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Sectoral differences in short- and long-term performance of Special Purpose Acquisition Companies (SPACs)

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Table of Contents

1. Introduction

Special purpose acquisition companies (SPACs) - also known as "blank check companies" - are *"companies that do not have any operating business, yet raise funds through initial public offerings (IPOs) for the sole purpose of merging with a private target company within a limited period of time"* (Kiesel et al., 2022). SPAC mergers are an alternative route to traditional IPOs and direct listing for private companies that want to go public. They are also an alternative for investors looking for opportunities in the financial markets.

This thesis addresses the research question: **"How do the short- and long-term performance of SPACs differ across the different sectors in which the target companies operate?"**. The performance of SPACs and the factors impacting it have been widely studied by various authors. However, there are no study exploring how SPACs perform across the different sectors to this date.

SPACs have drawn a lot of interest as an alternative to traditional IPOs. The major objective of these shell firms, which are created by experienced investors known as sponsors, is to raise money through an IPO and then acquire a target company. Through this acquisition, the target firm can go public without going through the complicated and demanding IPO procedure. While SPACs have been around for quite some time, they mostly gained popularity in the 2020-2021 period. In 2021 alone, SPAC IPOs raised more than 162 billion U.S. dollars (Statista, 2023).

Understanding the variations in SPAC performance across different sectors is of utmost importance for all the stakeholders, and especially for investors. This study intends to offer insightful information that can help investors make better-informed decisions by thoroughly examining the short- and long-term performance of SPACs across sectors. Furthermore, this study adds to the academic knowledge by filling the gap in sector-specific analysis of SPAC performance.

To address my research question, I approached it by examining the short- and long-term performance of SPACs separately. For the short-term analysis, the cumulative abnormal returns (CARs) around the announcement date of the merger were compared across the

different sectors. As concerns the long-term performance, I compared the one-year buy-and-hold abnormal returns (BHARs), starting from closing date of the merger.

My sample originates from the website https://www.spacresearch.com and consists of 457 U.S listed SPACs that completed an M&A operation between July 2016 and April 2023. I computed the CARs and BHARs using Excel. Then, I ran some statistical tests on R Studio to answer my research question.

The rest of my thesis is structured as follows: section 2 provides a comprehensive literature review at the end of which I develop my hypotheses. Section 3 presents the methodology, in which I explain how I measured the short- and long-term performance and which analytic techniques I used to conduct sector-wise comparisons. Section 4 highlights the findings of my analysis. Section 5 provides the conclusion of my thesis, along with the implication of my research and recommendations for future studies.

2. Literature Review

2.1. Presentation of SPACs

Special purpose acquisition companies (SPACs) - also known as "blank check companies" - are *"companies that do not have any operating business, yet raise funds through initial public offerings (IPOs) for the sole purpose of merging with a private target company within a limited period of time"* (Kiesel et al., 2022). SPAC mergers are an alternative route to traditional IPOs and direct listing for private companies that want to go public. SPACs must be completed within a predetermined period of usually 24 months (Klausner et al., 2022) with the proceeds that are raised through the IPO.

The way SPACs work is similar to private equity funds because the idea is to invest in a private business with potential for profit. But unlike private equity funds that gather money from a select group of accredited investors, a SPAC gathers money from the general public by selling its shares and securities on a regulated stock exchange or over-the-counter markets (Okutan Nilsson, 2018).

The SPACs are different than other companies because at the time of the initial public offering, it has no operations, no assets, and no business plan except to acquire a yet unidentified private company. This acquisition must be completed within a predetermined period of usually 24 months with the proceeds that are raised through the IPO (Klausner et al., 2022).

Investors who invest in SPACs have few criteria to base their investment decisions on, other than the credibility and expertise (in a particular industry or business sector) of the SPAC founders. These founders, also called sponsors, create and manage the SPAC and can be associated with a private equity or hedge fund, or they can simply be one individual or a group of individuals (Harris, 2022).

SPACs have many advantages for both investors, target companies and sponsors. Investors can benefit from the sponsors' expertise, and they get access to the M&A market to which they traditionally don't have access. They can invest in these SPACs buy buying units that usually cost 10$. Institutional investors also benefit from SPACs because unlike private equity investments, SPAC shares and warrants are liquid given that they can be traded on the market (Okutan Nilsson, 2018).

The target companies have many benefits as well. Firstly, companies that face financial problems can at the same time tackle their liquidity problems and have access to capital

markets, even when they might not be eligible for a traditional IPO (Okutan Nilsson, 2018). Secondly, even if going public through the SPAC route is not necessarily cheaper nor quicker than the traditional IPO route (Gahng et al., 2021), it offers some regulatory advantages. Indeed, in the United States, merger laws apply to SPAC mergers rather than issuance laws. This allows the private companies to make forecasts of future revenues and profits, which are more regulated under the issuance laws. Under the mergers laws, these projections are largely shielded from lawsuits with a "safe harbor" provision (Cazier et al., 2016). If the private company doesn't meet the projections, plaintiffs have to bring proof that the private company willingly made false statements (Gahng et al., 2021).

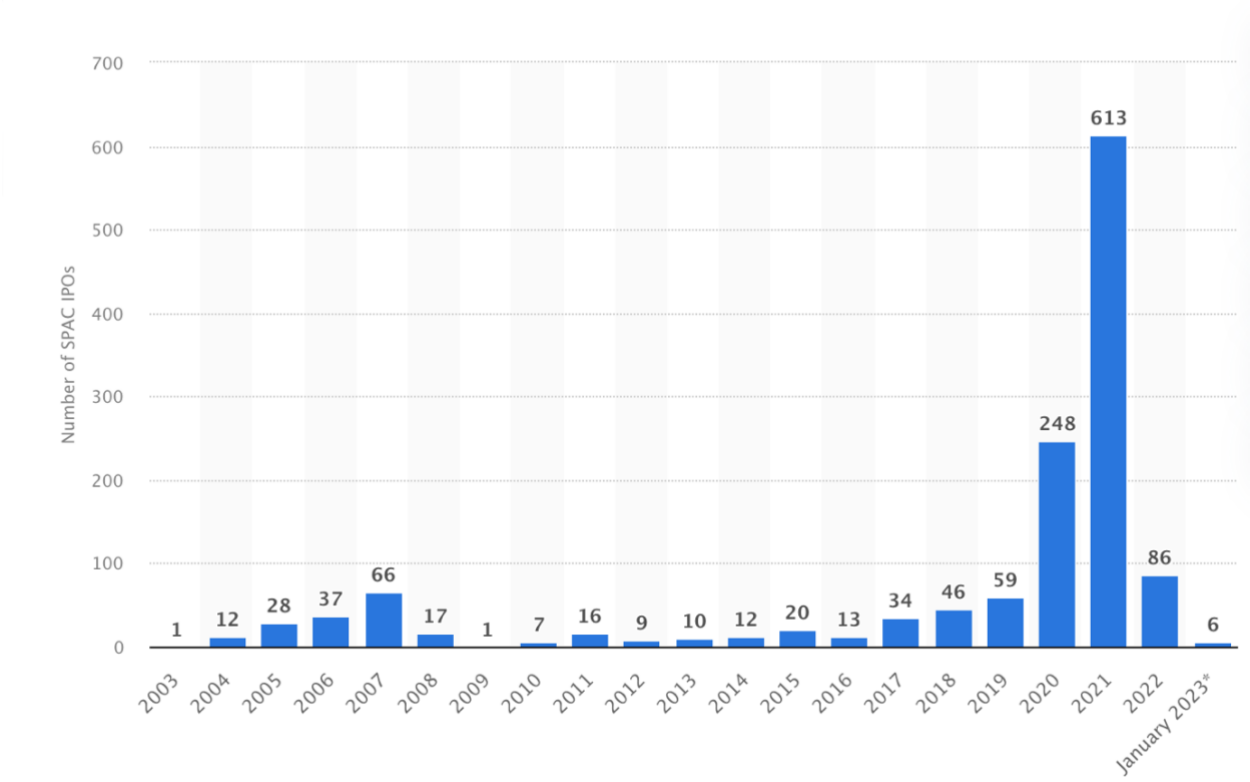
As concerns the sponsors, they don't receive any salary. However, before the IPO, the sponsors acquire a block of shares at a nominal price (of usually $25,000 according to Gahng et al. (2021)) that will be adjusted to amount to 25% of IPO proceeds or, equivalently, 20% of post-IPO equity of the SPAC. This is called the *sponsors promote* (Klausner et al., 2022). The rationale behind it is to align the interests of the shareholders with those of the sponsors. Let's illustrate this with an example:

Let's imagine that there is only one sponsor, and he receives 5 million shares at $0.005/share for $25,000 at the formation of the SPAC. The SPAC then raises $200 million in its IPO by issuing 20 million shares to the public shareholders at $10/share. Immediately after the IPO, the sponsor holds 20% of the equity and the public shareholders collectively hold 80% (Foerster, 2021). Additionally, sponsors may buy additional shares and warrants at the time of the IPO.

Once a target is found and the deal is completed, the sponsors usually get very high returns. Indeed, Klausner et al. (2022) report mean sponsor returns of 549% for a 12-month period for their sample of 47 deSPACs that took place between January 2019 and June 2020. However, there is usually a *lock-up period* during which the sponsors can't cash out their shares and exit the deal (Okutan Nilsson, 2018).

These shell companies gained popularity between 2003 and 2007. They accounted for about 25% of total IPO volume in 2007. However, following the 2008 crisis, the number of SPAC IPOs (as well the number of IPOs in general) decreased drastically. They started to gain more popularity post-2017 and achieved a huge success in the 2020-2021 period (see **Figure 1**). In the first half of 2021, the gross proceeds raised by the SPACs even overtook those raised in traditional IPOs (Gigante & Notarnicola, 2021).

Figure 1: Number of SPAC IPOs over the years



Source: Statista

There is no commonly held explanation for this boom, however some authors link it to inflows from retail investors during the COVID pandemic. The idea is that a lot of people stayed at home and didn't spend money on things like in-person entertainment and meals at restaurants. Instead, some of them engaged in stock market speculation, either directly or through ETFs, which experienced significant investor inflows in late 2020 and early 2021. These inexperienced retail investors in many cases had a preference for "cool" companies. This created a sort of bubble which led to some companies having valuations that were hard to justify (Gahng et al., 2021). This can be illustrated with the recent case of Intuitive Machines (NASDAQ: LUNR) who went public by merging with the SPAC Inflection Point Acquisition Corp. on the 14th February 2023. Intuitive Machines is a Houston-based aerospace company which provides space exploration infrastructure and data to support lunar missions conducted by NASA and others. This includes small spacecraft and robots that navigate the moon's surface while gathering valuable information. In terms of closing price, the share price rose from $10 to $44.7 following the merger. It increased even more in the following week and reached $82 on the 22nd February, before decreasing back to around $10 in the following days

(see **Figure 2**). One reason behind this is the fact Intuitive Machines experienced a short-lived period where it was considered a meme stock, drawing the interest of both individual and institutional investors who were hoping to make quick profits through swing trading (Noonan, 2023). A meme stock is a term used to describe company shares that have garnered widespread attention and popularity due to the increased social sentiment surrounding them, usually fueled by online activity, especially on social media platforms. These online communities invest significant effort and resources in researching and discussing particular stocks, resulting in more extensive analysis and discussion on platforms like Reddit, Twitter, and Facebook (Hayes, 2022b). In the case of Intuitive Machines, much of this speculation was fueled by rumors regarding collaborations with Elon Musk's SpaceX. Indeed, Intuitive Machine published a tweet in which they say: *"We knew @ElonMusk was taking #Dogecoin to the Moon, but had no idea it would be on our flight."* (Kenwell, 2023).

Figure 2: LUNR stock price

Source: Yahoo Finance

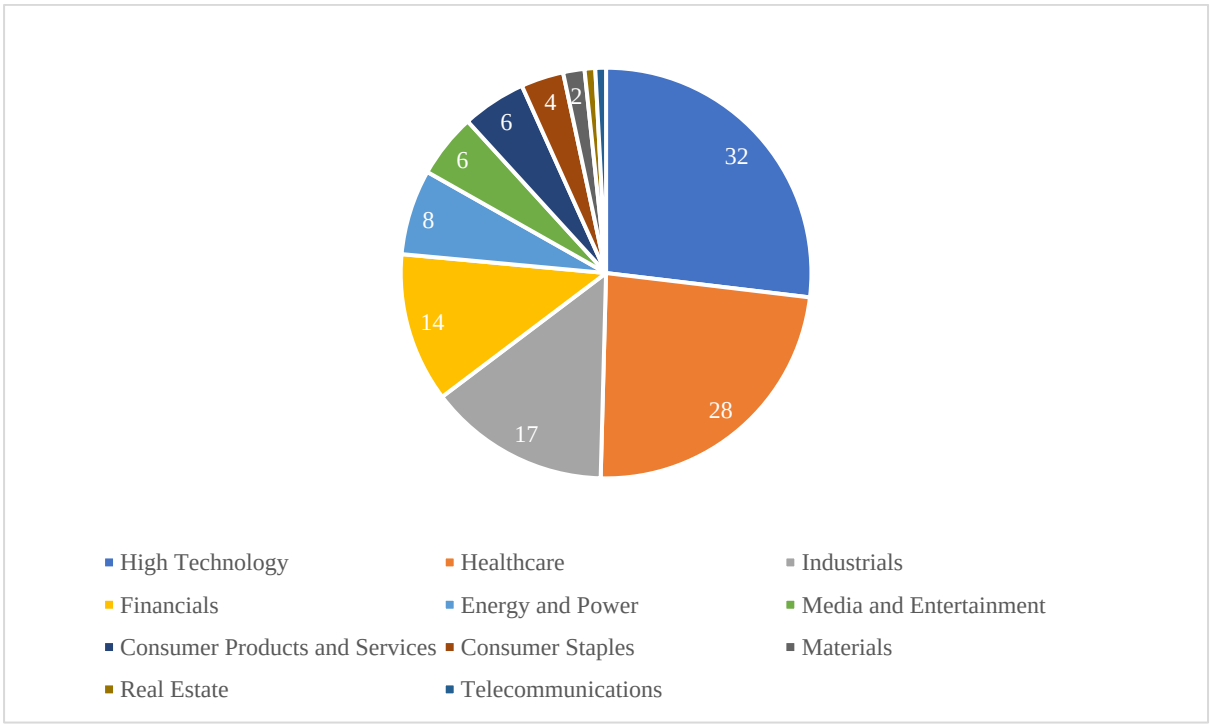
Another reason explaining the SPAC boom between 2020 and 2021 is the high volatility and instability provoked by the pandemic which made it harder for private companies to find the right "IPO window". SPACs then came to their rescue as an alternative way to go public (Gigante & Notarnicola, 2021)

Finally, long period of low interest rates that preceded the boom drove investors to make higher risk investments (Goldstein, 2022).

However, as illustrated by **Figure 1**, the number of SPAC IPOs drastically decreased in 2022. Several reasons explain this. The first element is the weak macro-environment (higher inflation, rising interest rates, and absence of government subsidy). The second element is the underperformance of SPACs post-IPO (as shown later in this paper) (Singh, 2022). The third and last element is the increased regulatory scrutiny, especially in terms of transparency (Capolaghi & Farooqui, 2022).

The number of de-SPAC deals in the US by target industry is illustrated below (see **Figure 3**). We can see that half of the deals conducted between the start of 2019 and the end of 2022 were in the high technology and healthcare sectors. Indeed, out of 119 deals, 32 were in the high technology sector and 28 in the healthcare sector. On the other hand, private companies in the telecommunications and real estate sectors were the least coveted by the SPACs. There was only one deal for each of these sectors.

