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An Alternative Perspective on Special Purpose Acquisition Companies (SPACs): Underpricing in the “No Target" Phase

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An Honors Paper for the Department of Economics

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Abstract

Special Purpose Acquisition Companies marked a restructuring of the often-fraudulent 1980s blank check company, an entity gathering funds to merge or acquire another business entity. Based on the Special Purpose Acquisition Company structure, "*the stock price should be greater than or equal to the pro-rata trust value, discounted from the SPAC's expiration date, at all times prior to the shareholder vote date.*" In this study, I research the "no target" phase of the Special Purpose Acquisition Company's lifecycle to evaluate whether there is a difference between their trust value and their market capitalization. Based on previous research, we know that there is a discount to trust value prior to 2009; however, I postulate the decoupling of the SPAC merger approval vote and the vote for investors to redeem may eliminate this discount. Using a first difference regression to establish the premium to the average trust value of 1,057 Special Purpose Acquisition Companies traded between 2005 and 2022, we find that both the period before 2010 and after 2010 trades at a negative premium, or discount. Because the decoupling of the merger vote and the redemption vote did not eliminate the negative premium to trust value, I postulate that the structure of SPAC redemptions, modeled as a call option with decaying time value, may be responsible for this mispricing. I also draw opportunities for future research to investigate if the embedding of a call option into the SPAC redemption structure discourages shareholders from desiring merger outcomes early in the SPAC lifecycle.

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I. Introduction

Uncertainty in equity markets during the COVID-19 pandemic led to the revival of the Special Purpose Acquisition Company (SPAC), an investment product forming a hybrid between an Initial Public Offering (IPO) and Mergers & Acquisitions (M&A) activities. Although the pandemic-era equity markets are primarily known for capitalizing on some of the most historically volatile conditions, this volatility gave rise to longer-term and more risk-forward investment opportunities that still influence the markets three years later.

Overarchingly, a SPAC is a publicly traded corporation formed by one or more sponsors to acquire or merge with a privately held operating business (known as the target company) by a specific date. With the SPAC fulfilling the same purpose as a traditional IPO upon acquiring a target company, the creation, and resurgence of, this product highlights that there are advantages that a SPAC brings to the target company that a traditional IPO would not. A SPAC would provide an opportunity for smaller, younger companies to be publicly listed, whereas the duration and regulatory screening process of the traditional IPO may prevent these companies from gaining access to public markets. Dimitrova (2017) finds that the target may desire a SPAC merger to avoid the long IPO process, avoid high costs, provide liquidity to owners wanting to cash out of the target and gain extra capital and expertise from the manager. In comparison to the Traditional IPO, the redemption option is another unique aspect of the SPAC structure that can be more appealing to investors. Moon (2021) finds that the option to redeem the value of the SPAC shares, plus any interest, at the time of the SPAC merger vote provides safety to SPAC IPO investors that the Traditional IPO does not. This redemption option provides liquidity to shareholders in the form of an embedded call option within their purchase of a share in the SPAC IPO.

This paper aims to investigate the relationship between SPAC trust values and their market capitalization in the period before the SPAC has announced an acquisition target. In accordance with previous literature, I break the SPAC lifespan into three distinct phases: the "no target phase," the "target phase," and the "post-merger" phase. A sizable body of research investigates SPAC returns post-merger and concludes that, on average, SPACs underperform the market; however, there is little causal research into the role that the SPAC as an investment vehicle plays in this underperformance. In response to the poor post-merger performance of SPACs, investors, banks and the media have portrayed the asset class in a negative light. I intend to research the "no target" phase of the SPAC lifecycle to investigate the trading performance of the SPAC without conflating the pricing in of an anticipated merger. Based on SPAC structure, "*the stock price should be greater than or equal to the pro-rata trust value, discounted from the SPAC's expiration date, at all times prior to the shareholder vote date*" (Lewellen 2009). However, previous research indicates that before 2009, SPACs in the "no target" phase traded below pro-rata trust value on average. Within my research, I hope to identify if this difference still exists and explain why the price per share of the SPAC may trade below the pro rata trust value. Using CRSP Daily Stock Price data on SPACs traded on major US exchanges between 2003 and 2022, I will consider two types of models to explain why this value difference may occur.

One possible mechanism that may cause this mispricing will be referred to as the "decoupling hypothesis." Before 2010, SPAC structure dictated that the SPAC merger approval vote and the vote for investors to redeem their shares at trust value with added interest occurred simultaneously. In 2010, these votes were uncoupled. To investigate if there is a mispricing problem within the "no target" phase of the SPAC lifespan I will build upon Lewellen's research

by running a first difference regression on the average premium to trust value distinguishing the period before January 1, 2010 from the period after. We find that both the period before 2010 and after 2010 trades at a negative premium, or discount.

Because the decoupling of the merger vote and the redemption vote did not eliminate the negative premium to trust value, I introduce a second mechanism to explain the discount, the time-value hypothesis. Here, the structure of SPAC redemptions is modeled as a call option with decaying time value. I use Black Scholes's option pricing theory to demonstrate that the time value of an embedded call option per share decays as the SPAC approaches maturity. Thus, causing a decrease in the value of each SPAC share with respect to trust value. I also provide context for future research regarding how the randomness of the merger vote date may affect the time-value of the option.

II. Background and Related Literature

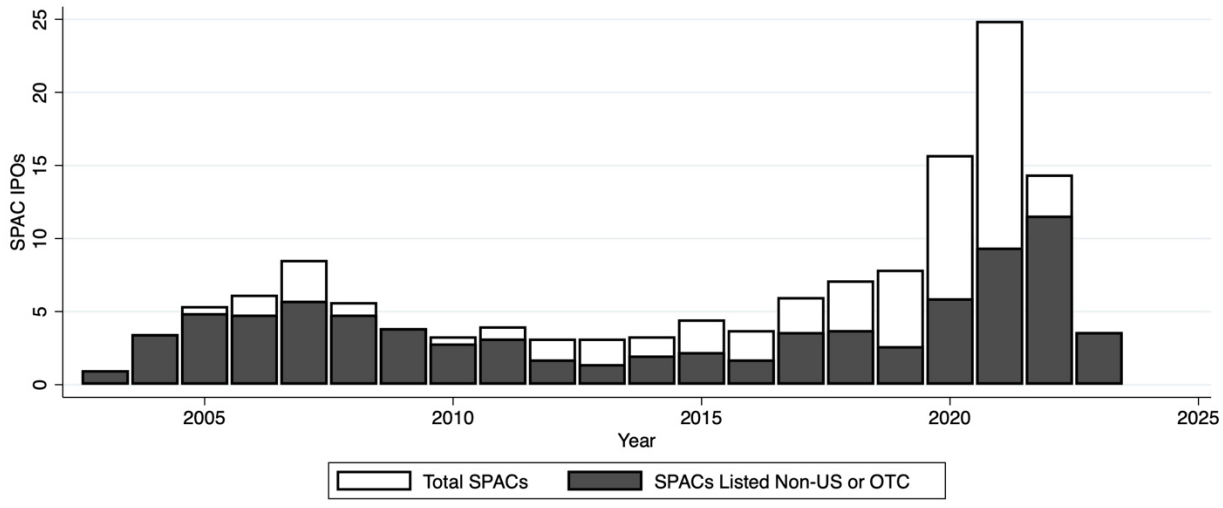
SPAC Eras

The SPAC was created with the intent of reforming the blank check company, an entity used to gather funds to merge or acquire another business entity, following the 1980s, a period heavy with fraud and manipulation of securities prices through these products. SPACs have several differences from a blank check company that are carefully constructed to protect the investor. The most significant differences within SPACs are that shareholders can buy and sell the SPAC's stocks and warrants rather than be required to hold them until the merger. Warrants are usually not exercisable until after the merger, and SPACs can add an additional six months to the eighteen months of the blank check time limit. Riemer (2007) also highlights the distinction that protections are provided to accredited investors from reputable sponsors of SPACs, whereas unsophisticated investors would be deceived by disreputable managers of blank checks. Since

their genesis in 1993, SPACs continued to evolve in three distinct stages. The specific eras of the SPAC demarcate changes in the operational structure of the SPAC, providing higher protections to investors in these products as concerns arose.

