

School of Economics and Management

From SPAC-boom to bust:

an analysis of the decline in SPAC performance and rising liquidation rates

Master Thesis Finance

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Abstract

Following the explosive growth of USA SPAC IPOs in 2020-2021, which shows a change in the SPAC market. However, the recent performance of SPAC structures remains relatively understudied in current literature. This study investigates the contemporary SPAC market using unique, manually collected data for 579 USA SPACs that went public between 2021 and 2023. The analysis is based on various return calculations and regression analyses to assess performance trends and underlying drivers comprehensively.

The findings show a sharp increase in the liquidation rate, reaching almost half of the period under review, where a more extended search period increases the probability of a SPAC merger. Returns have decreased sharply for several parties, for instance, SPAC-IPO investors show an average annualised return of 4.16%, which is lower than in previous periods. Sharp losses of -64.08% and -62.55% are observed for the post-merger returns of the common share and PIPE/FPA investors, respectively. While sponsors achieve an average total return of 7.28%, this is nothing compared to the previously observed returns of hundreds of percentages.

These outcomes are significantly lower than in previous periods. Cross-sectional analysis indicates that the high average redemption rate of 86.98% in the studied sample significantly explains the low returns, as higher redemption rates are associated with significantly lower post-merger performance. An additional analysis shows that the low average Net Cash Per Share (NCPS) of $4.16 is significantly associated with worse deSPAC common share returns. Overall, this research presents a deteriorating picture of SPACs in the post-boom period.

Keywords: SPACs, Performance, Redemption, deSPAC, Liquidation

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2. Introduction

Between 2020 and 2021, the number of listed Special Purpose Acquisition Companies (SPACs) increased sharply. This so-called SPAC boom led to an explosive growth in the number of SPAC Initial Public Offerings (IPOs) and a significant number of mergers with target companies. However, the strong emergence of SPACs as an alternative route to the stock market also led to concerns about transparency, conflicts of interest and costs.

Many existing studies, for example Gahng et al. (2023b), are based on a period when liquidations among SPACs were relatively rare. Their period studied had a liquidation rate of only six percent, with high positive returns for IPO investors and sponsors, reflecting especially favourable market conditions, with few liquidations and successful mergers. However, the dynamics changed in the later years of their observation period. From 2020, explosive growth took place, with 248 new SPAC IPOs in 2020 and as many as 613 in 2021 (Figure 1). Precisely, SPACs from these recent cohorts show a significantly increased risk of liquidation and significantly worse returns. Moreover, Gahng et al. (2023b) predicted that by the end of their sample, the number of liquidations would have rapidly increased, and it is estimated that 80% of SPACs still active at the end of 2021 would eventually have to liquidate. This development puts firm pressure on future returns and indicates that follow-up research into the post-boom period, when liquidations are common, is necessary to assess the current and future performance of SPACs realistically. Against this backdrop, the central research question of this study is as follows:

How has the SPAC market changed in the post-SPAC boom (IPO 2021-2023), and what have been the outcomes for returns, NCPS and liquidations?

To answer this question, this research addresses several sub-questions, examining different SPAC returns and characteristics: to what extent are the parties that were seen as winners before the SPAC boom, such as sponsors and early investors, still able to generate attractive returns, or have they become the new losers? And what are the factors (drivers), and characteristics of these returns? Klausner, Ohlrogge and Ruan (2022) identify the cost structure in terms of NCPS as an essential predictor of post-merger performance for previous periods, but how has the cost structure of SPACs changed after the SPAC boom, in terms of NCPS? Finally, it examines whether there are SPAC-IPO characteristics that increase the probability of a merger for the sample studied.

Much of the existing research on SPACs has focused on transactions that occurred before the boom period. Where the period of existing literature ends, this research continues there. As illustrated in Figure 1, there was an exceptionally high volume of SPAC IPOs in 2021, indicating a major change in the SPAC market. This study examines these changes by analysing various types of returns within the SPAC structure to provide a comprehensive overview of current SPAC market conditions. The returns for various investors, such as early investors (SPAC-IPO investors), post-merger investors, sponsors and Private Investment in Public Equity (PIPE) investors are the most important ones. Next, the factors and characteristics that have a significant effect on returns in the post-boom period are identified. Furthermore, any shifts in cost structures, specifically expressed as Net Cash Per Share (NCPS) and the effect on returns, will be considered. Finally, characteristics that increase the probability of a SPAC merger will be examined.

The findings will be compared with the studied periods of previous literature, which serve as a benchmark, so that changes can be identified. As a result, this research will contribute to a complete and more up-to-date picture of SPACs after the large increase in SPACs in the boom period. It is essential for investors to understand the extent to which SPACs remain an attractive investment opportunity, as well as which parties are most at risk and which factors play a significant role in this.

Extensive and detailed data were used in the study, including market prices for shares and warrants, which were utilised for return calculations. The return factor was also applied to common share calculations, following the methods employed by Gahng et al. (2023b) and Lin et al. (2024), among others. Furthermore, detailed SPAC-specific data were collected: redemption rate, derivative structures[1], IPO proceeds, underwriter fees and ranks, additional funding by PIPEs[2], sponsor forfeiture, overallotment and more sponsor[3] and SPAC-specific data[4]. SPAC-specific variable that look at the presence of conflict of interest was collected as well, such as the number of months between SPAC IPO and merger (Dimitrova, 2012), e.g. a longer SPAC period would lead to lower post-merger returns.

[1] How many shares, and any warrant and rights a unit contains. And its fraction. With which the dilution effect can be calculated.
[2] PIPE share prices paid, number of PIPE shares, additional bonus shares/warrants obtained, were also collected, so that the discount/premium obtained for PIPE investors can be calculated, for accurate return calculation.
[3] Such as promotion shares obtained, shares and warrant forfeiture, additional shares obtained, capital at-risk, number and type of capital at-risk securities, all to ensure most accurate return calculation.
[4] Bonus shares allocated to non-redeeming shareholder, underwriter fee forfeitures, or a stakeholder such as an underwriter or advisor has a shareholding interest in the SPAC.

Several data sources were used to collect the data. The primary source is the commercial database SPAC Research, which contains highly detailed SPAC-specific characteristics. The data from this database was carefully identified by SPAC, hand-collected and compared with the Gritstone Asset Management database. This has been compared with Securities and Exchange Commission (SEC) filings when in doubt and adjusted where necessary. Furthermore, Wharton Research Data Services (WRDS) was used, with Compustat - Capital IQ and Centre for Research in Security Prices (CRSP) modules. For the underwriters' rank, the data set '*IPO Underwriter Reputation Rankings (1980-2024')* of Jay R. Ritter professor at the University of Florida was used.

With this comprehensive dataset, the returns for various stakeholders and investors were calculated. Several factors were considered to achieve the most realistic representation possible. Subsequently, these returns were used as explanatory variables in several cross-sectional regressions to determine which SPAC-specific factors significantly influence returns. Lastly, a logit regression was performed to analyse the probability of merger or liquidation, using SPAC-specific characteristics available at the time of the SPAC IPO as explanatory variables.

The results show many negative returns. The common share investor in the post-merger period averages a negative total return of -64.08% one year after merger and -22.09% for the warrant return. Similar negative returns are seen for the PIPE/FPA investor, averaging -62.55%. For sponsors, an average total return of 7.28% is observed for the total sample. However, for the SPAC IPO investor – SPAC period – an average positive annualised return is achieved in the post-boom period. This averages 4.16% for the total sample. When differentiated for merged and liquidated SPACs, it is 6.47% and 2.12% respectively. These findings suggest that the SPAC market has undergone a robust turnaround across all calculated return measures. Because in previous periods under study, high positive returns were observed, with only a few slightly negative returns for deSPAC common share investors. The regression analyses indicate that the high redemption rate observed in the sample has a significantly negative effect on post-merger returns. This finding is robust across different return measures and model specifications. The average lower NCPS of $4.16 also has a significant impact on post-merger common share returns.

For the SPAC period return calculations, the 'optimal redemption strategy' was used, introduced by Gahng et al.(2023b) for which they showed a return of 23.9% for their period under study. This method has been used several times in other studies. For example, Lin et al. (2024) found

an average of 13.67% for their sample. Gahng et al.(2023b) also used the same simple buy-and-hold return calculations for the post-merger performance of common shares and warrants, for which they reported an average return of -11.3% and 72.2%, respectively. These studies will provide a benchmark for the sponsor and PIPE returns achieved, with returns of 619% and 9.3% respectively. The comparisons show large negative differences.

Net Cash Per Share, according to Klausner, Ohlrogge and Halbhuber (2022), a key explanatory variable for post-merger performance, has also been calculated for the current study. This is partly since in the new SEC rules SPACs must be clearer in dilution effects – effect of a warrant or right in the original unit, sponsor compensation and other direct and indirect costs, etc. These direct and indirect costs are included in the NCPS. Klausner, Ohlrogge and Ruan (2022) show in their study that SPACs are substantially more expensive than traditional IPOs, with hidden cost structures ensuring that, on average, only $4.10 net cash per share of the initial $10 remains on merger, for their calculated sample of 47 SPACs. They emphasise that these costs are primarily borne by non-redeeming shareholders, who, on average, earn strongly negative returns after mergers. In an additional study, Klausner and Ohlrogge (2023) confirm that this negative post-merger performance can be traced to low NCPS. In this study, for a larger sample size, they present an average NCPS of $6.40. Gahng et al. (2023b) show a higher mean of $7.46 for their sample.

In conclusion, the SPAC market shows a big change from the pre-boom period. For instance, the liquidation rate in the sample studied has increased tenfold compared to the pre-boom period. This change is also reflected in returns. For instance, the losers of earlier periods in the studied SPAC market have become even bigger losers and what used to be winners, such as sponsors and IPO investors, are currently achieving low positive returns. This trend can also be seen in the NCPS, this has also decreased compared to previous studies, meaning less cash is reaching the target company, making merging with a SPAC even more costly than before.

From the regressions on the calculated returns, it can be concluded that the redemption rate has the largest and most significant negative effect on returns, robust to the different returns. NCPS also has a significant explanatory contribution for the common share investor. For instance, a higher redemption rate leads to lower post-merger returns, and a higher NCPS leads, on average, to higher post-merger returns. A longer agreed search period for a target and a lower underwriter's rank appear to increase the likelihood of a merger. In short, much has changed in

the SPAC market, with structurally lower returns and NCPS. This is the result of high redemption rate in the sample studied.

In section 3, existing literature is discussed, which acts as a basis for the study. In section 4, the study period and the sample studied are clearly explained. The sample will consist of several sub-samples, so that the largest possible sample and most recent information is always used. Here, the working of a SPAC structure is explained as well, and descriptive statistics are discussed. Section 5 discusses the methodology for the different return calculations, Net Cash Per Share calculation, the cross-sectional OLS regressions on the different returns and the logit regression with the probability of a merger. In section 6, the findings are presented in tables and explained; key takeaways are presented here as well, summarising the main findings. Section 7 compares the findings of this sample with previous literature, discussing the magnitude of change in the SPAC market. Finally, section 8 concludes how the SPAC-market has changed in the post-boom period, based on the research questions, after which nutritional follow-up studies are discussed.

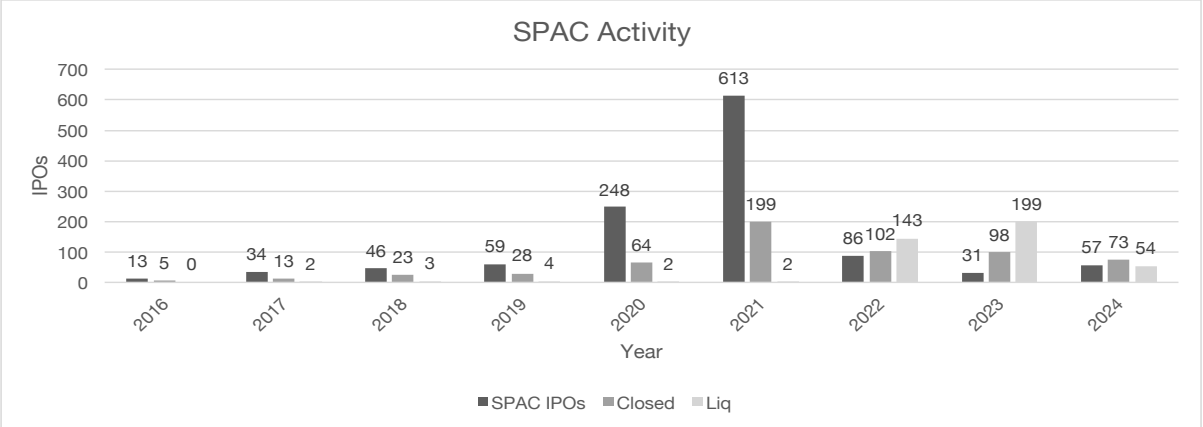


Figure1 SPAC Activity by year: shows the annual SPAC activity over the period 2016-2024. Three categories are shown for each calendar year: the number of SPAC IPOs (dark grey), the number of closed mergers (medium grey) and the number of liquidated SPAC.

3. Literature review

Special Purpose Acquisition Companies (SPACs) are publicly traded blank check companies that raise capital through an IPO with the aim of merging with a private company within 18 to 24 months, to make the private company publicly traded through this way. SPACs popularity expanded in 2020-2021, due to their perceived speed and flexibility as an alternative to traditional IPOs. During this period, more than half of all US IPOs were SPAC deals. A sharp decline followed this period in the number of SPAC IPOs, the number of liquidations increased (Figure1) and post-merger returns often proved as disappointing.

3.1 SPACs

SPACs have since evolved from simple 'blank check' vehicles into alternative stock market instruments. Their attractiveness lay in legal flexibility, speed and avoidance of traditional IPO complexity – factors that were particularly attractive to fast-growing or hard-to-value companies. In theory, SPACs offered public access to private deals and corrected some of the inefficiencies of the traditional IPO model (Berger, 2008). However, empirical studies point to structural shortcomings, disproportionate sponsor rewards, dilution of public shareholders and low realisation of the assumed efficiency benefits (Klausner, Ohlrogge, & Ruan, 2022; Gahng et al., 2023b).

At the same time, alternative perspectives show that SPACs can also provide functional benefits. Bai et al. (2021) view SPACs as useful market intermediaries within segmented capital markets, providing access to firms that cannot go public through traditional channels. These insights are supported by studies on governance, ownership structures and voting behaviour (Jenkinson & Sousa, 2009; Cumming et al., 2014). The governance structure thereby shifted from participation ("voice") to formal exit ("exit") to better protect shareholders from sponsor interests (Rodrigues & Stegemoller, 2011). The introduction of the redemption option for SPAC-period investors led to observed redemption rates of 37%, 58% and 55% on average, respectively, for Gahng et al (2023b), Klausner, Ohlrogge, & Halbhuber (2022), and Lin et al (2024).

3.2 Returns and conflict of interest

Gahng et al. (2023b) show for their studied sample that there are different returns to be obtained in the SPAC lifecycle and split the lifecycle into a pre- and post-merger period. Public shareholders experience negative return effects, especially during deSPAC period, on average - 11.3%, compared to a market return of 19.4%. More negative returns were observed in

research by Lin et al. (2024). However, Klausner, Ohlrogge and Ruan (2022) showed a positive return of 19.1%. This market-adjusted underperformance indicates a structural negative effect for SPAC bellwether stocks. Furthermore, Gahng et al. (2023b) suggest that if SPAC-IPO investors redeem their shares optimally, via the 'optimal redemption strategy', they achieve an average annualised return of 23.9%. Lin et al. (2024) showed for their larger sample an average return of 13.67% for common shares in the SPAC period, a similar return was found by Klausner, Ohlrogge and Ruan (2022).

Gahng et al. (2023b) report total returns for sponsor earnouts averaging between 619% and 748%, depending on the assumptions made about shares subject to vesting restrictions – 20% lower for a larger sample (Gahng et al., 2023a). These earn-out structures reduce the value of sponsor earn-out shares (Klausner & Ohlrogge, 2022). Klausner, Ohlrogge and Ruan (2022) found a lower sponsor return of 549% on average for their sample of 47 deSPACs from January 2019 to June 2020 and lower than the annual management return of 1900% in the period from 2003 to 2006, which Jog and Sun (2007) calculated.

The average annual return for PIPE investors is 9.3%, significantly higher than the average annual return of -19.8% that shareholders received in the public market (Gahng et al, 2023b), Lim et al. (2019) show an average abnormal return of 12.1% for their sample of the entire PIPE market.

Banerjee and Szydlowski (2024) argue that part of the explanation in return differences lies in behavioural aspects. They examine how overconfident investors overestimate the option value of redeemable shares. This leads to overinvestment in low-quality targets and explains why long-term investors suffer losses on average, while short-term arbitrageurs make profits. Rodrigues and Stegemoller (2021) show that the current system, which allows shareholders to vote for an acquisition while simultaneously withdrawing their shares, leads to a decoupling between voting rights and economic interest. Their analysis of SPACs from 2010-2019 shows that, on average, more than half of the shares are completed at deSPAC, and that a higher redemption rate is negatively correlated with post-merger returns. These findings are confirmed by Feng et al. (2023). Market prices around the voting date are crucial here: price falls below trust value often led to massive redemption (Jenkinson & Sousa, 2009).

SPACs face structural incentive distortions arising from the combination of a hard merger deadline, promotion structures and minimum spending requirements. Dimitrova (2012) shows that as a result, sponsors have strong incentives to complete a merger before the deadline, even if it is suboptimal, to secure their compensation. Kiesel et al. (2022) confirm that a longer time

between IPO and announcement leads to lower post-merger returns, which suggests that approaching deadlines increase agency conflicts between sponsors and common shareholders. This leads to systematic value destruction for shareholders. Gahng et al. (2023b) confirm these patterns and show that late mergers, high redemption ratios and low underwriter quality are associated with worse returns.

The strong asymmetry in sponsor compensation creates a structural conflict in the face of impending liquidation. Klausner, Ohlrogge and Ruan (2022) and Gahng et al. (2023) argued that sponsors lose their entire promotion and capital contribution in the event of liquidation, which may prompt them to face risky or marginal deals. In some cases, this leads to restructuring (forfeitures) of promote shares.

This conclusion is reinforced by Feng et al. (2023), they find that in SPACs, large agency costs are incurred by sponsor promoters regardless of the quality of the deal. This conflict of interest between sponsor and shareholders allows value-destroying mergers to continue, leading to lower returns for investors. The research shows that tying more sponsor rewards to earnouts and improving transparency around deals significantly improves outcomes for shareholders. Limiting warrants lowers agency costs only slightly.

Besides economic incentives, governance conflicts also play a major role. Jenkinson and Sousa. (2009) point to 'vote buying' by sponsors and ignoring market price signals around shareholder votes. This influences the voting process and puts pressure on the legitimacy of decision-making. Cumming et al. (2014) additionally highlight the importance of ownership structure, hedge fund shareholders are more likely to vote against mergers, while sponsor and management interests go hand in hand with approval.