Figure 3: Number of de-SPAC deals in the US by target industry (1st January 2019 – 31 December 2022)



Source: White & Case

2.2. SPACs lifecycle

Lewellen (2009) divides a SPAC's lifecycle into three stages, which is illustrated by Cumming et al. (2014) (see **Figure 4** below).

2.2.1. Phase 1: no target

The "no target phrase" starts on the IPO date and ends when the sponsors announce that a target has been identified. During a SPAC IPO, the firm issues units consisting of one share and one or more warrants for typically $10 per unit (for the early units) (Okutan Nilsson, 2018). The warrants give its owner the possibility to buy shares later in the company at a pre-determined price of usually $11.50 (Klausner et al., 2022), known as the strike price. Warrants, however, can only be exercised once an acquisition has been successfully completed. The units are divided into the two parts shortly after the IPO date, and shares and warrants start trading separately. The warrants expire after three to five years, depending on the terms of emission. Right after the IPO, the biggest part of the proceeds is transferred to the trust account administered by an underwriting bank, which ensures that the funds are only used for the specified purposes outlined in the prospectus. This helps to build trust between the company and its investors, as it demonstrates that the company is committed to using the funds raised during the IPO for the intended purposes. These proceeds are typically invested in US short-term government securities, earning the interest of Treasury Bills. The SEC requires that 90% of these proceeds must be held in a trust account until an acquisition is made (Okutan Nilsson, 2018). The proceeds that are not put in the trust account (around 10%) are used to cover:

- The underwriter's discount and other emission fees
- The offering expenses and the SPAC's working capital for items such as office expenses (Cumming et al., 2014)

2.2.2. Phase 2: target found

This stage starts when a potential target is found and is communicated to investors via an 8-K filing. Shareholders are then notified via a letter of intent. The proposed target size has to be at least 80% of the Net Asset Value of the SPAC. The shareholders will determine a date for the meeting to be held so that they can cast their votes on whether to approve the acquisition or not, provided that the 80% condition is satisfied. For an acquisition to be approved, two conditions should be met:

- The majority of shareholders (50% + 1) must vote in favor of the acquisition.

- The percentage of shareholders who choose to redeem their shares can't exceed a certain threshold. This threshold is specific to each SPAC and is disclosed in the prospectus. It usually ranges between 20% and 40%.

Investors who vote against the deal have two options. They can either hold onto their shares in the SPAC or redeem them to the SPAC. If they choose to redeem their shares, they will receive the proportional trust value of their shares, even if the deal is approved. The warrants can be traded independently, therefore, shareholders who choose to redeem their shares can keep their warrants or sell them in the market regardless of their voting behavior (Cumming et al., 2014).

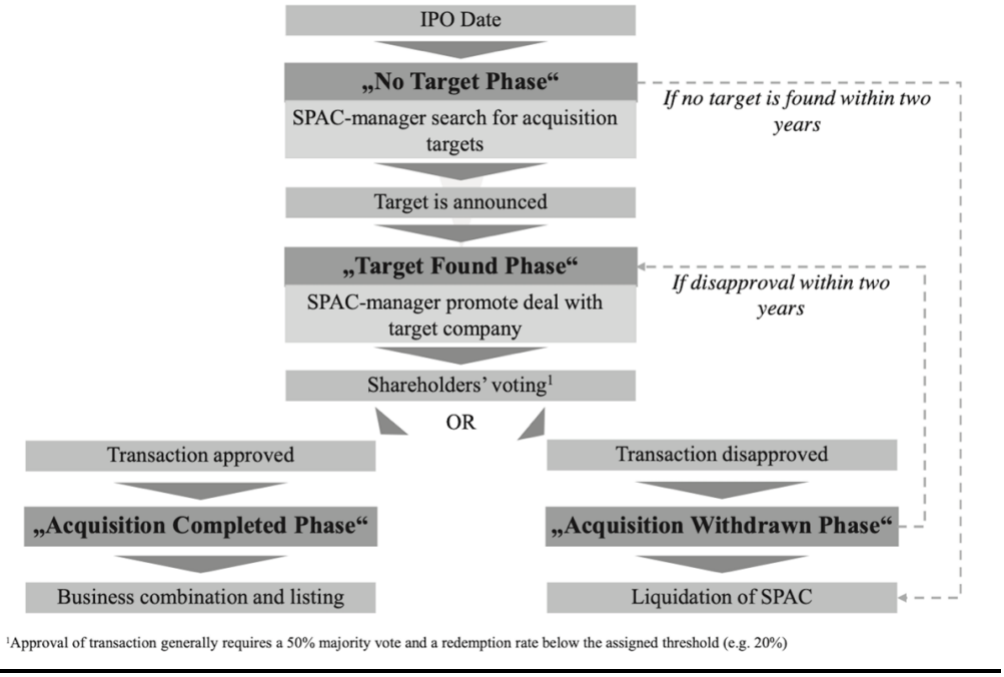
2.2.3. Phase 3: acquisition completed or withdrawn

After the shareholders' voting, the SPAC enters its third phase. The transaction is either approved, which leads to the acquisition completed phase, or disapproved, which leads to the acquisition withdrawn phase.

In the first case where shareholders vote to approve a business combination, the SPAC managers, underwriters, and legal advisors file new forms with the Securities and Exchange Commission (SEC) to issue securities related to the combination, and an 8-K form is filed to demonstrate that the transaction was approved. At this point, the funds held in escrow accounts are released to the SPAC management and can be used by the newly formed company. (Lakicevic & Vulanovic, 2013). The original owners of the SPAC may continue to hold a significant stake, become minority stakeholders, or leave their positions altogether, depending on the financing structure of the deal and the size of the stake acquired by the SPAC (Cumming et al., 2014).

In the second case where the merger is disapproved or no target was found within the predetermined period, the SPAC announces its liquidation. The trust value (including the interests earned) is then distributed to all shareholders who receive a pro rata based on the number of shares they hold. The sponsors, on the other hand, lose their sponsors promote and their warrants become worthless (Cumming et al., 2014).

Figure 4: SPAC lifecycle



Source: Cumming et al. (2014)

2.3. Factors leading to merger approval

In their paper, Cumming et al. (2014) identify the factors that have an influence on the approval probability of the merger during the proxy vote based on a sample of all US SPACs since 2003. They run a logit regression with more than twenty independent variables - divided into four categories which are “SPAC structure”, “IPO process, “Ownership structure” and “Operations and performance” - and where the dependent variable takes the value 1 if the merger proposal is approved and 0 if it is disapproved. The findings are as follows (**see Appendix 1**):

- The more sponsors are involved, the lower the probability of approval. Typically, the sponsors don’t directly manage the SPAC themselves. Instead, they act as consultants for a management team. A higher number of sponsors might show a lack of confidence in the management team.
- The average age of the managers has an impact on the probability of approval. Younger managers may have more time and energy to find a target and conclude a deal. Their drive for reputation, fulfillment and wealth are other factors that may explain these results. Finally, A common characteristic of younger managers is that they are more involved in the day-to-day operations of the business, which makes them more hands-

on. As a result, they tend to have a better understanding of market trends, the potential for creating value, and the needs of investors.

- A higher trust value (the percentage of IPO proceeds that is held in the SPAC's trust account) has a positive impact on the approval probability because it shows that the management team incurs lower IPO costs and requires less working capital. This signals a high efficiency and is perceived positively by the investors.
- The higher the number of underwriters, the lower the probability of approval. A larger number of underwriters (syndication) signals a need for risk-sharing, which is perceived negatively by the investors.
- The reputation of the underwriters has a positive impact on the approval probability.
- Blockholdings by active investors such as hedge funds and private equity funds have an impact on the approval probability of the deal. Unlike long-term investors such as mutual funds, hedge funds and private equity funds are more interested in short-term-oriented strategies such as arbitrage. For example, when the share price is lower than the pro-rata discounted trust value, hedge funds buy these shares, then redeem them in order to make a profit. So, the higher the proportion of shares owned by active investors, the lower the probability of approval.
- The number of voting rights detained by the managers before the proxy vote has a positive impact on the approval probability. Since the management has a high incentive in a deal approval, they will most likely vote in favor of it.
- The shorter the time between the announcement of a target and the proxy vote, the higher the approval probability, because a faster and smoother process may reassure the investors.
- The deal has more chances of getting approved in an upward-trending market environment. Investors would rather redeem their shares and receive liquidity in times of recession or crisis.

2.4. Performance of SPACs

Even though no papers comparing the performance of SPACs across different sectors have been written so far, several studies focusing on the overall short-term and long-term performance of SPACs have been conducted. This section covers some of them in a chronological order with the aim of establishing a framework and providing a theoretical basis for my research.

Jenkinson and Sousa (2009) are among the first authors to take an interest in the subject in their paper named *"Why SPAC investors should listen to the market".* They use a sample of 58 SPACs that conducted an IPO between August 2003 and June 2006 and that either completed an acquisition or got liquidated. For those who completed an acquisition, the results show an average cumulative return of -24% after six months and -55% after one year.

To pursue their analysis, they split their sample in two sub-samples, one with *Good SPACs*, the other with the *Bad SPACs*. Jenkinson and Sousa (2009) define *Bad SPACs* as follows: *"The Bad SPACs are those where investors approved a deal when the price at the decision date […] was below the trust value per share"*. As regards the *Good SPACs*, they are defined as follows: *"The Good SPACs are […] those where investors approved a deal when the share price at decision date was higher than the trust value per share.".* To calculate the performance, they risk-adjust the returns by computing the cumulative abnormal returns (CARs) using the single-factor CAPM in which they use the Russel 1000 as the market index. They report a CAR of -34% six months after the acquisition for the *Bad SPACs* and a CAR of -6% for the *Good SPACs.*

These results show that investors could have predicted the long-term performance of the SPACs based on the share price at the decision date. If that's indeed the case, one might wonder why these *Bad SPACs* were not liquidated. One possible explanation given in the paper is the vote-buying by the founders. Typically, the founders purchase additional shares on the public market before the decision date so that the acquisition can take place. The authors report that the stock turnover before the decision date is higher for those *Bad SPACs.* Another possible explanation according to Jenkinson and Sousa is the blind faith in the value-creating skills of the founders.

Lakicevic and Vulanovic (2013) study the performance of SPACs based on a sample of 161 SPAC IPOs conducted between August 2003 (date of the first modern SPAC) and July 2019. They analyze the performance of all three types of SPACs securities, namely units, common stocks and warrants around the announcement of the merger. The results are obtained using the market model from Brown and Warner (1985):

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt}$$

where:

- R_{jt} is the rate of return of the j^{th} SPAC security on the merger announcement day t

- R_{mt} is the rate of return of an equally weighted daily market index on day t
- α_j is the constant term of the regression. It represents the excess return of security j when the market return R_{mt} is zero. In other words, it's the part of the security's return that is not explained by the market return.
- β_j is the coefficient of the regression. It represents the sensitivity of the security to changes in the market return. It can also be referred to as the "market risk". The closer it is to 1, the more correlated the security and the market returns.

Then the abnormal return for the SPAC securities on merger announcement day t is:

$$AR_{jt} = R_{jt} - (\alpha_{0j} + \beta_{oj}R_{mt})$$

where α_0 and β_0 are ordinary least squares estimates of α and β. The parameter estimation period is 50 days prior to the announcement date of the announcement. For common stocks, for example, the α_0 is 0.0015893 and the β_0 is 0.1491343.

Lakicevic and Vulanovic (2013) first report the CARs of SPAC securities around the announcement of a merger. They find a common stock abnormal return of 0.85% on the announcement day, 1.2% over a two-day period and 0.047% over a 7-day period (see **Appendix 2**). For the units, holders experience an abnormal return of 2.42% on the announcement day, 3.43% over a two-day period and 7.88% over a 7-day period (see **Appendix 3**). Finally, as regards the warrants, holders experience an abnormal return of 10.49% on the announcement day, 9.83% over a two-day period and 6.66% over a 7-day period (see **Appendix 4**).

The authors further analyze the CARs of SPAC securities around the merger. They find that SPAC equity holders experience an abnormal return of -3.81% on the day of the completion of the merger and -9.59 over a 7-day period. Warrant holders on the other hand earn a 4.76% abnormal return on this same day and experience a 7.36% return over the 7-day period.

Lastly, the buy-and-hold performance of units is analyzed for different sub-samples based on the merger status of the SPACs. The first sub-sample contains the SPACs that completed a merger. On average, an investor who bought a unit and held it until the last week of June 2009 experiences a return of -28.69%. This shows that investors usually engage in value-destroying activities, as also discussed by Jenkinson and Sousa (2009). For the second sub-sample containing SPACs that announced a merger and that are in the process of approval,

they find a buy-and-hold return of 9.6%. Lakicevic and Vulanovic (2013) give two possible explanations for this outcome. First, investors may bid up the prices of either warrants or shares. Second, SPAC founders and underwriters who are under pressure to complete the merger may buy out original SPAC investors at prices higher than the original value. The last sub-sample contains SPACs that have completed an IPO but haven't announced a merger yet. These ones experienced a buy-and-hold return of -8.22%.

Kolb and Tykvová (2016) analyze and compare the long-term performance of SPACs to traditional the performance of IPOs based on a sample of 127 SPACs that completed an acquisition after 2003 and 1128 IPOs. They calculate the buy-and-hold abnormal returns (BHARs) of SPACs and IPOs (both matched and non-matched firms) by adjusting for (i) the market (using the Russel 2000 index), for (ii) size and book-to-market and for (iii) industry. The BHARs are calculated for a period of 6, 12, 24 and 60 months starting from the completion date of the acquisition. The results show that both SPACs and IPOs underperform all three benchmarks, but that underperformance is even stronger for SPACs (see **Appendix 5**). For example, if we look at the 24-month period, the SPACs underperform the three benchmarks by 59%, 96% and 85% on average. The sample of matched IPOs on the other hand, underperform these benchmarks by "only" 34%, 43% and 45% on average. When looking at the 60-month period, the results are impressive. The SPACs underperform the market by 102%.

Kolb and Tykvová (2016) further perform a calendar-time five-factor model analysis by regressing monthly calendar-time portfolio excess returns on these five risk factors according to the following specification:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + m_i MOM_t + l_i LIQ_t + e_{it}$$

where:

- R_{it} is the return on a portfolio containing SPAC firms
- R_{ft} is the T-bill return
- α_i is the portfolio excess return
- R_{mt} is the market return
- SMB_t is the difference between the return on a portfolio of small firms and a portfolio of large firms

- HML_t is the difference between the return on high book-to-market and low book-to-market stocks
- MOM_t is the difference between the return on high-prior-return portfolios and low-prior-return portfolios
- LIQ_t is the difference between the return on low-turnover portfolios and high-turnover portfolios.

After a 24-month period, for example, they find a monthly α of -5.2% for SPACs, -1.2% for all IPOs and -1.7% for matched IPOs. The results they obtain through this analysis are similar to those obtained with the BHARs method. The SPACs and the IPOs both underperform the market for each period considered (6, 12, 24 and 60 months) and that underperformance is even larger for SPACs (see **Appendix 6**).

Dimitrova (2017) also studies the performance of SPACs. She first analyzes the short-term, long-term and operating performance of SPACs. Then she presents the cross-sectional variations in SPACs' performance. Her sample is composed of a list of all SPACs that successfully completed an IPO and announced an acquisition which completed merger (61% of the sample) or withdrew (39% of the sample) over the period 2004–2010.

For the short-term performance, she calculates the cumulative abnormal returns (CARs) over a three-day event window around the announcement day and uses the Russel 2000 index as a benchmark. She finds a cumulative abnormal return (CAR) of 1.5% which shows that the announcements of acquisitions by SPAC acquirers are received positively by the market.

