ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis International Bachelor Economics and Business Economics

Analyzing abnormal returns in U.S. SPACs in 2020-2021

Name student: Floris Spiering

Student ID number: 474365

Supervisor: Amar Soebhag

Second Assessor: Jan Lemmen

Date final version: 13/06/2021

ANALYZING ABNORMAL RETURNS IN U.S. SPACS IN 2020-2021

Abstract

This thesis analyzes the abnormal returns earned by 523 U.S. special purpose acquisition companies (SPACs) in 2020-2021. First, the presence of IPO underpricing is examined. Furthermore, the abnormal returns are studied over three periods: (1) starting the day after the IPO until and including the day a merger is announced, (2) starting the day after the merger announcement and ending at the day of the merger completion or rejection and (3) starting the day after the IPO and ending at the day of the merger completion or rejection. The results show underpricing is relatively low at 2.9 percent and statistically significant abnormal returns of 26.68 percent, 43.79 percent and 66.94 percent have been earned for the three respective periods. The results are robust against the use of parametric and non-parametric tests and tests adjusted for skewness. Furthermore, the use of different benchmarks for the abnormal returns does not alter the results significantly. An OLS regression also shows there is a negative relationship between the number of days in between the IPO and merger announcement and the annualized abnormal return, to the extent of -0.6 percentage points per day. A similar conclusion for the period thereafter cannot be drawn.

Table of Contents

1. Introduction

Special Purpose Acquisition Companies (SPACs) are becoming increasingly popular vehicles for companies to go public. The definition of a SPAC as stated by the SEC is: "a development stage company that has no specific business plan or purpose or has indicated its business plan is to engage in a merger or acquisition with an unidentified company or companies, other entity, or person. A SPAC is created specifically to pool funds in order to finance a merger or acquisition opportunity within a set timeframe. The opportunity usually has yet to be identified." This has come as IPO and mergers and acquisitions activity is rising sharply and the somewhat shady reputation of blank-check companies from the 1980s is ebbing away (Domonoske, 2020).

To illustrate the popularity, in 2020 alone, SPACs have raised $83.33 billion from 248 counts, compared to $13.6 billion in 2019 from 59 counts. These numbers have already been surpassed year-to-date in mid-March 2021 with 276 SPAC IPOs grossing $89.9 billion (SPACInsider, 2021). For the first time ever, SPAC IPOs have outpaced traditional IPOs by $6 billion in 2020 (Fox, 2020). The largest SPAC deal thus far has been announced in April 2020 concerning Grab, a ride-hailing company. The company is set to receive a total of $4.5 billion – of which $4 billion through a later stage funding round – at a valuation of almost $40 billion. Given the recency of this rise in popularity, not much research has been done regarding observed (abnormal) returns under the current market circumstances for SPACs.

There is a literature documenting the negative returns for investors in SPACs, among other reasons due to its structure regarding the benefits to sponsors and subsequent dilution to other investors. Jenkinson and Sousa (2015) for example find that more than half of approved deals immediately destroy shareholder value when observing data from 2003-2010. Alternatively, Kolb and Tykvová (2016) conclude that "SPAC firms are associated with severe underperformance in comparison to the market, the industry and (comparable) IPO firms." Previous research on the share price performance of SPACs has additionally been done by Jog and Sun (2007) who study abnormal returns in different stages of its lifecycle based on a sample spanning from 2003-2006. Given the recent large rise in SPAC IPOs as well as transactions it is of economic relevance to study the financial performance in an arguably different market environment. The research question of this paper therefore is:

To what extent have abnormal returns been realized in U.S. SPACs in 2020-2021?

To answer the research question, a sample from spactrack.net of all 523 U.S. SPACs that have completed an IPO between the start of 2020 and March 18th 2021 is collected analyzed. As has been found by previous research of Jog and Sun (2007), SPAC IPOs in their sample did not exhibit significant underpricing, with median and mean first day returns of 1.9 percent and 0.9 percent respectively. They note that this is to be

expected since a SPAC IPO is essentially a cash transaction, there should not be an issue of valuing the SPAC incorrectly by the underwriters, the company does not have an operating history and investors have a right to veto M&A transactions. Furthermore, Jog and Sun argue overpricing is to be expected since the trust holdings of the SPAC will be lower than the total IPO proceeds due to issuance costs. Additionally, the sponsor will receive shares at an extreme discount, diluting the shares of initial investors. This leads to the following hypothesis:

H1: SPAC IPOs exhibit no underpricing on the initial trading day

With respect to the medium term returns, following Jog and Sun (2007) a distinction is being made between three subperiods, namely: 1) from the day after the IPO until the day of the merger announcement, 2) From the merger announcement to the merger outcome and 3) from the day after the IPO to the merger outcome. The authors find a median annualized return of negative 2 percent for the first period and a negative 3.35 percent and negative 2.97 percent for the second and third period, respectively. Therefore the following hypotheses are to be tested:

H2: A negative return is expected between the SPAC IPO and merger announcement dates.

H3: A negative return is expected between the merger announcement and the merger outcome dates.

In combination this defines the final hypothesis:

H4: A negative return is expected between the SPAC IPO and the merger outcome.

The hypotheses are tested using event study methodology, applying both parametric and non-parametric tests to evaluate the significance of the observed returns.

2. Literature review

2.1. An overview of SPACs

2.1.1. The history of SPACs

Shachmurove and Vulanovic (2017) give an overview of the history of what are today considered SPACs. The first time a blank check company similar to Special Purpose Acquisition Companies is observed dates back to 18th century England during the South Sea bubble. Then called blind pools, these were investment vehicles which made a stock offering without specification of the activities to be undertaken by the company. In the 1920s these instruments were introduced in the U.S. market under the name of investment trusts, though activity therein ceased to exist rapidly following the Great Depression.

Later, in the 1980s activity in blank check companies gained ground again in the U.S. with issuers being penny stock promoters whose shares were listed on Over the Counter (OTC) markets. This did not go without much ado, as there were limited disclosures about the intentions or the guarantees to investors. Reimer (2007) documents that management would often apply a so-called "pump-and-dump scheme", where the management team would exercise their warrants once an acquisition is announced in anticipation of a positive market reaction and once this has happened immediately dump their shares. Following this fraudulent behavior, U.S. Congress installed the Penny Stock Reform Act of 1990 requiring the SEC to stronger govern regulations in the blank check market. These new regulations, among which restrictions on trading blank check securities and an obligation to keep at least 80 percent of funds in a trust started in 1992 and brought order to the market (Shachmurove & Vulanovic, 2017).