3.3 SPAC liquidation

If a SPAC fails to find a suitable merger partner within the specified timeframe, the SPAC is liquidated and shareholders receive their deposit back pro rata from the trust account (Cumming et al., 2014); Gahng et al., 2023b). The structure provides strong downside protection for IPO investors as most of the capital is paid into a trust account. Upon liquidation, shareholders receive on average 96% of their deposit back (Cumming et al., 2014), making SPACs attractive as investments, with option value in successful mergers. This protection explains the popularity among arbitrageurs who benefit from the difference between market price and trust value, with the added advantage that they are often allowed to keep their warrants after redemption. A later period studied shows an average return of 2% per year for SPAC-IPO investors in the absence

of a merger (Gahng et al, 2023b). For sponsors, a liquidation means the loss of their promote and 'at-risk capital', which gives them a strong incentive to make a deal (Gahng et al., 2023b).

3.4 Cost structure

The economic efficiency of SPACs is the focus of several studies analysing the structural impact of dilution, remuneration structures and transaction incentives. Klausner, Ohlrogge and Ruan (2022) show, based on 47 merged SPACs, that the net present value per share on merger averages $4.10 – a significant drop from the initial SPAC IPO price of $10. This loss is largely due to indirect costs such as dilution, through sponsor promotion shares, fees, rights and warrants. A later study by Klausner and Ohlrogge (2023) showed an average of $6.40 NCPS. The study by Gahng et al. (2023b) confirms these findings with a dataset of SPACs from 2010 to 2021. They report that effective cash delivered to the target company averages $7.46 per share – more than from research by Klausner and Ohlrogge (2023). This difference is largely explained by assumptions of redemption ratios and the exclusion of warrants. In an additional study, Klausner and Ohlrogge (2022) confirm that post-merger performance is traceable to the amount of net cash per share at the SPAC merger.

3.5 Regulatory frameworks

Jackson and Morley (2022) argued that SPACs are legally very similar to mutual funds and may fall under the Investment Company Act (ICA) of 1940. Which would therefore put them in violation. For this reason, the authors filed lawsuits in August 2021. SPACs responded to the lawsuits and new SPACs shortened their duration and invested trust assets exclusively in short-term US government bonds or corresponding money market funds. Moreover, SPACs included explicit disclaimers in their prospectus. According to Jackson and Morley, these adjustments show that SPAC sponsors are anticipating impending regulation and proactively aligning their structure with ICA requirements. After which, in March 2022, the SEC confirmed this by announcing new rules for SPACs. In January 2024, the definitive new SEC rules took effect, requiring SPACs to report more comprehensively on sponsor fees, conflicts of interest, dilution, and other information and risks from SPAC-IPOs and de-SPAC transactions. In short, SPACs must now fully disclose more information and forecasts, the safe harbour lapses, and the target company often becomes jointly liable for the information provided (U.S. Securities and Exchange Commission, 2024).

3.6 Lockup

In addition, structural features such as lockups are found to affect price movements. Hanka (2001) shows in the context of traditional IPOs that the expiry of lockups leads to significant price declines – even without actual sales. These insights are applicable to SPACs, where similar lockup arrangements apply to sponsors, the target company and PIPE investors.

The literature shows varying returns, dilution effects, conflicts of interest and changing regulations. However, these findings were made for other market conditions, where liquidations and regulations were limited. This research focuses on the still reasonably under-researched period, where liquidations increase, stricter rules are announced, high redemption occurs and returns change. In this post-boom analysis, the focus is on the changes in returns and the factors that have led to these changes. This will be done partly through the analysis of the NCPS on returns. Finally, it will look at whether there are IPO-specific characteristics that increase the probability of a merger. After which the question can be answered: how has the SPAC market changed in the post-SPAC boom (IPO 2021-2023), and what have been the outcomes for returns, NCPS and liquidations?

4. Data

4.1 Period selection:

Gahng et al. (2023b) analyse the market for USA SPACs using a dataset that involves the period from January 2010 to December 2021, with deviations for different sub samples[5] . They limited their sample period to SPACs that went public before December 2020, giving SPACs enough time to merge or liquidate.

This context is essential for positioning this research. While Gahng et al. (2023b) conclude their analysis at the time when the SPAC market was still in a favourable market environment, this study focuses on the post-boom period from 2021, 2022, 2023 to 2024 and begin 2025. Fundamental changes are expected in this post-boom phase of the SPAC market. The changed market conditions, such as the announcement of stricter SEC regulations for SPACs, the increase in SPAC IPOs and a rise in liquidations, could have significantly affected the dynamics within the SPAC sector for this period. Based on the selected period, we can look at how the SPAC market has changed in recent years compared to the previous period.

[5] Gahng et al, 2023 used smaller sub-samples for sponsor and PIPE investor analyses.

4.2 Sample selection

For this study, a sample of SPACs that completed an initial public offering during the period from 1 January 2021 to 31 December 2023 and underwent a merger or liquidation before May 2025 was selected. Between 2021 and 2023, 730 SPACs went public through an IPO. Of which 610 SPACs were eligible, 333 Liquidated and 277 merged SPACs. This created two main groups that are analysed among themselves and in comparison, with previous studies (Figure2).

To ensure the relevance and comparability of the data, only USA traded SPACs listed on regular exchanges are included, where SPACs that were traded only on over-the-counter (OTC) markets are excluded[6] . These include the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX,) and the NASDAQ, identified by the CRSP exchange codes 1, 2, and 3, respectively. As a result of this selection, five SPACs were removed from the closed sample and seven SPACs from the liquidated sample. In addition, nineteen SPACs were removed from the liquidated sample due to the lack of reliable trust value data. Ultimately, this results in a final sample of 307 liquidated SPACs and 272 merged SPACs within the period described.

Several sub-samples are used so that the largest possible sample with the most recent information is always used. For instance, a sub-sample is created for the deSPAC common share return for SPACs merged before 31-12-2024, due to the lack of the return factor. For sponsor and PIPE investors, a sub-sample will be created for SPACs merged before May 2024, providing a full year after the merger. For the analysis of SPAC characteristics, the full sample will be used to get a complete picture of current SPAC conditions. This method of sample selection ensures that the most recent available information is used for each analysis, making the study as accurate as possible to current events.

4.3 Databases

A combination of public, commercial and manually supplemented data sources was used to construct the final dataset. The integration of different sources enabled the reconstruction of both quantitative core data and detailed merger structures of SPAC transactions.

The primary source for SPAC-specific information is the commercial database of SPAC Research, a specialised data provider with a focus on SPAC market dynamics. Through SPAC Research, information obtained for each SPAC included: tickers of the SPAC and the target

[6] The exclusion of SPACs traded only on the OTC market has been seen repeatedly in previous studies as well.

company, IPO date, merger date, unit structure, underwriters involved, PIPE financing raised, redemption rate, earnouts structures, merger and IPO sectors, overallotment, warrant prices, share prices, shareholder structures, level of 'at-risk' capital, bonus schemes, forfeitures, sponsor interests and more relevant data. The data from this source was manually collected for all 579 individual SPACs and structured by SPAC transaction, as much information is only available through individual sheets. Where necessary, additional verification was conducted using external sources, such as SEC filings and Gritstone (SPAC Research, n.d.).

To validate and extend price data, Wharton Research Data Services (WRDS) was used, particularly through Compustat – Capital IQ and CRSP (Centre for Research in Security Prices) modules. These sources were used to obtain historical and current stock prices, warrant prices, benchmark, return factor and delisting data of merged SPAC targets. Filtering was also applied through these sources to stock market listings for the NYSE, the AMEX and the NASDAQ.

The reputation scores of underwriters are from the database of Jay R. Ritter, professor at the University of Florida. His dataset, titled *IPO Underwriter Reputation Rankings (1980-2024)*, provides a standardised scale of underwriter prestige, ranging from 1 (low) to 9 (high). This ranking is widely used in academic research on the IPO market and has been used to classify the reputation of investment banks involved in SPAC transactions (IPO Data - Jay R. Ritter, 2025).

Finally, additional and missing information was searched through the U.S. Securities and Exchange Commission (SEC) database. Through the EDGAR environment, 8-K and S-1 filings were consulted to supplement or cross-check missing data from SPAC Research for accuracy, as well as with the publicly available database Gritstone Asset Management (Gritstone Asset Management). Information was manually collected from these documents on shareholder structures, including the exact number of shares granted to PIPE investors and the number of sponsor shares declared (forfeited) at closing of the merger (SEC.gov | Search filings, s.d.).

By triangulating the above sources, a robust, integrated dataset has been built that allows for reliable analysis of SPAC transactions in the period from 2021 to May 2025.

4.4 Institutional details

4.4.1 Functioning of the SPAC structure

A SPAC is a listed investment vehicle formed with the aim of merging with a private company within a predetermined period, typically 18 to 24 months, thereby enabling the private company to go public through this route. At its core, the SPAC constitutes a blank cheque vehicle: at incorporation, the SPAC possesses no operational activities and no assets of its own, other than the funds raised from investors during the SPAC's initial public offering.

The process begins with the formation of the SPAC by a sponsor, typically comprising experienced investors. The sponsors provide the initial working capital, known as at-risk capital, and in return receive the so-called ‘promote’ – usually 20% of the shares after the IPO at a fraction of the price, which are only distributed in the event of a merger (Gahng at al., 2023b). The SPAC is then floated via an IPO, with public investors buying units, often consisting of a common share and a warrant (or part of) or any right; these are converted into a fraction of a common share at the time of merger. In the IPO, a SPAC is assisted by underwriters, these bankers assist SPACs in the IPO, placing the units, and finding SPAC IPO investors. For this, the underwriters receive a fee, often in the form of an upfront and deferred fee, which is paid by the SPAC IPO investor. The proceeds of the IPO are placed almost entirely in to a trust account – often at a fixed interest rate, which can only be used upon the completion of a merger or liquidation.

After the IPO, the search phase starts, in which the sponsor starts looking for a suitable acquisition candidate. This target should meet predetermined criteria, such as a specific sector. When a suitable private company is found, the merger is announced. A shareholder vote is then held to obtain approval for the transaction. Public shareholders retain two rights at this stage: they may vote on the merger, and, regardless of the outcome of their vote, they may sell their shares back at the initial trust value plus accrued interest.

If enough shareholders agree and not too many shares are sold back (redemption), a merger will take place; otherwise, the SPAC is liquidated. The SPAC merges with the target and becomes publicly tradable under a new name and ticker symbol – the deSPAC period. If the sponsor does not find a target company within the specified period, then the SPAC is liquidated and the funds from the trust account are distributed pro rata to shareholders and the sponsor lose his investment.

Several stakeholders play key roles during the SPAC process. Sponsors are responsible for sourcing deals and negotiating them. PIPE investors often provide additional funding during the merger phase to increase the deal value and strengthen the balance sheet. Underwriters and legal advisers support IPO structuring and merger documentation.

The structure of SPACs creates unique incentive mechanisms. Sponsors are strongly motivated to close a deal, as their promotional rewards have value only in the case of success. At the same time, the downside risk for public investors is limited by the trust account and the right to buy back shares. Appendix3 outlines the lifecycle of a SPAC.

4.5 Variables and descriptive statistics

Figure1 shows that a lot has changed in the SPAC market. For instance, the figure shows that 2021, with 613 SPAC IPOs, is the actual SPAC-boom year. Never in history have there been so many SPAC IPOs as in 2021. The same year also saw a record 199 SPACs merging, with only two SPACs liquidating. SPAC IPOs dropped sharply in the following years, with only 86, 31 and 57 SPAC IPOs for 2022, 2023 and 2024, respectively. Thus, the number of liquidations in the years 2022 and 2023 were higher than the number of mergers.

Looking at the studied period (Figure2) of SPACs with only an IPO in the period 2021-2023, out of 730 SPACs, 37.94% have merged and 45.61% have liquidated by May 2025 as reference date. The remaining 16.43% are still ongoing.

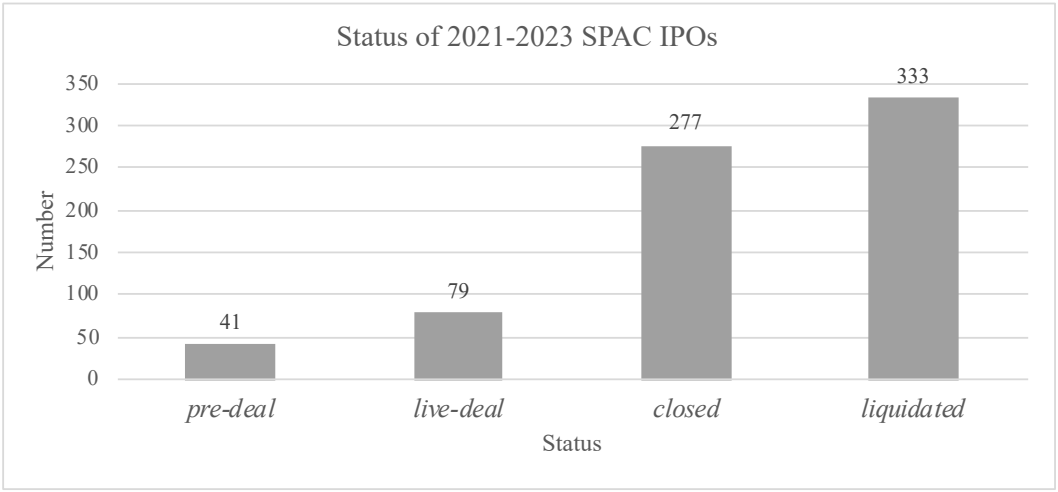


Figure2 Status of 2021-2023 SPAC IPOs the figure above shows the status of the total number of SPACs that underwent a SPAC IPO in the years 2021, 2022 and 2023 with May 2025 as the measurement date. The status of the SPAC is shown on the horizontal axis, pre-deal, live-deal, closed and liquidated. The numbers per status are shown on the vertical axis.

4.5.1 Closed SPACs

Table1 presents the descriptive statistics of all SPACs that underwent a SPAC IPO during the period from January 2021 to December 2023 and merged before May 2025. The variables in this table provide insight into both the initial structure of the SPAC and the final characteristics and conditions of the merger with a target.

Months_to_merger is the number of months between the SPAC IPO and the merger. On average, it takes a SPAC 22 months to merge with a target.

IPO Proceeds ($M) shows the gross amount in millions of USD raised during the SPAC IPO. On average, it is $233 million per SPAC, with a median of $230 million.

Total Enterprise Value ($M) (TEV) shows the total valuation of the target and SPAC at the time of merger, with an average of $1,340 million and a median of $607 million. This shows the size of targets and is a multiple of the SPAC IPO amount. The standard deviation of $2648 million indicates a large variation in size between the value of deals. The reduction of 23 observations is due to a lack of information.

TEV/IPO is the Total Enterprise Value, SPAC IPO Proceeds ratio. It shows how many times larger the value of the target is relative to the SPAC IPO proceeds. The average of 5.76 means that targets are, on average, almost six times larger than the capital raised by SPAC. The minority of 23 observations is attributed to a lack of information.

Earnout indicates whether an earnout structure was applied to sponsor-promote shares after the merger. In 68 out of 272 transactions, there is an earnout structure, with sponsors retaining shares based on post-merger performance.

Dilution SPAC unit (%)[7] represents the degree of dilution caused by derivatives in the IPO units, such as warrants and rights. Dilution is calculated as the percentage of additional shares (relative to one ordinary share) that a warrant or right represents. A unit consisting of one share, ¼ warrant, and 1/10 right represents 35% dilution. On average, this results in a dilution of 45.99%, a median of 50.00%, and a maximum dilution of 116.70%. This is because a unit

[7] For the merged sample, 244 SPACs contained warrants, and 41 SPACs contained rights in the initial SPAC unit.

contains a whole warrant – a warrant is converted into a common share in its entirety – and contains 1/6 rights.

Redeem (%) gives the percentage of public shares surrendered for redemption prior to the merger. The mean of 86.98% and median of 95.60% show that most investors sell their shares back before the merger, indicating low confidence in the proposed deals[8]. This is substantially higher than the percentages found in previous studies (Gahng et al, 2023b; Klausner, Ohlrogge, & Halbhuber, 2022; Lin et al., 2024).

Stakeholder shares (%) shows the proportion of total post-merger shares outstanding held by stakeholders such as underwriters or advisers. In 70 cases, shares are held by stakeholders in the deSPAC period. This represents 3.05% of total shares, according to SEC 8-K filings at the closing date.

Sponsor shares forfeit (%) shows the percentage of sponsor-promote forfeited before or during the merger. This is the percentage forfeited relative to the initial sponsor promote shares. In 112 cases, there was (potential) forfeiture, with an average percentage of 38.41%. This variable also includes potential forfeitures subject to an earn-out arrangement.

Promote (%) refers to the initial share the sponsor would acquire in a merger. On average, this is 20.49% of the pre-merger outstanding shares.

Promote after merger (%) reflects the ultimate sponsor interest after adjusting for forfeits, and other substitutions of sponsor promote shares, expressed as a percentage of total shares outstanding after the merger – according to SEC 8-K filings after the merger. The average is 9.53%. The minimum value of -2.11% indicates situations where sponsors have given up their 'at-risk' shares, which are excluded from this calculation. The maximum value of 51.63% shows that sponsors received more shares, a few shares are held by the new target or a high redemption rate at the merger. The reduction of 29 observations is due to a lack of information on total shares outstanding according to SEC 8-K filings after the merger.

Percentage at risk (%) shows the proportion of capital contributed by the sponsor itself in the SPAC IPO. These funds are used for operational costs and are not repaid upon liquidation, providing an incentive for the sponsor to secure a deal. The average is 3.36% of IPO proceeds.

[8] One observation was omitted due to lack of information.

Up-front UW fee (%) is the fee for underwriters paid directly at the IPO, this cost is for the SPAC investor. On average, this is 1.96% of the IPO proceeds.

Deferred UW fee (%) is the deferred fee to underwriters paid only in the event of a successful merger; this cost is for the SPAC investor. At an average of 3.47%, this creates an incentive for the underwriter to make the transaction successful.[9]

Bonus shares to non-redeem (%) shows the percentage of shares granted as a reward to public shareholders who do not redeem their shares on the merger. The bonus scheme is used in 18 out of 272 cases. On average, this bonus amounts to 210.11% of the total number of SPAC shares after redemption. These shares are remunerated by the additional issue of shares or by a deduction from sponsor promotion shares.

PIPE/IPO reflects the ratio of additional PIPE/FPA investment to IPO proceeds. PIPE/FPA structures were used in 170 cases; on average, PIPE/FPA structures provide additional funding for 47% of IPO proceeds.

Table1 Descriptive statistics of closed SPACs; the table reports the descriptive statistics of 272 Special Purpose Acquisition Companies (SPACs) that completed an initial public offering (IPO) between January 2021 and December 2023 and subsequently entered a merger (de-SPAC) with a target company. For each variable, the number of observations (N. Obs.), mean, median, mode, standard deviation (Std. Dev.), minimum, maximum value and 95% confidence interval (Conf. Lvl.(95)) are shown.

