The Indirect Cost of SPACs:
Examining the Implied Underpricing of SPAC Mergers

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Abstract: This study examines the implied underpricing for firms going public by merging with a Special Purpose Acquisition Company (SPAC), in direct comparison to traditional IPOs. Our data reveals a structural change, which coincides with the boost of popularity of SPACs by the passage of fiscal and monetary stimulus in response to the COVID-19 pandemic, and has brought about important IPO-like characteristics to underpricing behavior in SPAC mergers. Underpricing for SPAC mergers, which is rare before the structural change, becomes prevalent, and as in the IPO market, large underpricing tends to also exhibit high cross-sectional variation. We use Markov Regime Switching Model to confirm the occurrence of the structural change, and identify the timing as June 2020. Further analyses on the determinants of underpricing show that factors that exert differential effects on underpricing for SPAC mergers relative IPOs no longer affect the two markets in significantly different ways after June 2020. Overall, the study offers extensive evidence of a structural change that has assimilated underpricing behavior of SPAC mergers to that of traditional IPOs. The results are robust to testing of alternative hidden regimes, maximum likelihood estimation, and propensity score weighting.

Keywords: Special Purpose Acquisition Company; SPAC Mergers; IPO; Underpricing; Structural Change

JEL Classifications: G32; G34; G38

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1. Introduction

Special Purpose Acquisition Companies (SPACs) trace their roots back to the 1950s when Armand Hammer pioneered the reverse merger strategy by merging his oil company with a shell firm, creating Occidental Petroleum (Brenner and Schroff, 2004). However, not until recently have SPACs gained mainstream attention and market share. In 2021, SPACs accounted for approximately 66% of the IPO market in terms of the number of transactions and 55% in transaction value (Gahng, Ritter, and Zhang, 2023).

This remarkable growth could be attributed to the massive fiscal and monetary stimulus deployed as emergency rescues when the COVID-19 pandemic struck the U.S. in March 2020 (S&P Global Market Intelligence, 2022). On March 27, 2020, Congress passed the $2.2 trillion Coronavirus Aid, Relief and Economic Security Act (CARES Act). Simultaneously, the Federal Reserve slashed interest rates to zero and rolled out massive purchases of debt securities, which peaked at $120 billion per month by October 2021. Although these liquidity injections propelled both SPAC and traditional IPO markets, the growth in SPACs significantly outpaced its IPO counterparts (Huang, 2022), making SPACs an increasingly important alternative vehicle to access the public market. From an investors' standpoint, the idea of providing capital to a SPAC can be especially appealing in uncertain economic environments because the redemption option virtually guarantees investors their money back should they decide to pull out of the investment. The popularity surge of SPACs relative to traditional IPOs during the pandemic could also be attributed to their ability to help companies get listed and funded even in uncertain and recessionary periods (Ghiaie and Ressico, 2021; Huang, 2022). In addition, retail investors, many of whom have been

working remotely from home since the lockdowns, were given the time and opportunities to follow firms launched in the SPAC market (Rubinstein and Nussen, 2021).

This increase in investor appetite for SPACs has led to a growing literature. Recent academic studies have examined this market from various angles, such as the direct costs of SPACs and their characteristics, determinants, stock performance during the SPAC period (between SPAC IPO and completion of a merger with a private target), and deSPAC period (after merger completion) long-term performance (e.g., Cumming, Hass, and Schweizer, 2014; Dimitrova, 2017; Gahng et al. 2023; Kang and Lee, 2023; Kolb and Tykvova, 2016; Lin, Lu, Michaely and Qin, 2022). However, one crucial aspect largely overlooked is the indirect cost, or underpricing, associated with SPAC mergers. Our study fills this void by documenting the pattern, evolvement, and determinants of underpricing for SPAC mergers in direct comparison to traditional IPOs. Importantly, we uncover a structural change in the SPAC merger market that has brought crucial developments in underpricing behavior since its sharp rise in popularity.