Investors typically classify the period between 1993 and 1999 as 'SPAC 1.0', the period between 2000 and 2009 as 'SPAC 2.0', and from 2010 onwards as 'SPAC 3.0'. The SPAC 1.0 era was largely encompassed by David Nussbaum's 13 "blank check hybrids" that he created between 1993 and 1994. The investment vehicle then remained dormant until SPAC 2.0, when the tech boom caused a resurgence of small companies seeking access to the public equity markets. Rodrigues and Stegemoller (2012) label David Nussbaum's Millstream Acquisition Corp. as the start of the second wave. From 1993 through 2004, SPACs were only listed on OTC exchanges; however, starting in 2005, SPACs could list on the American Stock Exchange (AMEX), and in 2008 they could list on the NYSE or NASDAQ. Figure 1 depicts the total distribution of SPACs listed, and those listed on OTC and non-US exchanges, over the 2003-2023 period.

Figure 1: SPAC IPOs by Year



The SPAC 2.0 wave reached its peak in 2007 with 65 SPAC IPOs, 26.6% of all successful IPOs that year, as reported by Riemer (2007). This era ended with the 2008 financial crisis and SPAC 3.0 began in 2010, reaching its peak in February of 2021.

Two significant regulatory changes occurred in 2010 that demarcate SPAC 1.0 and 2.0 from SPAC 3.0. Gahng et al. (2021) discuss these. The first separated a shareholder's voting and redemption rights as seen in the figures below. Previously, an investor only had the option to redeem their shares for trust value plus interest if they voted against the merger. Beginning in 2010, an investor could vote to approve a merger and take part in a second vote to redeem their shares following merger approval. This creates an incentive for investors to approve any merger, even a bad one, as an investor has the option to withdraw their initial investment with interest and keep their warrants in the merged entity. The second significant change was that sponsors began to purchase private placement warrants to increase the trust value of the SPAC. Gahng et al. (2021) report that this purchase is usually $5 million or more. Coupled with the increased agency of SPAC investors regarding the option to redeem, the purchase of private placement warrants creates a financial incentive for SPAC sponsors to propose better mergers.

SPAC Timeline

The SPAC timeline is divided into two distinct periods: pre-merger and post-merger. The pre-merger period begins with the IPO and concludes with either a business combination vote or the liquidation of the SPAC. The post-merger period begins following the business combination of the SPAC and its target company. Within the pre-merger period, we can further break down the SPAC process to include the "no target phase" and the "target phase." Most research regarding the performance of SPACs focuses on the post-merger period and the "target phase" of the pre-merger period.

Redemptions

For a SPAC merger to successfully close, a specified percentage of investors must vote to approve the merger and a specified percentage of investors must vote to keep their shares of stock in the merged entity. The latter condition is known as a redemption threshold. Historically, no more than 20% of investors could vote to redeem their shares for trust value, but over time this percentage has increased. Lakicevic et al. (2013) find that in the 2003-2006 period, the threshold level was 20.47% and it increased to 84.24% in the period from 2009-2012. This change in redemption thresholds is likely due to the previously mentioned 2010 decoupling of the merger vote and the redemptions vote.

If redemptions do not surpass the threshold and the merger can close, a high number of redemptions will still impact the merged company poorly (Klausner et al. 2020). Klausner et al. (2020) found that the mean and median redemption rates were 58% and 73% for mergers that closed between 2019 and 2020 and that 77% of SPACs raised additional money at the time of their mergers. This additional funding is to offset the reduced value of the trust that redemptions brought. Between 2019 and 2020, around 40% of the cash a SPAC delivered in the merger process was attributed to cash infusions from the sponsor or a third party (Klausner et al. 2020).

Post-merger Performance

Following the close of a SPAC transaction, the merged entity trades on a stock exchange just as any company that went through the traditional IPO process would. Thus, there is a body of research comparing the stock market performance of companies that completed a SPAC transaction with other major indexes. Overwhelmingly, the literature has found that companies that underwent a SPAC transaction underperform in comparison to similar stocks. Klausner et al. (2020) compared the performance of SPAC mergers to the Russell 2000, an index of small-cap

stocks, and found that SPAC mergers never outperformed the index. The best year of SPAC merger returns still underperformed by 10%.

Aside from their comparison to other similar baskets of stocks, researchers of each of the SPAC eras study the share returns of SPACs post-merger with various time horizons and measures of returns. The first paper investigating SPAC returns, Jog and Sun (2007), finds a negative 3% annualized abnormal return for the shareholders of the SPAC and positive 1,900% for management. Jog and Sun measured the annualized abnormal return from the SPAC IPO and thus account for management's ability to invest a nominal amount for their shares rather than just measuring the return on share value post-SPAC IPO. This research reflects the need for the 2010 policy change requiring managers to have "more skin in the game" by raising the requirements for capital in the trust. Following the policy change, Jenkinson and Sousa (2011) find an average cumulative return of -55% for shareholders after one year. Thus, SPACS are still inherently value-destroying. Kolb and Tykvova (2016) build upon this research claiming that low-quality firms are drawn to SPACs, claiming the SPAC structure is responsible for creating an asset with a buy-and-hold average market-adjusted one-year return of -46% for investors.

However, in 2021, Bazerman and Patel revisit these studies in the context of the equity markets post-COVID-19. They find that the current market has improved sponsor terms and provided SPACs with higher valuations, less dilution, more transparency, lower fees, faster speed, and fewer regulations in comparison to traditional IPOs. Bazerman and Patel (2021) find that post-merger SPACs outperformed the S&P 500 between January 2020 and the first quarter of 2021 by 27 basis points. Bazerman and Patel (2021) are the only study that indicates a positive return on SPAC shares post-merger. Thus, the vast majority of SPAC literature found negative

returns for SPAC shares, and it is reasonable to conclude that SPACS have underperformed both their IPO counterparts and the broader market.

While this literature paints a negative picture of SPACs as an investment vehicle, it is important to consider that Financial Economics literature finds that companies that issue equity are poor long-term investments across the markets (Loughran & Ritter (1995); Chen & Zheng (2021)). Thus, the poor performance of SPACs in relation to the Russel 2000 and the market average only serves to reinforce this existing notion that SPACs follow similar patterns to other companies issuing equity, albeit their returns do exhibit more volatility than other traditional equity offerings. Thus, in this body of research, I will investigate the "no target phase" of the SPAC lifespan to consider only the SPAC as a vehicle for investment rather than a conflation of the value of a potential merger with a specific target company.

Merger Announcement Effect

While most of the literature has focused on the underperformance of SPACs post-merger, there is also a body of literature that suggests that there is a positive effect of SPACs announcing a potential merger in event windows up to 3 days. Kiesel, Klingelhöfer, Schiereck, and Vismara claim that "the announcement day of a proposed merger is the focal point in the lifetime of a SPAC" (2022). Their study on SPAC returns post-merger announcement is influenced by mergers and acquisitions (M&A) literature but notes that there is no potential for synergy gains as the acquirer in SPAC mergers does not have an operating company. Kiesel, Klingelhöfer, Schiereck, and Vismara find that between January 2012 and June 2021 United States SPACs have an average short-term announcement return of +7.4% and a 1-year abnormal return of −14.1% (−18.0% over 2 years) for public investors beginning from the merger announcement (2022). The announcement of a merger is a short-term catalyst for increased SPAC returns;

however, a 2022 study by Brax highlights how limited the time horizon is for these increased returns. Using 40 SPACs as a case study, Brax calculates abnormal returns for an event study focusing primarily on +/-3 days from the deal announcement. The study found that SPACs do not generate risk adjusted abnormal returns on the day after the announcement date; however, they do generate risk-adjusted abnormal returns on the announcement date (Brax 2022). While the scope of this study is limited, it is indicative of the perspective that the SPAC's merger with the target company is the most important aspect of the SPAC structure.

Aside from Lewellen's limited discussion of the violation of his hypothesis that "*the stock price should be greater than or equal to the pro-rata trust value, discounted from the SPAC's expiration date, at all times before the shareholder vote date*," regarding SPACs in the "no target" phase, no other economists have researched this underpricing of SPAC shares before merger announcement. No other economists have researched the "no target" phase. In this paper, I recognize that the "no target" phase of the SPAC is the only period in which share prices are not influenced by the predicted valuation of the potential target company, and thus, find that the "no target" phase is a mechanism to proxy if there is an underlying structural reason for why SPACs perform poorly outside of the characteristics or their mergers or the target companies that they attract.