Following this new regulation there was very little activity in blank check offerings, with as little as fifteen new market entrants in the early years of the 1990s (Heyman, 2007). Heyman notes this is due to easier access to capital markets via traditional IPOs as well as actions undertaken by the National Association of Securities Dealers (NASD) in 1997. This organization revoked licenses of twenty-nine brokers and the CEO of GKN Securities Corporation, the main promoter in the blank check market at the time. In 2003, the first modern SPAC was underwritten which was structured to raise more than $5 million and priced above the minimum $5 amount in order to avoid SEC rules regulating penny stocks and other blank check offerings (Shachmurove & Vulanovic, 2017).

2.1.2. The mechanics behind modern SPACs

2.1.2.1. Company structure

A SPAC is thus an entity which has as a sole purpose to acquire one or more operating businesses within the first eighteen months, or twenty-four if it has announced a letter of intent within those eighteen months after its IPO. If no target is found within this time period, the SPAC will be liquidated and its investors will receive back the value of the assets held in the trust (Hale, 2007). The founders who also form the management of SPACs and are also called sponsors, are generally a small team of prominent business leaders, investment bankers and celebrities who have expertise in a specific sector. Their primary goal is to create value through acquiring undervalued private businesses within this often pre-specified sector. Only the starting capital for the company is provided by the founders in return for a sizeable equity stake. Although all the shareholders have voting rights regarding the acquisition of a target company, Lewellen (2009) documents this creates potential risks since the management is incentivized heavily towards completing an acquisition. Management is typically granted a twenty percent equity stake although it is poised to lose its entire initial investment in case of liquidation given it is not entitled to the holdings of the trust account in such a case. Jenkinson and Sousa (2009) relate this to their findings that SPAC management

teams often purchase large blocks of shares prior to a shareholder vote which they interpret as evidence that management is trying to gain voting power in order to approve the acquisition.

2.1.2.2. Security structure and acquisition process

SPAC IPOs make use of a unit security structure, which is a composite security that consists of a certain number of shares and a certain number of warrants exercisable in some future date. These units typically consist of one share and either one half or one third out of the money warrant, exercisable either 30 days after the acquisition or twelve months after the IPO. Following a SPAC IPO, the net proceeds are being kept in a trust fund overseen by a third party trustee. These funds are invested in U.S. government bonds until an acquisition is completed. This makes an investment in a SPAC similar to holding a risk free zero-coupon bond with an option on a future acquisition. An overview of the life-cycle of SPACs has been documented by Lewellen (2009), divided into four mutually exclusive categories:

1. No Target (NT): In this stage the SPAC has not announced a target company which it intends to acquire.
2. Target Found (TF): The intended acquisition is announced, but not yet completed.
3. Acquisition completed (AC): The acquisition is completed with one or more target companies.
4. Acquisition Withdrawn (AW): The SPAC has withdrawn from an announced acquisition.

Once the target is announced, the shareholders vote on the approval of the acquisition which is consequently either approved and completed, or withdrawn. After approval the merged company starts trading, usually under its own name and a changed ticker and the warrants issued with the SPAC become exercisable. In the latter case the SPAC could either be liquidated or start looking for a new target depending on the point in its lifecycle. Additionally, any shareholders voting against a merger can redeem their shares for the pro-rata value in the trust. See appendix A for a graphical representation put forth by Lewellen (2009). The acquisition process of a SPAC is often referred to as a reverse merger, because the company that is being acquired ends up taking control over the newly created business entity.

A SPAC merger is typically accompanied by another round of funding in the form of a Private Investment in Public Equity (PIPE). In this round of funding, only a select group of large investors are able to participate after signing a non-disclosure agreement and receiving material, non-public information about the acquisition target. Research by Morgan Stanley shows a PIPE investment on average adds three times the existing purchasing power to the SPAC based on data of SPACs valued at more than half a billion dollars. They also conclude 167 million dollars is raised in this round for every 100 million in SPAC IPOs (Picker & Shah, 2021). Given the recent large rise in SPAC IPOs, an even larger flow of capital is expected to go through the PIPE funding rounds in 2021 and 2022.

PIPE investors usually receive their shares at a discount to the market price and sometimes even the IPO price. Klausner et al. (2020) find that approximately one in three SPACs that merged in 2019 and 2020 sold their shares at a 10% discount to the IPO price. They note this comes at the cost of earlier investors, whose shares are now diluted. Harvey Pitt, former chairman of the Securities and Exchange Commission said there are two 'losers' concerning PIPE investments in SPACs. The first are the existing shareholders, the second being the perception about fairness in our capital markets. General investors are not able to get these pricing discounts or equal information disclosures and see their holdings downgraded due to dilution (Picker & Shah, 2021).

2.2. IPOs

2.2.1. Empirical evidence from IPO returns

The pricing of traditional IPOs has been subject to an extensive amount of past research. One effect in particular is the underpricing generally accompanying such a listing, which is defined as the first day return of a security. In essence, underpricing means money is left on the table by the issuing party since the market values the security more highly than the price at which it is issued. Research has been done towards explaining this seemingly irrational occurrence by Booth and Chua (1996). The authors develop an explanation stating that underpricing facilitates dispersion in ownership, leading to more liquidity which reduces investors' required return. However, broad ownership increases information costs which are offset by underpricing. Other theories combine into three general categories: institutional, control and behavioral (Ljungqvist, 2007). Institutional theories focus on marketplace features such as taxes; the control theories reason a broader shareholder base reduces shareholder power and the behavioral theories argue irrational investors bid up the price on the IPO day. Loughran and Ritter (2004) examine the presence of IPO underpricing over time and find that it has increased from seven percent in the 1980-1989 period, spiking at sixty-five percent during the dot-com bubble after which it declined towards ten percent again. Ritter (2020) shows underpricing rises again to 41.6 percent in 2020 on average as the number of IPOs is rising again. Jog and Sun (2007) reported this has not been the case for blank check IPOs given their clear fundamental value being the holdings in the SPAC trust.

A second well-documented observation regarding IPO returns is the long term underperformance of firms after such a listing. Ritter (1991) finds issuing firms substantially underperformed matching firms in the first three years of trading. In addition to this finding he notes there is considerable variation in underperformance over time and across industries, with companies listing in high volume years in terms of IPOs having the worst relative performance. Ritter also concludes this is in accordance with an IPO market in which investors are periodically overly optimistic about the earnings potential of young growth companies and issuing firms taking advantage of this opportunity. Additional research has been done on the

timing of IPOs by Pastor and Veronesi (2005), showing that so-called IPO waves tend to be preceded by periods of high market returns and followed by periods of low market returns. Nevertheless, IPO firms underperform the general market also given low market returns. This is consistent with findings by Klausner et al. (2020) detailed below that SPACs perform poorly in the period following the acquisition.