Merging with a SPAC is essentially a going-public transaction for a private firm. When firms go public via traditional IPOs, they incur direct costs, such as investment banking fees, cash expenses for legal and auditing fees, other out-of-pocket costs, and the indirect cost of underpricing (Ritter, 1987). Since SPAC mergers and IPOs are alternative ways of going public, a direct comparison of the costs of the two mechanisms is essential to the decision-making of private companies and potential investors. Existing literature has examined the direct costs of SPAC mergers. For example, other than the obvious expenses of underwriting and legal fees, SPACs have additional costs, such as sponsors promote and dilution from warrants or rights (Klausner, Ohlrogge and Ruan, 2020; Gahng et al., 2023).

The other primary cost of going public is the indirect cost of underpricing. While there is extensive literature on the underpricing of traditional IPOs (Butler, Keefe and Kieschnick, 2014; Booth and Chua, 1996; Ritter, 1987; Li, Wang and Wang, 2019), underpricing of SPAC mergers has not been examined. This lack of research is understandable. For traditional IPOs, underpricing is measured by the initial returns from the offer price of the IPO (or money left on the table). Unlike traditional IPOs, a post-IPO SPAC is still a shell company with no underlying operations. Therefore, the concept of money left on the table is irrelevant until a merger with an operating company is completed. When a private firm goes public via a SPAC, the transaction is technically treated as a merger, which is not immediately associated with underpricing. However, underpricing occurs if the private company receives less capital than its initial capital market price would suggest, regardless of the method of going public. To capture this *"implied underpricing"* in SPAC mergers, we first estimate the offer price for these transactions, measured as net cash per share received by the target operating company. Then we calculate underpricing as the initial 1- and 21-day returns from the estimated offer price.[1]

Our analyses of underpricing for SPAC mergers have two objectives. First, we attempt to uncover the pattern and evolvement of underpricing for SPAC mergers, in terms of magnitude and variability, compared to IPOs. While significant underpricing is widely documented in the IPO literature, existing studies also offer evidence of substantial cross-sectional variation of underpricing in the IPO market (Butler et al., 2014; Lowry, Officer, and Schwert, 2010). Both underpricing and its cross-sectional variability reflect underwriters' pricing difficulty due to information asymmetry, thus in the IPO market, high underpricing is usually accompanied by its

[1] Our measure is similar to the one employed by Gahng et al. (2023) to calculate the indirect cost of a SPAC merger. However, Gahng et al. (2023) does not provide additional analysis beyond the summary statistics in this regard. Our research provides in-depth analysis of the magnitude, evolvement, and determinants of underpricing in the SPAC versus the IPO markets.

high-level of cross-sectional dispersion (Alti, 2005; Lowry and Schwert, 2002; Lowry et al., 2010). We seek evidence of whether such patterns hold for SPAC mergers. Moreover, in the past few years, SPACs have risen from a little-known niche market to a popular alternative to traditional IPOs. To uncover the potential effect of this remarkable rise in popularity, we also aim to examine whether it has brought any new developments in this market.

Second, despite extensive literature that examine the determinants of IPO underpricing,[2] there has been little research on the determinants of SPAC underpricing. We aim to investigate whether widely documented determinants of IPO underpricing exert differential effects on SPAC mergers. Given substantial differences in transparency and structure between SPAC mergers and IPOs, it is crucial to understand how these drivers may affect underpricing differently in the two markets.

Our sample consists of 200 completed SPAC mergers and of 537 IPOs of operating companies from January 2016 to December 2021. The data uncovers interesting differences and similarities in the patterns of underpricing between the two markets. First, consistent with the higher uncertainty associated with SPAC transactions, overall, the SPAC merger sample exhibits larger average and greater cross-sectional variability of underpricing than the IPO sample. For example, the average initial 21-day return for SPAC mergers is 0.3440, with a standard deviation of 1.0818, compared to an average of 0.2664, a standard deviation of 0.5777 for traditional IPOs.