III. Hypothesis

The purpose of this research is to investigate a mispricing problem within the "no target" phase of the SPAC lifespan that was previously established in the pre-2010 period by Stefan Lewellen. Lewellen's first assumption about SPACs states "*the stock price should be greater than or equal to the pro-rata trust value, discounted from the SPAC's expiration date, at all times before the shareholder vote date*." Because the redemption option within the SPAC

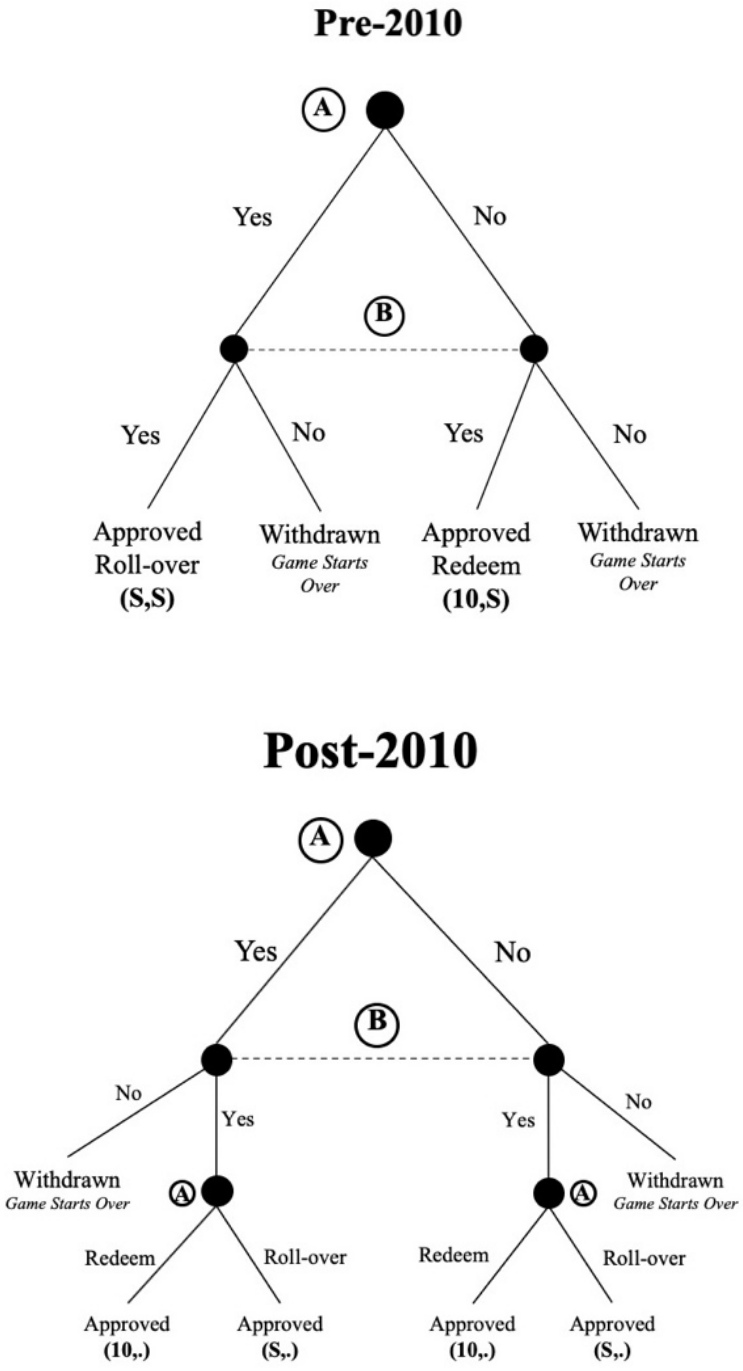
structure guarantees investors the trust value plus interest, the present value of the trust value should act as a price floor on the SPAC's stock price to prevent arbitrage opportunities. However, in the period before a SPAC announces its intended target, Lewellen found that the price per share of a SPAC is less than its pro-rata trust value. Because SPAC shareholders have the option to redeem their shares for the value of the pro rata trust value at two instances: at the time of the business combination and at the liquidation of the SPAC, an investor should not sell a share of a SPAC for lower than its pro rata trust value and Lewellen posits an interesting mispricing within the SPAC structure.

It is important to investigate if SPACs are simply responding poorly to volatile market conditions and liquidity shocks, like any other investment vehicle, or if there is an aspect of a SPAC itself, or the quality of investors it draws, that causes the vehicle to destroy value within the process. Since Lewellen identified this value problem in 2009, there has been a wealth of SPAC research focusing on the post-merger period; however, it appears that economists have not revisited this question of mispricing in the "no target" phase. If there continues to be a difference in the trust value and the market capitalization of the SPAC post-2010, this highlights irrational behavior as SPAC shares are discounted from their implied parity with the trust value, creating a situation where either the buyer or seller of the security is taken advantage of.

I am modeling the SPAC as an investment opportunity where an individual can hold stock in a SPAC with the embedded call option of redeeming a risk-free zero-coupon bond with a face value of $10 at the time of the business combination or a SPAC liquidation due to the option of redemptions. When purchasing a share of a SPAC, an investor is given this embedded call packaged with the security. It is important to highlight that in 2010, the SPAC underwent a

structural change where the shareholder's voting and redemption rights were separated, motivating my decoupling hypothesis (Figure 2 and Figure 5).

Figure 2: Changes to SPAC Redemption Structure in 2010



Before 2010, a SPAC shareholder's vote to approve a SPAC merger was inherently coupled with their vote to redeem. The lefthand side of the pre-2010 game theory tree depicts this decision-making process. If an individual shareholder (A) votes "yes" to a merger decision, and the majority SPAC shareholders (B) vote "yes" to the merger, then shareholder A has approved the merger and exercised their option to convert their SPAC share into equity in the merged company. Similarly, if shareholder A votes "no" to the merger and the majority shareholders (B) vote "yes" to the merger, seen on the right-hand side of the pre-2010 tree, shareholder A redeems their SPAC share for the pro-rata trust value of their share, typically $10 per share plus any interest accrued. I have included Stefan Lewellen's illustration of this pre-2010 structure as Figure 5 in the appendix.

However, beginning in 2010, an investor could vote to approve a merger and then vote to redeem their shares following merger approval as depicted in the post-2010 game theory tree. Here we see that shareholder A could vote "yes" to the merger and if majority shareholder B also voted "yes," then shareholder A had the right to vote a second time to decide if they wanted to redeem their shares or if they wanted to exercise the option to convert their shares into equity in the merged company.

Thus, the investor now has greater incentive to keep their shares until the close of the merger as they then have the option to withdraw their initial investment with interest and keep their warrants in the merged entity. Thus, one would speculate that after this structural change, the investor places a value on each SPAC share that is greater than or equal to the pro rata trust value of the SPAC. If there is no longer a difference between the trust value and the market capitalization after the 2010 structural change, this highlights that the combination of the merger approval vote and the redemption vote in the pre-2010 period may have destroyed the value of

the risk-free zero-coupon bond held in the SPAC trust in comparison to the same security outside of the vehicle.

If the results conclude that there is also a negative difference between the market capitalization and the trust value in the post-2010, then we can conclude that the separation of the merger approval vote and the redemptions vote did not correct, or did not entirely correct, this mispricing and there is a different aspect of the SPAC structure that causes investors to undervalue the risk-free zero-coupon bond that is held within the SPAC trust per share of stock. If the results conclude that there is a positive difference between the market capitalization and the trust value, we can conclude that the combination of the merger approval vote and the redemption vote in the pre-2010 period may have destroyed the value of the risk-free zero-coupon bond held in the SPAC trust; however, we could also assume that investors are valuing the potential of the SPAC merger at a higher value than that of the risk-free zero-coupon bond and that higher quality deals may be transacting on average post-2010.