2.2.2. SPACs as an alternative to traditional IPOs

SPACs offer a number of benefits in comparison to traditional IPOs. From the investor perspective, the downside risk is limited given the option to vote against or exit their investment when presented an acquisition. A second benefit to investors is the access to a private equity style of investing which is typically only available to buyout firms. The structure also offers benefits to the acquired firm. The target company avoids the risky and costly process accompanying a traditional IPO. SPACs typically pay a two percent underwriting fee at their IPO followed by a 3.5 percent fee at the completion of their merger, according to Katje (2021). He notes this is in comparison with a seven percent fee for a traditional IPO. Another benefit he describes is the shortened timeframe accompanying a SPAC merger. This process usually takes three to four months and can take as much as one year in case of a traditional IPO. Finally, a big incentive towards going public via a SPAC concerns the difference in regulatory scrutiny. When issuing shares via a traditional IPO, three years of audited statements have to be discussed amongst different measures. Private companies can additionally present forward-looking guidance on revenue and profitability whereas detailed financial projections are not allowed to be disclosed in the case of IPOs (Katje, 2021).

Aside from these benefits, a number of downsides exist regarding the SPAC IPO process. As mentioned before, initial shareholders often suffer from dilution given the sponsors next to free shares as well as the discount granted to PIPE investors. Together with the aforementioned managements' (overly) strong incentive to complete a merger this might misalign managements' and investors' incentives at the cost of the initial investors. Klausner et al. (2020) compare SPAC IPO returns with traditional IPO returns and find that in the three, six and twelve months following the IPO or merger, the SPAC returns drastically underperform the IPO index. They report three month returns underperform by more than 14.5 percent and even worse over longer periods, arguing this is due to share dilution. They note that although at first glance SPAC IPOs are less costly in terms of fees, total costs including dilution and underpricing are about fifty percent for SPACs compared to twenty-two percent for IPOs.

2.3. Mergers and acquisitions

2.3.1. Firm value creation following mergers and acquisitions

Mergers and acquisitions are undertaken from a variety of different perspectives. Trautwein (1990) summarizes the motives can be classified into seven groups, namely: efficiency gains, monopoly power,

private information, managerial empire-building, process influences, raider activity and macroeconomic disturbances. He also concludes the motives concerning private information, managerial empire building and process influences are most commonly observed. Motives concerning efficiency gains are generally considered most desirable in terms of value creation. Therefore, this is in accordance with evidence presented by Hitt et al. (2012) suggesting that little to no value is created by acquiring firms. The authors provide the inability to create synergies, paying too high of a premium, the selection of inappropriate targets and ineffective integration processes as possible explanations. Careful selection of targets, with capabilities complementary to the acquirer however can provide good opportunities for synergy and consequently value creation. They also note management is frequently reluctant to admit failure and divest prior acquisitions. Conclusively, the evidence on value creation is in this sense comparable to the aforementioned poor returns to SPAC investors following a merger and management being the recipient of most benefits.

2.3.2. Empirical evidence on stock returns following M&A activity

Bruner (2003) summarizes the results from 130 studies on M&A returns from 1971 to 2001. He concludes returns to target firms are materially positive, combining results of twenty-one studies over different time periods, types of deals and observation period of returns. He notes average abnormal returns to shareholders are in the twenty to thirty percent range. He notes returns to the acquiring firm shareholders pose a more promiscuous picture. Summarizing the results of forty-one studies he describes twenty studies report negative returns with thirteen being significantly negative. Twenty-four studies show positive returns to shareholders with seventeen being significantly different from zero. Conclusively, the results are divided almost equally in thirds regarding positive, negative and zero returns to shareholders of acquiring firms. Bruner also describes returns over a longer period tend to be more negative although these results might be clouded by other factors given the timeframe. He concludes that in the aggregate, acquiring firm shareholders tend to break even regarding acquisitions with zero abnormal returns. The combined effect is still significantly positive, benefiting the shareholders in the acquiring and target firms combined.

In light of the third hypothesis of this paper regarding the existence of abnormal returns to shareholders in between a merger announcement and its completion it is of interest to consider general merger and acquisition announcement effects. Cornett et al. (2011) provide a summary of existing research on returns for both target and acquiring firms. They describe that three day cumulative abnormal returns (CAR) to target firm shareholders are substantial, around twenty percent. CARs to bidding firms are found to be insignificant, although this effect depends heavily on the sample used. Acquirer CARs following an announcement are negative only in the case of large public firms bidding on large public firms. Fuller et al. (2002) have further decomposed this effect and found that bidding firm shareholders gain when buying a private firm or subsidiary but lose when buying a public firm. Returns are also positively correlated with

the target firm size and higher in case of a stock offer rather than a cash offer. Given the ambiguity in the results it is difficult to derive a general conclusion, but the notion that on average no substantial positive returns to bidding firm shareholders persist compares to the findings by Jog and Sun (2007) of slightly negative annualized returns following a SPAC merger announcement.

3. Data

3.1. Company data

A complete dataset from spactrack.net is used containing all 522 SPACs that have gone public in the U.S. between the beginning of 2020 up until March 18th 2021. SEC filings are used to distinguish between listings that have made an official merger announcement and the date of this filing is taken as the announcement date. Similarly, the date of the merger completion or rejection is taken from the SEC filings. This sample is absent of SPACs that have been liquidated (yet) and includes only those that are active or have completed a merger. Additionally, termination of a merger agreement has happened for only one of the listings, which later announced a new merger. The dataset is restricted to start at the beginning of 2020 since it is absent of liquidated SPACs. Given the typical deadline of 18-24 months until liquidation, the current sample is not bothered by this omission and is representative since it does include those that might fail to merge and are liquidated in the future.

Table 3.1

Number of SPACs in different stages of its lifecycle per March 18th 2021

Total number	Completed	Definitive agreement	Letter of Intent	In Talks	Searching
523	24	87	1	15	396

	Mean	Median
Days between IPO and merger announcement	147.34	144.00
Days between merger announcement and completion	107.33	112.00
Days between IPO and merger completion	252.71	260.00

Table 3.1 shows the number of SPACs studied classified by different stages in the acquisition process, as well as the average and median time between the studied phases. The distribution over the studied timeframe of SPAC IPOs is shown below in Figure 3.1, containing data up until March 18th, 2021. For an overview of the distribution of merger announcement and outcome dates see Appendix B. The SPACs can further be classified by target sector as well as the amount raised in the IPO. The average IPO size is around $328 million compared to a median of $276 million. Additionally, 29 of the active SPACs have received a PIPE investment of on average $533 million.