More importantly, a closer examination reveals a structural change in SPAC mergers, which roughly coincides with the timing when the SPACs took flight, in part, thanks to the passage of fiscal and monetary stimulus in response to the COVID-19 pandemic. This change appears to have

[2] The IPO underpricing literature proposes several theories with associated determinants that explain underpricing, such as firm uncertainty, certification function of underwriters, and incentive alignment (Chambers and Dimson, 2009; Liu and Ritter, 2011; Loughran and Ritter, 2004; Unlu, Ferris and Noronha, 2004).

given rise to IPO-like characteristics to the underpricing behavior among SPAC mergers. Specifically, before the structural break, SPAC mergers are largely associated with negative initial returns, or overpriced. But underpricing becomes dominant in SPAC mergers, as in IPOs, afterwards. Second, as larger magnitude and greater cross-sectional variance of underpricing tend to occur in tandem for IPOs (Lowry, et al., 2010), this pattern also starts to emerge for SPAC mergers after the structural change. This points to the idea that, as SPAC mergers ascend as a competitive alternative to IPOs, they also begin to assimilate their counterparts in important ways. Such a conversion lends support to the efficiency of market competition in eliminating arbitrage opportunities, so that significant pricing difference between the two markets cannot sustain.

To confirm the structural change, we employ the Markov Regime Switching Model. The model clearly identifies two distinct regimes for underpricing in the two markets, one in which underpricing is significantly lower for SPAC mergers than for IPOs, and the other where there is no significant difference between them. A hidden regime plot helps us to identify the timing of this structural change as June 2020. Using this timing, we more precisely confirm the aforementioned change in underpricing pattern.

Given the structural change, it is appropriate to investigate the effects of underpricing determinants in two separate periods, and how these effects have evolved due to the structural change. Major determinants of IPO underpricing include those arising from the role of firm uncertainty, the certification function of underwriters, and incentive alignment (Chambers and Dimson, 2009; Liu and Ritter, 2011; Loughran and Ritter, 2004; Unlu et al., 2004). Our regression results show that, before June 2020, several determinants exert significant differential effects on underpricing in the two markets. For instance, listing on NYSE is associated with higher underpricing for SPAC mergers relative to IPOs. Similar effects are also observed for listing on

NASDAQ or being a technology firm, financial firm, and *VIX*. In contrast, original shareholder ownership and underwriter fee are associated with significantly lower underpricing for SPAC mergers than IPOs.

Moving forward to post June 2020, interestingly, the determinants that show differential effects on the underpricing of SPAC mergers relative to IPOs no longer affect the former in significantly different ways. Diminished differential effects of these determinants says that determinants of underpricing also start to work in similar ways in the two markets after June 2020. This points to a third important way in which the structural change has converged SPAC mergers to traditional IPOs. All in all, the evidence yields a big picture in which, as SPAC mergers grows in prevalence, they adopt IPO-like characteristics.

We perform extensive robustness tests to confirm our findings. First, we test the possibility of alternative hidden regimes using the Markov Regime Switching Model. But the model fails to identify consistent alternative regimes. Second, based on the idea that both the size and cross-sectional variation of underpricing are functions of uncertainty, the errors term of our regression analysis of the determinants of underpricing could be correlated with the independent variables. This could lead to bias in the coefficients. To alleviate this concern, we follow Lowry et al. (2010) and run Maximum Likelihood Estimation (MLE). Our results remain unchanged. Third, to address the possibility that the choice of merging with a SPAC is not random, we calculate propensity scores of merging with a SPAC for each observation, and conduct weighted regression on the determinants of underpricing using inverse probabilities as weights. Once again, our findings remain materially unchanged. In addition, we use January and April 2020 as alternative timing of the structural change, and obtain similar results. Lastly, we investigate the effects of deal-specific characteristics on underpricing using the SPAC-merger sample alone, and find negative relation

between percentage of share redemption by SPAC shareholders with underpricing, as well as a negative effect percentage of sponsors' at-risk capital after June 2020. There is also some evidence that, after the structural change, underpricing is negatively associated with the number days remaining before liquidation deadline, and the presence of a cash offer, and positively related to percentage of dilution and PIPE ownership.