IV. Data and Methodology

This analysis consists of individual-level panel data from 2003 to 2022 companies that have been listed as SPACs on stock exchanges. I identified the SPACs through the combination of research from Milos Vulanovic, Magnus Blomkvist, and Stefan Lewellen alongside my hand collection of SPAC data. I then used the SPAC identification to compile a dataset of daily stock price data for 1,057 SPACs listed on major US exchanges from January 2005 – December 2022 using CRSPs daily stock price database.

Vulanovic and Blomkvist's Data

Vulanovic and Blomkvist's data on the institutional characteristics of SPACs are collected from the Security and Exchange Commission (SEC) website and The Electronic Data Gathering, Analysis and Retrieval (EDGAR) database. Just like other public companies, SPACs must report all issuance activities, major corporate changes, and updated financial statements to the SEC. Vulanovic and Blomkvist hand-collect their data from the initial registration S-1 forms and update the data with information reported before the IPO. They cross-check the data with updated public information about SPACs published by Morgan Joseph and recheck the original filings with the SEC when there is a discrepancy. Vulanovic and Blomkvist also collect their data on merger dates from the SEC and Morgan Joseph and cross-check against the reports from major business news providers, such as Yahoo and Bloomberg.

Vulanovic and Blomkvist reported all SPACs that were listed on any public exchange from 2003-2023. The sample period starts on August 22, 2003, and lasts until February 6, 2023, and the data provides information on 1,529 SPACs. This data set included the short form name of the SPAC and information on when the SPAC had its initial public offering, when the merger with its intended target company was announced, and when the merger with the intended target company was completed. They also cited the SEC fillings for each SPAC IPO including a link to the filing. Vulanovic and Blomkvist did not list the Center for Research in Security Prices identifying number (CRSP PERMNO) or the ticker symbol for these SPACs as they used DataStream to compile pricing information for their research. The long form name for each SPAC as well as information about the exchange on which each SPAC was listed was also unavailable.

Lewellen's Data

Lewellen uses similar methods to Vulanovic and Blomkvist to identify SPACs. He hand-identifies SPACs through a search of the EDGAR database for public companies with a SIC code of 6770 ("Blank Check Company"), published research reports from the investment banks Morgan Joseph and Maxim Group, LLC, and the database of SPAC transactions listed on the website SPACInfo.com. Lewellen collects company structure data from public SEC filings.

Lewellen reported data on all SPACs that were listed on any public exchange from 2003-2008. The sample period starts on August 22, 2003, and lasts until June 30, 2008. The data include observations for 236 SPACs all of which match the entries for Vulanovic and Blomkvist's data. Lewellen's data includes the company name, company address, ticker symbol, and SIC code as identifying characteristics. Lewellen also collected data on the IPO date, IPO size, first trading day, and on which stock exchange the SPAC is listed, among other data that is not relevant to my analysis.

Merging Existing Datasets and Collecting Daily Stock Price Data

Because Vulanovic and Blomkvist's data and Lewellen's data were both hand-collected samples, I merge the two datasets on company name to ensure that I identified the complete SPAC universe. Note that Lewellen's data only included SPACs from 2003-2008, thus I merge his dataset onto Vulanovic and Blomkvist's to build a complete representation of SPACs traded from 2003-2023. However, Vulanovic and Blomkvist used a short-form company name when identifying their SPACs and did not include any identifying information compatible with the CRSP database. Thus, I clean the company names in both datasets by dropping any descriptor words such as Inc., Corp, Group, etc., as well as Acquisition Corp., a common identifier to SPACs. This code also abbreviated common company descriptors and deleted spaces in the company names. After merging on the cleaned company names, I note that all companies

in the Lewellen dataset were represented in the Vulanovic and Blomkvist dataset, creating the complete SPAC universe.

Because Vulanovic and Blomkvist did not include ticker information or CRSP PERMNOs for their entries, I create a list of all companies that were publicly traded on major US stock exchanges between January 1, 2003 and December 31, 2022 from the CRSP stock identification database and performed the same cleaning code on the company names that it returned. The output was then matched by company name onto the database of the SPAC universe that was gleaned from merging Lewellen's data with Vulanovic and Blomkvist's. Of the 1,529 SPACs in the universe, 1,058 SPACs were matched with the 2003-2022 CRSP database. Since CRSP has not collected daily stock price information beyond the year-end of 2022, all observations in Vulanovic and Blomkvist's data taken in 2023 were not matched. The 92 of the 236 SPACs that were not listed on major US stock exchanges match with those of Vulanovic and Blomkvist's data that were not accounted for in the CRSP database. Because CRSP only collects data from stocks listed on NYSE or NASDAQ, the SPACs that were not matched are likely listed OTC or internationally. Of those that were not matched, I hand-checked all SPACs from 2003-2008 to ensure that they were not listed on major US stock exchanges as there is less data to consider in that timeframe, and excluding more data than necessary could potentially affect my analysis. When hand-cleaning the data, I also find that one SPAC was matched incorrectly and dropped it from the data. This dataset details a complete list of PERMNOs for 1,057 unique publicly traded SPACs.

Following this data merge, I input the PERMNOs of each SPAC that was matched to the CRSP stock information database into CRSP's daily stock price database. The dataset consists of 566,495 daily common stock prices, volumes, and shares outstanding for 1,057 unique publicly traded SPACs.

The dataset detailing the daily common stock prices, volumes, and shares outstanding for 1,057 unique publicly traded SPACs was then merged by PERMNOs back onto the complete database that

was gleaned from merging Lewellen and Vulanovic and Blomkvist's data with the CRSP stock identifier data. The dataset consists of 566,495 daily common stock prices, volumes, and shares outstanding for 1,057 unique publicly traded SPACs and includes data on each SPAC's IPO date, merger announcement date, and merger closing date.

Additional Data Categorization

After cleaning my data, a series of further variables were generated based on existing data to run the analysis. First, a dummy variable was created to distinguish SPACs that underwent an IPO process before 2010 from those that did afterward. Dummy variables were also generated to distinguish the stage of the SPAC lifespan ("no target phase," "target phase," or "post-merger phase") that each observation was in based on the observation date and its comparison to the IPO date, merger announcement date, and merger closing date.

Next, I generate additional variables that give information about the SPAC environment on each date and about the specific characteristics of each SPAC. First, I generate a variable that calculates the number of SPACs in the "no target phase" on any given trading day. The assumption is that if more SPACs are competing for same fixed pool of targets, then there will be a decreased probability that a merger will close. Next, I generate a variable that calculates the number of days each SPAC has spent in the "no target phase" for each observation. The inclusion of this variable was motivated by Kiesel, Klingelhöfer, Schiereck, and Vismara's study in 2022 that claims that "short-term returns decrease with longer times from initial public offering until announcement." The assumption is that if a SPAC has spent more time in the no target phase, then the SPAC is closer to the expiration date and thus has less time left until it reaches the expiration date or the day of its redemption vote. Lastly, I consider the shares outstanding variable as a metric to consider the size of the SPAC IPO. The assumption is that if a SPAC has a larger IPO value and consequently a larger trust value, then the SPAC will attract a larger

target that will demand a larger target premium for the sale of their company and extract more value from SPAC shareholders. This is in line with M&A literature that states that mergers seem to create shareholder value with most of the gains accruing to the target company (Andrade, Mitchell, & Stafford (2001)). I also generate a binary variable to determine whether a SPAC finds a target within the scope of my data. I feel that there might be some unmeasurable variable that determines whether a SPAC finds a target, and thus, I control for the possibility in my regression. Similarly, I calculate a variable that determines whether a SPAC completes a merger under the same logic. I find that before 2010, all SPACs found a target, but not all these SPACs completed their mergers. Thus, my analysis will focus on the merger completion variable.

The table below demonstrates a test of differences between the pre-2010 period and the post-2010 period for potential omitted variables. At the highest significance level, I find that SPACs before 2010 have a higher discount to trust value, both with and without including interest, and have lower numbers of SPACs in the "no target" phase. The pre-2010 period also has higher interest rates on average. Note that while SPACs in the pre-2010 period have a smaller IPO size, this difference is not statistically significant.