Descriptive statistics for closed SPACs

	N. Obs.	Mean	Median	Std. Dev.	Min	Max	Conf. Lvl. (95)
Months_to_merger	272	22	22	10	5	51	1
IPO Proceeds ($M)	272	233,05	230,00	164,27	44,30	1725,00	19,61
TEV ($M)	249	1340,32	607,00	2648,29	45,00	27062,00	330,55
TEV/IPO	249	5,76	3,36	12,09	0,30	160,13	1,51
Earnout	68	-	-	-	-	-	-
Dilution SPAC unit (%)	272	45,99%	50,00%	0,27	0,00%	116,70%	0,03
Redeem (%)	271	86,98%	95,60%	0,21	0,00%	99,90%	0,03
Stakeholder shares (%)	70	3,05%	1,25%	0,07	0,00%	42,68%	0,02
Sponsor shares forfeit (%)	112	38,41%	30,75%	0,27	2,89%	126,78%	0,05
Promote (%)	272	20,50%	20,00%	0,02	17,21%	50,00%	0,00
Promote after merger (%)	243	9,53%	6,92%	0,09	-2,11%	51,63%	0,01
% at risk (%)	272	3,63%	3,30%	0,01	0,29%	6,91%	0,00
Up-front UW fee (%)	272	1,96%	2,00%	0,00	0,00%	4,00%	0,00
Deferred UW fee (%)	272	3,47%	3,50%	0,01	0,00%	5,26%	0,00
Bonus shares to non-redeem (%)	18	210,11%	87,63%	3,52	3,60%	1427,00%	1,75
PIPE/IPO	170	0,47	0,29	0,69	0,01	6,12	0,10

[9] Underwriter haircuts for the deferred fee were also collected and analysed, this was observed in 14 out of 272 merged SPACs, this is taken into account in the NCPS calculation.

4.5.2 PIPE/FPA investors

Table2 reports the descriptive statistics of PIPE and Forward Purchase Agreement (FPA) structures of merged SPACs, which underwent a SPAC IPO in the period 2021-2023. These forms of additional financing are typically deployed around the time of the merger to supplement the cash level of the SPAC. This is particularly important when public shareholders sell back their shares via the redemption option (Liu & Joseph, 2024). PIPE and FPA investors often receive their shares at a different price – either at a premium or a discount – compared to the market or trust value, which can result in different returns compared to those of regular shareholders.

The variable PIPE+FPA ($M) reflects the total amount raised through PIPE and/or FPA structures per transaction. The mean is $132 million, with a median of $60 million and outliers of up to $1.3 billion. The standard deviation of $213 million indicates wide variation in size between deals.

PIPE share price reports the effective price paid by PIPE investors per share, excluding any additional warrants or rights. In the 159 observations, the average price is $10.06, with a median of $10.00. This shows that the PIPE investor, on average, pays the initial unit price of $10 for a share.

Eco discount (%) is the economic discount obtained by PIPE/FPA investors compared to market prices. These calculations include the additional warrants and shares (bonus) obtained for compensation according to the method of Lim et al. (2019)[10]. Here, the amount financed by PIPE investors is compared to the fair value of the securities obtained – including any bonus shares and warrants[11]. On average, a PIPE investor pays 22.26% more for its obtained securities compared to the market value of the obtained securities at closing, with a median of 3.83% which shows that there are some outliers where a higher premium is paid, which raises the average. For this, previous studies still showed obtained discounts for PIPE investors of 11.2% and 20.1% (Lim et al., 2019; Gahng et al., 2023b).

[10] The method of Lim et al. (2019) uses black-Scholes method for warrant pricing, but this calculation uses actual warrant prices.
[11] In this sample, 12 observations involved additional acquired warrants, and 5 observations involved additional acquired shares (bonus), these are included in the calculation of Eco discount.

Discount Trust P (%) represents the percentage difference between the PIPE purchase price and the trust value (liquidation value) per share at the time of deSPAC. This measures the relative discount (or premium) that PIPE investors obtain relative to what redeeming shareholders receive. On average, PIPE investors obtain a discount of (-) 3.32%.

Discount Close P (%) only shows the difference between the PIPE purchase price and the closing price of the stock on the day of the merger as used by Gahng et al. (2023b) and Liu & Joseph (2024). This indicates that PIPE investors pay, on average, 23.20% more than the current market price at closing, with a lower median.

These statistics show that PIPE investments are used in more than half of the sample, with a price paid per share is $10, corresponding to the initial unit price. However, the discounts obtained show a different observation, where in research by Gahng et al. (2023b) and Lim et al. (2019) another discount is seen for PIPE investors, in the studied sample a premium is paid on average. This illustrates how strongly the bargaining power and timing of a PIPE can vary and how this results in price differences compared to regular shareholders.

Table2 Descriptive statistics PIPE and FPA investments, this table reports the descriptive statistics of Private Investment in Public Equity (PIPE) and Forward Purchase Agreement (FPA) investments for 170 closed SPACs, with a SPAC IPO between 2021 and 2023. The table includes five variables that provide insight into the size of the investment and the discounts or premiums against the economically obtained value, including additional warrants and shares obtained, liquidation value (trust value), and the public closing price of the SPAC share on the merger day. In calculating this statistic, one extreme outlier with a share price of $1,907.09 was excluded. This price represented the only very large outlier in the dataset. The exclusion of this observation was necessary to maintain representativeness and not bias the reliability of the analysis. In this sample, 12 observations involved additional warrants obtained and five observations involved additional shares obtained (bonus), this was included in the calculation of Eco discount. The reported values include the number of observations (N. Obs.), mean, median, mode, standard deviation (Std. Dev.), minimum and maximum values, and the 95% confidence interval of the mean (Conf. Lvl (95)). The number of observations for PIPE share price is 12 lower than the number of PIPE transactions, this is due to a lack of information on the number of shares of PIPE investors. For discount percentages, the minus sign '-'represents a discount obtained.

Descriptive statistics for closed SPACs, PIPE/FPA

	N. Obs.	Mean	Median	Std. Dev.	Min	Max	Conf. Lvl.(95)
PIPE+FPA ($M)	170	132,41	60,00	213,20	1,00	1300,00	32,28
PIPE share price	159	10,06	10,00	1,60	2,69	18,00	0,25
Eco discount	158	22,26%	3,83%	0,79	-78,79%	511,11%	0,12
Discount Trust P	158	-3,32%	-0,10%	0,16	-73,45%	75,44%	0,02
Discount Close P	158	23,20%	4,15%	0,80	-78,79%	511,11%	0,13

4.5.3 Liquidated SPACs

Table3 presents characteristics of 307 SPACs that were liquidated within the period under study. The average IPO proceeds are $286 million, with a median of $253 million and outliers of up to $1.38 billion.

Dilution SPAC unit (%)[12], leaves at IPO an average dilution ratio of 37.84%, with a median of 33.33% and a maximum dilution of 120%.

Promote, the contractual promote percentage granted to sponsors at inception averages 19.84%, confirming the standard 20% promote shares.

Percentage at risk (%) averages 3.40%, with a median of 2.95%. The low spread in this variable also indicates a high degree of standardisation within this contractual component.

The up-front UW fee averages 1.99% of IPO proceeds and the deferred UW fee – which is only paid in the event of a successful merger, and therefore not collected in these cases – averages 3.51%, with a median of 3.50%.

Finally, the Months_to_liquidation variable shows that the average maturity of these liquidated SPACs is 24.39 months. This confirms that most liquidations take place at the end of the standard contractual life of 24 months.

Table3 Descriptive statistics of liquidated SPACs; This table reports the descriptive statistics of 307 SPACs that completed a SPAC IPO between January 2021 and December 2023 and were liquidated. The following variables are included: IPO proceeds, Dilution SPAC unit, the sponsor promote, the percentage of capital contributed by sponsors "at risk" (% at risk), the fee for underwriters (Up-front UW fee and Deferred UW fee), and the total duration in months between IPO and liquidation (Months_to_liquidation). For each variable, the number of observations (N. Obs.), mean (Mean), median (Median), mode (Mode), standard deviation (Std. Dev.), minimum (Min), maximum (Max) and 95% confidence interval (Conf. Lvl (95)) are reported.

Descriptive statistics liquidated SPACs

	N. Obs.	Mean	Median	Std. Dev.	Min	Max	Conf. Lvl. (95)
IPO Proceeds ($M)	307	286,01	253,00	169,81	50,90	1380,00	19,07
Dilution SPAC unit (%)	307	37,84%	33,33%	0,21	0,00%	120,00%	0,02
Promote (%)	307	19,84%	20,00%	0,03	0,00%	30,71%	0,00
% at risk (%)	303	3,40%	2,95%	0,01	0,70%	6,94%	0,00
Up-front UW fee (%)	306	1,99%	2,00%	0,00	0,00%	2,50%	0,00
Deferred UW fee (%)	306	3,51%	3,50%	0,00	2,00%	5,50%	0,00
Months_to_liquidation	307	24,39	24,33	6,02	9,83	44,77	0,68

[12] For the liquidated sample, 283 SPACs contained warrants, and 12 SPACs contained rights in the initial SPAC unit.

4.5.4 Underwriters rank

Appendix1 and Appendix2 show the involvement of bankers – lead underwriter – for merged and liquidated SPACs for the sample period. Both figures show per banker how often it acted as underwriter in the samples (right y-axis), combined with the corresponding ranking according to Jay R. Ritter's scale (left y-axis). In total, the first figure shows 40 different bankers for merged SPACs, and the second figure shows 35 bankers for liquidated SPACs. The black line shows the number of transactions per bank within the respective category, and the grey columns give the bank's reputation score, increasing from 1 (low) to 9 (high). This combined view allows visual comparison of the level of engagement of individual banks within the two samples.

5. Methodology

This section discusses the methodology for the return calculations, NCPS calculations and will look at the drivers behind these returns and their effect on them via cross-sectional regressions. Finally, the logit regression that looks at the characteristics that increase the likelihood of a merger has been presented.

5.1 Returns:

The return calculations and analyses are done by splitting the life cycle of a SPAC into two separate phases, based on research by Gahng et al. (2023b)[13], which allows the results to be compared with their and other previously studied periods. The first phase is the SPAC period, which ranges from the SPAC IPO to the time of merger or liquidation. The second phase is the deSPAC period, which starts at the time after the merger, when the combined company continues under a new name and ticker symbol. This period is not relevant for liquidated SPACs. This classification enables a structured examination of returns across the various stages of the SPAC process and facilitates comparison with studies from earlier periods.

To ensure the robustness of the return trend and to examine the trend of the entire SPAC structure, returns from various stakeholders are analysed: the SPAC IPO investor, the post-merger common share investor, the SPAC sponsor, and the PIPE investor. This addresses the question of how returns have evolved in the SPAC market and whether parties perceived as

[13] This split of the lifecycle of the SPAC is applied in several studies to which the returns found can be compared.

winners during the SPAC boom, such as sponsors and early investors, can still generate attractive returns or have become the new losers.

5.1.1 Annualised SPAC period returns

To calculate the return for public SPAC investors during the SPAC period, we use the '*optimal redemption strategy*'[14] , introduced by Gahng et al. (2023b). This strategy reflects the behaviour of rational investors who hold their SPAC units from the IPO until the exit moment – merger or liquidation of the SPAC – and act optimally by choosing between selling in the market or exercising the redemption right. The strategy assumes that an investor liquidates its position at a realistically feasible time, which is five trading days before merger or liquidation. If due to settlement delays or other administrative delays, investors need to tender their shares in time to sell. At that time, the value of the share is determined as the higher of two values: the market price or the trust (redemption) value. Separately, the corresponding warrants and rights are also valued at their current market price, weighted by the proportional interest in the original unit (e.g. 1/3 warrant or 1/10 right per share). This strategy is underpinned by the observation that more than 90% of public SPAC shareholders leave their position before merger or liquidation (Klausner, Ohlrogge, & Ruan, 2022).

This return measure reflects the total return an investor would achieve by buying a SPAC unit from the SPAC IPO and holding it until liquidation or merger. It considers all the components in a unit you receive as an investor: the ordinary shares, rights and warrants. The aim is to reflect as realistically as possible the total return achieved for the SPAC period. This method of measurement is important because it reveals the total economic value, and because many SPACs have different structures in terms of rights/warrants, the effect of these structures on the return will therefore also be looked at in section5.3.1 OLS regression SPAC period return. The resulting formula expresses the annualised return as a function of the ratio of the value at exit to the original purchase price of a unit, adjusted for maturity in months.

[14] The calculation of returns assumes that investors act rationally and choose the most economically favourable exit option each time; selling the share on the market or exercising the redemption right. It is assumed that all components of the original SPAC unit - share, the warrants and any rights - are separately tradable at market price, without additional costs. Market prices are measured five trading days before the exit moment.

$$P_s/P_i = (1 + R_{SPAC})^{(Months/12)}$$

- ◊ P_s = max (common_P_{t-5}, common_R_{t-5}) + ratio of warrant * warrant_ P_{t-5}+ ratio of right * right_ P_{t-5}.
- ◊ P_i = IPO price of a unit.
- ◊ *Months* refers to the number of months between the SPAC IPO and closing or liquidation.
- ◊ *The ratio of warrants and rights* is the fraction of a warrant or right a SPAC unit includes.
- ◊ *Common_*$P_{t-5}$is the price of a common share five trading days before closing.
- ◊ *Common_*$R_{t-5}$is the redemption value for a common share.
- ◊ *Warrant_*$P_{t-5}$is the price of a warrant five trading days before closing.
- ◊ *Right_*$P_{t-5}$is the price of a right five trading days before closing. This price is calculated as the fraction of a right that turns into a common share times the common share price five trading days before closing.

In this calculation, *max (common_*P_{t-5}*, common_*$R_{(t-)\,(5)}$*)* is the highest value of the market price of share or trust value, plus the market value of the individual warrant(s) and/or right(s), weighted by their proportional presence in the original unit. For example, if a SPAC unit contains one share and one-third warrant, the price of the warrant is multiplied by one-third; this reflects what an investor received at the IPO. Since SPACs do not pay dividends, the total return is based solely on price change. This approach results in a reliable measure of realised returns over the initial investment period (Gahng et al, 2023b). The full sample of merged and liquidated SPACs was used for this analysis.

5.1.2 deSPAC common share return

The post-merger common share return is calculated by a simple buy-and-hold strategy, which assumes that an investor buys a share on the first trading day after the merger – the SPAC and target combination – and holds it for a certain period. This method is consistent with the approach presented by Gahng et al. (2023b). At the time of study, the daily return factor used *'Return (ret)'* of CRSP daily stock is only available up to 31-12-2024. If the period between the merger (closing) and 31-12-2024 is less than one year, 31-12-2024 was used as the end date. If the one-year period is not available after the merger due to earlier delisting, the delisting date was used as the end date; otherwise, a one-year period after the merger was used (T). The daily returns are compiled based on CRSP data, considering both price changes, stock splits, and interim dividend payments. Thus, the total realised common stock return over the observed period is accurately calculated as:

$$\text{BHRC}_{(i.T)} = \prod_{t=1}^{\min(T,delist,31-12-2024)} \left(1 + R_{i,t}\right) - 1$$

$R_{i,t}$ is the return of stock 'i' at time 't', using the CRSP compounded daily returns. As a benchmark, the return on the Russell 2000 index was used. It was calculated using the same method and was calculated separately for each SPAC for the corresponding period. The Russell 2000 index was used instead of, for example, the S&P 500, because the market value of

companies in the Russell 2000 index is more in line with the SPAC sample, than the higher value of companies in the S&P500.

5.1.3 deSPAC warrant return

The return on warrants in deSPAC period is calculated by a simple buy-and-hold strategy. Which assumes that an investor buys a warrant at the market price on the first trading day after merger and holds it until the first of three possible endpoints: one year after closing (T), any delisting of the warrant, or the end of the sample period on 31 December 2024. The formula calculates the total return as the percentage change in the market price of the warrant between the time of the merger and the end date of the observation. Since warrants do not pay dividends, using closing prices without adjustment for interim distributions is sufficient, unlike common shares, where total returns are used. This method is consistent with the method of Gahng et al. (2023b) and provides a measure of the market value change of publicly traded SPAC warrants for the post-merger period, calculated as:

$$\text{BHRW}_{i,t} = \frac{P_{i\min(T,delist,31-12-2024)}}{P_{i_{closing_{date}}}} - 1$$

- ◊ P_i is the price of a warrant at time (T, delist,31-12-2024)
- ◊ P_i_deSPAC is the price of a warrant at the time of closing.

5.1.4 Sponsor return

The calculation of sponsor return is based on realised dollar gains. The sponsor return measures the realised dollar gains for the sponsor one year after the merger, divided by the initial at-risk capital invested. Given that the initial contractual lock-up period for sponsor shares at SPAC-IPO is 12 months, post-merger, in 70% of the sample observations, this lock-up period was assumed to be uniform for the full sample.

The calculation corrects for any forfeitures and other structural adjustments in sponsor interest, such as earnouts[15] and PIPE/FPA conversions[16]. The final return is annualised to compare differences in maturity between IPO and deSPAC fairly.

[15] For earnouts - potential forfeiture - it has been assumed that the earnout terms will not be achieved in the first year after the merger, partly based on the high negative returns on post-merger common shares (Table7). This assumption is conservative; if in exceptional cases earnouts do vest earlier, the calculated sponsor return will be slightly underestimated, although the effect on the total sample is expected to be negligible.

[16] In such cases, the relevant shares are removed from gains calculation, and the corresponding returns are calculated separately under the principle of PIPE or FPA investments in section 5.1.5 PIPE/ FPA investor return.

The sponsor return is calculated as the realised return on the sponsor's invested at-risk capital, considering the value of promotional shares received as well as any warrants and rights acquired through at-risk purchases, net of corrections[17]. The total dollar gains consist of the market value of these shares, warrants and rights, adjusted for any forfeitures or contractual adjustments. The annualised sponsor return is calculated as:

$$R_{Sponsor,Ann.} = \left(1 + R_{Sponsor}\right)^{12/Months} - 1$$

Where $R_{Sponsor}$ is the total return to the sponsor over the entire period, and Months[18] is the number of months between the SPAC IPO and the first anniversary of the SPAC. This sample used a subsample of 219 SPACs, which included only SPACs that had one year available after the merger. This subsample used of SPACs that had an IPO in 2021, 2022 and 2023 and merged before May 2024, so a one-year post-merger period was available.

If the SPAC liquidates, the sponsor loses its entire at-risk capital, which sets the sponsor's return at -100%. The accompanying panel B shows sponsor returns, including the 307 liquidated SPACs.

5.1.5 PIPE/ FPA investor return

The return for PIPE and FPA investors is calculated by a simple buy-and-hold strategy, based on the realised change in value over the one-year post-merger period. This is based on research by Lim et al. (2019), who suggest that the average holding period of a PIPE investor is 384 days – almost a year. Here, the PIPE investor acquires its shares on the first trading day, at an agreed price – on average $10Table2 – and holds them for a fixed period of one year (T). This is equivalent to the lock-up period used by sponsors.