Our study contributes to the expanding literature on SPACs by focusing on a critical yet overlooked aspect of going public via SPAC mergers. As SPACs have become a popular alternative vehicle to access the public market, a growing body of academic research has examined their direct costs, unique structure and characteristics, long-term performance, determinants, and stock returns during the SPAC and deSPAC periods. However, to our knowledge, no study has investigated the underpricing associated with SAPC mergers and how it compares with traditional IPOs. Our study measures the implied underpricing of SPAC mergers and uncovers important facts about the pattern, evolvement, and determinants of underpricing in the SPAC market. The most important revelation by our paper is that, as the fiscal and monetary stimulus in response to the COVID-19 pandemic led to the proliferation of SPACs, it gave rise a structural change to SPAC mergers, which led to the conversion to SPAC merger underpricing to traditional IPOs in terms of both characteristics and determinants. The findings of our study are crucial to understanding the still relatively newfound market of SPACs, as they not only complement existing research to provide a full picture of the cost of going public via SPACs, but also bring to light the assimilation of SPAC mergers to traditional IPOs as competition between the two markets intensity.

The rest of this paper is organized as follows. Section 2 reviews the literature. Section 3 reports data and variable construction. Section 4 discusses the sample distribution and summary statistics. Section 5 examines the pattern of underpricing for SPAC mergers vs. IPOs, and investigates the

structural change in the SPAC merger market. Section 6 conducts analysis on the determinants of underpricing for SPAC mergers relative to traditional IPOs, and Section 7 performs robustness tests. Finally, Section 8 offers concluding remarks.

2. Literature Review

2.1. SPACs

The literature on SPACs has three broad branches: direct costs and characteristics of SPAC transactions, determinants of SPAC mergers, and stock performance in both SPAC and deSPAC periods. Several studies provide details on the direct costs, financing, structure, management characteristics, market participants of SPACs, influence of underwriters on SPAC mergers, and common rules on their mergers (Berger, 2008; Blomkvist, Nocera and Vulanovic, 2021; Chong, Zhong, Li, Li, Agrawal and Zhang, 2021; Dimic, Lawrence, and Vulanovic, 2023; Gahng et al., 2023; Klausner et al., 2022). One common finding in this branch of literature is the high direct costs associated with SPAC transactions. For example, Klausner et al. (2022) reckon that, although nearly all SPACs raise $10 per share at IPO, by the time the median SPAC merges with a target, it holds only $6.67 in cash for each outstanding share, implying a whopping 33.30% of direct cost. Similarly, Kim, Ko, Jun and Song (2021) find that SPAC mergers incur high direct costs, and these do not create marketing benefits for the listing firm. Nilsson (2008) argues that management compensation schemes and the dilution of shares by warrants and rights diminish investor returns. Gahng et al. (2023) find that such designs have consistently favored the returns of SPAC sponsors and IPO investors at the expense of post-merger public shareholders. Murray (2020) makes a case that dilution complicates the valuation of SPACs. The paper concludes that investors often simply

price SPAC units based on the offer prices of recent issues or market prices. In addition, given SPACs are allowed to report forward-looking statements (Lamont, 2021), there is evidence that SPAC mergers often overestimate future revenue, which leads to abnormal retail trading (Blankespoor, Hendricks, Miller and Stockbridge, 2022; Dambra, Even-Tov, and George, 2022).

A second strand of the SPAC literature examines the factors that contribute to the decision for a firm to go public via a SPAC. Cumming et al. (2014) find SPAC mergers are less likely to be approved with the presence of glamor underwriters, larger underwriter syndicates, and the presence of hedge funds or private equities. Consistent with this finding, Kolb and Tykova (2016) also conclude venture capitalists and private equities dislike accessing the public market via SPACs. They also show evidence that SPACs are favored by small, low-growth, levered firms in volatile markets. Similarly, Bai, Ma and Zheng (2023) find firms that opt for SPAC mergers are smaller, younger, and riskier. Vulanovic (2017) presents evidence that SPAC mergers involving a foreign target are more likely to fail. Using a Korean sample, Kim et al. (2021) report that firms with large controlling shareholder ownership are more likely to merge with SPACs.