Test of Differences Across SPACs Issued Before and After 2010

	Pre-2010	**Post-2010**	**Pre-Post**
N =	*20,724*	*300,947*	
Premium to Trust	-5.29	-0.64	-4.65*
Premium to Trust (including interest)	-2.68	-0.50	-2.18*
Number of SPACs in "No Target" Phase	25	422	-397*
Days SPACs Spent in "No Target" Phase	575.29	513.64	61.65*
IPO Size (Shares Outstanding)	31,433	32,450	-1,017
Interest Rates	0.04	0.01	0.03*

Model

To test my decoupling hypothesis surrounding if there is still a mispricing problem within the "no target" phase of the SPAC lifespan as was previously established in the pre-2010 period

by Stefan Lewellen, I run a first difference regression between the period before January 1, 2010, and after January 1, 2010. Recall that in the period before a SPAC announces its intended target, Lewellen found that the price per share of a SPAC is less than its pro rata trust value. Also note that beginning in 2010, an investor could vote to approve a merger and take part in a second vote to redeem their shares following merger approval. Thus, my regression will focus on the change in SPAC structure as a possible mechanism for the mispricing problem.

The most basic form of my first difference equation is

$$PremiumtoTV = \beta_0 + \beta_1 Post2010$$

where $PremiumtoTV$ is the average difference between the pro-rata trust value and the daily share price of the SPAC and $Post2010$ is the dummy variable accounting for the change in policy regarding SPAC redemption structure. The regression was run only for SPACs that were categorized in the "no target phase" and was run first assuming a trust value of $10 per share, as is standard for SPACs, and then at $10 per share adjusted for daily interest accrual as the SPAC trust is typically invested in risk-free investments until the SPAC reaches maturity. A two-year US treasury bond was used to approximate the risk-free investment for SPACs as a SPAC typically reaches maturity, or its expiration date, in 18- to 24-months depending on its specific charter.

Thus, I expand my first difference model to control for the omitted variables of the number of SPACs in the "no target" phase, IPO size, and the time a SPAC spends in the "no target" phase:

$$PremiumtoTV = \beta_0 + \beta_1 Post2010 + \beta_2 LNUMNOTARGETS + \beta_3 LSHROUT + \beta_4 LTIMENOTARGET$$

where $PremiumtoTV$ and $Post2010$ hold the same meaning; $LNUMNOTARGETS$ is the natural log of the number of SPACs currently in the no target phase; $LSHROUT$ is the natural log of the number of shares outstanding for each SPAC, or the IPO size of the SPAC; and $LTIMENOTARGET$ is the natural log of the time each SPAC has spent in the "no target" phase. The regression was also run only for SPACs that were categorized in the "no target phase," and was run first assuming a trust value of $10 per share and then at $10 per share adjusted for daily interest based on two-year US treasury yields.

The approach outlined above uses the average premium to the SPAC's trust value as the dependent variable, termed $PremiumtoTV$. This is a numerical variable detailing the average difference in pro-rata trust value and daily share price across all SPACs from 2003-2022. The use of a First Difference approach between the period where redemptions were tied to merger vote (before 2010) and the period where they were decoupled (after 2010) allows for comparison between the two periods and establishes whether this mispricing problem still exists after the change in redemption structure. This approach yields space for interpretation as to if the opportunity to approve a merger and then vote to redeem their shares following merger approval gives an investor more incentive to keep their shares until the close of the merger.

I also rerun my more robust first difference model individually on the population of SPACs that successfully complete a merger and those that do not. The same regression accounting for omitted variables will be used:

$$PremiumtoTV = \beta_0 + \beta_1 Post2010 + \beta_2 LNUMNOTARGETS + \beta_3 LSHROUT + \beta_4 LTIMENOTARGET.$$

The regression was still only performed for SPACs that were categorized in the "no target phase."

The approach outlined above uses the average premium to the SPAC's trust value, accounting for interest accrual, as the dependent variable, termed $PremiumtoTV$. This approach holds the same meaning as the previous regression; however, I focus on the role that the SPAC's ability to complete a merger plays in my analysis and if there is some insider investor knowledge of a SPAC's potential to successfully merge with its intended target. The difference in the results of the two regression outputs will help determine if this is the case.

V. Results

Before performing a regression to determine whether there is a difference between the pro-rata trust value in both the pre-2010 period and the post-2010 period, it is important to ensure that there are not factors that are unaccounted for in my model that are creating outliers in specific years driving my regression results. Note that 12 of the past 18 years since 2005 exhibit a negative interest-adjusted premium to trust value (Table 1). There is no data depicted in 2009 as there were no SPACs that were listed as an IPO on major US exchanges that year. Of the five years that exhibited a positive premium to trust value, only one year, 2012, had a premium larger than 7 cents (Table 1). Because the positive premium to trust value is so small in magnitude in comparison to the years with a discount, the notion that the stock price is systematically undervalued in comparison to the trust value is supported by both the regression and the summary table below.

The period between 2005 and 2008 exhibited relatively large discounts in share price in comparison to pro-rata trust value with 2005 showing the largest discount valued at $3.43. Because we observed no major US SPAC IPOs in 2009, the period between 2005 and 2008 exhibits the pre-period and thus I conclude that this increase in magnitude is not skewing my results as it is consistently larger in size than the observations in the post-period. Similarly, the

2012 exhibits the highest positive premium to trust value; however, on average, this is still offset by the discount in share price to trust value over the course of the 2010-2022 period. Thus, my summary table indicates that the results of the regression are not driven by a few specific years and rather are driven by the trends of the period.

Table 1: SPAC Average Premium to Trust Value Per Year

This table shows the difference in pro-rata trust value and share price of SPACs separated by the year each SPAC underwent the IPO process. Each unit of observation is the daily share price of a SPAC in the "no target" phase. The sample is of all SPACs traded on major US exchanges from 2005-2022. Note that there were no SPAC IPOs in 2009 on major US exchanges.

IPO Year	Without Interest	Including Interest
2005	-3.12	-3.43
2006	-2.39	-2.74
2007	-1.80	-2.17
2008	-0.87	-1.10
2009	—	—
2010	-0.25	-0.29
2011	-0.20	-0.26
2012	0.19	0.17
2013	-0.26	-0.28
2014	-0.18	-0.21
2015	0.08	0.01
2016	0.09	0.02
2017	-0.06	-0.20
2018	0.13	-0.15
2019	0.08	-0.10
2020	0.09	0.07
2021	-0.34	-0.36
2022	0.12	0.04
2005-2022	-0.29	-0.36

Primary First Difference Regressions

Table 2, depicted below, contains the results of running my First Difference regression based on the conservative assumption that the SPAC trust value was valued at $10 a share. The leftmost column of the table illustrates the difference between the pre-2010 and post-2010 periods' premium to trust value. As the constant is negative and thepost-2010 variable is positive with less magnitude, we see that although the negative difference between the stock price and the pro-rata trust value has decreased, the difference still exists. A t-test confirmed the negative difference between the stock price and the pro-rata trust value post-2010 period at the highest significance level. While some of the discount to trust value can be explained by the decoupling of the SPAC merger vote date and the redemptions vote date, this difference still exists violating Lewellen's first assumption about SPACs. It is also important to note that there is considerable unexplained variance in this model with the post-2010 variable only explaining 4.8% of the variation in the discount to trust value. Thus, there is not plausible evidence to conclude that the structural change surrounding SPAC redemptions accounts for the decrease in the mispricing of SPAC stock.

To include potential omitted variables to increase the strength of my model, I perform the regressions in columns two, three, and four. My results demonstrate significant negative correlations between the premium to trust value and the IPO size, measured as shares outstanding, and the time a SPAC spends in the "no target" phase. The number of SPACs in the "no target" phase was significant when the IPO size was excluded from the model suggesting that there is a correlation between these values. It is reasonable to assume that there is a correlation between the shares outstanding variable and the number of SPACs in the "no target" phase as there was an increase in both size and number of SPAC IPOs post-2010, and thus, the

size of the SPAC is likely the value that is driving the increased discount to trust value. This analysis of the IPO size factor falls in line with existing M&A literature as target shareholders typically earn a larger premium in M&A deals at the expense of the acquirer's shareholders. In this case, the larger the SPAC, the larger the target it would need to attract as it has more funds to acquire a company of greater scale. Thus, the target company likely has alternative avenues to raise equity, such as an IPO. With additional bargaining power, the target company can extract more value from SPAC shareholders, meaning there may be some anticipation of this premium causing investors to sell shares before the merger, increasing the discount to trust value. The inverse relationship between premium to trust value and the time a SPAC has spent in the "no target" phase also falls in line with existing theory. Recall that I have modeled a share held in a SPAC as an investment opportunity where an individual can hold stock embedded with a call option of redeeming a risk-free zero-coupon bond with a face value of $10 at the time of the business combination or a SPAC liquidation. The Black Scholes Model for option pricing, the longer the time until expiry, the more the option is worth due to the potential for increased volatility. Because a SPAC has a fixed time to expiry, typically between 18-24 months, the longer a SPAC spends in the "no target" phase the closer it gets to the expiration date. Thus, although this doesn't account for why the discount exists, it does account for why the discount may increase as the inherent value of the embedded call option is decreasing.