PIPE/FPA investments provide the SPAC with additional capital around the merger, typically in exchange for ordinary shares, bonus warrants or other securities. Typically, PIPE shares were usually offered at a discount to the market price at the time of investment, in this treated sample it was found that PIPE investors, on average, pay a premium over the market (Table2). As not

[17] All adjustments to sponsor interest have been manually analysed and determined based on the 8-K filings and are applied consistently in the calculation. This measure's sponsor return based on the actual value of the remaining interest one year after the merger, adjusted for forfeitures, earnouts and other equity adjustments (Appendix4).
[18] The total lead time consists of the period from the IPO to the closing of the merger, plus the first year after the merger during which the lock-up applies. If the period between IPO and merger is one year, the return is thus calculated over a total investment horizon of two years. In this way, a similar annual return is determined for each SPAC regardless of the exact duration of the trajectory, duration is calculated in months.

all alternative securities (such as convertible bonds) are publicly tradable, the analysis is limited to PIPE financings by shares and any associated bonus warrants. The PIPE return is calculated as:

$$R_{PIPE/FPA} = \frac{Market\ value\ securities_T - Investment_t}{Investment_t}$$

- ◊ Market value securities, is the market value of the number of shares purchased and any bonus warrants or shares acquired one year after merger (T)[19] ;
- ◊ Investment: does the PIPE/FPA investment invest the initial capital at the time of merger (t). Here the discount/premium paid by PIPEs compared to the market price is taken into account.

In determining the market value of the securities, closing prices of the shares and warrants on the reference date are based on the closing price of the CRSP database. The return is calculated based on a sub-sample of SPACs with an IPO between 2021 and 2023, for which at least one year of post-merger data is available. The reference date is set to May 2025, SPACs whose merger took place after April 2024 or were delisted within one year of the merger are excluded from the analysis.

5.2 Net Cash Per Share

NCPS is a crucial indicator for investors in SPACs, according to Klausner, Ohlrogge & Halbhuber (2022), because it reflects the actual amount of cash contributed per share in the merger by the SPAC, net of all forms of dilution and expenses. Furthermore, the SEC's new rules also specify that SPACs must report more clearly on dilution and other costs. Among other things, what is included is the NCPS calculation (U.S. Securities and Exchange Commission, 2024) which suggests that NCPS makes it an essential predictor of post-merger performance in the future. Based on this NCPS calculation, it is evident how the cost structure in terms of NCPS has changed for the sample. NCPS will also be included in regressions to see the predictive effect of the driver on returns.

[19] Non-tradable or private securities are not taken into account in this calculation, so the outcome is representative of publicly observable returns.

5.2.1 Net Cash Per Share measurement:

Net Cash Per Share, according to Klausner, Ohlrogge & Halbhuber (2022), is a core measure that indicates the actual cash contributed per share to the de-SPAC transaction, net of all dilutive effects and costs. NCPS corrects for factors such as outstanding warrants, rights, sponsor promotions, shareholder redemption and fees[20]. It thus provides a realistic picture of the economic value remaining for shareholders in the merger. The exact calculation method follows that described by Klausner, Ohlrogge & Halbhuber (2022). Briefly, total net cash is divided by the number of shares entitled to this cash position, considering all dilution and related equity instruments.

An additional calculation takes into account the dilutive effects of outstanding warrants. The total value of all public and sponsor warrants is calculated using their market price at the time of closing. It is assumed here that sponsor warrants have the same price as public warrants.

5.3 Cross-Sectional Analysis of different SPAC returns

In this section, the methodology of the regressions on the calculated returns is discussed to identify which characteristics have a significant predictive effect on the return and to explain the negative return trend observed. The dependent variables are the excess returns of the SPAC period return, the deSPAC common share return, the sponsor return and the PIPE/FPA investor return.

The excess return for each return is calculated as the calculated return minus the return on the Russell 2000 index for the corresponding period, as mentioned in section 5.1.2 deSPAC common share return. Using the excess return corrects for market-specific conditions for the corresponding period.

IPO year Fixed Effects was used repeatedly; this choice was made given the large number of IPOs in 2021, the lawsuits filed by Jackson and Morley (2022) and the argument that SPACs alone responded to the lawsuits and the announcement of new rules for SPACs in 2022 and any year-specific circumstances. The choice of IPO year Fixed Effects is also reflected in previous studies.

[20] Transaction costs incurred by the target company (such as legal and financial advisory costs) are not included in this calculation due to inconsistent reporting in the documents reviewed. This limitation should be taken into account when interpreting the results.
If the deferred fee has been waived or converted to shares, as in 14 of the 272 transactions reviewed, it is not deducted.

The different regressions repeatedly used the variable defined in Table 4. These characteristics are used to see if they are significant drivers of the various returns and are defined as follows:

Table 4 Variable description: This table shows the variables used in the cross-sectional OLS and logit regressions.

Variable	**Description**
At-risk	Contributed sponsor capital at SPAC IPO (%). (Sponsor 'skin in the game').
IPO_proceeds	Natural logarithm of SPAC IPO proceeds.
Months_to_deadline	Natural logarithm of the number of months between SPAC IPO and the set deadline.
Months_to_merger	Natural logarithm of the number of months between SPAC IPO and the merger. This variable also measures the possible presence of conflicts of interest.
Months_to_liquidation	Natural logarithm of the number of months between SPAC IPO and liquidation.
Warrant	Dummy one if the SPAC unit contains a warrant.
Right	Dummy one if the SPAC unit contains a right.
Rank	The rank of the lead underwriter according to Jay R. Ritter (Appendix1Appendix2)
SPAC_return	The annualised return of the SPAC period (%).
Forfeit	Dummy one if the sponsor forfeits (fraction) shares.
PIPE	Dummy one if the SPAC had PIPE/FPA funding.
Redeem	Redemption percentage (%). Reflects the confidence of SPAC-IPO investors.
NCPS	Net Cash Per Share ($).
PIPE/IPO	Ratio of IPO proceeds and PIPE amount.
Eco_discount	The economic discount/premium obtained on a share for PIPE investments.
Forfeit_value	Percentage of common share forfeited by sponsor (%).
Forfeit_warrant_value	Percentage warrant forfeited by sponsor (%).
Sub_sponsor_value	Percentage of additional shares acquired/ forfeited by sponsor (%).
Financial	Dummy one if the SPAC sector is financial.
General	Dummy one if the SPAC sector is general.
Health	Dummy one if the SPAC sector is Healthcare.
Tech	Dummy one if the SPAC sector is technology.
Auto	Dummy one if the SPAC sector is automotive.
Energy	Dummy one if the SPAC sector is energy.

The explanatory variables in the table include the following characteristics available at the time of the SPAC-IPO, these are defined as followed; the percentage of sponsor capital at risk *(At-risk)* to see if the sponsor 'skin in the game' affects returns. The natural logarithm of IPO proceeds *(IPO_proceeds)* to see if larger SPACs achieve higher returns, the natural logarithm of the number of months between SPAC IPO and the deadline set at IPO *(months_to_deadline)* to see whether SPACs that are given more extended time to seek a target achieve higher returns or increase the probability of merger. Dummy variable for the presence of a warrant or right *(warrant & right)* in the original SPAC unit to see if that affects returns, the rank *(rank)* of the lead underwriter to see whether better underwriters lead to better returns, and IPO sector dummies, to check whether the four prominent sectors achieve higher returns.

The explanatory variables in the table include the following characteristics available at the time of merger; the NCPS as calculated in section: 5.2.1 Net Cash Per Share measurement: at closing, to see if NCPS is a significant driver of returns; the natural logarithm of the number of months between SPAC-IPO and merger (*Months_to_merger*) to see if a more extended search period leads to worse deals and performance, which may explain sponsor-investor conflicts of interest. The annualised return for the SPAC period *(SPAC_return*) to see of better pre-merger performance leads to better post-merger returns (section: 5.1.1 Annualised SPAC period returns), the redemption rate *(Redeem)* to see if higher redemption – lower SPAC-IPO investor confidence – leads to worse performance. A dummy variable for haircuts of sponsor promote shares *(Forfeit*) to see if sponsor forfeiture leads to better returns (lower dilution effect), dummy variable for additional PIPE/FPA investment *(PIPE)* to see if the additional funding leads to better or worse performance. The economic discount or premium *(Eco_discount)* for the PIPE investor (where negative values indicate a discount) to see whether the premium paid has an effect on the return of PIPE investor, *PIPE/IPO* ratio, to see whether a larger PIPE investment leads to better returns, and the merger sector dummies, to check whether the four prominent sectors achieve higher returns.

Finally, the explanatory variables for the sponsor returns are the percentage of sponsor share forfeiture *(Forfeit_value),* the percentage of sponsor warrants forfeiture *(forfeit_warrant_value),* and the percentage of additional shares acquired *(sub_sponsor_value).* These variables are applicable for the sponsor gains return calculation and including them in the regression can explain which factor has the largest effect on sponsor gains return.

The sector dummies *Financial, General, Health and Tech* are the four largest SPAC IPO sector dummies. *Auto, Energy, Health and Tech* are the four prominent merger sectors. These sector dummies were chosen based on the number of observations, out of 13 different sectors, the four sectors were selected with more than 27 observations each, and the remaining sectors are the reference.

In Section 5.3, the cross-sectional regressions on the market-adjusted returns are explained with corresponding regression equations. The concise variable descriptions can be found in Table 4, and the diagnostic tests of the models are described in the appendix: Validation regression models:. Where normality is tested using the Shapiro-Wilk test, heteroscedasticity is tested using the Breusch-Pagan test, and multicollinearity is tested using the VIF factor. Adjustments for outliers are discussed as well.

To ensure the robustness of the regressions, varying uses are made of IPO year fixed effects, sector-specific conditions, and outlier exclusion, with outliers identified and removed based on a Cook's distance rule of thumb.

Based on the comparisons shown for different returns in the sections below, it is possible to infer the drivers behind the returns beyond 2020, which explain the low returns. This is done for different types of returns and associated models, to identify the SPAC market as a whole and ensure robustness.

5.3.1 OLS regression SPAC period return

For the SPAC period analysis, OLS regressions were performed, with the dependent variable defined as returns calculated according to the optimal redemption strategy of Gahng et al. (2023b) (Table 5), adjusted by the Russell 2000 index for the corresponding period. The analysis is based on a sample of 574 closed and liquidated SPACs, after excluding 5 SPACs due to missing information on one or more explanatory variables. For the model without outliers (model 3), the number of observations is 550. The regression is as follows:

$$SPAC\ period\ excess\ return = \alpha + \beta_1 At-risk + \beta_2 IPO_proceeds + \beta_3 Months_to_deadline + \beta_3 Warrant + \beta_4 Right + \beta_5 Rank + \beta_6 Financial + \beta_7 General + \beta_8 Health + \beta_9 Tech + \epsilon$$

The explanatory variables in the model include only characteristics available at the time of the SPAC IPO.

5.3.2 OLS regression common share return

To analyse the deSPAC common share return, as calculated according to a simple buy-and-hold strategy in section5.1.2 deSPAC common share return , OLS regressions were performed, where the dependent variable is the market-adjusted return based on the corresponding Russell-2000 index return. The sample consists of a maximum of 255 merged SPACs, corresponding toTable7 , after excluding an observation due to the lack of the redemption rate. Observations may vary by model, depending on the availability of the variable NCPS and the adjustment for outliers. The following regressions were used with the corresponding variable:[21]

[21] Other potentially relevant factors, such as equity stakeholders, overallotment, fees, bonus for non-redeeming shareholders, earnouts, dilution of SPAC unit etc, were included in sensitivity analyses, but did not result in any significant improvement in the model, so they were excluded from the models.

Basic regression NCPS:

$$Common\ Share\ excess\ return = \alpha + \beta_1 NCPS + \epsilon$$

Extended regression NCPS:

$$Common\ Share\ excess\ return = \alpha + \beta_1 NCPS + \beta_2 Months_to_merger + \beta_3 Rank + \beta_4 SPAC_return + \beta_5 Auto + \beta_6 Energy + \beta_7 Health + \beta_8 Tech + \epsilon$$

Regression without NCPS:

$$Common\ Share\ excess\ return = \alpha + \beta_1 Month_to_merger + \beta_2 Rank + \beta_3 SPAC_return + \beta_4 Redeem + \beta_5 IPO_proceeds + \beta_6 Forfeit + \beta_7 PIPE + \beta_8 Auto + \beta_9 Energy + \beta_{10} Health + \beta_{11} Tech + \epsilon$$

Specifically, in the models that included NCPS as an explanatory variable, the variables used to calculate NCPS were excluded. This was deliberately done to avoid multicollinearity and to analyse the effect of NCPS, as defined by Klausner, Ohlrogge and Halbhuber (2022) purely on the sample. Different sub-samples were used for each model to achieve this purpose.

5.3.3 OLS regression sponsor return

For the analysis of the annualised excess return for SPAC sponsors, OLS regressions were performed, with the dependent variable defined as the annualised return according to section: 5.1.4 Sponsor return , adjusted for market developments by the corresponding return on the Russell 2000 index for corresponding periods. The analyses are based on a sample of 218 sponsor return data from merged SPACs (Table9), one observation is excluded due to missing information. The model without outliers contains 202 observations.

Basic regression:

$$Sponsor\ excess\ return = \alpha + \beta_1 Redeem + \beta_2 IPO_proceeds + \beta_3 At-risk + \beta_4 Forfeit_value + \beta_5 Forfeit_warrant_value + \beta_6 Sub_sponsor_value + \epsilon$$

Extended regression:

$$Sponsor\ excess\ return = \alpha + \beta_1 Redeem + \beta_2 IPO_proceeds + \beta_3 At-risk + \beta_4 Forfeit_value + \beta_5 Forfeit_warrant_value + \beta_6 Sub_sponsor_value + \beta_7 Auto + \beta_8 Energy + \beta_9 Health + \beta_{10} Tech + \epsilon$$

5.3.4 OLS regression PIPE/FPA investor return

For the analysis of returns for PIPE investors, OLS regressions were performed, where the dependent variable is defined as the return for PIPE investors, calculated according to section:5.1.5 PIPE/ FPA investor return (Table10) and adjusted by the corresponding Russell 2000 index return. The sample studied consists of the initial sample of 140 PIPE transactions – the maximum number of PIPE returns available in the dataset. In the model without outliers (model 4), 12 observations were removed, resulting in 128 observations.

Basic regression:

$$PIPE/FPA\ investor\ excess\ return = \alpha + \beta_1 Eco_discount + \epsilon$$

Extended regression:

$$PIPE/FPA\ investor\ excess\ return = \alpha + \beta_1 Eco_discount + \beta_2 PIPE/IPO + \beta_3 Redeem + \beta_4 SPAC_return + \beta_5 Auto + \beta_6 Energy + \beta_7 Health + \beta_8 Tech + \epsilon$$

5.4 Characteristics of merger versus liquidation SPAC period

Given the large number of liquidated SPACs in the analysed sample, this section discusses the method for examining whether specific SPAC-IPO characteristics have predictive value on the probability of a merger. Only characteristics available at the time of the SPAC IPO are discussed. A summary of variable descriptions can be found in Table 4. Based on this method, it is possible to examine whether there are explanatory factors that may increase the probability of a SPAC merger.

5.4.1 Logit analysis of the probability of merger versus liquidation SPAC period

For the analysis of determinants of merger or liquidation among SPACs, Logit regressions were performed, with the dependent variable defined as an indicator taking the value 1 in the case of a merger and 0 in the case of liquidation. The analyses were conducted on a sample of 574 SPACs, with five observations excluded due to missing information.

The model is defined as follows:

$$\begin{aligned} Probability\ of\ merger \\ = \alpha + \beta_1 IPO_proceeds + \beta_2 Warrant + \beta_3 Right \\ + \beta_4 Months_to_deadline + \beta_5 Rank + \beta_6 General + \beta_7 Tech \\ + \beta_8 Health + \beta_9 Financial + \epsilon \end{aligned}$$

The explanatory variables include the natural logarithm of IPO proceeds *(IPO_proceeds),* dummy variable for the presence of a warrant or right in the original SPAC unit *(Warrant & Right),* the natural logarithm of the number of months between IPO and the agreed deadline *(Months_to_deadline),* the rank of the lead underwriter *(Rank)* to see whether more prominent underwriters have explanatory value whether a SPAC merges, and sectoral dummies of the four largest IPO sectors; *General, Tech, Health and Financial*, with the remaining sectors as the reference category. Models 3 and 5 also include IPO year FE.

Because liquidated SPACs frequently involve multiple bankers (Appendix1 & Appendix2), banker fixed effects are added in the second set of models, to control for all factors that do not change within the same banker.

6. Results

This section discusses the results of the calculated returns from section 5.1, the NCPS calculation from section 5.2, the cross-sectional OLS regressions from section 5.3 and the logit regression from section 5.4.

6.1 Returns

In this section, returns from SPAC transactions are analysed using different measures of returns, each targeting a different type of investor or a different point in the SPAC lifecycle. This multidimensional approach ensures the robustness of the trends found in the SPAC market and provides a complete picture of the return potential for the current SPAC market.

The section begins with an analysis of returns for IPO investors, followed by SPAC investors, sponsors, and PIPE/FPA investors. Each return is discussed separately and then interpreted in context.

By calculating the returns for the different positions, it becomes clear to what extent SPACs remain attractive to various parties. Based on these findings, it is evident that SPACs remain profitable for various investor groups. By comparing these findings with studies from earlier periods, the question can be answered: To what extent are the parties that were seen as winners

during the SPAC boom, such as sponsors and early investors, still able to generate attractive returns, or have they become the new losers?

This systematic approach, which combines different return measures, enables the explicit consideration of recent changes in market structure, regulations, and incentive structures in the interpretation of the outcomes. More comprehensive tables of some returns are also presented in the appendix, referred to where necessary to substantiate findings.
At the end of this section, the subsection presents the key return findings and some reference returns from previous periods.

6.1.1 Annualised SPAC period return

The sections below discuss the annualised returns for the SPAC period – from SPAC-IPO to merger or liquidation. The annualised SPAC period return for SPACs reflects the average annualised return an IPO investor achieves by buying the initial SPAC unit at IPO and holding the various components until five trading days before the merger or liquidation. Calculated according to the '*optimal redemption strategy'* of Gahng et al. (2023b). Allowing for the most realistic picture of the total returns achieved for the SPAC period.

The three subsections below show the merged and liquidated SPACs individually, concluding with a section of the total sample. This separate display was selected because the SPAC period contains many liquidated SPACs.

6.1.1.1 Annualised SPAC period return closed SPACs

The results from Table 5 show that the average annualised return for IPO investors for merged SPACs in the period under review is 6.47% (median: 4.42%), with a relatively high spread between SPACs (standard deviation: 0.09). This return is substantially lower than the average for SPACs in the pre-boom period. Median returns are below the mean in all years, indicating a positively skewed distribution - some high returns pull up the mean. The minimum return is positive in all years, indicating that investors can still redeem without incurring a loss.