Figure 3.1

The distribution of SPAC IPOs over the studied timeframe
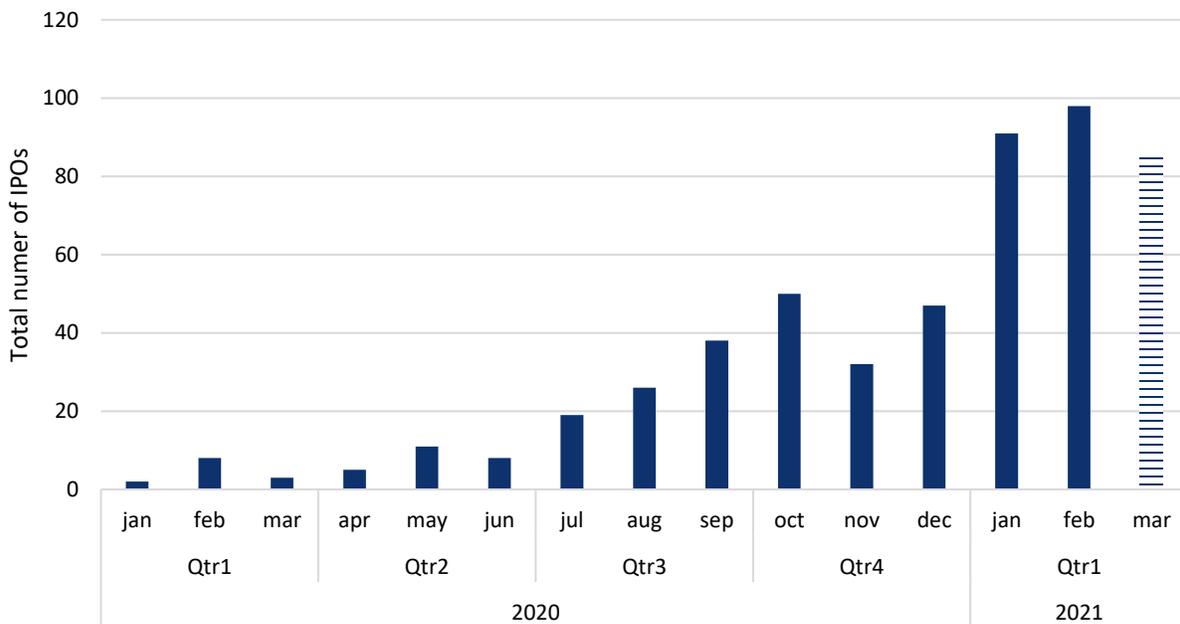
3.2. Share Price Data

Daily share price data is publicly available and taken from Yahoo Finance as all of the included companies are listed on public exchanges, with a few exceptions as specified below. All observed listings have gone public at a price of $10 per unit as is standard with SPACs, with a total of three exceptions. These were listed at either $20 or $25 and for the share price analysis have been divided by 2 and 2.5, respectively. For the analysis, the unit price data is taken which includes common stock and warrants. There are nine SPACs for which unit data is not available anymore due to the completion of an acquisition and their ticker not existing anymore or being replaced by another listing. For these companies no first trading day data is observed and in further analysis their common stock price is included rather than the unit price. For the other listings, historic share price information is publicly available on either Yahoo Finance or the website of ADVFN. Descriptive statistics regarding the closing prices of the first trading day and other event dates are stated in Table 3.2 below. Note that one rejected merger is included in the 'completed' group. For one of the completed SPACs no share price data is available on the announcement date.

Table 3.2

Descriptive statistics regarding SPAC closing prices

Number of observations	Mean closing price	Median closing price
First trading day		
513	10.29	10.18
Deal announced date		
87	14.06	12.20
Deal completed date		
23	17.31	13.87

To get an initial view on the relative share price performance of SPACs I have created an equal-weighted index. The index is constructed by taking the daily simple average of all securities listed at the time (see S&P Dow Jones Indices et al., 2013). It excludes 5 of the studied companies which are all in the *No Target* or s*earching* stage and do not have historical share price data on Yahoo Finance. The index can be seen in Figure 3.2 along with a cumulative return plot of the Nasdaq index over the period starting January 24th, 2020 and ending March 26th, 2021. The SPAC index has underperformed the Nasdaq at the end of this period by about 26.7 percent. Note that this is only an indication of returns and not a completely fair comparison as most SPACs are still non-operational trusts at this point.

Figure 3.2

Cumulative return plot of equally weighted SPAC and Nasdaq returns

4. Methodology

The event study methodology will be used, which is a widely accepted methodology which measures the effect of an economic or firm specific event on the share price of a particular firm. According to Binder (1998) it has become the standard method of measuring security price reaction to some announcement or event. Consistent with this methodology and in order to provide a reasonable estimate independent of general market sentiment, excess returns are observed rather than raw returns. To this end two benchmarks are used: a three month T-bill rate for the period prior to the announcement and the Nasdaq index for the period thereafter. The Nasdaq is chosen as a benchmark as the majority of SPACs in the dataset have the word 'Tech' included in their target focus, namely 255 of a total of 442 that have reported a specific focus. Adding to this there is a large amount of listings with target sectors such as Cybersecurity and E-Commerce. For robustness, the returns following the deal announcement will also be compared with the S&P500 as well as the Russel 2000 Small Cap Index, given that the average market capitalization of the observed companies at this stage is around $400 million. Abnormal returns are defined as follows

$$AR_{it} = RR_{it} - ER_{it} \tag{1}$$

Here, AR_{it} is the abnormal return for stock i at time t, RR_{it} is the realized return and ER_{it} is the expected return as measured by the benchmark for security i at time t, using the market model

$$RR_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{2}$$

The estimation window is set to the entire period in which each SPAC has traded, over which the market beta is defined as the daily covariance with the benchmark, divided by the sample variance of the benchmark and multiplied by the number of observed returns. However, the three month T-bill rate is set at zero percent given the current interest rate environment, making the beta meaningful only after an acquisition is announced. The event horizon differs with the hypotheses. Underpricing is, in line with the literature, defined as the first trading day excess return and will therefore be tested using a one day horizon. As can be seen from Table 3.2, this hypothesis will be tested using 513 observations. A t-test will be used to test for significance. With regard to the second hypothesis the dataset provides 101 observations. For the return regarding this period, the percentage excess return will be taken from the day after the listing until and including the day the merger is announced. Given that the event horizons differ, the returns will be annualized to allow for averaging and comparing of the results. A similar approach will be taken regarding the return in between the merger announcement and completion dates, with a total of twenty-three observations. Since first day return data is not available for nine of the SPACs that have completed a merger, for these companies the closing price is set to the median of 10.18 for the analysis regarding the returns in between the IPO and merger outcome dates.