Even with these variables considered, less than 10% of the variation in the discount to trust value is explained by my model. With further analysis and reduced time constraints to collect more detailed data, additional relevant variables might include the experience level of SPAC sponsors (Are they repeat SPAC issuers? How many SPACs have they issued? Were their

previous SPACs successful?) or fixed effects for the industry in which the SPAC is searching for their target.

In Table 3, I repeat the same analysis demonstrating the results of my First Difference regression based on the more accurate model valuing the SPAC trust value at $10 a share with a risk-free interest based on two-year treasury yields accruing interest daily. This analysis allows for the same interpretation as the original, more conservative regression. In this second regression, the constant is still negative and the post-2010 variable is still positive with less magnitude. Although the negative difference between the stock price and the pro-rata trust value has decreased, the discount to the trust value is still just over 23 cents per share. A t-test confirmed that there is a negative difference between the stock price and the pro-rata trust value post-2010 period at the highest significance level. Again, this model has considerable unexplained variance with the post-2010 variable only explaining 6.5% of the variation in the discount to trust value. Thus, there is not plausible evidence to conclude that the structural change surrounding SPAC redemptions accounts for the decrease in the mispricing of SPAC stock.

Table 2: SPACs are Undervalued in the No Target Phase

This table shows the First Difference panel regressions of the difference in pro-rata trust value and share price of SPACs on the post-2010 redemptions change. Each unit of observation is the daily share price of a SPAC in the "no target phase." The sample is of all SPACs traded on major exchanges from 2005-2022.

Dependent variable:	*Premium to Trust Value*			
	(1)	(2)	(3)	(4)
Post 2010 Treatment Variable	1.669***	1.942***	1.896***	1.767***
	(0.17)	(0.16)	(0.16)	(0.19)
Log(Number of SPACs in the No Target Phase)		-0.106***	-0.0825***	-0.0344
		(0.02)	(0.03)	(0.02)
Log(Time Spent in the No Target Phase)			-0.231***	-0.210***
			(0.06)	(0.05)
Log(Shares Outstanding)				-0.395***
				(0.084)
Constant	-1.855***	-2.109***	-2.066***	-1.945***
	(0.161)	(0.169)	(0.171)	(0.190)
Observations	320,704	320,704	320,704	320,704
R-squared	0.048	0.052	0.058	0.08

Robust standard errors, clustered by Company ID, in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: SPACs are Undervalued in the No Target Phase when Accounting for Interest Accrued

This table shows the First Difference panel regressions of the difference in pro-rata trust value and share price of SPACs on the post-2010 redemptions change. Each unit of observation is the daily share price of a SPAC in the "no target phase." The sample is of all SPACs traded on major exchanges from 2005-2022.

Dependent variable:	*Premium to Trust Value including Interest Accrued*			
	(1)	(2)	(3)	(4)
Post 2010 Treatment Variable	1.960***	2.169***	2.111***	1.986***
	(0.17)	(0.17)	(0.17)	(0.19)
Log(Number of SPACs in the No Target Phase)		-0.0812***	-0.0520**	-0.00521
		(0.02)	(0.02)	(0.02)
Log(Time Spent in the No Target Phase)			-0.293***	-0.272***
			(0.06)	(0.05)
Log(Shares Outstanding)				-0.384***
				(0.083)
Constant	-2.192***	-2.387***	-2.333***	-2.215***
	(0.164)	(0.172)	(0.174)	(0.192)
Observations	320,704	320,704	320,704	320,704
R-squared	0.065	0.067	0.078	0.098

Robust standard errors, clustered by Company ID, in parentheses
*** p<0.01, ** p<0.05, * p<0.1

First Difference Regression Accounting for Merger Outcomes

In Table 4, I repeat the first difference regression analysis of my more accurate model valuing the SPAC trust value with interest accruing daily, but I perform this analysis only on the population of SPACs in the "no target" phase that *will not* successfully complete a merger in their lifespan. This analysis allows us to control for unmeasurable variables that may exist in the SPAC structure that inform investors about a SPAC's ability to successfully merge with its intended target company. In this regression, the constant is still negative and the post-2010 variable is still positive with less magnitude than the regression depicted in Table 2. The negative difference between the stock price and the pro-rata trust value has increased, with the discount to the trust value around 27 cents per share. A t-test confirmed that there is a negative difference between the stock price and the pro-rata trust value post-2010 period at the highest significance level. Again, there is considerable unexplained variance in this model with the model including omitted variables explaining under 10% of the variation in the discount to trust value. Thus, there is still not plausible evidence to conclude that the structural change surrounding SPAC redemptions accounts for the decrease in the mispricing of SPAC stock.

Table 4: SPACs that will not Complete a Merger are Undervalued in the No Target Phase

This table shows the First Difference panel regressions of the difference in pro-rata trust value and share price of SPACs on the post-2010 redemptions change for SPACs that *did not* sucessfuly complete a merger. Each unit of observation is the daily share price of a SPAC in the "no target phase." The sample is of all SPACs traded on major exchanges from 2005-2022.

Dependent variable:	*Premium to Trust Value Including Interest Accrued*			
	(1)	(2)	(3)	(4)
Post 2010 Treatment Variable	1.954***	2.346***	2.185***	1.997***
	(0.22)	(0.23)	(0.23)	(0.27)
Log(Number of SPACs in the No Target Phase)		-0.134***	-0.0720*	0.006
		(0.04)	(0.04)	(0.04)
Log(Time Spent in the No Target Phase)			-0.345***	-0.295***
			(0.07)	(0.07)
Log(Shares Outstanding)				-0.506***
				(0.101)
Constant	-2.220***	-2.593***	-2.440***	-2.261***
	(0.215)	(0.238)	(0.237)	(0.271)
Observations	253,190	253,190	253,190	253,190
R-squared	0.046	0.048	0.06	0.091

Robust standard errors, clustered by Company ID, in parentheses

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

In Table 5, I continue my first difference regression analysis on the population of SPACs in the "no target" phase that *will* successfully complete a merger in their lifespan, allowing us to control for unmeasurable variables that may exist in the SPAC structure that inform investors about a SPAC's ability to successfully merge with its intended target company. In this regression, the constant is still negative and the post-2010 variable is still positive but with greater magnitude than the regression depicted in Table 2. The negative difference between the stock price and the pro-rata trust value has decreased, with the discount to the trust value only around 9 cents per share. A t-test confirmed that there is a negative difference between the stock price and the pro-rata trust value post-2010 period at the 5% significance level. Note that in controlling for the merger's success, the omitted variables' significance is lost. Thus, the success

of the merger eliminates the effect that the number of SPACs in the "no target" phase, the time spent in the no target phase, and the shares outstanding has on the average premium to trust value. While there is considerable unexplained variance in this model, this regression explains about 20% of the variation in the discount to trust value.

Thus, while there is still a significant difference between the post-2010 premium to trust value and zero, there is plausible evidence to conclude that the structural change surrounding SPAC redemptions accounts for part of the decrease in the mispricing of SPAC stock for SPACs that will successfully complete a merger. I note that in controlling for a SPAC's potential success, I have accounted for some of the underlying mispricing of SPAC stock.

Table 5: SPACs that will Complete a Merger are Undervalued in the No Target Phase

This table shows the First Difference panel regressions of the difference in pro-rata trust value and share price of SPACs on the post-2010 redemptions change for SPACs that sucessfuly completed a merger. Each unit of observation is the daily share price of a SPAC in the "no target phase." The sample is of all SPACs traded on major exchanges from 2005-2022.