The duration between IPO and the merger ranges from 9 to 34 months on average, with similar medians. This suggests that SPACs in the later cohorts took longer to find a target and exceeded the standard 24-month timeframe.

In summary, this suggests that SPAC-IPO investors can still achieve an average positive return for SPACs that merge. Their losses are covered by the redemption option, which ensures that

in the case of this sample, the investor always gets back his initial deposit. Although on average, much lower returns are observed than in previous periods.

Table 5 Annualised SPAC period returns closed SPACs: This table shows the annualised SPAC period returns for public SPAC investors, calculated for the full sample of 272 SPACs that had an IPO between January 2021 and December 2023 and merged before May 2025. Returns are calculated according to the optimal redemption strategy of Gahng, Ritter and Zhang (2023). The results shown are ordered by the year of merger, with January to May for 2025. The variable months represents the number of months between the SPAC IPO and the merger. For all variables, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown.

Annualised SPAC period returns for merged SPACs							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl.(95)**
2021							
Ann. Return	38	7,73%	5,32%	0,10	0,00%	45,15%	0,03
Months	38	8,90	9,15	1,39	5,47	11,13	0,46
2022							
Ann. Return	65	3,37%	2,25%	0,04	0,00%	17,77%	0,01
Months	65	15,29	14,07	3,71	10,13	24,03	0,92
2023							
Ann. Return	87	6,75%	3,69%	0,10	0,12%	59,52%	0,02
Months	87	23,83	24,03	5,30	12,37	36,03	1,13
2024							
Ann. Return	69	7,60%	5,66%	0,09	2,28%	77,08%	0,02
Months	69	31,40	30,37	6,81	11,20	42,73	1,64
2025							
Ann. Return	13	10,38%	7,46%	0,07	3,32%	24,96%	0,04
Months	13	33,82	36,20	8,84	21,10	50,57	5,34
Total							
Ann. Return	272	6,47%	4,42%	0,09	0,00%	77,08%	0,01
Months	272	22,10	21,93	9,63	5,47	50,57	1,15

6.1.1.2 Annualised SPAC period return of liquidated SPACs

The results from Table6 show that the average annualised return for IPO investors for liquidated SPACs in the period under review is 2.12% (median: 1.25%), with a relatively low spread between SPACs (standard deviation: 0.028). This return corresponds to the average for liquidated SPACs in the pre-boom period. The annualised return based only on the trust return averages 1.75% (Appendix5). This suggests that, despite the SPAC not announcing a merger, investors can still achieve higher returns by selling their shares on the market, rather than exercising their redemption option.

The minimum return has been positive in all years, indicating that it is still possible for investors to redeem without incurring a loss, even when a SPAC is liquidating.

The duration between IPO and liquidation averages 24 months, showing that SPACs liquidate on average after the standard period. For the later cohorts, more extended periods are observed

on average. This suggests that, despite the extension of the standard period, SPACs can still be liquidated.

In summary, this suggests that SPAC-IPO investors, although the SPAC liquidates, can still achieve positive returns on average. This shows the downside protection for SPAC-IPO investors, which ensures that, in the case of this sample, the investor always gets back their initial investment through the redemption option. These findings are consistent with the SPAC period for liquidated SPAC from previous periods, suggesting that SPACs still provide the same risk protection for IPO investors.

Table6 Annualised SPAC period returns liquidated SPACs. This table shows the annualised SPAC period return for SPAC-IPO investors of the full sample of 307 SPACs that went through an IPO between January 2021 and December 2023 and liquidated before May 2025. The returns 'Ann. Return' are calculated according to the optimal redemption strategy of Gahng, Ritter and Zhang (2023). Months represents the number of months between the SPAC IPO and liquidation. Results on the year of liquidation, with for2021 the SPAC Gores VII liquidated on 15-12-2021 and for 2025 the SPAC Global Blockchain liquidated on 15-04-2025. For all variables, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown.

Annualised SPAC period returns for liquidated SPACs

	N. Obs.	Mean	Median	Std. Dev.	Min	Max	Conf. Lvl.(95)
2021							
Ann. Return	1	0,12%	0,12%	-	0,12%	0,12%	-
Months	1	9,83	9,83	-	9,83	9,83	-
2022							
Ann. Return	91	0,86%	0,36%	0,017	0,00%	11,32%	0,00
Months	91	20,80	21,77	3,09	11,90	24,07	0,64
2023							
Ann. Return	176	2,26%	1,56%	0,026	0,00%	29,41%	0,00
Months	176	23,93	24,43	4,30	12,77	34,77	0,64
2024							
Ann. Return	38	4,37%	3,60%	0,039	0,51%	24,20%	0,01
Months	38	35,22	36,47	5,19	13,07	44,77	1,70
2025							
Ann. Return	1	8,33%	8,33%	-	8,33%	8,33%	-
Months	1	35,70	35,70	-	35,70	35,70	-
Total							
Ann. Return	307	2,12%	1,25%	0,028	0,00%	29,41%	0,00
Months	307	24,39	24,33	6,02	9,83	44,77	0,68

6.1.1.3 Annualised SPAC period return total

Appendix6 shows the equally weighted annualised SPAC period returns for the total sample of 579 SPACs, for merged and liquidated SPACs. The total return for the entire sample averages 4.16%, with a median of 2.69%. This shows that SPAC-IPO investors achieve positive returns on average regardless of the outcome.

In summary, merged SPACs structurally achieve higher SPAC period returns than liquidated SPACs. This can be explained by the fact that, five days before the merger, SPACs that proceed with a merger have a higher market price than SPACs that are liquidated; specifically, the market price of the stock exceeds the trust value. Regardless of the outcome, the redemption option allows the initial investment to be always recovered and any higher returns to be achieved by selling in the market, given this sample. Although earlier periods still saw average returns of more than 20% this is considerably lower in the post-boom period, mainly due to the lower returns achieved for merged SPACs and more liquidated SPACs, which show lower returns.

6.1.2 deSPAC common share return

deSPAC common share return is calculated according to the buy-and-hold strategy where an investor buys a share of the merged company on the first trading day after the merger and holds it for the period of one year, delist date or until 31-12-2024. Calculated using the return factor of CRSP.Table7 shows that the average return for all cohorts is sharply negative, with a total of -64.08% (median: -76.61%), with a high spread between SPACs (standard deviation: 0.39). This indicates that there is a positive skew, where some high returns pull the average up. SPACs perform worse on average than the Russell 2000 index for the corresponding period, with an average excess return of -67.84%. This suggests that SPAC investors are structurally underperforming the market on a one-year basis.

In summary, the returns of the current sample period show substantially lower returns on average than periods studied in previous literature, these findings are robust to different weighting methods Appendix7. The post-merger period performs worse than the market on average, and higher positive returns are observed only for a few cases. The 2024 cohort shows fewer negative returns compared to the previous three years, suggesting that a reversal of the negative trend may be taking place.

Table7 common share return: This table shows the realised post-merger return for common shares of the deSPAC period, calculated for all SPACs that underwent a SPAC IPO between January 2021 and December 2023 and merged before 31-12-2024. This subsample covers 256 SPACs - out of 272 total sample, there are 13 SPACs excluded as they had a merger after 31-12-2024, one SPAC from which the return factor was not available, one SPAC delisted after five days - Mountain Crest IV - and one SPAC merged on 26-12-2024 - Coliseum Acq. The post-merger period covers one year after the merger, the delisting date or 31-12-2024, whichever end date is reached first. The returns are calculated according to the buy-and-hold strategy, where a share is bought on the first day after the merger, using daily compound returns based on CRSP dates, including splits and dividend adjustments: section5.1.2 deSPAC common share return. The table reports for each year of merger the average one-year return 'SPAC', the corresponding Russell 2000 Index benchmark over the same observation period for each SPAC, and the difference 'Diff' between the two. For all variables, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown.

deSPAC common share return							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl.(95)**
2021							
SPAC	37	-72,99%	-80,45%	0,26	-97,25%	29,19%	0,09
Russell 2000	37	-20,29%	-21,12%	0,04	-26,32%	-11,22%	0,01
Diff	37	-52,70%	-59,31%	0,26	-84,72%	48,04%	0,09
2022							
SPAC	65	-69,15%	-80,43%	0,38	-99,84%	100,55%	0,09
Russell 2000	65	-1,21%	-0,83%	0,09	-20,51%	15,07%	0,02
Diff	65	-67,94%	-76,77%	0,39	-108,56%	100,66%	0,10
2023							
SPAC	87	-67,46%	-82,15%	0,37	-100,00%	94,15%	0,08
Russell 2000	87	15,99%	12,43%	0,10	0,26%	38,84%	0,02
Diff	87	-83,45%	-95,40%	0,39	-135,29%	76,83%	0,08
2024							
SPAC	67	-49,85%	-56,19%	0,47	-99,94%	151,24%	0,11
Russell 2000	67	6,00%	8,01%	0,06	-7,41%	15,00%	0,01
Diff	67	-55,85%	-62,36%	0,48	-111,41%	143,03%	0,12
Total							
SPAC	256	-64,08%	-76,61%	0,39	-100,00%	151,24%	0,05
Russell 2000	256	3,76%	7,04%	0,14	-26,32%	38,84%	0,02
Diff	256	-67,84%	-72,42%	0,42	-135,29%	143,03%	0,05

6.1.3 deSPAC warrant return

deSPAC warrant return is calculated according to the buy-and-hold strategy, where an investor buys a warrant from the merged company on the first trading day after the merger and holds it for one year, delist date or until 31-12-2024. Calculated by the percentage price change.

Table8[22] presents an average warrant return of -22.09% (median: -63.64%) with a very high spread between SPACs (standard deviation: 1.12). This indicates a positive skew, where some very high returns pull the average upwards. The returns found are robust to different weighting methods (Appendix9). These findings are substantially lower than the returns from studies of earlier periods, where high positive returns were still obtained on average.

[22] Two extreme outliers were excluded here, results with the two outliers see Appendix8.

In summary, the post-merger warrant returns for this post-boom sample, on average, show lower – negative – returns than found in periods from previous studies. The results also show an increase in returns, suggesting that warrant returns are recovering.

Table8 deSPAC period warrant returns: these tables show the realised post-merger returns for warrants of deSPAC period, calculated for all SPACs that underwent an IPO between January 2021 and December 2023 and merged before 31-12-2024. This subsample covers 213 SPACs - out of the total 235 SPACs with warrants - there are 10 SPACs excluded due to merger in 2025, 9 SPACs excluded due to lack of warrant pricing and one SPAC excluded that merged on 26-12-2024 - Coliseum Acq. and two extreme outliers where exclude The post-merger period covers one year after closing, the warrant delisting date, or 31-12-2024, whichever ends first. The returns have been calculated according to the buy-and-hold strategy, where a warrant is bought on the first day deSPAC - closing price on the day of closing - and held until the next relevant end date. This assumes the percentage price change, section:5.1.3 deSPAC warrant return . The table reports per year of closing the average and median one-year return of the warrants, as well as the standard deviation, minimum, maximum and the 95% confidence interval, in addition to the number of observations "N. Obs.". in this table, two extreme outliers have been omitted.

Warrant return							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl.(95)**
2021	30	-68,19%	-86,50%	0,53	-98,23%	167,23%	0,20
2022	58	-53,37%	-72,48%	0,62	-99,83%	217,69%	0,16
2023	74	-5,95%	-57,56%	1,43	-100,00%	800,00%	0,33
2024	51	17,18%	-7,41%	1,15	-96,88%	466,78%	0,32
Total	213	-22,09%	-63,64%	1,12	-100,00%	800,00%	0,15

6.1.4 Sponsor return:

The sponsor return is calculated by total realised dollar gains one year after the merger, considering promote shares, additional warrants and rights, net of forfeiture. Because the maturities of SPACs differ, the annualised sponsor return is calculated.

The results from Table9 show that the average annualised sponsor return for merged SPACs over the period under study is 16.62% (median: 1.49%), with a high spread between observations (standard deviation: 0.69). These results suggest that sponsors of merged SPACs can still achieve positive returns on average on their initial investment, although complete value losses are also observed. The fact that the median is substantially below the mean – and negative from 2023 onwards – suggests that most sponsors today realise only limited or even negative returns, while a few exceptionally successful SPACs pull the averages upwards.

Panel B includes sponsor returns from liquidated SPACs. If a SPAC liquidates, the sponsor loses its entire investment – a return of -100%. This results in a total annualised average return for SPAC sponsors of the sample studied of -51.35% and a total return of 7.28%, sharply lower than that of only merged SPACs. This is explained by the number of highly liquidated SPACs, where the complete loss of value reduces the average return.

Compared with research by Gahng et al. (2023b), which still showed an average annualised sponsor return of 113% for their sample, including liquidated SPACs – with only 9 liquidated SPACs – and 110% for their large sample size (with a total mean return of 510%) (Gahng et al., (2023a). This is substantially lower or even negative for this sample, when taking liquidated SPACs into account. *Appendix10* shows that dollar gains one year after the merger have decreased by 65%, compared to the time of the merger. This was before research by Gahng et al. (2023b), which showed only a 36% decline. This suggests that, among other things, poor post-merger performance results in lower sponsor returns.

Overall, sponsors of merged SPACs are still able to achieve positive returns on average, although these will depend on a few successful deals. However, this result is worsened if the complete loss of value from the liquidated SPAC is considered. Both approaches indicate that, in recent periods, sponsors have not been able to achieve the high returns they once did.

Table9 Sponsor return closed SPAC: This table shows the results of the sponsor return analysis for merged SPACs with an IPO between 2021 and 2023, for which at least one year of post-merger data is available. The analysis was carried out on a sub-sample of SPACs whose merger took place before May 2024 - end date 31-04-2025 - and which were not delisted within one year of merger. This excluded 47 SPACs due to merger after April 2024, three SPACs excluded due to delisting within one year of merger and three SPACs excluded due to lack of information. For each year of merger: the total return for the sponsor 'Total return' and the annualised return 'Ann. Return' are shown. For all variables, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are displayed. ***Panel B:*** *reports the average return for sponsors from liquidated SPACs and sponsors of merged SPACs with dates one year after merger. The sponsor return for liquidated SPACs is -100%.*

Sponsors return closed SPACs

	N. Obs.	Mean	Median	Std. Dev.	Min	Max	Conf. Lvl.(95)
2021							
Total return (%)	37	162,17%	95,18%	2,29	-71,45%	771,85%	0,76
Ann. Return (%)	37	61,57%	43,39%	0,87	-53,04%	282,58%	0,29
2022							
Total return (%)	65	123,65%	12,52%	3,48	-99,33%	2076,60%	0,86
Ann. Return (%)	65	17,40%	4,24%	0,74	-91,81%	286,65%	0,18
2023							
Total return (%)	83	83,02%	-17,10%	3,12	-99,99%	2144,95%	0,68
Ann. Return (%)	83	0,03%	-5,99%	0,50	-95,41%	143,83%	0,11
2024							
Total return (%)	34	396,91%	-8,96%	13,15	-99,98%	6477,80%	4,59
Ann. Return (%)	34	6,67%	-3,49%	0,60	-92,66%	181,13%	0,21
Total							
Total return (%)	219	157,18%	4,35%	5,95	-99,99%	6477,80%	0,79
Ann. Return (%)	219	16,62%	1,49%	0,69	-95,41%	286,65%	0,09

Panel B. Total sponsor return

	N. Obs.	Mean
Total return (%)	*526*	7,28%
Ann. Return (%)	526	-51,35%

6.1.5 PIPE/FPA investor return

The return for PIPE/FPA investors is calculated as the percentage change in value of the security acquired, one year after the merger. Here, it has been found that PIPE/FPA investors pay a premium on average for this sample compared to the corresponding market price – previously these were discounts.

The results from Table10 show that the average return, considering bonuses obtained, is - 62.55% (median: -79.54%) for the PIPE/FPA investor over the period under study, with a high dispersion between observations (standard deviation:0.54). This indicates a positive skewness, where several high returns pull the mean upward. These findings are robust across cohorts. Excluding the bonuses obtained and calculating only the returns on PIPE/FPA shares obtained makes only a minimal difference (Appendix11). This suggests that obtaining bonus warrants or shares makes only a minimal difference. Compared to previous literature, positive returns were still observed for PIPE investors in earlier periods.

In summary, returns for PIPE/FPA investors are negative on average for the period under study, where in the pre-boom period they were still able to achieve positive returns on average. The results are in line with the negative return pattern seen for common shares in the deSPAC period.

Table10 PIPE/FPA investor return: This table shows the realised one-year post-merger returns for PIPE/FPA investors, for closed SPACs with an IPO between 2021 and 2023, for which at least one year of post-merger data is available. The analysis was conducted on a subsample of SPACs whose merger took place before May 2024 - end of reference date 31-04-2025 - and which were not delisted within one year of the merger. The final sample consists of 140 observations of a total of 170 PIPE/FPA investments, 20 were excluded due to a merger date after April 2024, 9 were excluded due to a lack of accurate data and 1 observation was omitted due to an extreme share price of $1,907.The return was calculated based on the realised change in value of publicly tradable PIPE/FPA investments, including any bonus warrants and shares, one year after the merger, according to the methodology described in section5.1.5 PIPE/ FPA investor return . The table reports the mean and median PIPE investor return for each year of merger, as well as the standard deviation, minimum, maximum and 95% confidence interval, in addition to the number of observations "N. Obs."

PIPE/FPA investor return

	N. Obs.	Mean	Median	Std. Dev.	Min	Max	Conf. Lvl.(95)
2021	33	-67,87%	-76,80%	0,28	-95,89%	24,43%	0,10
2022	47	-65,85%	-84,44%	0,61	-99,92%	302,50%	0,18
2023	44	-59,07%	-80,57%	0,53	-99,86%	159,90%	0,16
2024	16	-51,42%	-76,24%	0,75	-99,99%	205,47%	0,40
Total	140	-62,55%	-79,54%	0,54	-99,99%	302,50%	0,09

6.1.6 Key takeaways return changes

Table11 shows the key results of the calculated returns from the previous sections. Reference returns from studies of prior periods are shown here, providing a clear picture of changes in returns.

This shows that the SPAC market has undergone a significant change, given significantly lower returns than before, which is robust across all calculated results. The SPAC-IPO investor can still achieve positive returns on average. However, this is the opposite in the deSPAC period, where returns are sharply lower for each stakeholder. For instance, positive returns were observed for warrants and PIPE/FPA investors in previous periods but are significantly negative for the period under review. Losses for the common share investor have increased even more, making them bigger losers. Finally, very high returns were previously achieved for sponsors; however, in the post-boom period, only a fraction of that remains, and even becomes negative when adjusted to the annualised return, making them only limited winners.

Table11 Returns comparison table. This table presents the calculated returns for selected return references from previous studies, spanning various periods. The table shows the equally weighted means per calculated return of the current sample and another sample from prior periods.