A cross-sectional t-test will be used to test for significance of the annualized Cumulative Average Abnormal Returns (CAARs).

$$t_{CAAR} = \sqrt{N} \frac{CAAR}{S_{CAAR}} \tag{3}$$

Where S_{CAAR} is the standard deviation of the annualized CARs over the sample:

$$S_{CAAR}^2 = \frac{1}{N-1} \sum_{i=1}^{N} (CAR_i - CAAR)^2 \tag{4}$$

Given the potential existence of skewness in the distribution of CARs, as a robustness test the skewness adjusted t-test introduced by Hall (1992) will be used, where the skewness estimator is defined as follows:

$$\gamma = \frac{N}{(N-2)(N-1)} \sum_{i=1}^{N} (CAR_i - CAAR)^3 S_{CAAR}^{-3} \tag{5}$$

The skewness adjusted test statistic is subsequently given by

$$t_{skew} = \sqrt{N} \left(S + \frac{1}{3}\gamma S^2 + \frac{1}{27}\gamma^2 S^3 + \frac{1}{6N}\gamma \right) \tag{6}$$

Where

$$S = \frac{CAAR}{S_{CAAR}} \tag{7}$$

Furthermore, as a non-parametric test the Generalized Rank Test as described by Kolari and Pynonnen (2008) is performed, which is robust to abnormal return serial correlation and does not assume a normal distribution in the abnormal returns. Additionally, the results regarding this test are not sensitive to outliers as can be the case with parametric tests. The cumulative abnormal returns over the event period τ are first standardized

$$SCAR_{i\tau} = \frac{CAR_{i\tau}}{S_{CAR_{i\tau}}} \tag{8}$$

Next, the generalized standardized abnormal returns are defined as follows, where the cumulated return period is taken as one time point

$$GSAR_{it} = \begin{cases} SCAR_{it} \ for \ t_1 + 1 \ \leq t \ \leq t_1 + \tau, \\ SAR_{it} \ for \ t = T_0 + 1, \dots, t_1, t_1 + \tau + 1, \dots, T_2 \end{cases} \tag{9}$$

With

$$SAR_{it} = \frac{AR_{it}}{S_{AR_{it}}} \tag{10}$$

Here, t_0 is the event day, $T_0 + 1$, $T_0 + 2$, …, T_1 are the estimation period days and $T_1 + 1$, $T_1 + 2$, …, T_2 are the event window days. The CAR period is thus taken as one observation with time indexing $t = 0$. The total number of observations is reduced to $T' = T - \tau + 1$ and the ranks are given by

$$K_{it} = \frac{Rank(GSAR_{it})}{T'+1} \tag{11}$$

Finally, the generalized rank t-statistic is defined as

$$t_{grank} = \frac{\bar{\bar{K}}_0 - 0.5}{S_K} \tag{12}$$

Where

$$S_K = \sqrt{\frac{1}{T'}\sum_{t=T_0+1}^{T_2} \frac{n_t}{n}(\bar{K} - 0.5)^2}, \tag{13}$$

$$\bar{K}_t = \frac{1}{n_t}\sum_{i=1}^{n_t} K_{it} \tag{14}$$

This test will only be performed regarding the second and third hypotheses, as the cumulative event day would be the only observation for the entire period starting after the IPO until the merger outcome making it impossible to rank it against non-event returns. Furthermore, re-standardization with the cross-sectional standard deviation as proposed by Kolari and Pynonnen is left out since the event dates differ per firm.

Next to these statistical tests, the results are also tested against benchmarks other than the Nasdaq for the period following the merger announcement. To this end, the S&P 500 and Russell 2000 Small Cap indices are used. The Russell 2000 index is taken because the average SPAC market capitalization was $400 million at the deal announcement date, similar to small cap stocks. The market betas will be recalculated in relation to these markets and multiplied by the observed respective market returns over the period to obtain the new expected returns from which the abnormal returns are derived. Furthermore, a robustness test regarding the SPACs market betas with the Nasdaq is implemented. Given the short lifetime of SPACs there are relatively few datapoints to estimate the beta over (see Figure B2 in Appendix B) and these also include the event periods, possibly clouding the estimated coefficient. To account for this, the significance tests are performed again with the expected return calculated using the average beta for all firms with a completed or rejected merger, rather than their individual ones. As a result, possible extremes in terms of betas due to a merger being announced in a period of market declines, for example, are averaged out. This again only applies to the latter two periods given the assumed zero percent three month T-bill rate.

A possible problem exists that the fastest SPACs to announce and complete a merger are the most successful ones in terms of abnormal returns. These observations are overrepresented in the used dataset since not all

time has elapsed for all SPACs to complete a merger, which can possibly bias upward the results. To test for this effect, an ordinary least squares regression of the annualized CARs is run on the number of days L_1 in between the IPO and the merger announcement, as well as on the number of days L_2 between the merger announcement and outcome.

$$Annualized\ CAR_t = \alpha_t + \beta_t L_t + \varepsilon_t \tag{15}$$

Additionally, the annualized abnormal returns for the 412 SPACs that have not announced a merger are observed and tested in the same manner as before for significance. This is tested using 408 observations for which the data is available, again using the three month T-bill rate as the benchmark.

5. Results

5.1. Cross-sectional t-tests

The sample distribution and significance test results for the (cumulative) abnormal returns of the four studied periods are reported in Figure 5.1 and Table 5.1, respectively. Regarding the first hypothesis that no underpricing should be observed, the test does show statistically significant underpricing of 2.9 percent ($t = 15.086$), although economically not very meaningful when compared to traditional IPOs as described above. Furthermore, the annualized returns are 66.25 percent for the period in between the IPO and merger announcement and 145.30 percent for the period in between the merger announcement and outcome. Combined, an annualized return of 96.57 percent is realized. Based on these statistics, all four hypotheses of negative abnormal returns in the periods described here can be rejected at the 0.5 percent significance level, meaning SPACs have outperformed their benchmark over the entire lifecycle.