Dependent variable:	*Premium to Trust Value Including Interest Accrued*			
	(1)	(2)	(3)	(4)
Post 2010 Treatment Variable	2.055***	2.036***	2.033***	2.046***
	(0.25)	(0.24)	(0.25)	(0.24)
Log(Number of SPACs in the No Target Phase)		0.0181	0.0174	0.0117
		(0.07)	(0.07)	(0.06)
Log(Time Spent in the No Target Phase)			-0.103	-0.101
			(0.06)	(0.07)
Log(Shares Outstanding)				0.0274
				(0.106)
Constant	-2.147***	-2.131***	-2.128***	-2.139***
	(0.249)	(0.249)	(0.250)	(0.243)
Observations	67,514	67,514	67,514	67,514
R-squared	0.209	0.209	0.211	0.212

Robust standard errors, clustered by Company ID, in parentheses

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

VI. Discussion

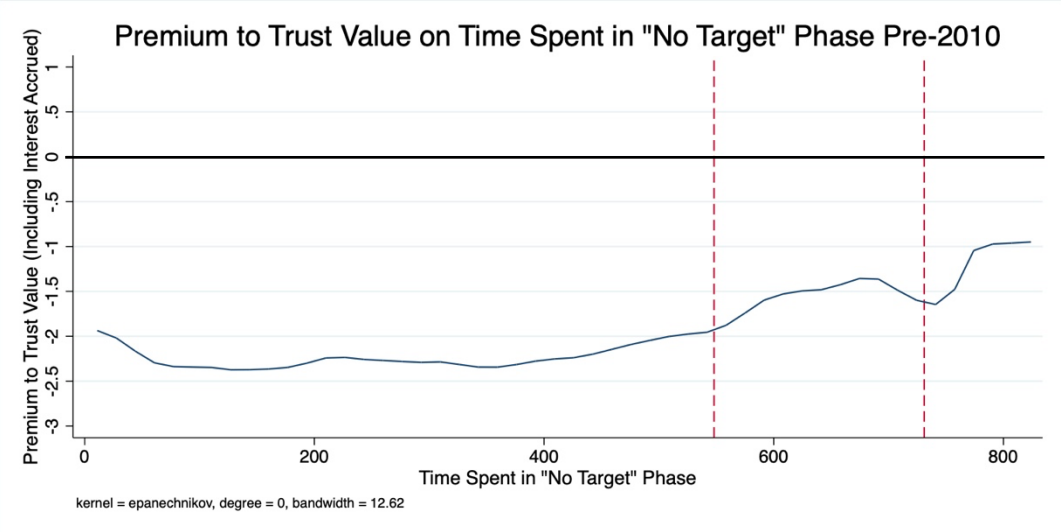
Based on the results of all four of my regressions, we see that there continues to be a statistically significant negative difference between SPAC share price and pro-rata trust value. Thus, I cannot conclude that the change to the SPAC voting structure in 2010 was the cause of the negative difference between SPAC share price and trust value as our mispricing problem continues to exist post-2010. Because this mispricing still exists, we must consider other aspects of the SPAC structure that may be responsible for the discount to trust value such as my time-value hypothesis.

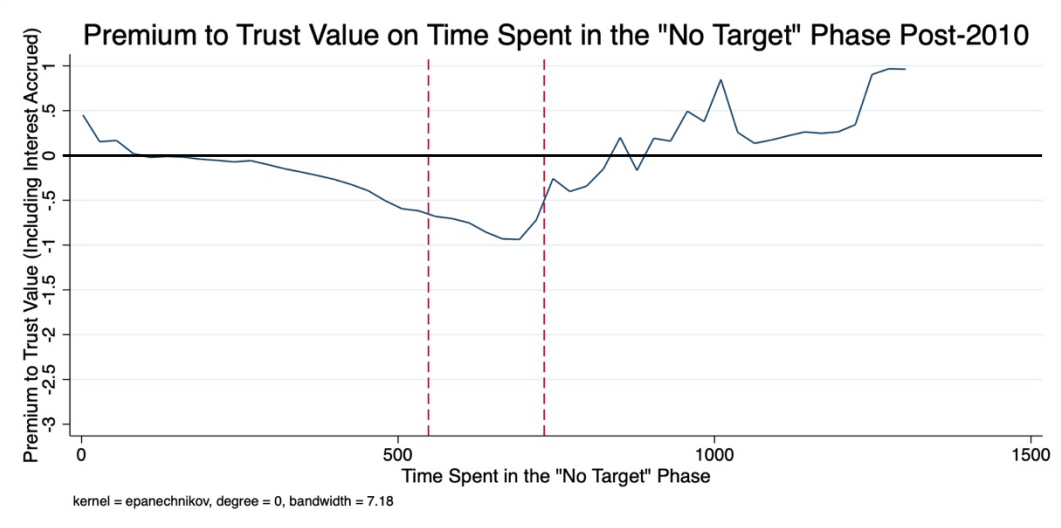
When comparing the SPAC premium to trust value to time spent in the "no target" phase, we can see that the negative difference between SPAC share price and pro-rata trust value grew in magnitude for roughly the first 400 days after IPO for SPACs listed before 2010 and for roughly the first 650 days after IPO for SPACs listed after 2010 (Figure 3). In both comparisons, a sharp decrease in the magnitude of the negative difference between SPAC share price and pro-rata trust value did not occur until the timeframe approached the 18-month mark of the SPAC lifespan, with the difference remaining negative on average through the 24-month mark. Because these graphs only depict data for SPACs in the "no target" phase, it is important to distinguish that all SPACs in the pre-2010 period found a target before the SPAC was liquidated while not all SPACs in the post-2010 period did. This is likely why we see an increased time horizon for SPACs in the post-2010 period as I exclude SPACs from this regression as they find their targets.

Note that the typical SPAC lifespan from IPO to expiry is between 18 to 24 months, depicted between the two dashed red lines on the figure, depending on the SPAC's charter. Thus, the decrease in magnitude to the negative premium to trust value seems to coincide with a

SPAC's approach to its expiration date. Data past the 24-month SPAC expiry deadline exists as SPAC shareholders have the chance to vote to extend the SPAC lifespan at the expiry date or vote to redeem their shares for their portion of the trust value. Often SPAC shareholders vote to extend if they have confidence that the SPAC will be able to complete a merger and they vote to redeem if they do not believe a merger is a possibility. Thus, it is reasonable that there will be a decrease in the magnitude of the difference between the SPAC share price and pro-rata trust value after the vote to extend if the SPAC is not liquidated. SPACs are excluded from the data after they are liquidated as they are no longer traded on any stock exchange.

Figure 3: SPAC Premium to Trust Value on Time Spent in the "No Target" phase





From the data analysis of my regressions coupled with the information depicted in Figure 3, I postulate that the amount of time a SPAC spends in the “no target” phase plays an integral role in the way a share of a SPAC is valued. This relationship comes in two stages depending how far the current trading date is from the SPAC’s IPO date and how close it is to the SPAC’s expiration date.

Recall that I model each share of a SPAC in the "no target" phase as the ownership of a zero-coupon bond valued at $10 with an embed call option to exercise for equity in the merged company at either the merger vote date or the vote to extend the SPAC lifespan at expiry. Because the option is embedded into the shareholder's purchase of the $10 zero-coupon bond, the SPAC issuers are inherently carrying the cost of the option for the shareholders that invest at the IPO. Thus, the value of a share of stock in a SPAC in the "no target" phase is the coupling of the included call option value and the zero-coupon bond.

For my analysis, I separate the value of the embedded call option into its "intrinsic value" and the "time-value." When a shareholder purchases a share of a SPAC in the "no target" phase, there is no announced business combination. Thus, the intrinsic value of the call is unknown to the SPAC investors as its value is dependent on the price per share of the merged rather than the SPAC itself. When valuing the option, shareholders are only able to consider the time value of the option because they have no knowledge of the intrinsic value. Based on the shareholder's knowledge in the "no target" phase, their option reaches maturity at the time of SPAC expiry, between 18 to 24 months later depending on the SPAC charter. For each day the SPAC spends in the "no target" phase, the closer the SPAC gets to the expiration date. Textbook option pricing theory states that with all else equal, options with less time to maturity are less valuable than options with a longer time to maturity. Thus, the shortening of the call option timeline would erode the value of the call option and zero-coupon bond bundle, decreasing the value of the SPAC share with respect to the trust value.