For the long-term performance, she compares the SPAC returns to three different benchmarks: the Russel 2000 index benchmark, the industry- and size-matched firms benchmark and the other IPOs benchmark just like Kolb and Tykvová (2016). Her results show that SPACs underperform the market and the other firms from the same industry with similar sizes for all sub-periods except for the period from the announcement of the merger to the effective date of the merger. For example, when using the Russel 2000 index as a benchmark, the results show a buy-and-hold abnormal return (BHAR) of -41.4% from the announcement of the merger to 1-year post-merger. As regards the other IPOs benchmark, the SPACs underperforms it for every sub-period (see **Appendix 7**).

Dimitrova (2017) further looks into the cross-sectional variations in SPACs' performance. She finds an inverted U-shaped relationship between the time to announce an

acquisition and the performance. Acquisitions announced too early or too late are seen as less valuable. On one hand, if the SPAC announces the acquisition too early, it might be seen like the sponsors didn't put enough time and effort to find a suitable target. On the other hand, if this announcement takes place closer to the deadline, it might be seen like a last-minute opportunistic deal.

The presence of deferred underwriter fees and the fact that the underwriters are also the advisers of the SPACs also impact their performance in a negative way. Underwriters that have not collected all their fees yet can push the sponsors for any potential deal, even bad ones, for their own incentives.

She also finds that higher sponsor ownership leads to worse performance. According to her, a possible explanation is that sponsors may buy additional shares in the open market and approve value-destroying acquisitions just to get their compensation. Sponsors board representation however increases performance, possibly thanks to the involvement of their expertise during the monitoring of the newly merged company.

Lastly Dimitrova (2017) finds that institutional blockholders ownership (such as hedge funds ownership) has a negative effect on performance. She explains that those institutional investors acquire SPAC shares for investment reasons only and keep their shares for a short period of time. Therefore, their exit has a downward pressure on price.

Gahng et al. (2021) study the performance of SPACs as well. They lead a study on the deSPAC period returns earned by public market investors during two different periods. They first document returns from the SPAC period, which starts on the SPAC IPO date and ends five trading days before either a business combination completion date or a liquidation date. For SPACs that went public between January 2010 and December 2020, they find an average annualized return of 23.9% based on an "optimal redemption strategy" in which an investor buys a SPAC unit at the offer price and sells (or redeems if the redemption value is higher than the market price) each component of the SPAC unit at the closing price of five trading days prior to the completion or liquidation date (see **Appendix 8**). They also find that larger SPACs (SPACs with higher IPO proceeds) provide on average higher returns.

Next, they examine the returns of common shares during the deSPAC period. They find a one-year buy-and-hold return of -11.3%. Moreover, these SPACs underperform the market by 30.7% (see **Appendix 9**). These findings are consistent with prior studies.

Gahng et al. (2021) also look at the cross-sectional patterns for the returns of common shares during the deSPAC period. They first compare the one-year returns of SPAC mergers

and traditional IPOs and find that the private companies which chose the SPAC route to go public have lower returns than those who chose the traditional IPO route. This applies to all levels of sales. However, the returns are on average higher for firms that have a sales level above $100 million (see **Appendix 10**). Then, based on a regression analysis, they find that the presence of sponsor expertise and reputable underwriters both have positive impact on the performance during the deSPAC period, whereas the redemption ratio and the time between the IPO and the merger have a negative effect (see **Appendix 11**).

The only paper (to my knowledge) concerning the performance of SPACs in a particular industry is the one published by Gigante and Notarnicola (2021) in which they discuss the performance of SPACs that completed a merger with healthcare companies. Their sample consists of 33 SPACs that completed their merger between December 2018 and June 2021.

The returns are compared to two benchmarks, the Russel 2000 and the S&P 500 Healthcare Sector Index, and it is shown that SPACs which merged with healthcare companies underperform these two benchmarks in the short-term. However, in the long term (especially after 2 years), the SPACs provide similar returns to the Russel 2000 as well as the S&P 500 Healthcare Sector Index (see **Appendix 12**).

Gigante and Notarnicola (2021) further perform a regression analysis on the cumulative returns generated from the day before the business combination announcement to fifteen days after the merger completion. This analysis shows that the redemption of a large number of shares has a significant and strong negative impact on the returns of the combined entity. The presence of serial SPAC sponsors has been found to have a negative impact on healthcare SPAC returns, likely due to their lower focus resulting from managing multiple SPACs simultaneously. Furthermore, the analysis has provided evidence indicating that healthcare SPAC returns are negatively affected by cross-border deals and the presence of private equity or venture capital funds among the target company's sellers. These findings align with previous research on SPACs. Regarding the financial advisors involved in business combination transactions, it has been observed that a large number of buy-side advisors have a significantly positive impact on SPAC returns. On the other hand, having a high percentage of boutique investment banking firms among the sell-side advisors is seen as unfavorable for healthcare SPAC market performance.

Finally, Kiesel et al. (2022) analyze what happens when SPACs announce business combinations. Their analysis of 236 ‘deSPACs’ completed between January 2012 and June

2021 in the United States documents an average short-term announcement return of +7.4% for deSPACs with completed deal combinations and a 1-year abnormal return of −14.1% (−18.0% over 2 years) for public investors. Unlike other similar studies, the event day that is chosen is the merger announcement date and not the deSPAC date.

The cumulative average abnormal returns (CAARs) for the event windows [−1, +1], [−1, +2] and [−1, +3] are used for the short-term performance. The reason why the day before the announcement day is also included was to consider any leakage or rumors regarding the merger. After splitting the sample and analyzing for SPACs with and without prior rumors independently, they find no significant difference. The CAAR in the event window [−1, +3] is +6.44%, while those during the [−1, +2] and [−1, +1] event windows are +6.35% and +6.67%, respectively. It is also found that the CAAR is much higher for de-SPACs announced after 2020 compared to those announced before. For the event window [−1, +3] for example, they find CAARs of respectively 11.79% and 2.13%.
Their short-term results also show that the longer it takes a SPAC to identify a target company, the lower the short-term announcement of abnormal returns will be.

The buy-and-hold abnormal returns (BHARs) are used for the long-term performance. They are first computed for post event periods of 6, 12, 18 and 24 months, starting from the announcement date. The average BHAR is +3.57% for the 6-month period, which still mainly covers the premerger period as the deal has not been completed yet in many cases. It is, however, statistically negative for 12 (−14.10%), 18 (−20.18%) and 24 months (−18.02%), when the post-merger performance is incorporated.
The BHARs are then computed for the same periods, but this time, starting from the completion date of the deal. Kiesel et al. (2022) find an average BHAR of -18.79% for the 6-month period, -18.53% for the 12-month period, -6.87% for the 18-month period and -13.45% for the 24-month period. According to Klausner et al. (2022), this big difference between short-term and long-term performance is due to the fact that the sponsors paint a “rosy picture” and that they benefit from information asymmetries. The fact that the long-term performances found by Kiesel et al. are better than those of previous studies (especially pre-2010) may be linked to the fact that SPAC managers have improved their abilities to identify value-creating target companies over the time and also to the fact that the announcement date was chosen as the focal point.
Furthermore, they focus on three possible determinants of long-term performance and they find that: the involvement of a reputable underwriter, the relative deal size (the book value of target assets relative to the market value of the SPAC's public float) and the time to announcement

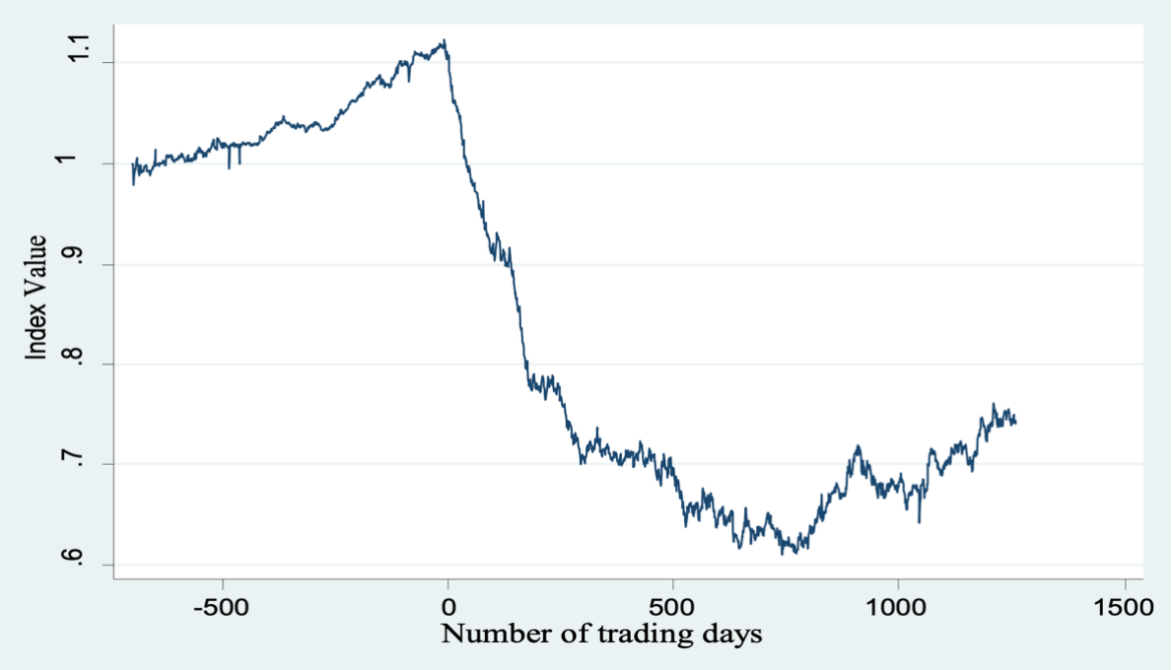
(time between IPO and announcement of a target) have an impact on the long-term performance, with the last two being statistically significant. The bigger the relative deal size and the shorter the time to announcement, the better the long-term performance.

2.5. Survival of SPACs

Vulanovic (2017) leads a study on the post-merger survival of SPACs based on a sample of 105 SPACs that entered the US capital market since August 2003 and which successfully closed a merger before the end of 2013 Out of these 105 SPACs, 61 failed (58,09%) and the rest survived. A SPAC is classified as failed if it is no longer publicly traded. It is shown that overall, the targets were companies within financial services, telecommunications, and transportation industry.

The author first reports the buy-and-hold returns for one, three and six months after the merger. The results are respectively -3%, -19% and -40%. He then reports the performance of an equally weighted index of all the 105 SPACs (see **Figure 5**) where the day 0 is the merger announcement day. It can be seen that the index value increases around the announcement day and reaches its minimum around the 750th day.

Figure 5: SPAC Index performance



Source: Vulanovic (2017)

Vulanovic (2017) then looks at the SPAC characteristics and pre-IPO prospectus that would impact the chances of survival after the merger (see **Appendix 13**). He finds that the more founders there are, and the more warrants these founders buy, the higher the chances of survival. The latter shows the founders' commitment. The higher the managerial commitment, the lower the asymmetric information and the moral hazard. Similarly, higher involvement of underwriters and the size of syndicate network have a positive impact because the larger the network of investment banks, the more resources potentially committed to the merger. The quality of the underwriter also has a positive impact. SPACs that worked with underwriters such as Citigroup or Deutsche Bank have more chance to survive. On the contrary, variables that increase the cost of initial merger and likely increase the degree of information asymmetry such as the level of underwriter fee and the level of deferred fee are increasing the likelihood of failure.

Bank financing is another factor that has a significant impact on the survival likelihood. Indeed, a SPAC has recourse to bank financing if it fails to finance acquisition through the equity market or debt market. So the higher the bank financing, the higher the chance to fail.

Next, he finds that SPACs with higher one-year post-merger returns have higher chances of survival, which seems quite intuitive. The same thing applies to SPACs that have paid dividends at least once because this is usually a sign of a healthy company.

He also finds that SPACs that take less time to announce an acquisition, as well as the the fact that they are a *Good SPAC* (as defined by Jenkinson and Sousa) have a higher probability of survival.

Finally, Vulanovic (2017) reports that SPACs which merge with a foreign private company have higher chances of failure. He associates this to the fact that following actions from SEC in 2011, some SPACs which acquired companies from China were delisted from the US exchanges. Another possible explanation he gives is the presence of asymmetric information for those SPACs. The presence of asymmetric information could be more prevalent, as there may be cultural, language, and regulatory differences between the foreign company and the SPAC. This could make it more difficult for the SPAC to accurately assess the value and potential of the foreign company, leading to a higher risk of failure.

2.6. Research question and hypotheses

This literature review shows that all authors find converging results. They all find on average a positive short-term performance and a negative long-term performance, regardless

of the time frame and the methodology that have been used. Moreover, even though several studies analyzing the short-term and long-term performance of SPACs have been conducted so far, none of them compares these performances across the different sectors. This leads me to the following research question in order to fill this gap in the literature: **"How do the short- and long-term performance of SPACs differ across the different sectors in which the target companies operate?"** which can be divided into two sub-questions**:** "How does the short-term performance of SPACs differ across different sectors in which the target companies operate?" and "How does the long-term performance of SPACs differ across different sectors according to the sector in which the target companies operate?".

My two hypotheses to answer my research question are the following:

Hypothesis 1

H_0*: SPAC returns do not significantly differ across the different sectors in the short-term*

H_1*: SPAC returns significantly differ across the different sectors in the short-term*

Hypothesis 2

H_0*: SPAC returns do not significantly differ across the different sectors in the long-term*

H_2*: SPAC returns significantly differ across the different sectors in the long-term*

3. Methodology

My initial sample originates from the website https://www.spacresearch.com and consists of 457 U.S listed SPACs that completed an M&A operation between July 2016 and April 2023. This website gives valuable information (issued from the SEC filings) for my research such as the name of the SPAC, the name of the target company, the sector to which it belongs, the ticker, the announcement date of the deal and the completion date of the deal. I made sure that the information I used was reliable by comparing it with the information found on the Bloomberg Terminals at the library of my faculty and also with information disclosed the SEC filings.

3.1. Short-term performance

To answer my first sub-question *"How does the short-term performance of SPACs differ across different sectors in which the target companies operate?",* I decided to compute the Cumulative Abnormal Return (CAR) for the event window [-1:3] around the announcement date of the merger. The CAR method was widely used in previous studies, which is the reason why I decided to use it as well.

The "abnormal return" can also be referred to as the "excess return". The idea is to compare the return of the stocks to the return of a benchmark. I decided to use the Russel 2000 index as my benchmark. It's a small-cap stock market index which measures the performance of the 2,000 smallest stocks of the Russel 3000 index. The Russel 3000 index, on the other hand, tracks the performance of the 3 000 largest U.S.-traded stocks, which collectively account for roughly 97% of all U.S.-incorporated equities (Hayes, 2022a). For the interpretation of my results, using the abnormal returns is more interesting than using just returns. For example, a daily return of -10% for a given stock could be perceived as bad. However, on the same day, the market may have had an average daily return of -30%. In this example, the SPAC would have a decent performance relative to the market.

The short-term stock performance is measured by first computing the daily abnormal return (AR) for each day of the event window [-1:3] (0 being the announcement day):

$$AR_{i,t} = R_{i,t} - R_{m,t},$$

where $R_{i,t}$ is the return of stock i on day t and $R_{m,t}$ is the return of the Russel 2000 index on day t.

The return, on the other hand, is defined as follows:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}},$$

where P_t is the price on day t and P_{t-1} the price on the previous day.

The abnormal returns of each day are then summed to obtain the Cumulative Abnormal Return (CAR):

$$CAR_{i,(T1,T2)} = \sum_{t=T1}^{T2} AR_{i,t}$$

It is important to note that the days in question are working days. So, for example, if the announcement date falls on a Monday, the previous day would be Friday. The holidays are also not considered as working days.