Figure 5.1

Sample distribution of (annualized cumulative) abnormal returns for each of the observed periods
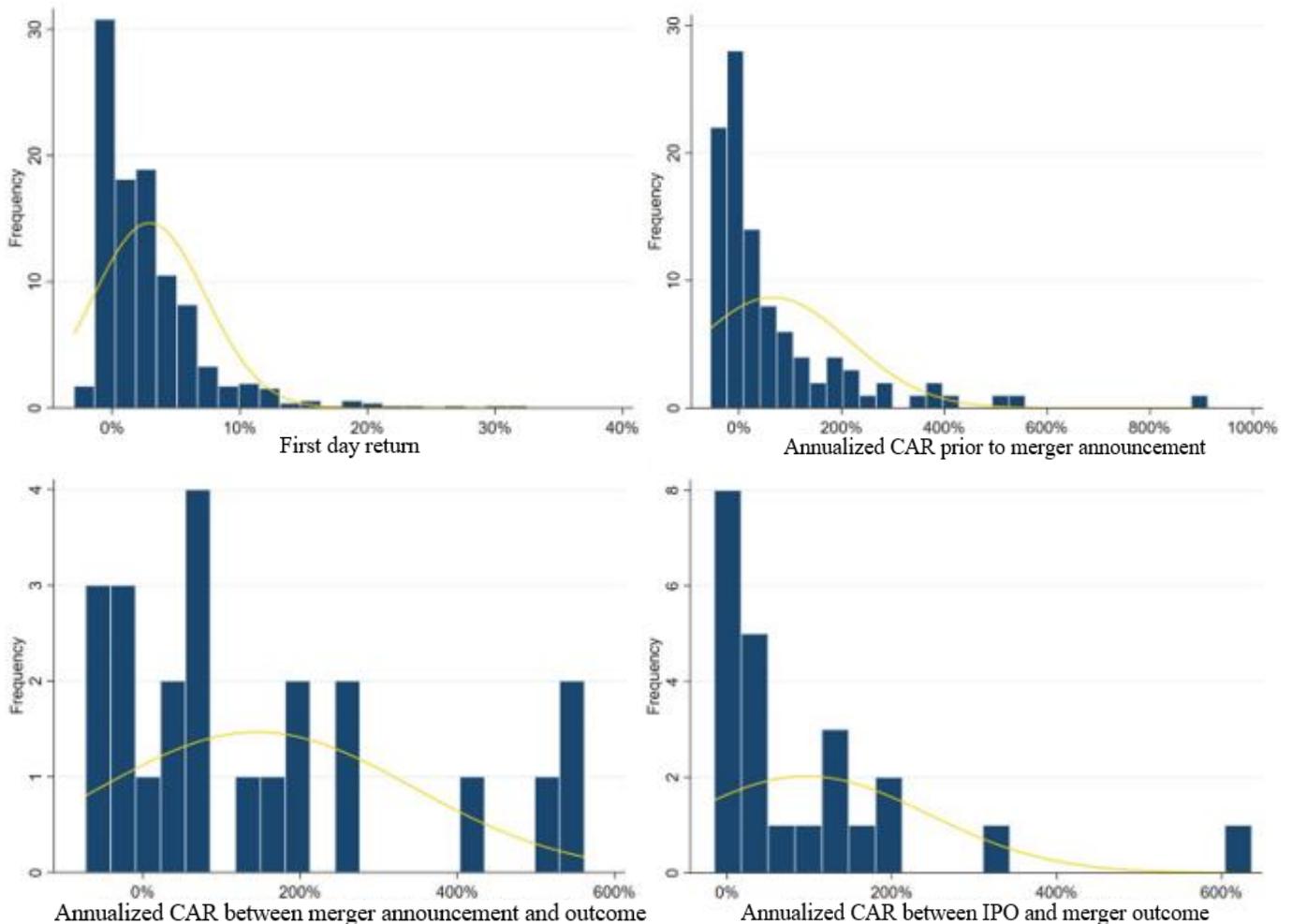
Table 5.1

Cross-sectional t-test results for significance of the abnormal returns per observed period

Observed Period	t	df	Mean	Median	95% Conf. Interval	
First day return	15.086	512	2.927%**	1.80%	2.546%	3.301%
IPO to merger announcement (annualized)	4.438	100	66.25%**	9.12%	36.63%	95.86%
Merger announcement to outcome (annualized)	3.510	22	145.30%**	71.37%	59.44%	231.15%
IPO to merger outcome (annualized)	3.130	22	96.57%**	41.92%	32.59%	160.56%

** $p < .005$.

Furthermore, it is interesting to note that especially for the period leading up to the merger announcement, the median CAR is substantially lower than the mean, at 9.12 percent compared to 66.25 percent. This can also be inferred from the skewed distribution in Figure 5.1. This is not surprising given the shareholders' right to vote against a merger and redeem their shares at fair value, which provides a lower bound around the IPO price. The same factor arises regarding the remaining two periods, justifying the use of a skewness adjusted test. The adjusted test statistics are reported below in Table 5.2.

5.2. Skewness adjusted tests

Table 5.2

Tests for significance of the returns per observed period corrected for skewness

Observed Period	t	95% Conf. Interval	
First day return	26.020**	23.513	28.527
IPO to merger announcement (annualized)	6.564**	4.887	8.240
Merger announcement to outcome (annualized)	4.430**	2.524	6.336
IPO to merger outcome (annualized)	5.067**	3.264	6.870

** $p < .005$.

The skewness corrected t-statistics are higher in all cases, which is attributable to the positively skewed data. The fact that the means are higher than the median likely causes the sample to have more than fifty percent of values below the population mean, leading to downward biased results. Especially important in small samples such as the group that has completed a merger, a higher t-statistic corrects for this by rejecting the null-hypothesis more easily. In this case, the results are not meaningfully affected and all hypotheses are still rejected in favor of abnormal returns at the 0.5 percent significance level.

5.3. Generalized Rank Tests

Table 5.3

Generalized Rank Test results for significance of abnormal returns before and after the merger announcement

Observed Period	t	df
IPO to merger announcement	3.866**	110
Merger announcement to merger outcome	2.500**	22

** $p < .005$.

The Generalized Rank Test results show somewhat weaker test statistics compared to the cross-sectional t-test, although still highly significant ($p < 0.005$). This means the results are not derived solely from a few large outliers in terms of high abnormal returns, but are based on a general presence in the data.

5.4. Additional benchmark results

Table 5.4.1

Cross-sectional t-test results for significance of abnormal returns using the S&P 500 and Russell 2000 as benchmarks

Observed Period	t	Mean	Difference w. Nasdaq	Median	95% Conf. Interval	
Merger announcement to outcome (annualized)						
S&P 500	3.550	148.05%**	2.75%	78.53%	61.57%	234.54%
Russell 2000	3.251	135.53%**	-9.77%	70.11%	49.08%	221.99%
IPO to merger outcome (annualized)						
S&P 500	3.332	101.41%**	4.84%	60.51%	38.28%	164.53%
Russell 2000	3.127	96.05%**	-0.52%	62.81%	32.35%	159.76%

** $p < .005$.

Table 5.4.2

Cross-sectional t-test results for significance of abnormal returns using an average market beta for all observations

Observed Period	t	df	Mean	Median	95% Conf. Interval	
Merger announcement to outcome (annualized)	3.453	22	145.00%**	79.61%	57.92%	232.08%
IPO to merger outcome (annualized)	3.172	22	97.44%**	57.42%	33.73%	161.15%

** $p < .005$.

Table 5.4.1 shows the test statistics when taking the S&P 500 and Russell 2000 indices as a benchmark for the period after the merger announcement, rather than the Nasdaq. The results do not change drastically, with around 148 percent and 135 percent annualized abnormal returns in between the IPO and merger announcement and around 101 percent and 96 percent for the period in between the merger announcement and outcome. This means CARs are slightly higher when benchmarked against the S&P 500 and slightly lower in relation to the Russell 2000 index.