A third group of studies examines the stock performance of SPACs, both in SPAC and deSPAC periods. For example, Kolb and Tykvova (2016) report the long-term underperformance of SPAC mergers relative to the market. Dimitrova (2017) found that merger announcements generate positive abnormal returns but are only concentrated among completed mergers. In addition, long-run stock and operating performances are both poor for SPAC mergers. Corroborating these findings, Bodowes (2021) also report positive announcement abnormal returns but negative buy-and-hold returns post-announcements. Using earlier data from 2006-2008, Floros and Sapp (2011) report a 48.1% three-month post-announcement abnormal return. Chong et al. (2021) examine SPAC returns between IPO and merger completion and find positive abnormal returns for many,

but not all sectors. Based on 1- and 3-year long-term performance, Gahng et al. (2023) report 23.9% annualized returns for IPO investors, -11.3% first-year return on shares, and 72.2% on warrants for investors of the merged company. In comparison, SPAC sponsors earn an annualized return of at least 112%. Lin et al. (2022) offer evidence that sponsors' networks and connections explain a large portion of post-merger long-term stock returns. International evidence is also available for the Korean and Italian markets (Ghiaie and Ressico, 2021; Kang and Lee, 2023; Kim et al., 2021).

Interestingly, while studies on SPAC performance have examined both SPAC and deSPAC periods, a gap is left out for the crucial initial trading days of the merged company. Studies on traditional IPOs greatly emphasize this period, as this window measures underpricing. A parallel examination is essential since SPACs represent an alternative channel for going public. To fill this void, we focus on the initial trading period of the merged company to evaluate the level of implied underpricing of SPAC mergers.

2.2. IPO Underpricing

A vast literature documents underpricing in the IPO market. The earliest evidence shows 14.80% underpricing for firm commitment offers, and 47.78% for best efforts offers from 1977 to 1982 (Ritter, 1987). Subsequently, Loughran and Ritter (2004) examine the long-run pattern of IPO underpricing. They find that the average first-day return for IPOs evolved from 7% in the 1980s to almost 15% between 1990 to 1998, then jumped to 65% during the dot-com bubble from 1999 to 2000 before reverting to 12% between 2001 and 2003. Using data from 1981 to 2007, Butler et al. (2014) report an average IPO underpricing of 20.10%. According to Nielsson and

Wojcik (2016), first-day underpricing averaged 16.90% between 2010 and 2014. Lowry et al. (2010) show that IPO underpricing exhibits substantial variability. They find that the monthly volatility of IPO initial returns fluctuates over time and is substantially larger in "hot markets" featuring high initial returns. They rationalize this finding as high initial return volatility indicates high information asymmetry and thus speaks to the difficulty of valuation. Therefore, it tends to be accompanied by high underpricing.

The literature proposes a vast number of theories to explain underpricing.[3] The most prominent among these theories include the role of firm uncertainty, the certification function of underwriters, and incentive alignment. Ritter (1984) introduces the changing risk composition hypothesis concerning firm uncertainty, according to which riskier IPOs will be more underpriced. This stems from the argument that underpricing arises as an incentive for investors to participate in risky IPOs. Firm risk can be captured by firm size, return volatility, and belonging to the technology sector (Chambers and Dimson, 2009; Lowry et al., 2010). According to the certification theory, issuing firms are willing to accept underpricing in exchange for the benefit of their IPOs being certified by a reputable underwriter. Therefore, higher underwriter ranking leads to more underpricing (Beatty and Welch, 1996; Cooney, Singh, Carter and Dark, 2001; Carter and Manaster, 1990; Carter, Dark and Singh, 1998; Liu and Ritter, 2011). In addition, according to the theory of incentive alignment, lower CEO ownership and increased ownership fragmentation tend to increase underpricing because these changes make the decision-makers of the issuing firm less motivated to bargain for the offer price (Loughran and Ritter, 2004; Unlu et al., 2004). In our