The reason why the announcement date of the merger was chosen as the focal point of the short-time performance is to assess the market's response and measure investor sentiment. This provides an indicator of how investors perceive the potential risks and benefits associated with the merger. It's important to note that the announcement date is not the date at which the shareholders agree to merge with/acquire the target company. In fact, it's the day during which the SPAC management announces that it reached an agreement with the target company. Through this announcement, the management discloses the terms of the merger, the purchase price, the ownership structure of the combined company etc. The shareholders then vote on the proposed merger, usually a few months after this announcement, during the proxy vote.

As concerns the event window, I decided to choose the timeframe [-1:3] because it was widely used in previous studies, which will allow me to make comparisons. This event window

includes the day before the announcement in order to account for any potential leakage or rumor regarding the deal.

To compute the CAR of each stock, I used Microsoft Excel. Here are the steps I followed:

1. After downloading my data from https://www.spacresearch.com, I opened it with Excel.
2. I generated the dates before (up to two days before) and after (up to three days after) the announcement date using the =*WORKDAY* function. This allowed me to exclude the weekends.
3. I used the =*STOCKHISTORY* function to retrieve the closing price of each stock (using its ticker) for each date. This formula retrieves the data from Refinitiv, which is a third-party financial data provider.
4. I downloaded the daily historical prices of the Russel 2000 Index, which I imported on another Excel sheet. Then, I used the =*VLOOKUP* formula to get the closing price of the index for each date.
5. I calculated the daily returns for the stock price and for the Russel 2000 index for each ticker.
6. I summed the daily returns of the stock price and the Russel 2000 index for each ticker in order to have the cumulative returns.
7. I subtracted the cumulative returns of the Russel 2000 index from the cumulative returns of the stocks to obtain the Cumulative Abnormal Return (CAR).

However, I had to manually enter some data due to various reasons:

1. The =*WORKDAY* function only excludes the weekends but not the holidays. Therefore, I had to manually adjust some dates and take the previous day instead for dates during which the stock market was closed.
2. The =*STOCKHISTORY* function only returns values for stocks that are still trading. However, in my sample, I had stocks that were delisted (no longer trading). For these shares, I had to use the historical data coming from the website https://www.barchart.com, which gives the historical share prices of stocks that are no longer trading (unlike Yahoo Finance).

3. Some companies started to trade with a different ticker at some point for different reasons:
    a. The ticker changed once the merger was completed, in which case I looked at the old name of the ticker on https://www.spacresearch.com.
    b. The ticker changed because the company went into a bankruptcy process, in which case the letter Q was added at the end of the ticker. For example, the ticker BOXD started trading under the ticker BOXDQ.
4. The *=STOCKHISTORY* didn't return any value for an unknown reason, in which case I retrieved the data from https://finance.yahoo.com.

To analyze my data, I decided to use R Studio, which is an integrated development environment for R, a programming language for statistical computing and graphics (see **Appendix 14**).

After importing my dataset, I first examined the sector breakdown of my sample to see how many deals were completed in each sector. Then, I computed the descriptive statistics for the CARs and performed a visual representation using boxplots. This offered a concise visualization of the central tendency, spread, and presence of outliers in the CAR data.

Next, I wanted to answer my first research question *"How does the short-term performance of SPACs differ across the different sectors in which the target companies operate?"* by testing my first hypothesis (H_1) against the null hypothesis (H_0):

H_0*: SPAC returns do not significantly differ across the different sectors in the short-term*

H_1*: SPAC returns significantly differ across the different sectors in the short-term*

My initial idea was to perform a one-way ANOVA (Analysis of Variance) test to determine whether there are significant differences among the mean CARs of different sectors. The logic behind the one-way ANOVA is based on the assumption that if the means of the groups are truly equal, any observed differences between group means are due to random variation or chance. Conversely, if the means differ significantly, it suggests that there is a

genuine difference between the groups being compared. The one-way ANOVA test is a parametric test, and it makes three assumptions (*One-way Anova*, 2018):

1. Independence: It is assumed that the observations within each group or category are unrelated to one another. To put it another way, the values of one group should not be connected to or affected by those of another. This assumption cannot be statistically tested; however, my study design and data collection process do not go against the independence assumption.
2. Normality: The dependent variable is normally distributed within each group that is being compared (technically, it is the residuals that need to be normally distributed, but the outcome will be the same). I tested the normality using the Shapiro-Wilk test. I found that the normality was not respected within each sector. I then decided to visually represent the distribution within each group using histograms.
3. Homogeneity of Variances: The variance of the residuals is equal across all groups (also known as homoscedasticity). I tested this assumption by performing a Levene's test and found that the homogeneity of variances was not respected either.

Because the last two conditions were not met, I had to opt for another method to test my hypothesis. I decided to perform a Kruskal-Wallis test, which is a non-parametric alternative test to the one-way ANOVA test. The logic behind it is to test for differences in medians instead of means. If the medians of the groups are truly equal, any observed differences between group medians are due to random variation or luck. Conversely, if the medians differ significantly, it suggests that there is a genuine difference between the groups being compared. After performing the Kruskal-Wallis test, I illustrated the CAR distributions of each sector with boxplots.

3.2. Long-term performance

To answer my second sub-question *"How does the long-term performance of SPACs differ across different sectors in which the target companies operate?",* I decided to compute the one-year buy-and-hold abnormal return (BHAR) starting from the closing date of the merger. The BHAR was widely used in previous studies, which is the reason why I decided to use it as well.

The one-year BHAR of firm i is computed as follows:

$$BHAR_{i,(t_1,t_2)} = \prod_{t=t_1}^{t_2} (1 + R_{i,t}) - \prod_{t=t_1}^{t_2} (1 + R_{m,t}),$$

where t_1 is the closing date of the merger, t_2 is the closing date of the merger + 1 year, $R_{i,t}$ is the one-year return of the stock and $R_{m,t}$ is the one-year return of the benchmark, which is once again the Russel 2000 index.

In other words, the BHAR is the difference between the one-year return of the stock and the one-year return of the Russel 2000 index.

The reason why I chose the closing date of the merger as the focal point of my long-term study was to ensure comparability across the firms' performance. Given that the time separating the announcement of the merger from the completion of the merger is different for each SPAC, it would have made less sense to choose the announcement date as the reference point. If I did so, I would have compared, for example, the performance of a SPAC that completed the merger 2 months after the announcement to a SPAC that completed the merger 5 months after the announcement. In this example, the "activity periods" of the newly merged company would be respectively 10 months and 7 months.

Out of my initial sample that I used for my short-term study, which consists of 457 U.S listed SPACs that completed an M&A operation between July 2016 and April 2023, I created a sub-sample of 361 observations. This is because I had to remove 96 SPACs that completed their merger after May 2022 (for which I am unable to compute the one-year return at the time of writing).

The steps I followed to compute the BHAR on Excel are very similar to those of the short-term study. However, this time, I generated the values "closing date + 1 year" for each closing date, while making sure that this new date falls on a working day. For example, if the closing date is the 5th March 2021, the date one year later is the 5th March 2022, which falls on a Saturday. In this case, my Excel formula corrected it so that it falls on the next working day, which is the Monday 7th March 2022. Then, I computed the yearly return of the stock. Finally, I determined the yearly return of the Russel 2000 index, which I subtracted from the yearly return of the stock in order to obtain the buy-and-hold abnormal return (BHAR).

I also had to manually enter some data due to the exact same reasons stated in the previous section.

Once more, I analyzed my data using R studio (see **Appendix 15**). After importing my dataset, I first examined the sector breakdown of my sample to see how many deals were completed in each sector. Then, I computed the descriptive statistics for the BHARs and performed a visual representation using boxplots. This offered a concise visualization of the central tendency, spread, and presence of outliers in the BHAR data.

Next, I wanted to answer my second research question *"How does the long-term performance of SPACs differ across the different sectors in which the target companies operate?"* by testing my second hypothesis (H_2) against the null hypothesis (H_0):

H_0*: SPAC returns do not significantly differ across the different sectors in the long-term*

H_2*: SPAC returns significantly differ across the different sectors in the long-term*

I wanted to perform a one-way ANOVA test to compare the BHARs of different sectors. However, I had to check if the independence, normality, and homogeneity of variances were respected. Just like for the short-term analysis, I performed the Shapiro-Wilk test to check for the normality and the Levene's test to check for the homogeneity. After finding that the homogeneity of variances was respected but not the normality, I performed a Kruskal-Wallis test again.

4. Results and Discussions

4.1. Short-term performance analysis

4.1.1. Descriptive statistics

The sector breakdown of my sample shows that Healthcare and Technology are the leading industries with a combined 38.73% of the total deals (see **Table 1**). This is in line with what I mentioned in my literature review (see **Figure 3**) where they accounted for 50.24% of the total deals. In **Figure 3**, the deals took place between 1st January 2019 and 31st December 2022, whereas my sample consists of deals that took place between July 2016 and April 2023, which could explain the difference. However, even if the percentages are not the same, there seems to be a trend towards these two sectors.

Table 1: Sector breakdown

Sector	*Count*	*Percentage*
Automotive	60	13,13%
Cannabis	5	1,09%
Consumer	25	5,47%
Energy	29	6,35%
Financial	38	8,32%
Food	20	4,38%
Healthcare	91	19,91%
Industrial	44	9,63%
Materials	4	0,88%
Media & Entertainment	28	6,13%
Real Estate	15	3,28%
Technology	86	18,82%
Travel & Hospitality	12	2,63%
Total	*457*	*100%*

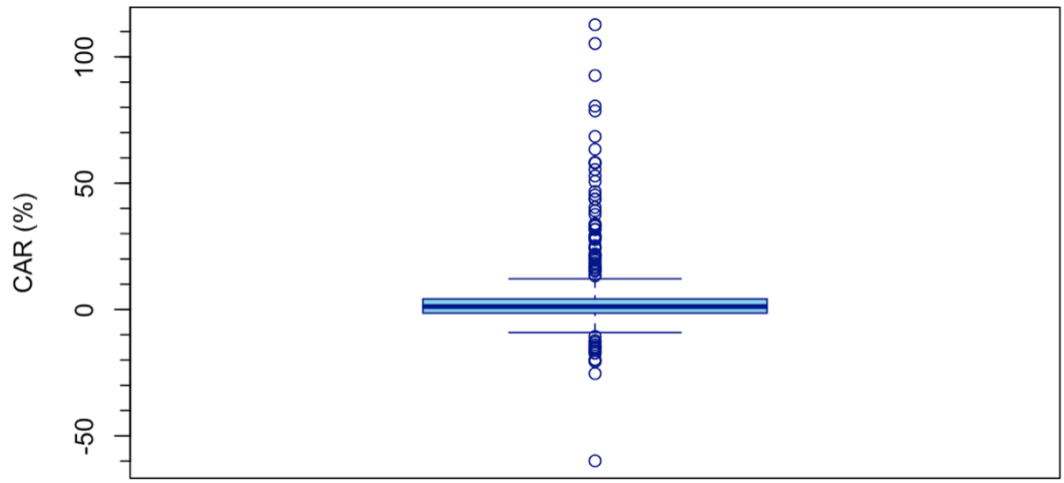
Looking at the descriptive statistics of CARs (see **Table 2**), we can see that on average, stocks experience a positive CAR of 4.4% percent for the event window [-1:3]. This positive result is in line with prior studies. For example, Kiesel et al. (2022) had found an average CAR of 6.44% for the same event window around the announcement date, for a sample of 236 SPAC

deals completed between January 2012 and June 2021. Then, if we look at the distribution of the data (more particularly at the 1st and 3rd quantiles), we can see that 50% of the companies experience a CAR between -1.5% and 4.2%. The spread of the data can also be illustrated with a boxplot (see **Figure 6**). We can see that most of the data is centered around 0%, but the of the data is not uniformly distributed around it. We can also see that there is a significant number of outliers, most of which are on the positive side.

Table 2: CAR descriptive statistics

Min.	*1st Qu.*	*Median*	*Mean*	*3rd Qu.*	*Max.*
-0,599	-0,015	0,012	0,044	0,042	1,127

Figure 6: CAR boxplot

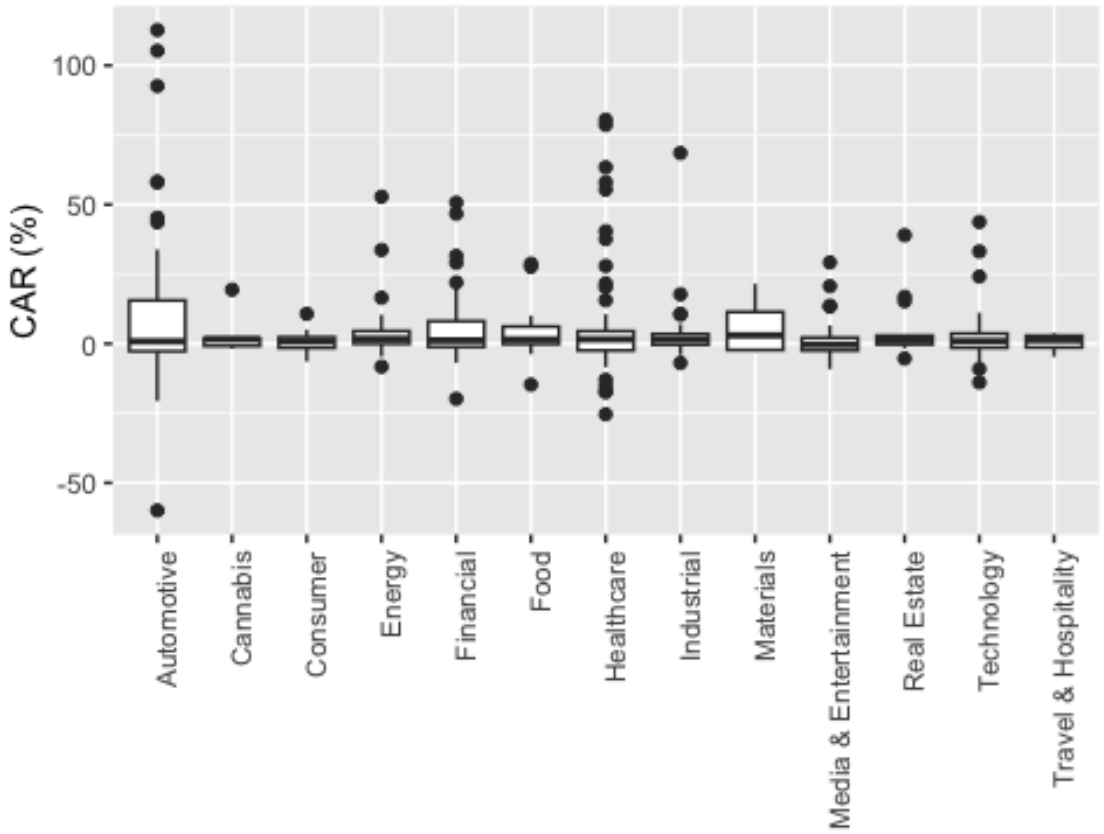


The descriptive statistics can be extended to each sector separately as seen below in **Table 3** and **Figure 7.** It's interesting to note that the Automotive sector has both the highest (112.7%) and the lowest (-59.92%) returns.