Returns comparison table

	This sample	Other samples	Period	Reference
SPAC period				
Merger	6,47%	33,20%	2010-2020	Gahng et al (2023b)
Liquidated	2,12%	2,00%	2010-2020	Gahng et al (2023b)
Total	4,16%	23,90%	2010-2020	Gahng et al (2023b)
		13,67%	2003-Q2 2022	Lin et al (2024)
		11,60%	2019-Q2 2020	Klausner et al (2022)
deSPAC period				
Common share	-64,08%	-11,30%	2010-2020	Gahng et al (2023b)
		-28,87%	2003-Q2 2022	Lin et al (2024)
		19,10%	2019-Q2 2020	Klausner et al (2022)
Warrant	-22,09%	72,20%	2010-2020	Gahng et al (2023b)
Sponsor (total)	7,28%	619,00%	2015-Q1 2021	Gahng et al (2023b)
		549,00%	2019-Q2 2020	Klausner et al (2022)
PIPE/FPA	-62,55%	9,30%	2015-Q1 2021	Gahng et al (2023b)
		12,10%	2001-2015	Lim et al (2019)

6.2 Net Cash Per Share

The section below presents the results of NCPS, calculated according to section:5.2.1 Net Cash Per Share measurement: by comparing these findings with previous periods, we can see whether cost structure of a SPAC transaction has changed in terms of NCPS. Next, NCPS will be used as an independent variable to examine the effect of NCPS on post-merger common share returns. The results are shown for four redemption rate intervals.[23]

6.2.1 Net Cash Per Share

Net Cash Per Share is calculated following the method of Klausner, Ohlrogge & Halbhuber (2022). NCPS corrects for factors such as outstanding warrants, rights, sponsor promotions, shareholder redemption, and fees. It thus provides a realistic picture of the economic value remaining for shareholders in the merger.

NCPS averages $4.16 for the total sample (Table12), with a slightly lower median. These results get worse when adjusted for warrants, with an average of $3.61 (Appendix12). These results are, on average, $2.20 to $3.30 lower compared to those of Klausner and Ohlrogge (2023) and Gahng et al. (2023b), respectively. This suggests that in the post-boom period there is less cash per share remaining at the time of merger than before. Based on the redemption rate intervals, the NCPS becomes lower after the redemption rate increases. This suggests that high redemption rates mainly explain the lower average NCPS.

In summary, NCPS is on average lower than was found by studies from the pre-boom period. This effect becomes larger when adjusted for warrant dilution. A higher redemption rate shows a lower NCPS on average. For the period under study, the lower NCPS is primarily explained by the higher redemption rate, which ensures that, at the time of merger, less than half of the original $10 unit price remains.

[23] The redemption category (75%-100%) shows a negative minimum, in some cases the SPAC has to meet minimum cash requirement for a merger, then additional financing is done based on notes or other non-publicly traded securities, which are not reflected in the NCPS calculation, so NCPS can be negative in this calculation.

Table12 Net Cash Per Share: This table shows the net cash position per share (NCPS) at closing, calculated for all SPACs with an IPO between 2021 and 2023 and merged before May 2025. The sample consists of 243 SPACs, out of 272 total sample, 29 SPACs are excluded due to missing or inaccurate data on the number of shares outstanding at the merger. Four redemption rate intervals are used to rank the results. NCPS, including outstanding warrants, is shown, as calculated in section 5.2.1 Net Cash Per Share (NCPS). For each variable, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown.

Net Cash Per Share							
Redemption rate	**N. Obs.**	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl. (95)**
NCPS (incl. Warrants)							
0% - 25%	10	8,26	8,32	0,47	7,31	8,91	0,34
25% - 50%	7	7,90	7,95	1,39	6,18	9,60	1,29
50% - 75%	21	6,96	7,30	1,94	3,58	10,71	0,88
75% - 100%	205	3,54	2,54	4,40	-3,42	43,82	0,61
Total	243	4,16	3,84	4,34	-3,42	43,82	0,55

6.3 Cross-Sectional Analysis of different SPAC returns

In the following sections, regressions are run on the returns as shown in section: 6.1 Returns. This looks at which SPAC specific characteristics have a significant effect on returns and therefore what might be the reason for the drop in returns. The following key participants are considered for this analysis: the SPAC period investor, post-merger common share investor, sponsor and PIPE/FPA investor.

Corrections have been made for market-specific conditions by using the excess return over the Russell 2000 index return for the corresponding period. To ensure the robustness of the regressions, varying methods are employed, including the use of IPO year fixed effects, sector-specific conditions, and the exclusion of outliers. For the SPAC period return, only characteristics known at the time of IPO are used. For the common share, sponsor, and PIPE/FPA returns, only characteristics known prior to the merger have been used.

The end of this section contains a sub-section with key takeaways from the findings, where the most important changes can be seen.

6.3.1 OLS regression SPAC period return

Table13 presents the results of regression outcomes for the SPAC period return, in which the annualised return during the SPAC period is explained by various characteristics of the SPAC structure known at the time of the SPAC IPO. The dependent variable concerns the excess return.

The results show that at-risk has a significant positive effect on excess return during the SPAC period, which is robust across all models. This suggests that a higher percentage of at-risk capital from the sponsor – a bigger sponsor's 'skin in the game' – is associated with significantly higher shareholder returns over the SPAC period, other factors constant. A 1%-point increase in sponsor at-risk capital leads to an average increase of 1.76 percentage points in SPAC period return, other factors being constant. Significant at the 1% level (Model 2).

The period given to sponsors for target search (*Months_to_deadline*) has a significantly negative effect, robust to all models. This suggests that when sponsors have more time to find a potential target, it leads on average to lower returns for the SPAC-IPO investor, other factors constant.

The presence of a right also has a significant effect. This suggests that if a right is present in the original unit, it leads on average, to higher returns in the SPAC period, other factors constant. The presence of a right increases the upside potential for investors.

These findings highlight the importance of strong sponsor incentives, a short time to the merger deadline, and an investor-friendly unit structure as the key predictive characteristics for achieving higher returns during the SPAC period.

*Table13 OLS - SPAC period return: This table reports the results of OLS regressions of the impact of SPAC characteristics in which the annualised SPAC period return, calculated according to the optimal redemption strategy (Gahng et al (2023b) and adjusted for the market, via excess return, calculated as the return minus the corresponding return on the Russell 2000 index. At-risk is the percentage of sponsor capital at risk (in percentage points), IPO_proceeds is the natural logarithm of the proceeds at IPO, months_to_deadline refers to the natural logarithm of the number of months between SPAC IPO and the set deadline for a merger/liquidation, warrant and right are dummies indicating whether the original SPAC unit contained a warrant or a right, rank refers to the rank of the underwriter, Financial, General, Health and Tech are sector dummies (with all other sectors as the reference category). Column (1) is estimated without fixed effects, column (2) contains IPO-year fixed effects, and column (3) repeats the analysis without observations with a Cook's distance greater than 4/n to examine the influence of outliers. The main sample comprises 574 observations after excluding 5 SPACs due to information deficiencies in the variables used. The number of observations varies due to the exclusion of outliers in model (3). Standard errors are in brackets. Significance levels: * p < 0.10; ** p < 0.05; *** p < 0.01.*

SPAC period return			
	(1)	**(2)**	**(3)**
(Intercept)	0.364***	0.324***	0.381***
	(0.071)	(0.068)	(0.044)
At-risk	0.939**	1.764***	1.647***
	(0.404)	(0.407)	(0.258)
IPO_proceeds	0.005	0.009	0.006
	(0.010)	(0.009)	(0.006)
Months_to_deadline	-0.095***	-0.095***	-0.103***
	(0.013)	(0.013)	(0.008)
Warrant	0.005	0.008	-0.006
	(0.013)	(0.012)	(0.008)
Right	0.004	0.040***	0.033***
	(0.014)	(0.014)	(0.009)
Rank	-0.002	-0.003	-0.003*
	(0.002)	(0.002)	(0.001)
Financial	0.010	0.007	0.002
	(0.013)	(0.012)	(0.008)
General	0.004	0.005	0.002
	(0.009)	(0.009)	(0.005)
Health	0.006	0.002	-0.001
	(0.012)	(0.011)	(0.007)
Tech	-0.004	-0.002	0.000
	(0.010)	(0.009)	(0.006)
Year FE	No	Yes	Yes
Num.Obs.	574	574	550
R2 Adj.	0.101	0.180	0.370

* p < 0.1, ** p < 0.05, *** p < 0.01

6.3.2 OLS regression common share return

Table14 reports the results of OLS regressions in which the one-year excess common share return for the deSPAC period is explained by various SPAC-specific characteristics. [24]

The results show that NCPS has a positive and significant effect on post-merger excess returns. This is robust for all models with NCPS. This suggests that higher NCPS results in better deSPAC performance on average, other factors fixed. A $1 increase in NCPS leads to a 1.60 percentage point increase in common share return, other factors being constant, significant at the 5% level. This supports the findings of Klausner et al. (2022) in the post-boom phase.

In the models without NCPS, the redemption rate (*Redeem*) has a significantly negative effect on post-merger performance. This suggests that when SPAC-IPO shareholders lack confidence in the target and redeem their shares, this negatively impacts post-merger performance, other factors remaining constant. This effect is robust across all models. Based on model three, a 10%-points increase in the redemption rate leads to an average decrease of (-) 5.1%-points in the common share return, all else being equal. Significant at the 1% level.

Sponsor 'haircuts' for promote shares have a positive significant effect, robust across all models. This suggests that when a sponsor forfeits shares, this results in better returns for the deSPAC common share investor, other factors constant. This can be explained by the fact that sponsor forfeiture leads to lower dilution effects, which works in favour of investors. So, if a sponsor forfeits shares, it leads to an average increase of 9.6 percentage points in common share return, other factors fixed. Significant at the 10% level (Model three).

The conflict of interest between sponsor and common share investor described by Dimitrova (2012), only has a significant contribution after correction for outliers. For this, if the sponsor finds a last-minute target – to secure its promotion shares – this leads to a sub-optimal deal and results in lower post-merger returns, other factors constant. The four largest sectors also repeatedly show significant effects on post-merger performance. For instance, the Energy sector has a positive contribution to post-merger returns, other factors constant.

[24] Other potentially relevant factors, such as equity stakeholders, overallotment, fees, bonus for non-redeeming shareholders, earnouts, dilution of SPAC unit etc, were included in sensitivity analyses, but did not significantly improve the model and had no significant contribution.

These findings highlight the importance of shareholder confidence in the target; for instance, higher redemption rates lead to structurally lower post-merger performance. Higher NCPS results in better returns. Sponsor forfeiture, which reduces the negative impact of dilution, has a positive effect on post-merger performance. The agency problem, as outlined earlier, is only observed in the models without outliers for the post-boom sample.

*Table14 OLS - common share return: this table shows OLS estimates of the impact of SPAC characteristics on the one-year excess return of common shares after the merger date, calculated as the share return minus the corresponding return on the Russell 2000 index. NCPS is the net cash position per share at closing, Months_to_merger is the natural logarithm of the number of months between SPAC IPO and merger, rank measures the rank of the underwriter according to Jay R. Ritter, SPAC_return is the annual return in the SPAC period, redeem is the redemption rate in percentage points, IPO_proceeds is the natural logarithm of IPO proceeds, forfeit is dummy 1 for sponsor-haircuts, PIPE is dummy 1 if there is a PIPE/FPA investment, sector dummies (Auto, Energy, Health, Tech) are interpreted relative to the residual category "Other". Year fixed effects are based on the SPAC IPO year, to accommodate year-specific market conditions. Model (7) and (8) repeat the analysis after removing observations with a Cook's distance greater than 4/n to examine the influence of outliers. Sample sizes vary because NCPS was not available for 24 deals. Standard errors are in brackets. Significance levels: * p < 0.10; ** p < 0.05; *** p < 0.01.*

deSPAC common share return								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
(Intercept)	-0.746***	-0.559**	-0.051	-0.753***	-0.559**	-0.106	-0.573***	-0.182
	(0.038)	(0.227)	(0.336)	(0.041)	(0.234)	(0.343)	(0.181)	(0.262)
NCPS	0.018***	0.016**		0.019***	0.016**		0.017**	
	(0.006)	(0.007)		(0.006)	(0.007)		(0.007)	
Months_to_merger		-0.065	-0.030		-0.068	-0.027	-0.087*	-0.090*
		(0.064)	(0.065)		(0.064)	(0.066)	(0.051)	(0.050)
Rank		0.009	0.008		0.010	0.011	0.017	0.012
		(0.013)	(0.017)		(0.014)	(0.017)	(0.011)	(0.013)
SPAC_return		0.097	-0.209		0.088	-0.246	0.062	-0.130
		(0.301)	(0.311)		(0.303)	(0.314)	(0.225)	(0.233)
Redeem			-0.508***			-0.522***		-0.340***
			(0.142)			(0.144)		(0.110)
IPO_proceeds			-0.017			-0.011		-0.003
			(0.060)			(0.060)		(0.046)
Forfeit			0.096*			0.094*		0.097**
			(0.056)			(0.056)		(0.044)
PIPE			-0.062			-0.063		-0.027
			(0.056)			(0.057)		(0.043)
Auto		-0.145	-0.159*		-0.148	-0.162*	-0.215***	-0.216***
		(0.092)	(0.088)		(0.092)	(0.088)	(0.071)	(0.067)
Energy		0.203**	0.221**		0.203**	0.211**	0.082	0.087
		(0.092)	(0.089)		(0.093)	(0.090)	(0.074)	(0.072)
Health		-0.133*	-0.105		-0.133*	-0.100	-0.138**	-0.129**
		(0.074)	(0.068)		(0.074)	(0.068)	(0.055)	(0.051)
Tech		-0.147*	-0.142**		-0.148*	-0.142**	-0.125**	-0.130**
		(0.076)	(0.070)		(0.076)	(0.070)	(0.058)	(0.053)
Year FE	No	No	No	Yes	Yes	Yes	Yes	Yes
Num.Obs.	231	231	255	231	231	255	218	242
R2 Adj.	0.032	0.076	0.100	0.025	0.068	0.096	0.121	0,143

* p < 0.1, ** p < 0.05, *** p < 0.01

6.3.3 OLS regression sponsor return

Table15 reports the results of OLS regressions in which the annualised return for SPAC sponsors is explained by different characteristics, adjusted for market movements via the Russell 2000 index for the corresponding period.

The results show that the redemption rate at the merger has a strong negative and significant effect on sponsor returns, robust to all models, like what is found for deSPAC common share investors. This suggests that lower SPAC investor confidence – a higher redemption rate – on average results in lower sponsor returns, other factors fixed. The effect of the redemption percentage on the sponsor return is at least twice as great as the effect on the common share return. Thereby, the results highlight that high redemption substantially disadvantages not only shareholders but also sponsors.

In addition, the analysis shows that the at-risk rate has a large, negative, and significant effect on sponsor returns, which remains robust across all models. This means that a higher portion of 'skin in the game' by the sponsor results in a substantially lower return. A 1%-point increase in at-risk capital leads to a (-) 15.11%-point decrease in sponsor return, other factors constant. Significant at the 1% level (Model 2). This can be explained by the fact that a higher value at risk leads to lower sponsor capital gains.

The percentage of forfeited shares has a negative and significant effect on sponsor returns; this is robust to all models at the 1% level. This suggests that when a sponsor must do a larger 'haircut' in its promoted shares, it leads to a substantially lower return for sponsors, other factors constant. Similar to higher-at-risk capital, this can be explained by the fact that higher forfeiture leads to lower sponsor capital gains. In contrast, the forfeiture of sponsor warrants and additional acquired shares has no significant effect.

The four largest sectoral effects, sponsors in the auto, health and tech sectors have systematically lower returns than sponsors in other sectors. This effect is robust across the two different models.

These findings highlight that, as for common share returns, low SPAC-period investor confidence – high redemption rates – has a significant negative effect on returns. Higher capital at risk and promote forfeitures structurally result in lower sponsor returns.

*Table15 OLS - sponsor return: This table reports the results of OLS regressions in which the annualised excess return for SPAC sponsors is explained by different characteristics of the transaction, adjusted for market developments by correcting the return with the corresponding return on the Russell 2000 index over the same period. Redeem is the percentage of shares redeemed in the merger (in percentage points), IPO_proceeds is the natural logarithm of the IPO proceeds, at-risk is the percentage of sponsor capital deployed (in percentage points), forfeit_value is the percentage of sponsor shares declared (in percentage points), forfeit_warrant_value is the percentage of sponsor warrants declared (in percentage points), sub_sponsor_value is the percentage of additional shares granted to the sponsor at closing (in percentage points). Auto, Energy, Health and Tech are sector dummies, with all other sectors as the reference category. Column (1) is the base model without sector dummies or fixed effects, column (2) contains sector dummies and IPO-year fixed effects, and column (3) repeats the analysis without observations with a Cook's distance greater than 4/n to examine the influence of outliers. Sample sizes vary due to the exclusion of observations with missing values and the removal of outliers in model (3). Standard errors are in brackets. Significance levels: * p < 0.10; ** p < 0.05; *** p < 0.01.*

Sponsor return			
	(1)	**(2)**	**(3)**
(Intercept)	1.299**	1.381**	1.470***
	(0.638)	(0.624)	(0.490)
Redeem	-1.062***	-1.079***	-1.117***
	(0.182)	(0.175)	(0.138)
IPO_proceeds	0.097	0.114	0.095
	(0.091)	(0.088)	(0.068)
At-risk	-17.896***	-15.111***	-16.712***
	(5.140)	(5.170)	(4.132)
Forfeit_value	-0.470***	-0.558***	-0.527***
	(0.164)	(0.160)	(0.121)
Forfeit_warrant_value	0.204	0.295	0.269
	(0.269)	(0.266)	(0.200)
Sub_sponsor_value	0.219	0.343	-0.112
	(0.366)	(0.357)	(0.298)
Auto		-0.362***	-0.357***
		(0.131)	(0.098)
Energy		-0.098	0.085
		(0.159)	(0.122)
Health		-0.308***	-0.271***
		(0.108)	(0.083)
Tech		-0.452***	-0.375***
		(0.109)	(0.082)
Year FE	No	Yes	Yes
Num.Obs.	218	218	202
R2 Adj.	0.282	0.340	0.496

* p < 0.1, ** p < 0.05, *** p < 0.01

6.3.4 OLS regression PIPE/FPA investor return

Table16 presents the results of OLS regressions in which the return, for PIPE investors is explained by different SPAC and deal characteristics.

The results show that economic discount – the economic '-' discount or '+' premium paid by PIPE investors at the time of merger – has a significant and negative effect on the return for the PIPE/FPA investor, robust to all models. This suggests that the premium paid – average observed for this sample – rather than a discount results in lower returns for the PIPE/FPA investor, other factors constant. A (-)10% discount leads to an average increase of 2.1%-points in PIPE/FPA returns, other factors constant. Significant at the 5% level (Model 2). This suggests that the more favourable the price at which these investors can enter relative to the market, the higher their final realised returns. This explains that the premium paid for PIPE/FPA investors in this sample has an explanatory effect on the low returns.