[3] See Bajo and Raimondo (2017), Bradley and Jordan (2002), Brennan and Franks (1997), Da, Engelberg and Gao (2011), Hanley (1993), Ibboston, Sindelar and Ritter (1994), Li et al. (2019), Liu and Ritter (2011), Loughran and McDonald (2013), Loughran and Ritter (2002), Loughran and Ritter (2004), Lowery and Schwert (2002), Marcato, Milcheva and Zheng (2018), Nielsson and Wojic (2016), Peng, Jia, Chan and Wang (2021), Ruud (1993), Stoughton and Zechner (1998), Tinic (1988).

empirical analysis, we examine whether these factors in traditional IPO underpricing theories exert differential effects on the underpricing of SPAC mergers.

3. Sample and Variables

The sample of completed SPAC mergers is collected from the commercial website SPACResearch.com. We complement merger details obtained from the website with hand-collected information from SEC filings, primarily super 8-Ks. Data on traditional IPOs are gathered from Thomson Reuters SDC on WRDS. In addition, we use data on stock returns and firm financials provided by CRSP-Compustat Merged (CCM). After deleting observations with missing information, our sample consists of 200 completed SPAC mergers and 537 IPOs of operating companies from January 2016 to December 2021.

The reason why our sample ends in 2021 is the lack of essential information on SPAC mergers going forward. While we are able to gather deal profiles beyond December 2021, nearly all transactions that happened outside our sample period are dropped out due to either their absence in CCM, or missing critical information from SEC. As a result, we could collect full information for only one SPAC merger in 2022. The main cause for this cutoff is the sharp decline of SPAC mergers after 2021. The market saw 199 completed mergers in 2021, compared to 102 in 2022, and 98 in 2023. In terms of total deal value, the figure is $471.4 billion in 2021, significantly higher than the total of $108.3 billion in 2022, and $92.1 billion in 2023. Smaller firm sizes can explain the absence of these transactions in CCM. Also notably, majority of transactions consummated after December 2021 involve a foreign private issuer, for which, there are significant differences in SEC disclosure requirements than for domestic companies.

Our variable of interest is underpricing. A widely accepted measure of IPO underpricing is initial returns, or the percentage change of the first-day closing price of IPO shares from the offer price. We adopt this standard measure for the sample of traditional IPOs. However, as discussed earlier, when a firm goes public via a SPAC, the deal is structured as a merger, with the private operating firm being the target. Thus, there is no explicit IPO offer price. Therefore, we back out "implied underpricing" from transaction details. Specifically, underpricing of SPAC mergers is estimated as the difference between the market value of shares held by non-target shareholders and net cash received by the target company, scaled by net cash received. Non-target shareholders include public SPAC investors, SPAC sponsors, PIPE and backstop investors.[4]

A second issue to address related to underpricing is the window of measurement. The majority of IPO research calculates underpricing as the first-day market return. However, several studies note that underwriter price stabilization activities influence stock price in the days immediately following the IPO (Hanley, Kumar and Seguin, 1993; Lowry et al., 2010; Ruud, 1993). Lowry et al. (2010) measure underpricing by the initial 21-day returns to ensure that the aftermarket price reflects market value. Thus, in our analysis, we use the initial 1- and 21-day returns (*Underprc1* and *Underprc21*) as alternative measures of underpricing for both SPAC mergers and traditional IPOs.