Reflecting on Figure 3, we understand that the farther away a SPAC is from its IPO date, the closer it comes to the time when an investor must exercise or forfeit their call option. Because of this, we see the negative premium to the SPAC's trust value increase leading up to

the 18- to 24-month time window as there is a decreased time to option maturity. Similarly, in Figure 3, we see that as a SPAC gets closer to its expiration date, the period between the dashed red lines, the negative premium seems to decrease in magnitude. This is because the time-value of the option begins to increase instantaneously as the SPAC reaches an extension date. Here the time-value of the option adjusts from zero to six more months.

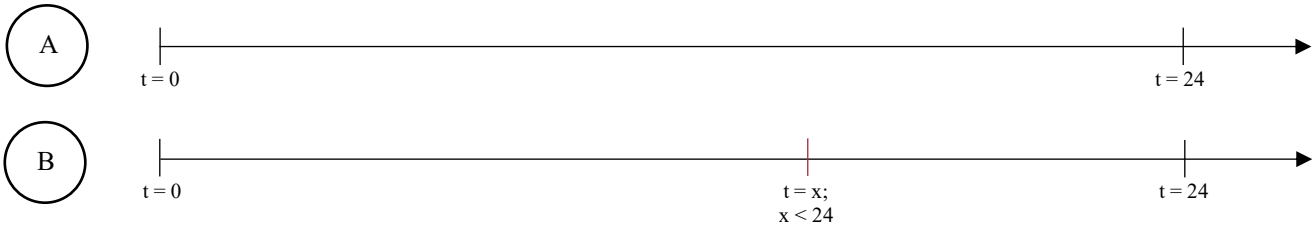
While my primary theory that motivates the analysis of Figure 3 relies on the time-value of the embedded call option in SPAC shares, there is also the possibility that selection effects drive the negative change in trust premium. The farther we move into the "no target" phase, the more likely it is that successful SPACs find their targets, thus eliminating them from our sample. There is strong likelihood that SPACs that spend more time in the "no target" phase may share some immeasurable characteristics, such as poor management, that keep them in the no target phase for longer and indicate decreased value of the company. The exclusion of SPACs that find a target weights the value of these "bad" SPACs more heavily the farther right we go on the timeline. However, this selection effect does not account for the decrease in the magnitude of the discount when the SPAC approaches its expiration date. Thus, I feel that the time-value hypothesis is the most likely of the two mechanisms that describe the behavior of the SPAC trust discount over its time in the "no target" phase.

While part of this discount can be explained by the decrease in the time-value of the embedded call concerning the SPAC expiration date, there is also a possibility that anticipation of a SPAC merger also erodes the time-value of the option, further decreasing the value of the call. Further research could consider the hypothesis that SPAC investors will assume that the farther away a SPAC is from its IPO date, the more likely its probability of announcing a merger and eventually reaching a merger approval date; coupled with the idea that the closer a SPAC

gets to its expiration date, SPAC investors will assume that there is a lower probability that the SPAC will be able to announce and complete a merger before its expiration and extension vote date. I postulate that the obligation to either exercise or forfeit the option to call equity at the merger vote negatively influences the value of the SPAC shares in comparison to exercise or forfeit at the expiry date.

In Figure 4 below, we see this illustrated using a binary decision tree model. The figure assumes a 24-month SPAC lifespan; however, note that the timeline is typically between an 18- to 24-month lifespan. Timeline A depicts the standard call option time horizon for a SPAC share where the call for equity is known to reach maturity in 24 months at the SPAC expiration date. Timeline B depicts an alternate timeline where the SPAC finds a target, announces a merger, and reaches a vote date before the 24-month expiration date. Thus, the call option for a SPAC shareholder in Timeline B reaches maturity in some period before the originally anticipated 24-months. Thus, I postulate that the packaged zero-coupon bond and call option may lose value in Timeline B in comparison to Timeline A.

Figure 4: Binary Decision Framework for SPAC Call Option Maturity



Based on the framework of the "no target" phase, the possibility of a merger may erode the value of a SPAC share due to the investor's lack of knowledge about a potential merger. In the "no target" phase of the SPAC lifecycle, the investment vehicle is valued only as a zero-

coupon bond with an embedded call option for equity in a merged company. However, individual shareholders have no knowledge of the future success of a merger or how to value the intrinsic value of the option, and thus, they value their investment based on known variables such as the IPO date of the SPAC and the time horizon until the SPAC expires. This valuation is only true for the "no target" phase as the announcement of a merger will give shareholders insight into the value of the potential merger, changing the nature of the shareholder's knowledge of their investment. Without any knowledge of the value and potential success of a merger, SPAC shareholders may view the potential of a merger announcement as either a positive or negative investment opportunity. Because their valuation framework states that a merger announcement decreases the time horizon to their call option's maturity date, this will also decrease the value of the call option with reference to option pricing theory for the period immediately up to merger announcement. Thus, future research could use the framework of a binary decision tree to model the value of a call option with an uncertain maturity date to speculate about the behavior of the options price regarding the randomness of the merger vote date.

VII. Conclusion

When investigating the relationship between SPAC trust values and their market capitalization in the period before the SPAC announced an acquisition target, I find that SPACs in the "no target" phase are undervalued on average in both the pre-2010 period and the post-2010 period. While previous literature asserts that, "*the stock price should be greater than or equal to the pro-rata trust value, discounted from the SPAC's expiration date, at all times before the shareholder vote date,*" my model demonstrates that in the "no target" phase, SPACs are valued below the pro-rata trust value of $10 per share in both periods (Lewellen 2009).

One plausible mechanism that caused this mispricing was the pre-2010 coupling of the SPAC merger approval vote and the vote for investors to redeem their shares. However, by running a first difference regression on the average premium to trust value distinguishing the period before January 1, 2010, from the period after; I was able to determine that the coupling of these votes was not responsible for the negative premium to trust value. In my most conservative model, considering successful SPACs in the "no target" phase, I still found there to be a negative premium to trust value at the 0.1% significance level in the post-2010 period, indicating that although the structural change in 2010 may have decreased the magnitude of this mispricing, it did not solve the puzzle.

Because the decoupling of the merger vote outcome and the redemption vote did not account for the negative premium to trust value, I postulated that the structure of SPAC redemptions may be responsible for this mispricing. Considering the redemption opportunity to be a zero-coupon bond with an embedded call option in the "no target" phase, I separated the value of the embedded call option into its "intrinsic value" and the "time-value."

I used binary decision frameworks to model the effects of an uncertain maturity date for the call option due to merger vote dates occurring at a time unknown to investors in the "no target" phase. Here I found that the potential of a merger vote date erodes the value of the embedded call option by shortening the time horizon to maturity. Thus, the value of the SPAC shares trade lower than the value of the zero-coupon bonds to account for the uncertainty of the exercise date for the call option. In the "no target" phase, the possibility of a merger holds negative value as it decreases the potential volatility in the call option time horizon by forcing option expiry at a date earlier than the anticipated 18- to 24-months of the SPAC maturity detailed in the SPAC charter.

While most of the literature on SPACs investigates their post-merger returns, this study contributes to the analysis of SPACs by postulating whether aspects of the SPAC structure cause SPACs to underperform the market on average. Investors, banks, and the media have used the post-merger returns of SPACs to portray the asset class in a negative light; however, this study incorporates the knowledge that the SPAC redemption structure causes the time-value of an embedded call option to decay the value of the share price in the "no target" phase while leaving the trust value unchanged. Thus, in researching the "no target" phase of the SPAC lifecycle, I investigate the trading performance of the SPAC alone without incorporating investors' expectations of an anticipated merger into the value of the asset. I find that the redemption outcome compensates the SPAC shareholders by providing additional value that a traditional zero-coupon bond does not, but also accounts for some of the discount to trust value as the time to SPAC expiry has a direct relationship with the time value of the embedded call option. I also postulate for future research that the SPAC issuers embedding of a call option into the SPAC redemption structure discourage shareholders from desiring merger outcomes early in the SPAC lifecycle.

VIII. References

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IX. Appendix

Figure 5: Typical SPAC Lifespan Pre-2010

As depicted by Stefan Lewellen (2009)