The PIPE/IPO ratio has a positive and significant effect on the returns of PIPE investors in all models. This means that a larger PIPE investment relative to total SPAC IPO returns leads to higher returns for the PIPE investor, with all other variables held constant.

The effect of the SPAC period return is positive and significant in all models. This suggests that a better SPAC period return contributes positively for the PIPE return, other factors constant. However, this effect was not observed for the deSPAC common share investor.

The redemption rate only shows a significant (1% level) negative effect on PIPE returns when outliers are corrected for. This suggests that lower SPAC-IPO investor confidence in the merger – higher redemption rates – results in lower returns for the PIPE investor one year after the merger. These results are robust for the deSPAC common share investor and the sponsor.

The sectoral effects show significantly lower returns for the two prominent Health and Tech sectors, robust to all three models.

In short, the results show that PIPE/FPA investors mainly benefit from a favourable economic discount and a relatively higher share of PIPE financing. In addition, better returns in the SPAC period positively impact PIPE investors. The previously identified effect of investor confidence on post-merger performance is also observed for the PIPE/FPA investor.

*Table16 OLS - PIPE/FPA investor return: This table reports the results of OLS regressions in which different SPAC characteristics explain the excess return for PIPE investors. The dependent variable is the return for PIPE investors, calculated according to section, adjusted for the market average by the corresponding return on the Russell 2000 index for the corresponding period. The explanatory variables are Eco_discount, the economic discount (or premium) received by the PIPE investor (expressed in percentage points; negative values indicate discount, positive values indicate premium), PIPE/IPO, the ratio between the PIPE amount invested and the IPO return, redeem (in percentage points), and SPAC_return, the return for the SPAC period (in percentage points). In addition, sector dummies for Auto, Energy, Health and Tech are included, with other sectors serving as reference categories. Model (1) and (2) are estimated without IPO year fixed effects, model (3) includes FE and sector dummies, and model (4) is corrected for outliers (Cook's distance greater than 4/n). The sample consists of 140 PIPE transactions, with 128 observations and no outliers. Standard errors are in brackets. Significance levels: * p < 0.10; ** p < 0.05; ***p < 0.01*

PIPE/FPA investor return				
	(1)	**(2)**	**(3)**	**(4)**
(Intercept)	-0.596***	-0.414**	-0.414**	-0.500***
	(0.046)	(0.184)	(0.184)	(0.120)
Eco_discount	-0.270***	-0.205**	-0.194**	-0.140***
	(0.091)	(0.086)	(0.087)	(0.049)
PIPE/IPO		0.185***	0.180***	0.271***
		(0.059)	(0.060)	(0.061)
Redeem		-0.262	-0.243	-0.329***
		(0.178)	(0.179)	(0.110)
SPAC_return		0.899*	0.927*	1.033*
		(0.532)	(0.534)	(0.544)
Auto		-0.224	-0.234	-0.100
		(0.147)	(0.148)	(0.089)
Energy		0.092	0.101	0.072
		(0.150)	(0.152)	(0.087)
Health		-0.256**	-0.266**	-0.153**
		(0.109)	(0.110)	(0.061)
Tech		-0.231*	-0.233*	-0.134*
		(0.121)	(0.122)	(0.069)
Year FE	No	No	Yes	Yes
Num.Obs.	140	140	140	128
R2 Adj.	0.053	0.208	0.205	0.349

* p < 0.1, ** p < 0.05, *** p < 0.01

6.3.5 Key takeaways return drivers

Significant effects were observed for several variables, for example, for SPAC period returns, a large sponsor 'skin in the game' is a significant indicator for better returns, and a longer agreed search time leads to worse returns. The presence of a right increases the upside potential for investors.

For post-merger returns, IPO investor confidence – the redemption rate – is a significant factor on returns. Thus, a higher redemption rate leads to significantly lower returns, robust to all calculated returns. This effect is, on average, more than twice as large for the sponsor return than for the common share return.

The findings for NCPS, for common share returns, support the argument of Klausner et al. (2022), that NCPS has a significant explanatory factor for post-merger performance. Therefore, a higher NCPS leads to better post-merger performance, all other factors being constant.

For sponsor returns, higher capital at risk and larger forfeitures result in substantially lower returns. For PIPE investors, the premiums paid show a significant negative effect on returns and higher PIPE funding and better SPAC period returns indicate significantly better returns.

In summary, given the high redemption rates and the higher coefficients for the different models, the redemption rate is one of the most important factors for post-merger performance for this sample.

6.4 Characteristics of merger versus liquidation SPAC period

A very high liquidation rate was observed in the analysed sample, with a proportionally higher number of SPACs liquidated than before. Therefore, the section below presents a logit regression with SPAC-IPO-specific characteristics to determine if there are characteristics that increase the likelihood of a merger.

Given some lead underwriters are substantially more involved, banker fixed effects are used for models four and five. As previously discussed, IPO year fixed effects are applied in varying ways.

6.4.1 Logit analysis of the probability of merger versus liquidation SPAC period

Table17 presents the results[25] of the logit regressions examining which SPAC characteristics, available at the time of SPAC-IPO, affect the probability of merger. The dependent variable is a dummy variable with dummy 1 for merger and 0 for liquidation.

The results show that the number of months given to a sponsor, from the SPAC-IPO to the final deadline, has a positive significant effect on the probability of a merger with a target. This is robust and significant across all models. This suggests that SPACs where the sponsor gets a longer period to find a target company, increases the probability of a SPAC merger, other factors constant.

Lead underwriter rank has a significant negative effect on the probability of a merger, robust for all models without banker fixed effects[26]. This suggests that SPACs with a lead underwriter with a higher rank – a more prominent lead underwriter – results in a lower probability of a SPAC merger, other factors constant. This can be explained by the idea that better lead underwriters prevent sub-optimal mergers, causing the SPAC to liquidate.

In summary, the results show that a longer period to deadline increases the probability of SPAC merger, while a better underwriter lowers the probability of merger. Other characteristics and sectoral differences analysed, has no significant effect.

[25] Shown in log-odds

[26] By including banker fixed effects, differences between lead underwriters are no longer observable, rendering the "Rank" variable non-significant.

*Table17 Logit regression, probability of merger or liquidation: This table reports the results of Logit regressions examining which SPAC characteristics predict the probability of merger where dummy 1 for merger, 0 for liquidation. IPO_proceeds is the natural logarithm of the at IPO proceeds, warrant and right are dummies indicating whether the original SPAC unit contained a warrant or right, months is the natural logarithm of the number of months between the IPO and the agreed deadline, rank is the rank of the underwriter, General, Tech, Health and Financial are sector dummies for the four largest sectors (all other sectors are the reference category). Model (2) is estimated without fixed effects, model (3) includes IPO-year fixed effects, model (4) includes banker fixed effects and model (5) includes banker and IPO-year fixed effects. The explained power is represented by the pseudo-R-squared. The sample contains 574 observations; five SPACs are excluded due to missing variables. Standard errors are in brackets. Significance levels: * p < 0.10; ** p < 0.05; *** p < 0.01.*

	Logit				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
(Intercept)	-0.443	-0 .323	-0. 631	-0.524	-0.884
	(1.406)	(1.475)	(1.483)	(2.425)	(2.443)
IPO_proceeds	-0.323	-0. 336	-0. 290	-0.119	-0.073
	(0.220)	(0.225)	(0.225)	(0.263)	(0.264)
Warrant	-0.201	-0 .223	-0. 263	-0.294	-0.337
	(0.327)	(0.338)	(0.340)	(0.354)	(0.358)
Right	0.608	0.556	0.339	0.537	0.288
	(0.399)	(0.405)	(0.422)	(0.469)	(0.493)
Months_to_deadline	1.176***	1.184***	1.190***	1.342***	1.357***
	(0.348)	(0.350)	(0.352)	(0.380)	(0.382)
Rank	-0.228***	-0.231***	-0. 226***	-0.364	-0.359
	(0.063)	(0.063)	(0.063)	(0.268)	(0.271)
General		0.107	0.112	-0.035	-0.032
		(0.236)	(0.237)	(0.257)	(0.258)
Tech		-0. 100	-0. 108	-0.195	-0.200
		(0.254)	(0.255)	(0.267)	(0.268)
Health		-0 .080	-0 .044	-0.023	0.021
		(0.312)	(0.313)	(0.341)	(0.343)
Financial		-0. 329	-0. 319	-0.519	-0.484
		(0.344)	(0.344)	(0.386)	(0.380)
Year FE	No	No	Yes	No	Yes
Banker FE	No	No	No	Yes	Yes
Pseudo-R2	0.079	0.081	0.086	0.13	0.134
Num.Obs.	574	574	574	574	574

* p < 0.1, ** p < 0.05, *** p < 0.01

7. Discussion

The SPAC market has undergone significant and rapid changes, as illustrated in Figure 1. For instance, the figure shows that 2021, with 613 SPAC IPOs, was the actual year of the SPAC boom. Never in history have there been as many SPAC IPOs as in 2021. That liquidation rate has increased tenfold in the past three years compared to the previous three.

This large change is also reflected in the calculated returns, which show a worrying pattern; the sharply lower returns found are robust across the entire SPAC structure. For instance, Lin et al. (2024) and Gahng et al. (2023b) still found returns of 11.60% and 23.90% respectively, for the SPAC-period return; the sample studied shows at most a third of that.

For the deSPAC period, the results for common share returns show an average of -64.08%, which is significantly lower than the returns of -11.30% and -28.87% observed in previous periods (Gahng et al., 2023b; Lin et al., 2024). Klausner, Ohlrogge and Ruan (2022) even showed positive returns. This trend was also observed for warrant returns.

Whereas previously the sponsor still achieved substantially high returns, averaging hundreds of percentages, only a fraction of that remained, averaging 7.28%. For the PIPE/FPA investor, Lim et al. (2019) and Gahng et al. (2023b) still showed positive returns; however, similar negative returns are now observed, comparable to those of the common share investor.

This negative trend is also seen in NCPS, with an average of $4.16; thus, the current results show 1.5 times lower NCPS than in the period of Klausner and Ohlrogge (2023). Compared to Gahng et al. (2023b), it was even half as low.

The cross-sectional regressions of the different returns suggest that SPAC-IPO investor confidence has the largest and most significant negative effect. Thus, low confidence leads to high redemption rates, resulting in lower returns. These findings are robust to all calculated deSPAC returns. Additionally, these results support the findings of Rodrigues and Stegemoller (2021) and Feng et al. (2022).

This suggests that the large drop in returns from a SPAC structure is due to the large increase in redemption – investor confidence has dropped sharply. This averages 86.98% for the current sample, previous studies showed averages of 37%, 58% and 55% (Gahng et al., 2023b; Klausner, Ohlrogge, & Ruan, 2022; Lin et al, 2024), for which much better returns were

observed. However, this study does not investigate why the redemption rate is higher than in previous periods.

The argument of Klausner, Ohlrogge and Halbhuber (2022) that NCPS is predictive of post-fusion performance is supported by the results found. Thus, higher NCPS leads to significantly higher post-fusion efficiencies for the sample studied. Also, the calculated $4.16 NCPS shows a lower value on average than calculated in previous periods, which suggests that the cost of a SPAC structure has increased.

8. Conclusion

This study provides an in-depth and up-to-date analysis of the performance, cost structures and success factors of SPACs in the post-2020 period, during which liquidations increased sharply, and returns deteriorated structurally. Whereas previous literature was mainly based on prior periods with favourable market conditions with low liquidation rates, (high) positive returns and only a few negative returns, this study shows that the picture has fundamentally changed since 2020. With structurally worse returns, lower NCPS and higher liquidations are observed.

The study utilised a substantial amount of hand-collected data, providing rich information on various SPAC-specific characteristics and incorporating different types of returns throughout the SPAC lifecycle. A most accurate and realistic picture of SPAC market developments emerges. Thus, for the SPAC period, by considering all components of the SPAC unit and using the 'optimal redemption strategy', an accurate approximation is given for the total return achieved by a SPAC-IPO investor in the period under study. This includes accurate adjustments for sponsors with, e.g. forfeitures, at-risk capital and earnouts. And for PIPE/FPA investors, adjustments are made for premiums paid and bonuses received. Additionally, for the NCPS calculation, careful use was made of, e.g., dilution securities, various fees, and trust account returns.

The main finding is that SPACs from the studied sample are characterised by substantially lower returns on average than previous studies showed from previous periods. On average, negative returns were seen for almost all parties studied, except for SPAC period investors and, to a limited extent, sponsors. For post-merger common share investors, the average return one year after the merger is -64.08% and for warrants, it is -22.09%. PIPE/FPA investors achieved a similar return of -62.55%, paying an average premium of 22.26% (median: 3.83%) for their shares. For the total sample, the sponsor realised a slightly positive return of 7.28% on average,

these results improve when looking only at sponsors of merged SPACs. For the total sample, the SPAC-IPO investor always recovered its initial investment, provided it was traded according to the 'optimal redemption strategy' (Gahng et al., 2023b), resulting in an overall average annualised return of 4.16%. Distinguishing between merged (6.47%) versus liquidated (2.12%) SPACs. This confirms that the strong downside protection for IPO investors is still present, and via the redemption option, their initial investment retains any upside potential.

These results contrast sharply with previous periods, which found high positive returns for IPO investors and only slightly negative returns for post-merger shareholders. This highlights the turnaround in the SPAC market and the increased risks for various investors, including common share investors, PIPE/FPA investors, and, to some extent, sponsors. This makes the SPAC period investor and (sometimes) sponsors still winners to a limited extent and the common share and PIPE/FPA investors are the big losers.

The cost structure expressed in NCPS is also a significant predictor of the post-merger performance of the common share investor, which supports the argument of Klausner et al. (2022). For instance, an average NCPS of $4.16 was observed for the sample studied, lower than previous periods showed, this suggests that the cost of a SPAC structure has increased in terms of NCPS.

For the cross-sectional analysis of post-merger performance, three key participants were used: the deSPAC common share investor, the sponsor and the PIPE/FPA investor. Here, it was found that IPO investor confidence has a significant negative effect on post-merger performance. This suggests that a higher redemption rate significantly leads to lower post-merger returns, which is robust across all three different returns.

The redemption rate shows a higher significance and greater magnitude than NCPS for the SPAC common share return. The NCPS results also show that a higher redemption rate, on average, results in lower NCPS. This suggests that the redemption rate is a more important metric for post-merger performance than NCPS. The high redemption rate – the sharp decline in investor confidence for the post-merger period – has resulted in lower returns for the analysed SPACs, in contrast to previous periods. For this, previous research periods showed only half the number of redemptions as observed in this period.

Furthermore, the agency conflict outlined by Dimitrova (2012), where a late merger would lead to lower post-merger returns, is only present to a limited extent for the common share investor.

A decrease in the dilution effect, due to sponsor forfeiture, has a significantly positive impact on post-merger performance.

Sponsors with lower at-risk capital and no forfeitures tend to perform better for the period under study, and for PIPE/FPA investors, obtaining a discount and higher SPAC period returns are indicators of better returns.

The findings for the SPAC-period investor highlight the importance of strong sponsor incentives, a shorter deadline, and an investor-friendly unit structure as the key predictive characteristics for achieving higher returns during the SPAC period.

Finally, the results of the logit analysis show that a longer available period for target search increases the probability of merger, and better lead underwriters, characterised by a higher rank, show the opposite. Suggesting that better bankers are preventing suboptimal deals, which can cause a SPAC to liquidate.

In summary, the study reveals a significant shift in the SPAC market, characterised by a high liquidation rate, sharply lower returns, and rising costs associated with the SPAC structure. As a result, in the post-boom period, value creation for long-term investors is mostly absent. Based on the results, this is primarily explained by the high redemption rates observed during the period under study.

9. Limitations and further research

The limitation of the study concerns the fact that the data may contain errors, given that a lot of the data was collected by hand. Although I was very precise in collecting the data and checked it several times, there is still a chance of error.

However, the period studied still contains some SPACs that had not merged or liquidated at the time of the study, points to the importance of reproducing the study later.

The current research has shown that there have been major changes in the post-boom period, and the low returns are mainly the result of high redemptions, based on this study. However, this study does not examine why redemption rates are so high. A follow-up study could investigate the cause of the high redemption rate. For instance, a low-quality target could lead to low confidence for the post-merger period, leading shareholders to choose the redemption option.

A similar study can be conducted on the factors contributing to the lower perceived NCPS. This study suggests that a high redemption rate results in a lower NCPS, but this is only one factor; perhaps there are other essential factors contributing to the lower NCPS. This keeping in mind that the new SEC rules require more disclosure on e.g. dilution securities, costs and promotions and these issues are partly included in NCPS, which may make NCPS a value-packed indicator in the future.

Reanalyse the same sample in a few years, when all SPACs have been fully merged. Field and Hanka (2001) demonstrate in their research on traditional IPOs that the expiration of lockups results in significant price declines. This study only used post-merger performance after one year, and the lockup period for most SPACs is also one year; this may result in lower returns. Therefore, at a later stage, when more post-merger data is available, it is crucial to calculate returns over multiple time intervals. To observe any effects of lockups.

The results show that a prominent lead underwriter reduces the likelihood of a merger, suggesting that better lead underwriters prevent suboptimal deals, which lead to the liquidation of the SPAC. However, this is not fully substantiated, requiring a more in-depth analysis of this suggestion.

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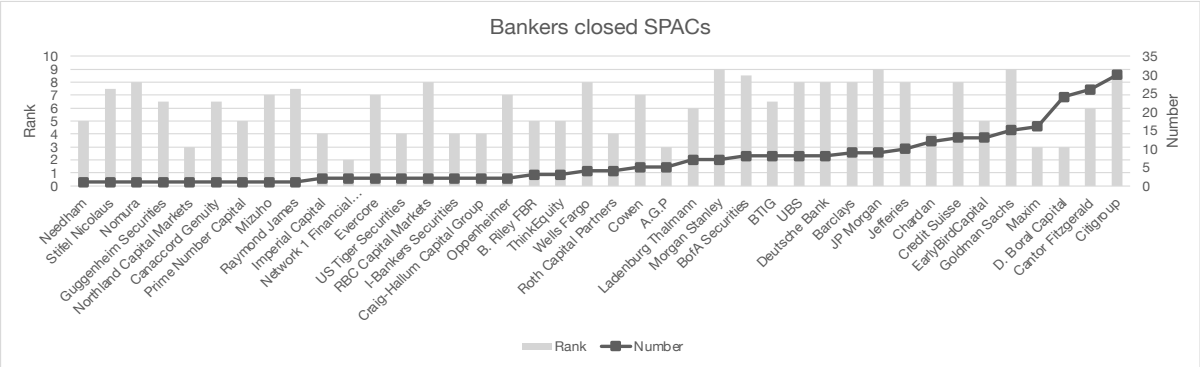
Use of AI

ChatGPT and Grammarly were used to a limited extent during the writing of this thesis. ChatGPT was used to generate general ideas, clarify or further explain concepts that were not immediately apparent, and summarise or explain scientific articles. ChatGPT was also used occasionally to support programming in R. Grammarly was used to improve writing style and grammar.