The results when calculating abnormal returns using the average SPAC's market beta rather than their individual ones are reported in Table 5.4.2. The means stay almost exactly equal at 145 percent and 97 percent for the two periods. The median values are somewhat higher when using the average beta, at around eight and sixteen percentage points annualized for the two periods, respectively. It is not surprising that the results do not change drastically given the heavy outperformance over the Nasdaq initially.

5.5. Regression results and searching SPACs

First, a Breusch-Pagan test for heteroskedasticity of the error terms is performed, which shows heteroskedasticity is present at the five percent significance level. Therefore a regression with robust standard errors is performed.

Table 5.5.1

OLS regression results for the relationship between the annualized CARs and period length (days)

Observed Period	Coefficient	R^2	N
IPO to merger announcement	-0.006**	0.125	108
	(0.001)		
Merger announcement to outcome	-0.010	0.030	22
	(0.013)		

** $p < .005$.

The regression results for the first period show a significant negative relationship between the number of days in between the IPO and merger announcement date and the realized CARs in this period. The relationship is quite large in absolute terms, with 0.6 percentage points lower annualized abnormal returns for each day the period is extended. For the second period, no significance is found, which could however be attributable to the small number of observations.

Table 5.5.2

Cross-sectional t-test results for significance of annualized CARs for SPACs that have not announced a merger within the studied period

	t	df	Mean	Median	95% Conf. Interval	
Annualized CAR	-12.80	407	-16.73%**	-13.14%	-19.31%	-14.16%

** $p < .005$.

Table 5.5.2 shows the results regarding the SPACs that have not officially announced a merger yet and are in talks or still searching. These show a clear division in returns between this group and those that have announced a merger, making the overall picture less optimistic. For computation and comparison purposes this number is annualized, however there is a lower bound to the share price. This means annualizing the returns observed over a short time-frame might overestimate the effect as the price would stabilize once the lower bound is reached. Nevertheless, the abnormal returns here are negative at -16.73 percent annualized.

6. Conclusion

This paper attempts to answer the question to what extent abnormal returns have been realized in U.S. SPACs in 2020-2021, looking at different stages of its lifecycle. As described in the section above, all four studied stages have exhibited significantly positive abnormal returns in 2020-2021. Only regarding IPO underpricing the number is not economically meaningful, especially in comparison to non-SPAC IPOs. For the other periods, abnormal returns span from 26.68 percent on average in the period leading up to the merger announcement and 43.79 percent in the period ending with the merger outcome. Together, this means that having invested in all SPACs that have completed the whole process would have led to a 66.94 percent abnormal return over the period. This is certainly contrary to the negative single digit returns found for these three stages by Jog and Sun (2007) using data from the beginning of this century. The results are essentially unaffected by the use of parametric versus non-parametric tests, as well as different benchmarks for the expected returns. Accounting for the possibility that the market betas are biased due to estimation period limitations also does not alter the results in a significant manner.

As can be seen from the OLS regression, there is however a significant negative relationship between abnormal returns and the length of time in between the IPO and merger announcement. This means true returns in this period can be expected to be lower as an overrepresentation of the fastest group is present in the data. For the returns after the merger announcement this does not seem to be the case as no significant relationship has been found. The strong positive returns for the last two periods are however aided by the fact that only one of the announced mergers was rejected, whose SPAC experienced an 11.72 percent underperformance over the period. Those that fail to complete an announced merger might do so in a later

stage which would likely cause the true returns to be lower than found in this study for the two periods following the merger announcement. It is also of interest to report the significantly negative annualized abnormal return of -16.73 percent for the SPACs that have not announced a merger yet, being the largest group at the time of this research.

Given the limitations regarding available data in this study on liquidated SPACs, it would be interesting to analyze a more complete dataset. This would account for the large group that has not completed the process of the SPAC merger, in order to make valid inferences about this group and get a more comprehensive picture of overall returns. Lastly, as previously mentioned research by Klausner et al. (2020) has found – although outside the scope of this paper – returns following SPAC mergers have been significantly negative in recent years. Certainly, having invested in the group of SPACs that have either announced or completed a merger since the beginning of 2020 would have earned significant abnormal returns. This might however give an overly optimistic view on the returns being earned in SPACs in general.