Table 3: CAR descriptive statistics per sector

	Min	*1st Qu.*	*Median*	*3rd Qu.*	*Mean*	*Max*
Automotive	-0.5992	-0.026825	0.00850	0.155500	0.096451667	1.1270
Cannabis	-0.0180	-0.007700	0.01640	0.019500	0.040860000	0.1941
Consumer	-0.0640	-0.014700	0.00870	0.023500	0.003972000	0.1075
Energy	-0.0825	-0.000400	0.01750	0.045500	0.052634483	0.5284
Financial	-0.1980	-0.011150	0.01200	0.081000	0.057210526	0.5069
Food	-0.1470	-0.001350	0.01500	0.061675	0.041125000	0.2874
Healthcare	-0.2535	-0.024150	0.01590	0.045250	0.051369231	0.8050
Industrial	-0.0692	-0.003400	0.01520	0.034625	0.034606818	0.6850
Materials	-0.0277	-0.022375	0.02995	0.114200	0.061875000	0.2153
Media & Entertainment	-0.0912	-0.024350	-0.00330	0.021775	0.018800000	0.2921
Real Estate	-0.0532	-0.002550	0.01230	0.028800	0.051466667	0.3900
Technology	-0.1390	-0.014300	0.00950	0.036550	0.019598837	0.4375
Travel & Hospitality	-0.0472	-0.013350	0.01305	0.028600	0.004891667	0.0381

Figure 7: CAR boxplots per sector



4.1.2. Normality test

In order to perform a one-way ANOVA, the CARs have to be normally distributed within each sector. This assumption is checked with the Shapiro-Wilk test, which tests against the null hypothesis that the CAR values are normally distributed in each sector.

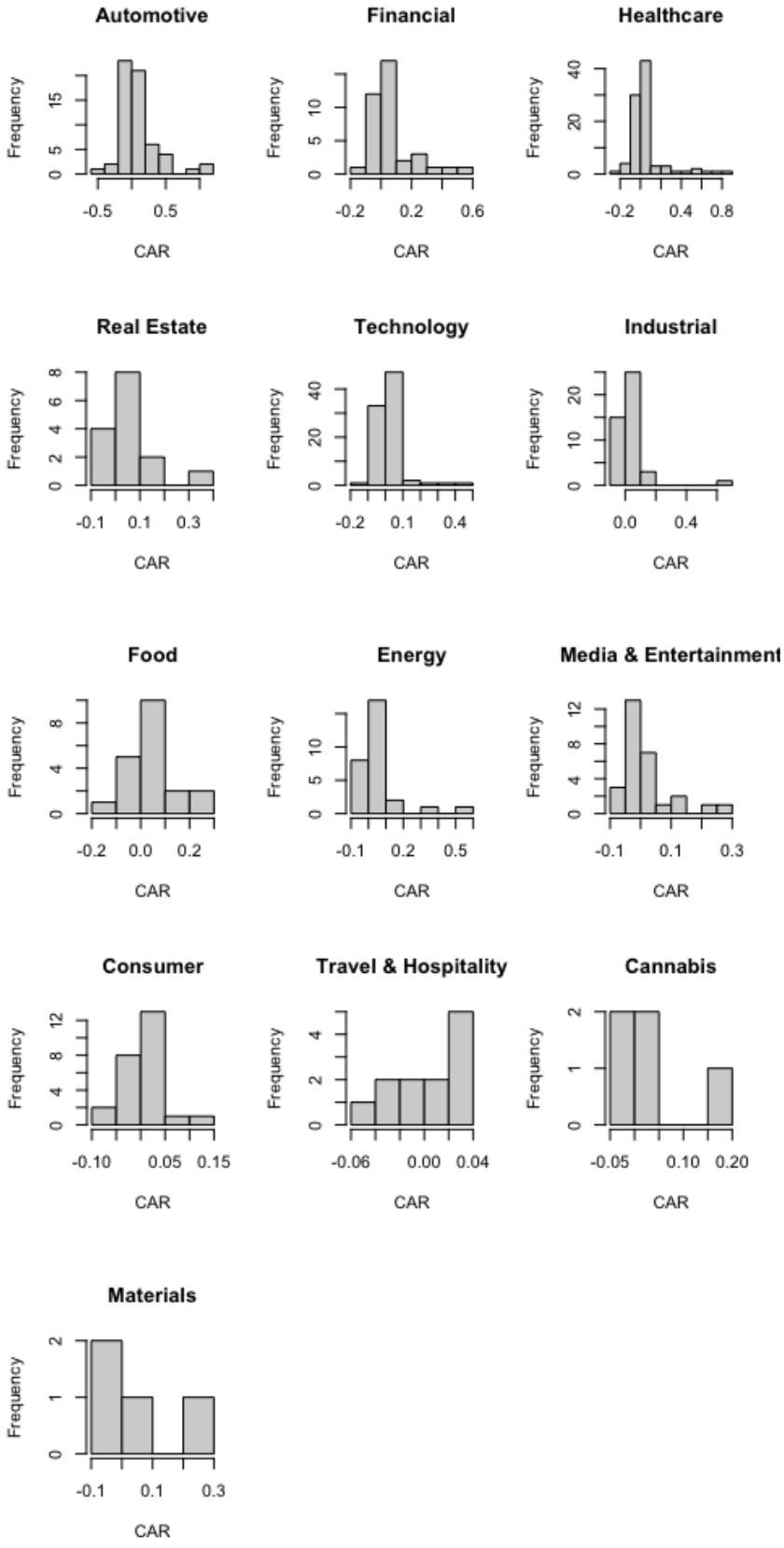
Table 4: Shapiro-Wilk test

Sector	*W statistic*	*p_value*
Automotive	0.7809297	0.0000000465871
Financial	0.8161431	0.00002267295
Healthcare	0.6622205	0.0000000000003699089
Real Estate	0.6858084	0.0001759398
Technology	0.7143777	0.00000000001214502
Industrial	0.4625011	0.00000000001742138
Food	0.8363799	0.003178365
Energy	0.6448985	0.0000003733628
Media & Entertainment	0.8079747	0.000148033
Consumer	0.9566869	0.3524484
Travel & Hospitality	0.9119144	0.225735
Cannabis	0.7169581	0.01428855
Materials	0.8728696	0.309076

If we consider a significance level α of 5%, we can conclude the following based on the p-values of **Table 4**: We have enough evidence to reject the null hypothesis which states that the CAR values are normally distributed because the CAR values are not normally distributed for at least one of the sectors. In fact, we have enough evidence to reject the normality for all sectors except Consumer, Travel & Hospitality and Materials which have a p-value higher than 5%. For the last two, there are respectively 12 and 4 observations. These small number of observations in the sample can explain the lack of evidence to reject the normality.

These results can be illustrated with histograms representing the distribution of CAR values. We can see on **Figure 8** that indeed, the data does not follow a normal distribution for most sectors.

Figure 8: CAR histograms per sector



4.1.3. Homogeneity of Variance test

In order to perform a one-way ANOVA, the variance of the residuals of the CARs must be equal across all sectors. This assumption is checked with the Levene's test which tests against the null hypothesis that the variance of residuals of the CARs are equal across all sectors.

Table 5: Levene's test

Df	*F Statistic*	*p_value*
12	3.634	0.00003253

If we consider a significance level α of 5%, we can conclude the following based on the p-value of **Table 5**: We have enough evidence to reject the null hypothesis which states that the variance of residuals of the CARs are equal across all sectors. In fact, the p-value is so small that we can reject the homogeneity of the variance for all significance levels.

4.1.4. Kruskal-Wallis test

Since the assumptions of the one-way ANOVA are not respected, I perform a Kruskal-Wallis test which compares the medians of the different sectors (unlike the ANOVA which compares the means).

Table 6: Kruskal-Wallis test

Df	*H statistic*	*p_value*
12	7.6883	0.809

If we consider a significance level α of 5%, we can conclude the following based on the p-value of **Table 6**: There is not enough evidence to reject the null hypothesis which states that there is no significant difference in the medians of the CARs across the different sectors. The medians can be visualized with the boxplots in **Figure 7**.

Let us look back at my first hypothesis which is the following:

H_0 *: SPAC returns do not significantly differ across the different sectors in the short-term*

H_1 *: SPAC returns significantly differ across the different sectors in the short-term*

We can conclude that there is not enough evidence to reject H_0 with a significance level of 5%. Therefore, we can conclude that the SPAC returns do not significantly differ across the different sectors in the short-term.

4.2. Long-term performance analysis

4.2.1. Descriptive statistics

The sector breakdown of my sample of 361 deals is shown in **Table 7**. There is no need to further analyze this table because it's only a sub-sample of the original sample of 457 deals.

Table 7: Sector breakdown

Sector	*Count*	*Percentage*
Automotive	53	14,68%
Cannabis	4	1,11%
Consumer	20	5,54%
Energy	25	6,93%
Financial	33	9,14%
Food	14	3,88%
Healthcare	65	18,01%
Industrial	34	9,42%
Materials	4	1,11%
Media & Entertainment	23	6,37%
Real Estate	13	3,60%
Technology	65	18,01%
Travel & Hospitality	8	2,22%
Total	*361*	*100%*

Looking at the descriptive statistics of BHARs (see **Table 8**), we can see that on average, stocks experience a negative one-year BHAR of 41.58%. This negative result is in line with prior studies which all found negative BHARs. For example, Dimitrova (2017) had found a one-year BHAR of 41.40%, Kolb and Tykvová (2016) a one-year BHAR of -46% and Kiesel et al. (2022) a one-year BHAR of -18.53%, all using the Russel 2000 index as their benchmark. Gahng et al. (2021), on the other hand, had found a one-year BHAR of -30.7% using the CRSP market index as their benchmark.

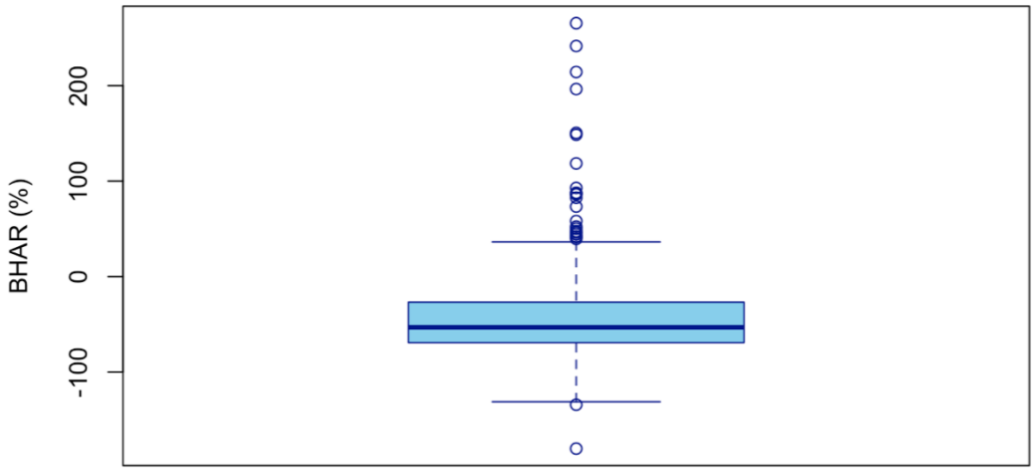
Furthermore, if we look at the distribution of the data (more particularly at the 1st and 3rd quantiles), we can see that 50% of the companies experience a BHAR between -69.34% and -26.87%.

Moreover, the boxplot on **Figure 9** shows the presence of outliers which tend to be on the positive side as well.

Table 8: BHAR descriptive statistics

Min.	*1st Qu.*	*Median*	*Mean*	*3rd Qu.*	*Max.*
-1,8026	-0.6934	-0.5321	-0.4158	-0.2687	2,6544

Figure 9: BHAR boxplot

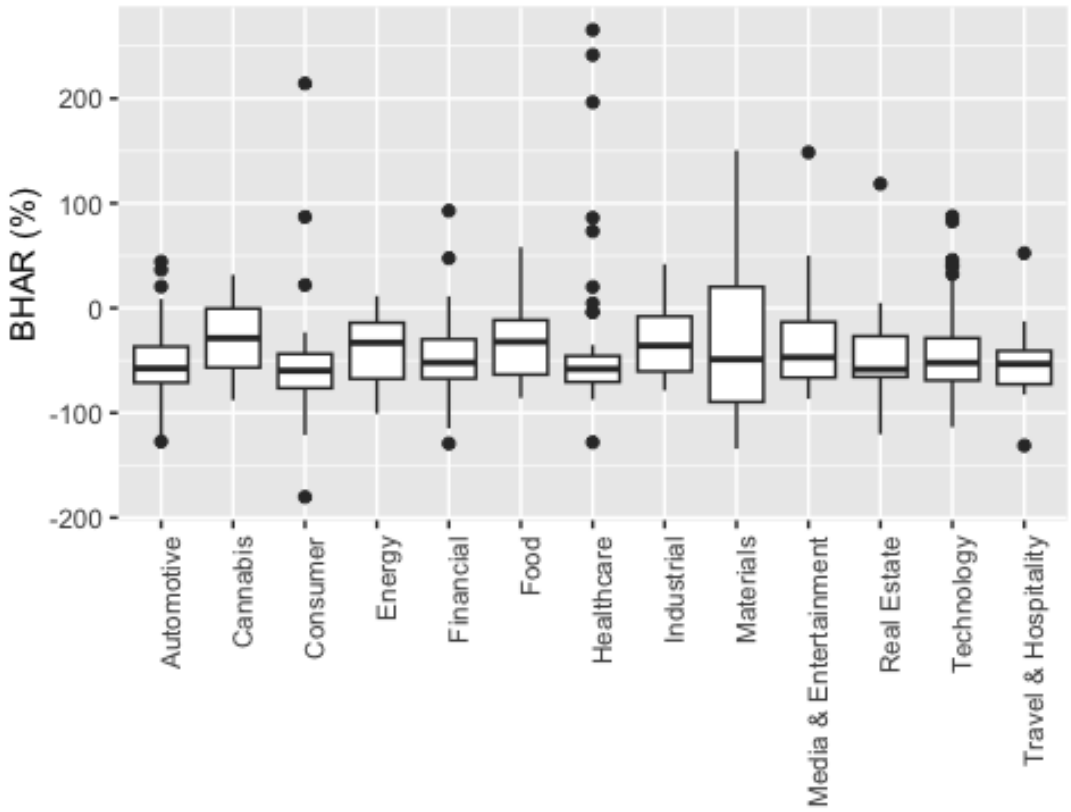


The descriptive statistics can be extended to each sector separately as seen below in **Table 9** and **Figure 10.** The lowest return is observed in the Consumer sector, where a stock experienced a one-year BHAR of -180.26%. The highest return, on the other hand, is observed in the Healthcare sector, where a stock experienced a return of 265.44%. The mean one-year BHAR for the latter is -40.41%, which is in line with the one-year BHAR of -29.46% found by Gigante and Notarnicola (2021) in a previous study.

Table 9: BHAR descriptive statistics per sector

	Min	*1st Qu.*	*Median*	*3rd Qu.*	*Mean*	*Max*
Automotive	-1.2743	-0.711500	-0.57570	-0.368100	-0.5205981	0.4430
Cannabis	-0.8793	-0.567675	-0.28775	-0.004525	-0.2844500	0.3170
Consumer	-1.8026	-0.764275	-0.59755	-0.437225	-0.4537750	2.1433
Energy	-1.0077	-0.674600	-0.33090	-0.140700	-0.4167240	0.1153
Financial	-1.2926	-0.672400	-0.52090	-0.298100	-0.4529242	0.9285
Food	-0.8584	-0.634750	-0.32220	-0.115375	-0.3053643	0.5816
Healthcare	-1.2811	-0.705700	-0.58140	-0.457300	-0.4041477	2.6544
Industrial	-0.7870	-0.604525	-0.35875	-0.080150	-0.3173647	0.4192
Materials	-1.3426	-0.895675	-0.48970	0.201825	-0.2041500	1.5054
Media & Entertainment	-0.8667	-0.663800	-0.47080	-0.133000	-0.3010261	1.4859
Real Estate	-1.2042	-0.657600	-0.58560	-0.268800	-0.4098308	1.1856
Technology	-1.1368	-0.690600	-0.52270	-0.287200	-0.4387354	0.8777
Travel & Hospitality	-1.3121	-0.726775	-0.53330	-0.408850	-0.5004750	0.5240

Figure 10: BHAR boxplots per sector



4.2.2. Normality test

In order to perform a one-way ANOVA, the BHARs have to be normally distributed within each sector. This assumption is checked with the Shapiro-Wilk test, which tests the null hypothesis that the BHAR values are normally distributed in each sector.