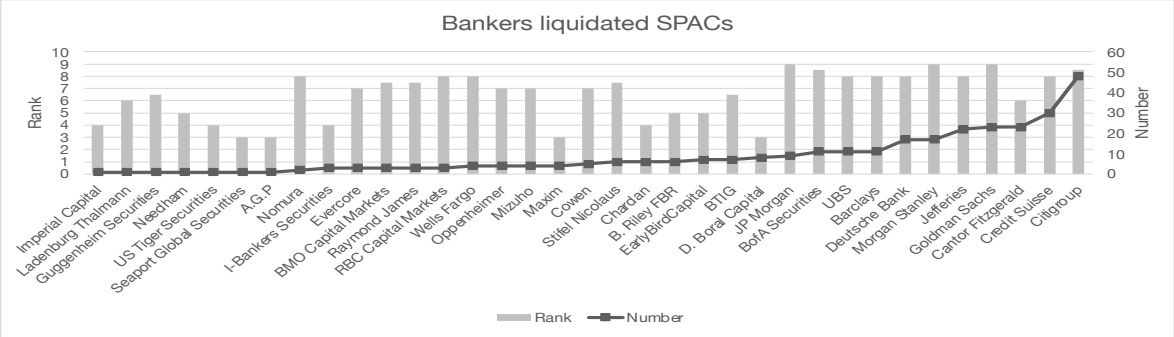
In no case was AI used as a source or for writing complete texts. All content analyses, interpretations, and final text were prepared and validated by me. AI tools were used solely to support, not to replace, my own scientific insights or writing.

Appendix:

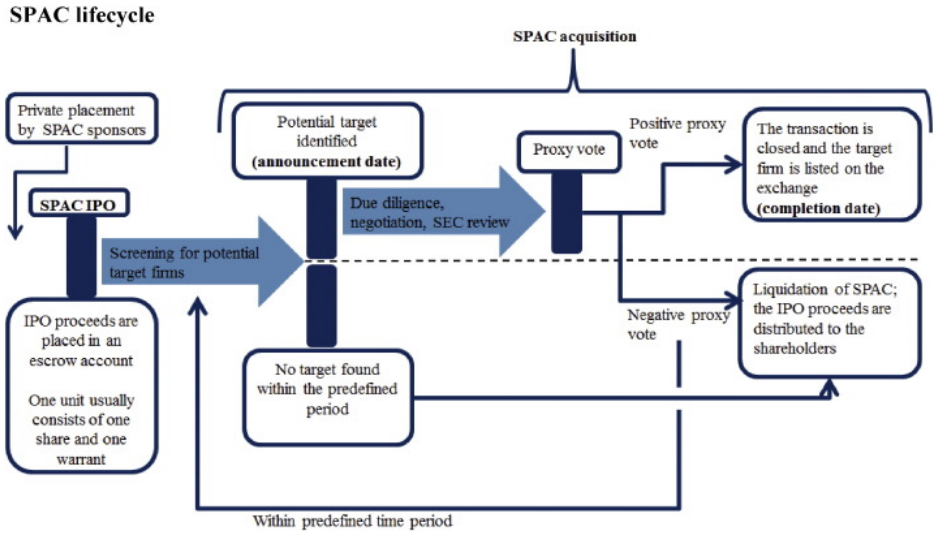
Figures



Appendix1 Bankers closed SPACs shows for each banker (x-axis) the number of closed SPAC deals involving that bank as underwriter during the period 2021-2023 (right y-axis), and the corresponding underwriter rank based on the scale from Jay R. Ritter's IPO Underwriter Reputation Rankings (1980-2024) *database (left y-axis). The black line represents the number of deals per bank; the grey columns represent the underwriter rank, increasing from 1 (lowest) to 9 (best). Jay R. Ritter, IPO Underwriter Reputation Rankings (1980-2024), University of Florida.*



Appendix2 Bankers Liquidated SPACs shows for each banker (x-axis) the number of liquidated SPAC deals involving that bank as an underwriter during the period 2021-2023 (right y-axis), and the corresponding underwriter ranking based on the scale from Jay R. Ritter's IPO Underwriter Reputation Rankings (1980-2024) *database (left y-axis). The black line represents the number of deals per bank; the grey columns represent the underwriter rank, increasing from 1 (lowest) to 9 (best). Jay R. Ritter, IPO Underwriter Reputation Rankings (1980-2024), University of Florida.*



Appendix3 SPAC Lifecycle (Kobl et al. (2016)

Tables

Sponsor security adjustments				
	N. Obs.	**Mean**	**Median**	**Std. Dev.**
Shares forf.	112	37,62%	29,55%	0,26
Warrant forf.	26	48,62%	49,99%	0,32
Additional sub.	52	7,41%	6,07%	0,47

Appendix4 Sponsor security adjustments: The table reports the sponsor security adjustments. For the entire closed SPAC sample. Shares forf. Is the percentage of forfeited shares compared to the initial number of sponsor promoted shares, in 112 out of 272 SPACs an average of 37.62% of the shares are forfeited. Shares subject to an earn-out structure are also included here. Warrant forf. Is the percentage of warrants forfeited relative to capital at risk and warrants acquired by unit, in 26 of 272 SPACs an average of 48.62% of private warrants are forfeited. Exstra sub. Is the percentage of additional forfeited or acquired shares relative to the initial number of sponsor promoted shares. In 52 of the 272 closed SPACs, the sponsor receives an average of 7.41% additional shares. This variable also includes, for example, converted sponor shares, which are converted into PIPE investments, in which case it is reduced from the sponsor promote shares and the returns on those shares are included as PIPE/FPA returns. All three the variable are calculated at time of merger using data from the 8-k fillings. For each variable, the number of observations, mean, median and standard deviation were reported.

Annualised SPAC period returns for liquidated SPACs							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl.(95)**
2021							
Ann. Return	1	0,12%	0,12%	-	0,12%	0,12%	-
Ann. Return Liq.	1	0,12%	0,12%	-	0,12%	0,12%	-
Return Liq.	1	0,10%	0,10%	-	0,10%	0,10%	-
Months	1	9,83	9,83	-	9,83	9,83	-
2022							
Ann. Return	91	0,86%	0,36%	0,017	0,00%	11,32%	0,00
Ann. Return Liq.	91	0,59%	0,43%	0,01	0,00%	3,27%	0,00
Return Liq.	91	0,93%	0,80%	0,01	0,00%	4,70%	0,00
Months	91	20,80	21,77	3,09	11,90	24,07	0,64
2023							
Ann. Return	176	2,26%	1,56%	0,026	0,00%	29,41%	0,00
Ann. Return Liq.	176	2,02%	1,56%	0,01	0,00%	10,85%	0,00
Return Liq.	176	3,95%	3,15%	0,03	0,00%	23,40%	0,00
Months	176	23,93	24,43	4,30	12,77	34,77	0,64
2024							
Ann. Return	38	4,37%	3,60%	0,039	0,51%	24,20%	0,01
Ann. Return Liq.	38	3,21%	2,95%	0,01	0,51%	5,79%	0,00
Return Liq.	38	9,58%	8,45%	0,04	1,50%	19,40%	0,01
Months	38	35,22	36,47	5,19	13,07	44,77	1,70
2025							
Ann. Return	1	8,33%	8,33%	-	8,33%	8,33%	-
Ann. Return Liq.	1	4,78%	4,78%	-	4,78%	4,78%	-
Return Liq.	1	14,90%	14,90%	-	14,90%	14,90%	-
Months	1	35,70	35,70	-	35,70	35,70	-
Total							
Ann. Return	307	2,12%	1,25%	0,028	0,00%	29,41%	0,00
Ann. Return Liq.	307	1,75%	1,18%	0,02	0,00%	10,85%	0,00
Return Liq.	307	3,77%	2,30%	0,04	0,00%	23,40%	0,00
Months	307	24,39	24,33	6,02	9,83	44,77	0,68

Appendix5 Annualised SPAC period return liquidated SPACs This table shows the annualised SPAC period return for public SPAC investors in the full sample of 307 SPACs that went through an IPO between January 2021 and December 2023 and liquidated before May 2025. The returns 'Ann. Return' are calculated according to the optimal redemption strategy of Gahng, Ritter and Zhang (2023), further annualised liquidation returns of the trust account 'Ann. Return Liq.' and the total (non-annualised) liquidation return of the trust account 'Return Liq.' reported. Months shows the number of months between SPAC IPO and liquidation. The returns and months shown are ordered by the year of liquidation, with for2021 the SPAC Gores VII liquidated on 15-12-2021 and for 2025 the SPAC Global Blockchain liquidated on 15-04-2025. For all variables, the number

of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown.

Annualised SPAC period returns total sample			
	N. Obs.	**Mean**	**Median**
Ann. Return	579	4,16%	2,69%

Appendix6 Annualised SPAC period returns, total This table shows the annualised SPAC period returns for public SPAC investors in the full sample for the total sample of 579 SPACs that went through an IPO between January 2021 and December 2023 and merged or liquidated before May 2025. The returns 'Ann. Return' are calculated according to the optimal redemption strategy of Gahng, Ritter and Zhang (2023), which assumes that investors always rationally choose the most favourable exit option

Different weighting methods common share return	
	One-year return
Equally weighted mean	-64,08%
IPO proceeds weighted mean	-60,64%
TEV value weighted mean	-64,93%
Median	-76,61%

Appendix7 Different weighting methods common share return : the table gives of the common share return the total sample mean 'Equally weighted mean', the IPO proceeds weighted mean 'IPO proceeds weighted mean', the total enterprise value weighted mean 'TEV value weighted mean' and the median for the sample.

Warrant return including outliers							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl.(95)**
2021	30	-68,19%	-86,50%	0,53	-98,23%	167,23%	0,20
2022	58	-53,37%	-72,48%	0,62	-99,83%	217,69%	0,16
2023	75	20,85%	-56,32%	2,72	-100,00%	2003,88%	0,63
2024	52	56,01%	-5,50%	3,02	-96,88%	2036,36%	0,84
Total	215	-3,09%	-63,52%	2,26	-100,00%	2036,36%	0,30

Appendix8 warrant return incl. outliers This table shows the realised post-merger one-year warrant return, not excluding the two outliers.

Different weighting methods warrant return		
	One-year warrant return incl. outliers	***One-year warrant return***
Equally weighted mean	-3,09%	-22,09%
IPO proceeds weighted mean	-4,57%	-21,44%
TEV value weighted mean	-18,51%	-26,90%
Median	-63,52%	-63,64%

Appendix9 Different weighting methods warrant return. The table shows for the one-year post-merger warrant return, the total sample average 'Equally weighted mean', the IPO proceeds weighted mean, the total enterprise value weighted mean 'TEV value weighted mean' and the median for the sample

Sponsor return closed SPACs							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl.(95)**
2021							
Value at risk ($M)	37	9,15	8,00	5,35	2,00	28,88	1,78
Dollar gain cl. ($M)	37	84,31	75,09	53,35	17,29	300,85	17,79
Dollar gains one year ($M)	37	22,85	14,68	19,92	1,77	70,33	6,64
Total return (%)	37	162,17%	95,18%	2,29	-71,45%	771,85%	0,76
Ann. Return (%)	37	61,57%	43,39%	0,87	-53,04%	282,58%	0,29
2022							
Value at risk ($M)	65	7,18	7,16	3,22	2,00	18,00	0,80
Dollar gain cl. ($M)	65	54,07	44,04	42,68	3,06	237,61	10,57
Dollar gains one year ($M)	65	18,28	6,52	33,27	0,05	226,37	8,24
Total return (%)	65	123,65%	12,52%	3,48	-99,33%	2076,60%	0,86
Ann. Return (%)	65	17,40%	4,24%	0,74	-91,81%	286,65%	0,18
2023							
Value at risk ($M)	83	7,27	6,85	3,20	1,93	19,25	0,70
Dollar gain cl. ($M)	83	40,69	29,41	33,76	0,04	147,26	7,37
Dollar gains one year ($M)	83	13,99	5,60	24,62	0,00	154,01	5,38
Total return (%)	83	83,02%	-17,10%	3,12	-99,99%	2144,95%	0,68
Ann. Return (%)	83	0,03%	-5,99%	0,50	-95,41%	143,83%	0,11
2024							
Value at risk ($M)	34	8,41	8,12	3,75	0,63	17,60	1,31
Dollar gain cl. ($M)	34	62,85	38,82	95,25	5,38	551,73	33,23
Dollar gains one year ($M)	34	29,58	8,31	67,19	0,00	307,63	23,44
Total return (%)	34	396,91%	-8,96%	13,15	-99,98%	6477,80%	4,59
Ann. Return (%)	34	6,67%	-3,49%	0,60	-92,66%	181,13%	0,21
Total							
Value at risk ($M)	219	7,74	7,31	3,78	0,63	28,88	0,50
Dollar gain cl. ($M)	219	55,47	41,69	55,14	0,04	551,73	7,34
Dollar gains one year ($M)	219	19,18	7,23	36,49	0,00	307,63	4,86
Total return (%)	219	157,18%	4,35%	5,95	-99,99%	6477,80%	0,79
Ann. Return (%)	219	16,62%	1,49%	0,69	-95,41%	286,65%	0,09

Appendix10 Sponsor return closed SPACs This table shows the results of the sponsor return analysis for merged SPACs with an IPO between 2021 and 2023, for which at least one year of post-merger data is available. The analysis was performed on a sub-sample of SPACs whose merger took place before May 2024 - end date 31-04-2025 - and which were not delisted within one year of merger. This excluded 47 SPACs due to merger after April 2024, three SPACs excluded due to delisting within one year of merger and three SPACs excluded due to lack of information. By year of merger: the average risk capital invested by the sponsor 'Value at risk', the realised dollar gain at the time of merger 'Dollar gain cl.', the realised dollar gain one year after merger 'Dollar gains one year', the total return to the sponsor from SPAC IPO to one year after merger 'Total return' and the annualised return 'Ann. Return' (5.1.4 Sponsor return) are shown. For all variables, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown.

PIPE return Excl. Bonus	
	One-year return
Equally weighted mean	-62,74%

Appendix11 PIPE/FPA return excl. bonus: the table shows the total average return for PIPE/FPA investments excluding bonus shares or warrants granted.

Net Cash Per Share							
	N. Obs.	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**	**Conf. Lvl. (95)**
0% - 25%							
NCPS incl. Warrants	10	8,26	8,32	0,47	7,31	8,91	0,34
NCPS excl. Warrants	10	7,07	8,07	2,84	-0,87	8,61	2,03
25% - 50%							
NCPS incl. Warrants	7	7,90	7,95	1,39	6,18	9,60	1,29
NCPS excl. Warrants	7	7,59	7,41	1,53	6,07	9,58	1,41
50% - 75%							
NCPS incl. Warrants	21	6,96	7,30	1,94	3,58	10,71	0,88
NCPS excl. Warrants	21	6,33	6,34	1,93	3,03	10,51	0,88
75% - 100%							
NCPS incl. Warrants	205	3,54	2,54	4,40	-3,42	43,82	0,61
NCPS excl. Warrants	205	3,03	2,17	4,17	-7,34	35,95	0,57
Total							
NCPS incl. Warrants	243	4,16	3,84	4,34	-3,42	43,82	0,55
NCPS excl. Warrants	243	3,61	3,44	4,15	-7,34	35,95	0,52

Appendix12 Net Cash Per Share: This table shows the net cash position per share (NCPS) at closing, calculated for all SPACs with an IPO between 2021 and 2023 and merged before May 2025. The sample consists of 243 SPACs, out of 272 total sample, 29 SPACs are excluded due to missing or inaccurate data on the number of shares outstanding at merger. The results are ranked by four redemption rate intervals. Both the NCPS including and excluding outstanding warrants is shown, as calculated in section:5.2.1 Net Cash Per Share measurement: . For each variable, the number of observations "N. Obs.", mean "Mean", median "Median", standard deviation "Std. Dev.", minimum, maximum and the 95% confidence interval are shown

Validation regression models:

This section discusses the diagnostic tests of the regression models, which are shown for each return.

Diagnostic tests OLS regression SPAC period return

To validate the regression models, diagnostic tests were conducted to assess four key assumptions. Normality of the residuals was tested with the Shapiro-Wilk test, which formally showed a violation of normality, but given the large sample size, it is assumed, based on the central limit theorem, that the OLS estimates are robust. Heteroscedasticity was tested using the Breusch-Pagan test, which was non-significant, indicating homoscedasticity of the residuals. Multicollinearity was assessed using the variance inflation factor (VIF), which yielded a value below 2 for all variables except log_IPO_proceeds (VIF = 2.8), which is not considered problematic. Some visual outliers were observed in the Q-Q plots; these were systematically removed based on Cook's distance according to the rule of thumb - 4/nrow - to ensure robustness of the results.

Diagnostic tests OLS regression common share return

Diagnostic tests were conducted to test the validity of the regression models. Normality of the residuals was tested using the Shapiro-Wilk test, which showed a violation of the normal distribution. Given the relatively large sample, it is assumed that the central limit theorem guarantees are sufficient so that the results are reliable. Heteroscedasticity was tested with the Breusch-Pagan test, which was non-significant; this indicates that the variance of the residuals is constant within the models used. Multicollinearity was examined using the variance inflation factor (VIF), where for all models, the VIF scores were below 2, for a single variable 2.2 – IPO_proceeds and rank – showing that there is no significant multicollinearity between the included explanatory variables. During the initial analysis, some outliers were observed in the Q-Q plots. To examine the influence of these outliers on the sample, observations with a high Cook's distance were excluded, according to the rule of thumb - 4/nrow - and two models were repeated without outliers (Table14). This resulted in more robust and reliable estimation results.

Diagnostic tests OLS regression sponsor return

To validate the estimated models, four main diagnostic tests were performed. Normality of the residuals was tested via the Shapiro-Wilk test, formally rejecting it, but given the sample size, the estimates were assumed to be robust based on the central limit theorem. Heteroscedasticity was examined with the Breusch-Pagan test, which was non-significant, indicating homoscedasticity of the residuals. Multicollinearity was assessed via the variance inflation factor (VIF), which found values below 2 for all variables. The Q-Q plot showed some obvious outliers that were excluded according to Cook's distance and the rule of thumb to test the robustness of the model without outliers.

Diagnostic tests OLS regression PIPE/FPA investor return

To validate the regression results, four diagnostic tests were performed. Multicollinearity was assessed using the variance inflation factor (VIF), for all variables a VIF smaller than 1.2 was shown. The Breusch-Pagan test was not significant, the variance of the residuals being constant. The Shapiro-Wilk test was significant, but due to the size of the sample, the central limit theorem is used. Some outliers were observed in the Q-Q plots, these were excluded according to Cook's distance and rule of thumb.

Diagnostic tests Logit analysis of the probability of merger

The explanatory power of the logit models was assessed based on the McFadden pseudo-R-squared and added in the table. Multicollinearity was examined using the variance inflation factor (VIF); all explanatory variables showed VIF scores below 1.9, no problematic multicollinearity.