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Appendix A

Figure A1

Graphical overview of the typical SPAC lifecycle

```
                          ┌──────────┐
                          │   IPO    │
                          │   Date   │
                          └────┬─────┘
                               │
                               ▼
                      ┌─────────────────┐
                      │  SPAC looks for │◄──────────────┐
                      │ acquisition     │               │
                      │ targets         │               │
                      │ (no target phase)│              │
                      └────────┬────────┘               │
                               │                        │
                               ▼                        │
                      ┌─────────────┐                   │
                      │  Target is  │                   │
                      │  announced  │                   │
                      └──────┬──────┘                   │
                             │                          │
                             ▼                   ┌────────────┐
                    ┌─────────────────┐          │ No target  │
                    │  SPAC works to  │          │ is found   │
                    │  complete the   │          └────────────┘
                    │  transaction    │
                    │ (target found   │
                    │  phase)         │
                    └────────┬────────┘
                             │
   ┌──────────────────┐      ▼
   │ Shareholders     │ ┌─────────────────┐
   │ voting 'no' can  │◄┤ Shareholders    │
   │ redeem their     │ │ vote on the     │
   │ shares for the   │ │ proposed        │
   │ pro-rata value   │ │ business        │
   │ in trust         │ │ combination     │
   └──────────────────┘ └───┬─────────┬───┘
```
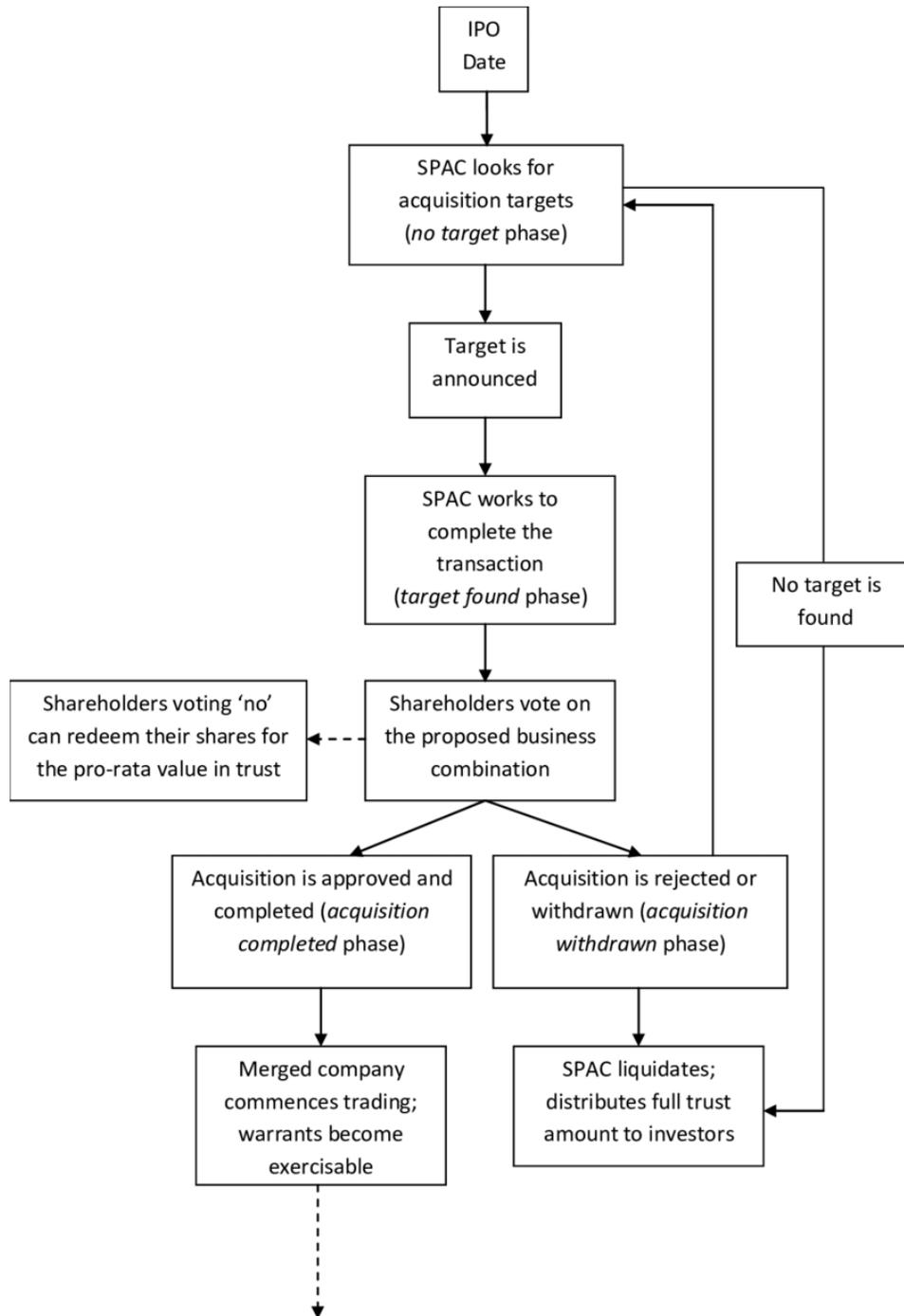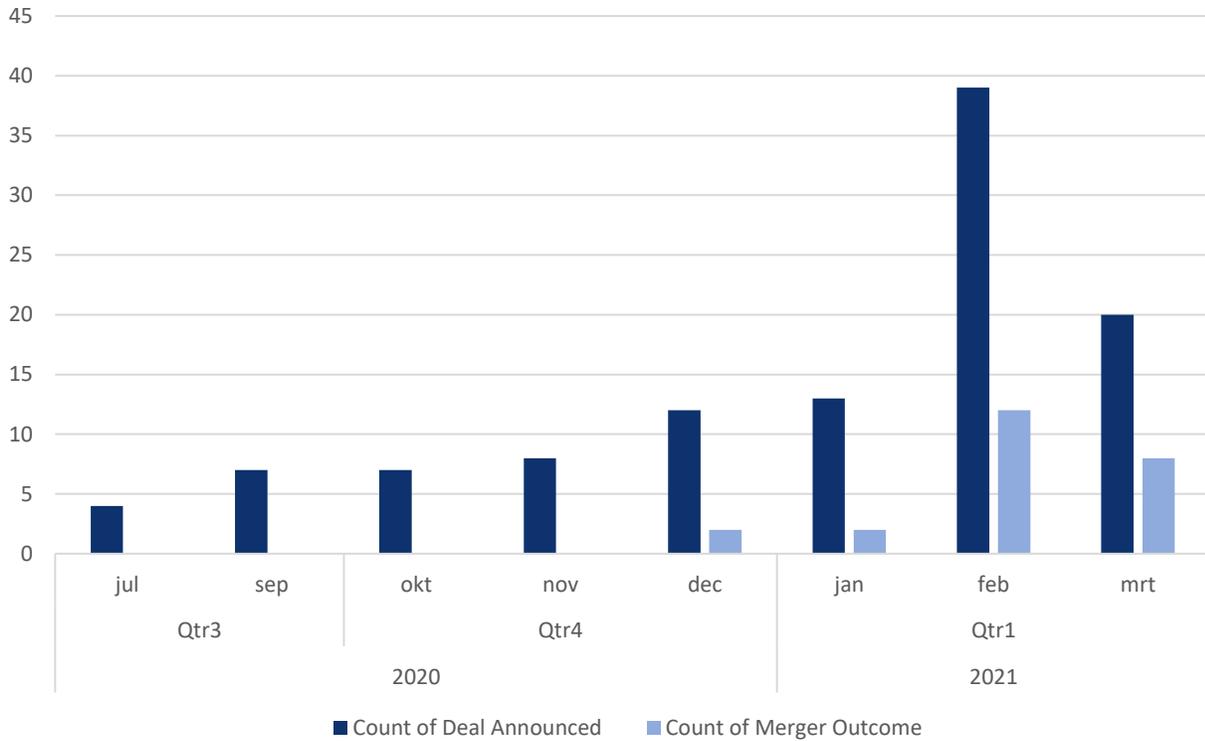
Adapted source: Lewellen, 2009.

Appendix B

Figure B1

Distribution of the observed SPAC deal announcements and merger outcomes over time

Figure B2

Number of days used for market beta estimation of the SPACs with a completed or rejected merger