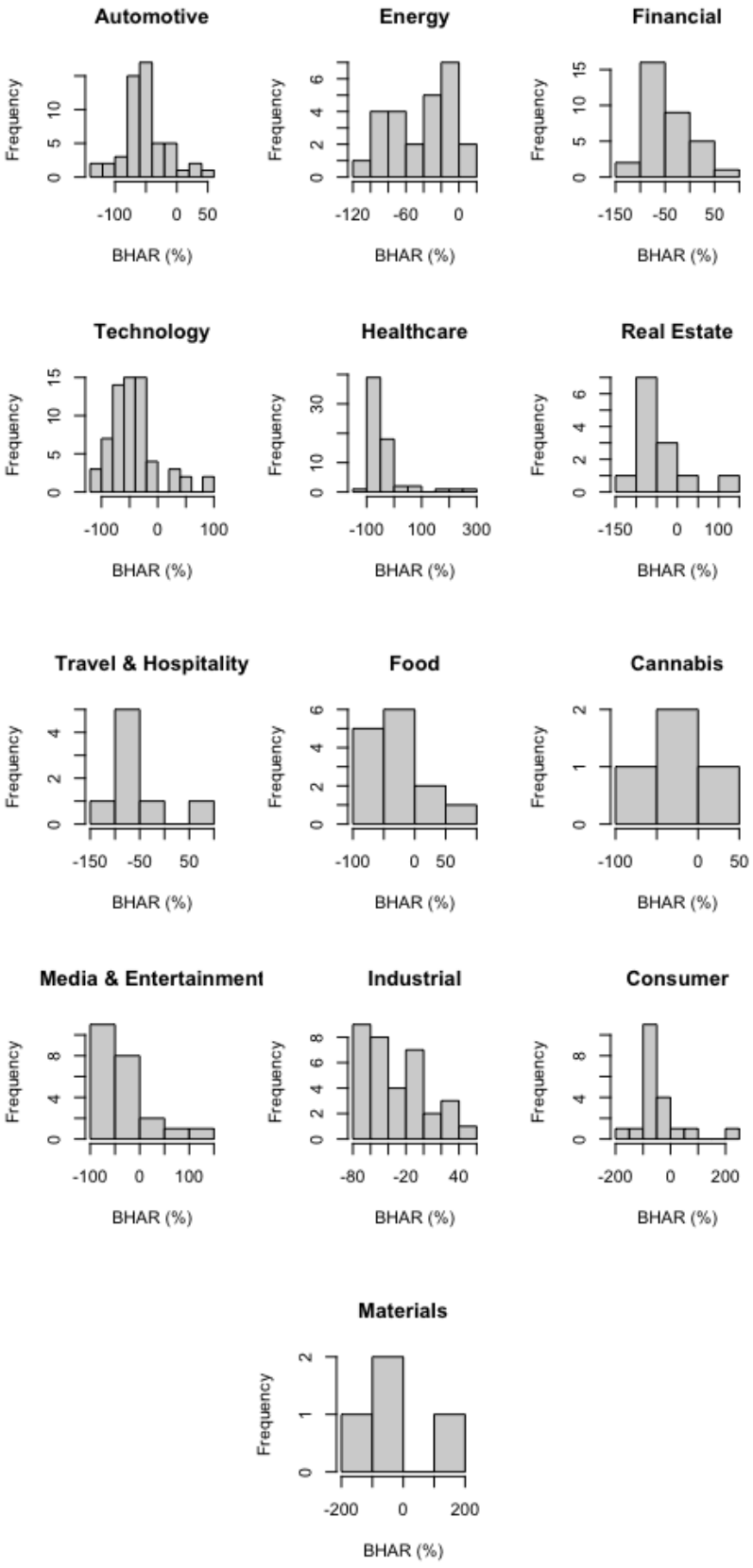
Table 10: Shapiro-Wilk test

Sector	*W*	*p_value*
Automotive	0.9588422	0.06529914
Energy	0.9420277	0.1648703
Financial	0.9106469	0.01017867
Technology	0.9135349	0.0002410951
Healthcare	0.5799816	0.000000000002371778
Real Estate	0.8133780	0.009872051
Travel & Hospitality	0.9388436	0.5997396
Food	0.9475494	0.5233473
Cannabis	0.9975664	0.9920349
Media & Entertainment	0.8262308	0.001039169
Industrial	0.9330324	0.03836391
Consumer	0.7999819	0.0008634137
Materials	0.9245274	0.5626199

If we consider a significance level α of 5%, we can conclude the following based on the p-values of **Table 10**: We have enough evidence to reject the null hypothesis which states that the BHAR values are normally distributed because the BHAR values are not normally distributed for at least one of the sectors. We can reject the normality for sectors for which the p-value is lower than 5%.

These results can be illustrated with histograms representing the distribution of BHAR values. We can see on **Figure 11** that indeed, the data does not follow a normal distribution for some sectors. The Cannabis sector, on the other hand, follows a distribution which is almost perfectly normal and its p-value of 0.99 (extremely close to 1) proves it.

Figure 11: BHAR histograms per sector



4.2.3. Homogeneity of Variance test

In order to perform a one-way ANOVA, the variance of the residuals of the BHARs must be equal across all sectors. This assumption is checked with the Levene's test which tests the null hypothesis that the variance of residuals of the BHARs are equal across all sectors.

Table 11: Levene's test

Df	*F Statistic*	*p_value*
12	0.912	0.535

If we consider a significance level α of 5%, we can conclude the following based on the p-value of **Table 11**: We don't have enough evidence to reject the null hypothesis which states that the variance of residuals of the BHARs are equal across all sectors. Indeed, the p-value is higher than 5%. Therefore, we can conclude that the homogeneity of variances is respected.

4.2.4. Kruskal-Wallis test

Since the assumptions of the one-way ANOVA are not respected, I perform a Kruskal-Wallis test which compares the medians of the different sectors (unlike the ANOVA which compares the means).

Table 12: Kruskal-Wallis test

Df	*H statistic*	*p_value*
12	13.298	0.3478

If we consider a significance level α of 5%, we can conclude the following based on the p-value of **Table 12**: There is not enough evidence to reject the null hypothesis which states that there is no significant difference in the medians of the BHARs across the different sectors. The medians can be visualized in the boxplots in **Figure 10**.

Let us look back at my second hypothesis which is the following:

H_0 *: SPAC returns do not significantly differ across the different sectors in the long-term*

H_2 *: SPAC returns significantly differ across the different sectors in the long-term*

We can conclude that there is not enough evidence to reject H_0 with a significance level of 5%. Therefore, we can conclude that the SPAC returns do not significantly differ across the different sectors in the long-term.

5. Conclusion

This study tried to answer the following research question **"How do the short- and long-term performance of SPACs differ across the different sectors in which the target companies operate?"** based on an initial sample of 457 U.S listed SPACs that completed an M&A operation between July 2016 and April 2023.

For both the short-term and the long-term analysis, the results I found are similar to those found in previous studies. My results show an average cumulative abnormal return (CAR) of 4.4% for the event window [-1:3] around the announcement date of the merger. They also show an average buy-and-hold abnormal return (BHAR) of -41.58% over a period of one year starting from the closing date of the merger. After performing a Kruskal-Wallis test for both the short-term and long-term performance, I found no evidence supporting a difference in performance across the different sectors. Indeed, the p-values of 0.81 (short-term) and 0.35 (long-term) are both way above my significance level of 5%.

This lack of significant difference across sectors suggests that the sectoral variations may not be a good predictor of SPAC performance and that the performance is rather affected by common factors that transcend sector boundaries, such as the time between the IPO date and the announcement date (Kiesel et al., 2022), or the percentage of blockholders' ownership (Dimitrova, 2017).

Despite the insights gained from this research, there are some limitations that need to be acknowledged because of their potential impact on my findings. One limitation of my research is the underrepresentation of some sectors in my sample. Out of my sample of 457 SPAC deals, only 4 were in the Cannabis sector, 4 in the Materials sector and 12 in the Travel & Hospitality sector. On the other hand, some sectors were overrepresented such as the Healthcare sector with 91 deals. My results would have been more accurate and reliable if all the sectors were equally represented in my sample. A second limitation of my research is that I computed the BHAR over a 1-year period, which may not be long enough. For this long-term analysis, I used a sub-sample of 361 deals out of my original sample of 457 deals. However, if I had performed the analysis over the 2-year period, my sample would be reduced to 152 deals, which would not have been sufficient to perform an accurate analysis. What makes me think

that the SPACs performance could differ across the difference sectors is the study led by Gigante and Notarnicola in 2021. They found that on average, SPACs in the Healthcare sector underperform the Russel 2000 index by "only" 2.14% in the 2-year period following the closing of the merger, whereas others authors found an overall average underperformance of SPACs which is way larger than 2.14% for the same time frame.
The third and final limitation of this thesis is that the performance was only studied for common stocks and not for the warrants, which may have exhibited different results.

When embarking on this thesis, I had two primary objectives: first, I wanted to help investors make better-informed decisions. Secondly, I wanted to address a gap in the current literature. I am reluctant as to whether my first objective was met because there are no significant performance differences across the different sectors. On average, the long-term buy-and-hold abnormal returns (BHARs) are negative for all sectors. Consequently, I couldn't advise investors to invest in SPACs in a particular sector. However, as regards the short-term performance, on average, the cumulative abnormal returns (CARs) seem to be positive for all sectors. This suggests that investors who engage in short-term trading shouldn't "fear" any particular sector.

Further research could explore the buy-and-hold abnormal returns over a 2-year period (or more) to ascertain whether there are still no differences in performance across the different sectors. Further research could also explore whether the results I found are specific to SPAC mergers, or if they also apply to "traditional" mergers and acquisitions.

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7. Appendices

Appendix 1: Logit regression – probability of approval

Table 3
Logit regression analysis results. The sample covers 139 SPACs. We do not consider those with dual classes for equity and warrants. We run the logit regressions so that the dependent variable equals 1 if the acquisition is approved, and 0 if the SPAC is liquidated. In specification 1, we do not control for year fixed effects; in specification 2, we do. Specification 1′ and 2′ show the marginal effects. As a robustness check, we run probit regressions, and find that the results remain qualitatively stable. This table is available upon request from the authors. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Specification 1	Specification 2	Specification 1′	Specification 2′
(1) Constant	9.5844	3.7208		
	SPAC structure			
(2) # of Managers	0.1939	0.1781	0.02331	0.0158
(3) # of Sponsors	−0.7880*	−1.0011*	−0.0947	−0.0888
Average team age	−0.1000*	−0.1256*	−0.0120	−0.0111
(5) Instrumentalized threshold	−6.7435	−10.7617	−0.8107	−0.9543
(6) Manager incentive structure (Herfindahl)	1.155	0.7046	0.1389	0.0625
(7) SPAC size	−0.6371	−0.3674	−0.0766	−0.0326
(8) Sponsors promote	3.5848	5.4329	0.4309	0.4818
(9) Trust value	1.2845*	1.2116	0.1544	0.1074
(10) Trust Value × Days to Announcement	−0.0026*	−0.0031*	−0.0003	−0.0003
	IPO process			
(11) # of Underwriters	−0.5439*	−0.7973*	−0.0654	−0.0707
(12) Average reputation underwriter	0.1452***	0.1998**	0.0175	0.0177
(13) Herfindahl underwriter	−1.3478	−1.5450	−0.1620	−0.1370
(14) Highest reputation underwriter	−0.1225*	−0.1540	−0.0147	−0.0137
(15) Highest underwriter reputation × volume	0.6771	0.8655	0.0814	0.0768
	Ownership structure			
(16) Pre-target found % hedge fund and % private equity	−0.0370*	−0.0394	−0.0045	−0.0035
(17) Pre-target found % Manager	0.0563	0.0608	0.0068	0.0054
(18) Pre-proxy vote % hedge fund and % private equity	−0.0139	−0.0281	−0.0017	−0.0025
(19) Pre-proxy vote % Manager	0.2060*	0.2681*	0.0248	0.0238
	Operations and performance			
(20) Announcement 3-Day CAR	−1.5728	−2.7536	−0.1891	−0.2442
(21) Days to announcement	0.0062	0.0073	0.0007	0.0006
(22) Days between announcement and proxy voting	−0.0156***	−0.0177**	−0.0019	−0.0016
(23) Market return 3-months before proxy voting	9.5844***	10.4550**	1.1322	0.9271
(24) IPO 3-Day CAR	2.9131	3.2405	0.3502	0.2874
Year fixed effects	NO	YES		
Mc Fadden R2	43.92%	46.61%		
LR-ratio	63.02	66.88		
Number of Observations	112	112		

Appendix 2: Common stock returns around the merger announcement day

Table IV:
Returns for SPACs common stock holders around the merger announcement day

Panel A presents abnormal returns on the announcement day calculated by the market model. In Panel B cumulative abnormal returns up to seven days are reported.. Panel C is graphical presentation of the results obtained in Panels A and B.

Panel A: SPAC Stock Returns around the merger announcement date:

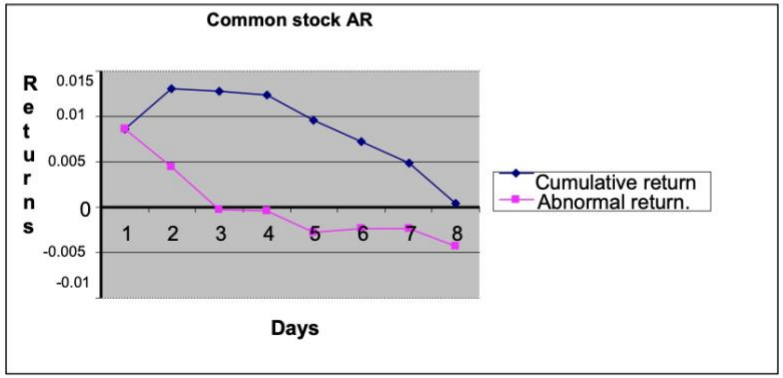
Announcement date stock abnormal returns:

Variable	Mean	Std.Dev	Min	Max
Return	0.0105292	0.0309743	-0.0818182	0.1523178
Alpha	0.0015893	0.0053485	-0.0065305	0.0318480
Beta	0.1491343	1.3783496	-5.5826787	10.8151338
Abnormal return	0.0085756	0.0310120	-0.0770958	0.1521550

Panel B: Cumulative abnormal returns (1,2,3,4,5,6 and 7 days after announcement date)

Variable	Mean	Std.Dev	Min	Max
Car 1	0.0130111	0.0526251	-0.0872362	0.3570612
Car 2	0.0127385	0.0609731	-0.2296609	0.3489474
Car 3	0.0123245	0.0679592	-0.2549082	0.4174220
Car 4	0.0096026	0.0722733	-0.3031013	0.3743839
Car 5	0.0072508	0.0739745	-0.3857526	0.3076525
Car 6	0.0048525	0.0757266	-0.4282087	0.2595993
Car 7	0.0004777	0.0920902	-0.5552372	0.3082256

Panel C: Graphical representation of announcement and cumulative returns:



Appendix 3: Unit returns around the merger announcement day

Table V:

Returns for SPAC unit holders around the merger announcement day

Panel A presents abnormal returns on the announcement day calculated by the market model. In Panel B cumulative abnormal returns up to seven days are reported. Panel C is a graphical presentation of results obtained in Panels A and B.

