinTech	TSXV:LQWD	CA	#N/A	-	√\$2,280,000	\$2,831,052	1X	฿ 60
MOGO	NADQ:MOGO	CA	\$492,160,000	0.50%	? \$2,359,210	\$2,359,210	1X	฿ 50
Phunware, Inc.	NADQ:PHUN	US	\$65,937,060	1.80%	√\$1,499,831	\$1,217,352	1X	฿ 26
Globant S.A.	NYSE:GLOB	US	\$11,267,201,168	0.00%	√\$500,000	\$707,763	1.4X	฿ 15
BlackRock	NYSE:BLK	US	\$139,542,147,272	0.00%	√\$360,000	\$290,183	1X	฿ 6.15

Figures correct as at 15/08/2021

Adapted from [BitcoinTreasuries.Net](https://www.bitcointreasuries.net) by NVK