Panel A: SPAC Units Returns around the merger announcement date:

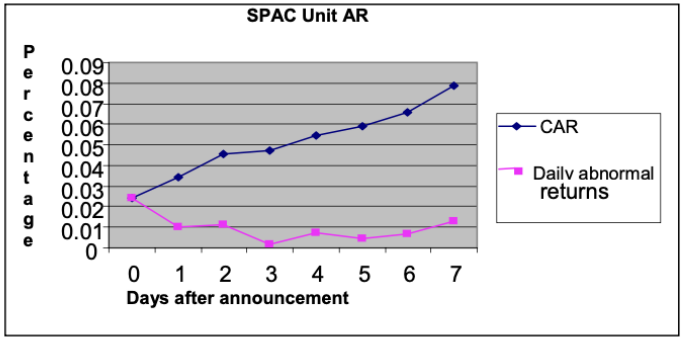
Announcement date unit abnormal returns:

Variable	Mean	Std.Dev	Min	Max
Return	0.0201213	0.0369744	-0.0816062	0.1606154
Alpha	-0.0061846	0.0646209	-0.4519244	0.0202665
Beta	0.2214427	1.4714179	-5.7847016	7.2536888
Abnormal return	0.0242951	0.0584504	-0.0730680	0.3506924

Panel B: Cumulative abnormal returns (1, 2, 3, 4, 5, 6 and 7 days after announcement date)

Variable	Mean	Std.Dev	Min	Max
Car 1	0.0343930	0.1214649	-0.1104080	0.8063082
Car 2	0.0456363	0.2035615	-0.1708533	1.3982602
Car 3	0.0472249	0.2629527	-0.2089938	1.8181650
Car 4	0.0544885	0.3196409	-0.2418225	2.2132872
Car 5	0.0589535	0.3926259	-0.1794673	2.7294429
Car 6	0.0658968	0.4531131	-0.2005421	3.1477479
Car 7	0.0788217	0.5188870	-0.1777621	3.6114892

Panel C: Graphical representation of announcement and cumulative returns to unit holders



Appendix 4: Warrants returns around the merger announcement day

Table VI:
Returns for SPAC warrant holders around the merger announcement

Panel A presents abnormal returns on the announcement day calculated by the market model. In Panel B cumulative abnormal returns up to seven days are reported. Panel C is graphical presentation of the results obtained in Panels A and B.

Panel A: SPAC Warrants Returns around the merger announcement date:

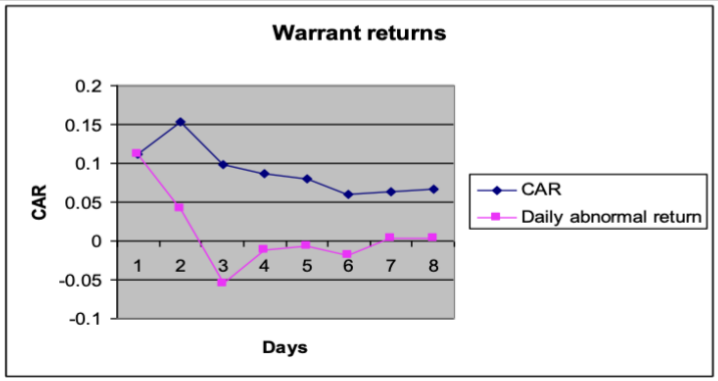
Announcement date unit abnormal returns:

Variable	Mean	Std.Dev	Min	Max
Return	0.1235652	0.1988161	-0.1304348	0.6721311
Alpha	0.0027198	0.0141125	-0.0151523	0.0553368
Beta	1.5358577	4.1435663	-1.2398772	15.8324139
Abnormal return	0.1049899	0.2025111	-0.1203337	0.6824944

Panel B: Cumulative abnormal returns (1, 2, 3,4,5,6 and 7 days after announcement date)

Variable	Mean	Std.Dev	Min	Max
Car 1	0.1539946	0.3590699	-0.7523790	0.9322721
Car 2	0.0983182	0.3614209	-0.7523790	0.9258369
Car 3	0.0866005	0.3478715	-0.4115571	0.9321125
Car 4	0.0795737	0.3825961	-0.4882695	0.8281739
Car 5	0.0604376	0.3701326	-0.4652856	0.8281739
Car 6	0.0629939	0.3292217	-0.4698862	0.7278656
Car 7	0.0660083	0.4048455	-0.5371966	0.9335521

Panel C: Graphical representation of returns to warrant holders :



Appendix 5: Long term stock performance using BHARs: SPACs vs IPOs

Buy and hold abnormal returns.

				Whole sample					Matched sample				
	SPAC BHARs			IPO BHARs			WMW Test	*t*-Test	IPO BHARs			WMW Test	*t*-Test
	Median	Mean	*N*	Median	Mean	*N*	*z*-Value	*t*-Value	Median	Mean	*N*	*z*-Value	*t*-Value
6 months													
Market adjusted	−0.28***	−0.29***	109	−0.07***	−0.06***	1112	5.89***	6.48***	−0.13***	−0.06	113	3.92***	4.50***
Size & btm adjusted	−0.30***	−0.32***	92	−0.10***	−0.07***	1046	5.56***	5.57***	−0.16***	−0.09*	104	3.49***	3.96***
Industry adjusted	−0.31***	−0.34***	109	−0.10***	−0.08***	1100	6.36***	6.66***	−0.17***	−0.09*	111	4.04***	4.64***
12 months													
Market adjusted	−0.46***	−0.46***	109	−0.15***	−0.08***	1082	7.40***	8.29***	−0.17***	−0.12**	110	4.75***	4.96***
Size & btm adjusted	−0.58***	−0.57***	92	−0.16***	0.10***	1021	7.53***	7.59***	−0.18***	−0.14**	101	4.88***	5.14***
Industry adjusted	−0.51***	−0.57***	109	−0.18***	−0.13***	1070	7.91***	8.59***	−0.23***	−0.15*	108	5.13***	5.59***
24 months													
Market adjusted	−0.56***	−0.59***	104	−0.30***	−0.21***	969	6.22***	7.11***	−0.35***	−0.34***	108	3.36***	3.23***
Size & btm adjusted	−0.92***	−0.96***	87	−0.39***	−0.30***	914	7.27***	6.88***	−0.43***	−0.43***	99	4.71***	4.77***
Industry adjusted	−0.88***	−0.85***	104	−0.44***	−0.36***	958	7.01***	7.17***	−0.54***	−0.45***	106	4.29***	4.34***
60 months													
Market adjusted	−0.90***	−1.02***	88	−0.58***	−0.20	704	7.47***	4.01***	−0.69***	−0.37*	84	4.87***	3.82***
Size & btm adjusted	−2.07***	−2.48***	76	−1.05***	−0.79*	666	9.14***	5.88***	−1.29***	−1.01**	78	6.01***	5.56***
Industry adjusted	−1.72***	−1.80***	88	−1.25***	−0.98**	695	5.62***	3.75***	−1.25***	−1.13***	83	3.79***	3.58***

This table presents median and mean (log) BHARs of SPAC acquisitions and IPOs executed in the period 01/2004–12/2015 over 6, 12, 24 and 60 months and their significances. It also shows the values and significances of the Wilcoxon–Mann–Whitney (WMW) test and *t*-test we run to compare BHARs between SPAC acquisitions and all as well as matched IPOs. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Appendix 6: Long term stock performance using five-factor model analysis: SPACs vs IPOs

Factor regressions — market portfolio.

	All SPACs				All IPOs				Matched IPOs			
	(1) 6 months	(2) 12 months	(3) 24 months	(4) 60 months	(5) 6 months	(6) 12 months	(7) 24 months	(8) 60 months	(9) 6 months	(10) 12 months	(11) 24 months	(12) 60 months
Intercept (α)	−0.0510***	−0.0533***	−0.0521***	−0.0416***	−0.0116***	−0.0114***	−0.0120***	−0.0134***	−0.0071	−0.0102*	−0.0169***	−0.0195***
	(0.0096)	(0.0076)	(0.0067)	(0.0056)	(0.0035)	(0.0028)	(0.0027)	(0.0024)	(0.0071)	(0.0054)	(0.0051)	(0.0044)
RMRF	1.3087***	0.8408***	0.7596***	1.0636***	0.9823***	1.0016***	1.1291***	1.1523***	0.9892***	0.8990***	1.2216***	1.2840***
	(0.2471)	(0.1999)	(0.1749)	(0.1479)	(0.0908)	(0.0746)	(0.0710)	(0.0624)	(0.2003)	(0.1444)	(0.1333)	(0.1160)
SMB	0.3655	0.1291	−0.0828	−0.1603	0.8377***	0.8407***	0.7723***	0.8164***	0.9201***	0.8999***	0.7117***	0.6651***
	(0.4241)	(0.3384)	(0.2950)	(0.2495)	(0.1532)	(0.1258)	(0.1197)	(0.1052)	(0.3204)	(0.2419)	(0.2249)	(0.1956)
HML	−0.2819	−0.0858	−0.1562	−0.2774	−0.5898***	−0.4749***	−0.5020***	−0.1960*	−0.4745	−0.5642**	−0.0503	0.0449
	(0.4160)	(0.3345)	(0.2933)	(0.2481)	(0.1523)	(0.1251)	(0.1191)	(0.1046)	(0.3477)	(0.2415)	(0.2236)	(0.1945)
MOM	0.1516	−0.1551	−0.1471	−0.2561**	0.1028	−0.0108	−0.1467**	−0.1728***	0.1365	0.0126	−0.0899	−0.2357**
	(0.2085)	(0.1683)	(0.1474)	(0.1246)	(0.0765)	(0.0629)	(0.0598)	(0.0526)	(0.2016)	(0.1530)	(0.1123)	(0.0977)
LIQ	−0.0175	0.1535	0.1095	0.1072	0.1595***	0.1444***	0.1145***	0.1003***	0.2066*	0.1209	0.1146	0.0231
	(0.1366)	(0.1096)	(0.0960)	(0.0812)	(0.0499)	(0.0409)	(0.0390)	(0.0342)	(0.1081)	(0.0778)	(0.0732)	(0.0637)
Adjusted *R*-sq	0.23	0.19	0.17	0.38	0.66	0.75	0.80	0.85	0.32	0.41	0.57	0.66

This table presents calendar-time analysis of SPAC acquisitions and IPOs that were executed in the period 01/2004–12/2015 using a five-factor model. The dependent variable is the monthly equal-weighted portfolio excess return for SPAC acquisitions in Specifications (1) to (4), IPOs (whole sample) in Specifications (5) to (8) or IPOs (matched sample) in Specifications (9) to (12) for calendar-time periods of 6, 12, 24 and 60 months. Independent variables include the monthly market premium on all NYSE/Amex/Nasdaq firms (RMRF), the difference between the monthly return on small firms and large firms (SMB), the difference between the monthly return on a portfolio of high book-to-market stocks and low book-to-market stocks (HML), the difference between the return on high prior return portfolios and low prior return portfolios (MOM) and the difference between the return of low-turnover portfolios and high-turnover portfolios (LIQ). Standard errors are provided in parentheses. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Appendix 7: Long term stock performance of SPACs using alternative benchmarks.

Table 7.
Long-term stock performance of SPACs using alternative benchmarks.

In Panel A, the benchmark is the Russell 2000 index. In Panel B, the benchmark is the industry- and size-matched non-acquisitions. In Panel C, the benchmark is all companies, apart from special purpose acquisition companies (SPACs) that became public in the year of the SPAC initial public offering (IPO) and all companies that became public in the year of the SPAC acquisition. Returns are computed assuming a buy-and-hold strategy. The *t*-tests of differences in means and nonparametric Wilcoxon signed rank tests of differences in medians are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	SPACs				Benchmark				Difference		
Respective period	Mean	Median	Std. Dev.	Skew	Mean	Median	Std. Dev.	Skew	Mean	Median	*N*
Panel A: Russell 2000 index benchmark											
Announcement: Effective date	0.044	-0.002	0.297	1.838	0.022	0.047	0.147	-0.719	0.022	-0.049	71
Announcement: 1 year post-merger	-0.415	-0.584	0.561	1.596	-0.001	-0.033	0.284	0.046	-0.414***	-0.551***	71
Effective date: 3 months post-merger	-0.095	-0.145	0.371	0.965	0.005	0.034	0.135	-1.064	-0.100***	-0.179***	71
Effective date: 6 months post-merger	-0.198	-0.242	0.400	1.022	0.003	0.025	0.202	-0.267	-0.201***	-0.267***	71
Effective date: 9 months post-merger	-0.338	-0.371	0.359	0.287	-0.016	0.014	0.222	0.070	-0.322***	-0.385***	71
Effective date: 1 year post-merger	-0.410	-0.589	0.563	2.462	-0.013	-0.052	0.270	0.362	-0.397***	-0.537***	71
Effective date: 2 years post-merger	-0.563	-0.722	0.508	2.633	0.014	-0.064	0.366	0.911	-0.577***	-0.658***	71
Panel B: Industry- and size-matched firms benchmark											
Announcement: Effective date	0.058	0.006	0.298	1.873	-0.009	-0.020	0.487	-0.211	0.067	0.026	67
Announcement: 1 year post-merger	-0.440	-0.600	0.496	1.083	-0.050	-0.201	0.851	1.291	-0.390***	-0.399***	68
Effective date: 3 months post-merger	-0.091	-0.129	0.375	0.958	0.019	-0.019	0.551	3.395	-0.110	-0.110*	68
Effective date: 6 months post-merger	-0.205	-0.260	0.406	1.063	0.227	-0.050	1.628	6.743	-0.432**	-0.210***	68
Effective date: 9 months post-merger	-0.344	-0.385	0.364	0.323	0.037	-0.055	0.527	1.140	-0.380***	-0.330***	68
Effective date: 1 year post-merger	-0.447	-0.580	0.445	1.043	0.198	-0.250	1.789	4.903	-0.645***	-0.330***	68
Effective date: 2 years post-merger	-0.542	-0.707	0.524	2.627	0.029	-0.151	0.885	2.229	-0.571***	-0.556***	63
Panel C: Other IPOs benchmark											
IPO date: 3 years post-IPO	-0.417	-0.650	0.735	1.384	-0.140	-0.149	0.200	0.026	-0.277***	-0.501***	70
IPO date: 4 years post-IPO	-0.519	-0.675	0.548	2.062	0.085	-0.169	0.321	0.163	-0.604***	-0.506***	70
IPO date: 5 years post-IPO	-0.586	-0.722	0.488	1.675	-0.019	-0.125	0.234	0.524	-0.567***	-0.597***	67
Effective date: 3 months post-merger	-0.093	-0.129	0.373	0.946	-0.042	0.006	0.073	-0.405	-0.051	-0.135	70
Effective date: 6 months post-merger	-0.197	-0.248	0.403	1.012	-0.106	-0.161	0.102	0.406	-0.091*	-0.087***	70
Effective date: 9 months post-merger	-0.340	-0.375	0.361	0.299	-0.170	-0.282	0.154	0.501	-0.170***	-0.093***	70
Effective date: 1 year post-merger	-0.432	-0.564	0.449	0.749	-0.194	-0.199	0.181	0.207	-0.238***	-0.365***	69
Effective date: 2 years post-merger	-0.563	-0.722	0.514	2.613	-0.256	-0.075	0.263	0.091	-0.307***	-0.647***	69

Appendix 8: Number of SPACs and annualized returns per year

A. Based on year of SPAC IPO

Year	Number of SPACs	Annualized returns
2010	2	1.4%
2011	6	3.4%
2012	9	3.9%
2013	10	11.0%
2014	11	5.4%
2015	20	6.1%
2016	13	19.6%
2017	34	9.4%
2018	46	19.3%
2019	59	26.1%
2020	248	30.7%
Total	**458**	**23.9%**

Appendix 9: Common shares returns

A. Common shares

		One-year returns			Three-year returns		
Year	Number	SPACs	CRSP	Diff.	SPACs	CRSP	Diff.
2010	0	-	-	-	-	-	-
2011	0	-	-	-	-	-	-
2012	1	-53.2%	20.4%	-73.6%	-98.1%	37.2%	-135.3%
2013	5	-30.1%	17.9%	-48.0%	-41.1%	28.0%	-69.1%
2014	4	-51.6%	5.7%	-57.3%	-89.6%	26.7%	-116.2%
2015	9	-19.5%	0.7%	-20.2%	87.7%	33.1%	54.6%
2016	9	-5.2%	19.0%	-24.2%	-35.1%	40.3%	-75.3%
2017	13	-11.0%	11.7%	-22.6%	-44.5%	30.3%	-74.7%
2018	23	-35.0%	8.8%	-43.8%	-8.1%	51.7%	-59.8%
2019	25	2.0%	8.8%	-6.8%	13.4%	56.2%	-42.8%
2020	63	-3.0%	32.6%	-35.6%	-19.1%	40.3%	-59.4%
Total	**152**	**-11.3%**	**19.4%**	**-30.7%**	**-12.0%**	**42.6%**	**-54.5%**

Appendix 10: SPAC and IPO returns according to sales levels

A. SPAC mergers (2012–2020)

	One-year returns from deSPAC		
	SPAC	CRSP	Diff.
Total (N = 152)	**-11.3%**	**19.4%**	**-30.7%**
Sales > $100 million (84)	**-5.4%**	**16.2%**	**-21.6%**
Profitable (42)	-1.1%	15.0%	-16.1%
Not profitable (42)	-9.7%	17.5%	-27.2%
Sales < $100 million (68)	**-18.6%**	**23.2%**	**-41.8%**
Profitable (16)	-17.2%	18.9%	-36.1%
Not profitable (52)	-19.0%	24.5%	-43.5%

B. Traditional IPOs (2012–2020)

	One-year returns from first close		
	IPO	Style	Diff.
Total (N = 1,167)	**14.0%**	**15.7%**	**-1.7%**
Sales > $100 million (549)	**18.5%**	**15.9%**	**2.6%**
Profitable (283)	25.3%	16.8%	8.5%
Not profitable (266)	11.4%	15.0%	-3.6%
Sales < $100 million (618)	**10.0%**	**15.9%**	**-5.9%**
Profitable (52)	2.1%	10.2%	-8.1%
Not profitable (566)	10.7%	15.9%	-5.2%

Appendix 11: Regression analysis of SPACs performance during deSPAC period

Dependent variable	*One-year market-adjusted deSPAC common returns*			*Three-year market-adjusted deSPAC common returns*		
	(1)	(2)	(3)	(4)	(5)	(6)
Sponsor expertise	0.255**		0.139	0.270		0.218
	(0.127)		(0.141)	(0.198)		(0.201)
Underwriter rank	0.018		0.054	0.0437		0.087*
	(0.028)		(0.033)	(0.053)		(0.049)
Dilution per unit	-0.519*		-0.311	-0.710		-0.550
	(0.267)		(0.236)	(0.567)		(0.552)
SPAC period return		-0.138	-0.184*		-0.128	-0.205**
		(0.094)	(0.095)		(0.101)	(0.095)
Redemption ratio		-0.492**	-0.355		-0.240	-0.020
		(0.200)	(0.250)		(0.186)	(0.212)
ln(Months)		-0.537**	-0.541**		-0.473*	-0.475**
		(0.240)	(0.227)		(0.280)	(0.232)
ln(1+Sales)		-0.015	-0.023*		-0.002	-0.017
		(0.012)	(0.013)		(0.026)	(0.013)
Profitability		0.142	0.212		0.139	0.258
		(0.123)	(0.129)		(0.171)	(0.160)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
No. observations	152	152	152	152	152	152
Adj. *R*-squared	.037	.129	.162	.075	.041	.083

Appendix 12: Healthcare SPAC portfolio returns versus benchmarks

Source: Authors' elaboration.

Time Horizon		Healthcare SPAC Portfolio	Russell 2000 Index	S&P 500 Healthcare Index
3 Months Statistics	3M-Cumulative Returns	–16.60%	–1.77%	8.89%
	3M-Extra Cumulative Return	/	–14.83%	–25.50%
	3M-Daily Volatility	1.79%	1.26%	0.64%
6 Months Statistics	6M-Cumulative Returns	–10.43%	7.36%	14.74%
	6M-Extra Cumulative Return	/	–17.79%	–25.17%
	6M-Daily Volatility	2.04%	1.46%	0.68%
1 Year Statistics	1Y-Cumulative Returns	20.92%	50.38%	25.23%
	1Y-Extra Cumulative Return	/	–29.46%	–4.32%
	1Y-Daily Volatility	1.63%	1.43%	0.88%
2 Years Statistics	2Y-Cumulative Returns	39.25%	41.38%	45.97%
	2Y-Extra Cumulative Return	/	–2.14%	–6.72%
	2Y-Daily Volatility	1.35%	2.10%	1.47%
2 Years Annualized Statistics	2Y-Annualized Return	18.00%	18.91%	20.82%
	2Y-Annual Volatility	21.35%	33.25%	23.32%
	2Y-Annual Sharpe Ratio	0.83	0.56	0.88

Appendix 13: multinomial logistic regression analysis of SPACs' outcomes

Variables	New SPAC failed			New SPAC acquired		
	Coef.	Std.	z	Coef.	Std.	z
SPAC Structure at IPO						
Gross Proceeds at IPO	0.0083	0.0133	0.62	-0.0095	0.0108	-0.88
Proceeds in escrow percent	14.0077	51.9377	0.27	-45.6708	45.6442	-1.00
Warrants per unit	3.1120	3.9859	0.78	2.0040	3.5008	0.57
Warrant strike price	0.4666	0.9424	0.50	-2.1566	1.6745	-1.29
Threshold in percent	-0.0929	0.1057	-0.88	0.1419	0.1272	1.12
Foreign target	5.5209	2.6736	2.06 **	-3.9222	2.5167	-1.56
Focus of merger	-2.0049	2.3260	-0.86	-1.3303	2.1895	-0.61
Dilution	0.3439	0.1910	1.80 *	-0.0903	0.1883	-0.48
Stakeholders involvment						
Number of SPAC founders	-1.8011	0.8207	-2.19 **	0.5038	0.6141	0.82
Average age of founders	-0.2811	0.1716	-1.64	0.1161	0.1522	0.76
Warrant purchases by founder (Y/N)	-12.2748	4.9941	-2.46 **	-0.7800	2.5865	-0.30
# Underwriters in syndicate	-2.4558	1.1974	-2.05 **	0.1924	0.4598	0.42
Total underwriter fee in percent	4.7020	1.5069	3.12 ***	0.1323	0.9687	0.14
Deffered underwriter fee in percent	3.6224	1.3691	2.65 ***	0.6990	0.7992	0.87
Warrant purchases by underwriter (Y/N)	31.1198	12.8836	2.42 **	-10.7928	1435.4580	-0.01
Overallotment exercised percent	4.2767	2.9795	1.44	1.1177	2.0433	0.55
Underwriter Quality	12.8110	6.1929	2.07 **	-1.7600	3.4554	-0.51
EarlyBirdCapital	-4.4097	3.2998	-1.34	2.5027	2.6382	0.95
Founder Private Equity Fund(Y/N)	-1.5402	2.7187	-0.57	1.6395	2.0924	0.78
Founder has previous SPACs experience	1.1472	2.4289	0.47	-2.6162	1.8534	-1.41
IPO Hot year (Y/N)	2.4296	2.5171	0.97	2.3911	2.8980	0.83
Merger Characteristics						
Merger announcement share price	-0.0093	1.2032	-0.01	1.8816	1.3325	1.41
Announcement to merger days	-0.0446	0.0188	-2.38 **	0.0036	0.0101	0.36
GoodSPAC (Y/N)	-4.9834	2.7769	-1.79 *	-1.5259	1.6927	-0.90
Merger size $million	0.0037	0.0028	1.30	0.0049	0.0032	1.53
SPAC Management after merger (Y/N)	3.2701	3.3588	0.97	-4.7672	3.8507	-1.24
SPAC founders after merger ownership	-0.2376	0.1882	-1.26	-0.0179	0.2388	-0.07
Warrants forfeited (Y/N)	-3.8742	2.3875	-1.62	-1.7528	2.8095	-0.62
Announcement price of warrant	2.6477	1.7963	1.47	-1.7000	1.2898	-1.32
Bank financing of merger (Y/N)	10.0490	4.1498	2.42 **	6.2985	2.7996	2.25 **
Debt financing of merger (Y/N)	3.9976	2.4817	1.61	-2.3504	2.3054	-1.02
Cash Merger (Y/N)	-3.9072	2.7586	-1.42	0.2598	2.0519	0.13
Finder fee (Y/N)	11.4161	4.7095	2.42 **	1.8183	3.6148	0.50
Post Merger Characteristics						
One month after merger return	8.5307	5.8641	1.45	5.0034	3.5906	1.39
Three month after merger return	-5.3294	5.5934	-0.95	0.4741	3.6124	0.13
One year after merger return	-8.2470	3.5578	-2.32 **	-3.5253	2.1826	-1.62
Didivend payment	-18.6963	6.7145	-2.78 ***	-2.6781	2.7079	-0.99
Constant	-39.7946	55.0345	-0.72	27.4614	55.3388	0.50
Mc Fadden R square	63.31%					
LR Ratio	139.27					
Number of observations	105					

Appendix 14: R Studio code for short-term analysis

```
---
title: "SPACS short-term analysis"
output:
  word_document: default
  pdf_document: default
  html_document:
    df_print: paged
date: "2023-05-11"
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

#Setting the working directory
```{r}
setwd("/Users/volkancoskun/Documents/Thesis R Excel")
```

#Importing data and formating variables
```{r}
shortterm <- read.csv("short-term.csv", header=TRUE)
shortterm$Announced.Date <- as.Date(shortterm$Announced.Date, format = "%m/%d/%Y")
shortterm$CAR <- as.numeric(gsub("%", "", shortterm$CAR)) / 100
```

#Loading libraries
```{r}
library(ggplot2)
```
```

```
#Sector breakdown
```{r}
sector_counts <- table(shortterm$Sector)
print(sector_counts)
sector_percentages <- prop.table(sector_counts) * 100
print(sector_percentages)
sector_table <- data.frame(Sector = names(sector_counts), Count = as.vector(sector_counts), Percentage =
as.vector(sector_percentages))
print(sector_table)
```
```

```
#Descriptive statistics of CAR
```{r}
car_stats <- summary(shortterm$CAR)
print(car_stats)

sector_stats <- by(shortterm$CAR, shortterm$Sector, function(x) c(min(x), quantile(x, c(0.25, 0.5, 0.75)), mean(x), max(x)))
sector_stats_df <- as.data.frame(do.call(rbind, sector_stats))

# Set column names
colnames(sector_stats_df) <- c("Min", "1st Qu.", "Median", "Mean", "3rd Qu.", "Max")

# Print the sector-wise descriptive statistics in table format
print(sector_stats_df)



boxplot(shortterm$CAR, ylab = "CAR", col = "skyblue", border = "darkblue")
axis(side = 2, at = pretty(shortterm$CAR, n = 15), labels = FALSE, tck = -0.02)
ggplot(shortterm, aes(x = Sector, y = CAR)) +
  geom_boxplot() +
  labs(x = "", y = "CAR") +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))
```
```

```
#Shapiro-Wilk test for normality
```{r}
for (sector in unique(shortterm$Sector)) {
  car_values <- shortterm$CAR[shortterm$Sector == sector]
  shapiro_result <- shapiro.test(car_values)
  print(paste("Sector:", sector))
  print(shapiro_result)
}

results <- data.frame(Sector = character(),
                      W = numeric(),
                      p_value = character(),
                      stringsAsFactors = FALSE)

for (sector in unique(shortterm$Sector)) {
  car_values <- shortterm$CAR[shortterm$Sector == sector]
  shapiro_result <- shapiro.test(car_values)

  result_row <- data.frame(Sector = sector,
                           W = shapiro_result$statistic,
                           p_value = format(shapiro_result$p.value, scientific = FALSE))

  results <- rbind(results, result_row)
}

print(results)

```
```

```
#CAR histograms per sector
```{r}
library(ggplot2)
par(mfrow = c(2, 3)) # Set up a 3x4 grid of plots for 12 sectors

for (sector in unique(shortterm$Sector)) {
  hist(shortterm$CAR[shortterm$Sector == sector], main = sector, xlab = "CAR")
}
```

#Levene's test
```{r}
library(car)
leveneTest(CAR ~ Sector, data = shortterm)

```

#Kruskal-Wallis
```{r}
kruskal.test(CAR ~ Sector, data = shortterm)

```
```

Appendix 15: R Studio code for long-term analysis

```
---
title: "SPACS long-term analysis"
output: word_document
date: "2023-05-17"
---

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

#Loading libraries
```{r}
library(ggplot2)
```

#Setting the working directory
```{r}
setwd("/Users/volkancoskun/Documents/Thesis R Excel")
```

#Importing data and formating variables
```{r}
longterm <- read.csv("long-term.csv", header=TRUE)
longterm$Closed.Date <- as.Date(longterm$Closed.Date, format = "%m/%d/%Y")
longterm$BHAR <- as.numeric(gsub("%", "", longterm$BHAR)) / 100
```
```

```
#Sector breakdown
```{r}
sector_counts <- table(longterm$Sector)
sector_percentages <- prop.table(sector_counts) * 100
sector_table <- data.frame(Sector = names(sector_counts), Count = as.vector(sector_counts), Percentage =
as.vector(sector_percentages))
print(sector_table)
```

#Descriptive statistics of BHAR
```{r}
bhar_stats <- summary(longterm$BHAR)
print(bhar_stats)

sector_stats <- by(longterm$BHAR, longterm$Sector, function(x) c(min(x), quantile(x, c(0.25, 0.5, 0.75)), mean(x), max(x)))
sector_stats_df <- as.data.frame(do.call(rbind, sector_stats))

colnames(sector_stats_df) <- c("Min", "1st Qu.", "Median", "Mean", "3rd Qu.", "Max")

print(sector_stats_df)

longterm$BHAR_percent <- longterm$BHAR * 100
boxplot(longterm$BHAR_percent, ylab = "BHAR (%)", col = "skyblue", border = "darkblue")


ggplot(longterm, aes(x = Sector, y = BHAR_percent)) +
  geom_boxplot() +
  labs(x = "", y = "BHAR (%)") +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))
```
```

```
#Shapiro-Wilk test for normality
```{r}
for (sector in unique(longterm$Sector)) {
  bhar_values <- longterm$BHAR[longterm$Sector == sector]
  shapiro_result <- shapiro.test(bhar_values)
  print(paste("Sector:", sector))
  print(shapiro_result)
}

results <- data.frame(Sector = character(),
                      W = numeric(),
                      p_value = character(),
                      stringsAsFactors = FALSE)

for (sector in unique(longterm$Sector)) {
  bhar_values <- longterm$BHAR[longterm$Sector == sector]
  bhar_values <- as.numeric(bhar_values)
  shapiro_result <- shapiro.test(bhar_values)

  result_row <- data.frame(Sector = sector,
                           W = shapiro_result$statistic,
                           p_value = format(shapiro_result$p.value, scientific = FALSE))

  results <- rbind(results, result_row)
}

print(results)
```
```

````
#CAR histograms per sector
```{r}
library(ggplot2)
par(mfrow = c(2, 3))

for (sector in unique(longterm$Sector)) {
  hist(longterm$BHAR_percent[longterm$Sector == sector], main = sector, xlab = "BHAR (%)")
}
```


#Levene's test
```{r}
library(car)
leveneTest(BHAR ~ Sector, data = longterm)

```

#Kruskal-Wallis
```{r}
kruskal.test(BHAR ~ Sector, data = longterm)

```
````

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