The independent variables of our regressions capture the widely documented determinants of underpricing. Specifically, to capture uncertainty, we include firm size (*LogAT*), age at the time of merger or IPO (*Age*), an exchange dummy (*NYSE*), and a risky-firm dummy that indicates the technology sector or listing on the *NASDAQ* (*Risky*). To proxy the certification function of

[4] Note that Gahng et al. (2023) use a similar measure to calculate the indirect cost of SPAC mergers. However, the authors only provide this measure in summary statistics without any further analysis.

underwriters, we use underwriter ranking (*UndRank*). To measure incentive alignment, we use the percentage of shares owned by original target shareholders (*TargetOwn*). Moreover, we control for transaction cost using underwriter fees (*UndFee*), size of transaction (*TransactionSize*), the financial sector (*Fin*), and market sentiment (*VIX*) (Bai et al., 2023).

In propensity score weighting analysis, we follow Bai et al. (2023) in modeling the decision of going public via SPAC merger vs. IPO. Additional firm characteristics we capture for this purpose include cash holding (*Cash*), profitability (*Profit*) and dividend payout (*Dividend*).

For SPAC-specific characteristics, we calculate the number of days remaining before liquidation deadline (*DayRemain*), percentages of dilution from warrants and rights (*Dilution*), shares redeemed by SPAC shareholders before merger consummation, at-risk capital (*AtRisk*), shares held by PIPE investors (*PIPE*), and a dummy variable indicating cash offer for a merger. Details of variable construction are provided in the Data Appendix.

4. Sample Distribution and Summary Statistics

Figure 1 shows the distribution of SPAC mergers and traditional IPOs by year. The IPO sample serves as our benchmark for comparison. The figure clearly demonstrates that IPO remains the primary means to access the public market over the sample period. Moreover, starting 2020, the number of traditional IPOs sharply increases, as seen in the 130 transactions in 2020 and 180 in 2021, compared with a high of 73 from 2016 to 2019.

In comparison, the SPAC merger market was clearly dominated by IPOs in 2016 and 2017. The number of SPAC mergers increased visibly in 2018 and 2019 when transactions amounted to

13 and 14, respectively. Nonetheless, the number of transactions remained trivial relative to traditional IPOs throughout 2019. The real takeoff of SPAC mergers began in 2020, when the number of completed deals hit 46, more than a third of the number of traditional IPOs in the same year. One catalyst for the rapid growth of the SPAC market may be the passage of the CARES Act and massive monetary stimulus by the Federal Reserve in response to the COVID-19 pandemic that drew capital disproportionally to the SPAC market (S&P Global Market Intelligence, 2022). This expansion continued into 2021. By year end, 120 firms went public via SPACs, equivalent to two thirds of the number of IPOs in that year. Therefore, in big picture, while both markets have seen significant expansion in the sample period, the growth of SPAC mergers is much more aggressive than traditional IPOs in the post-pandemic world.

Table 1 shows the sector distribution of the sample. The construction industry leads the IPO market, followed by finance, insurance and real estate, whereas SPAC mergers are dominated, similarly, by finance, insurance, and real estate, and then manufacturing.

Table 2 presents the summary statistics of key variables for the IPO sample (Panel A) and SPAC merger sample (Panel B). Underpricing measured as the initial 1- and 21-day returns exhibit both higher average and greater variation for SPAC mergers than IPOs. For example, the average initial 1-day return is 0.3592 for SPAC mergers, with a standard deviation of 0.7533, compared to an average of 0.2644 and standard deviation of 0.5777 for IPOs. The higher average and cross-sectional variability of underpricing for SPAC mergers presents the first evidence of the higher uncertainty associated with these transactions. We report more detailed comparison of underpricing in following sections.

Panel C reports T-test comparison of firm and deal characteristics between IPOs and SPAC mergers. On average, firms that choose SPAC mergers are smaller but older than IPO firms, and hold less cash. They are more likely to be listed on NYSE and belong to the financial sector, yet less likely to be listed on NASDAQ or be a technology firm. In addition, SPAC mergers are associated with lower underwriter ranking, original shareholder ownership, and underwriter fee. In addition, sample SPAC mergers are higher in value than IPOs.

With regards to SPAC merger-specific characteristics, the average deal closed roughly 253 days before the liquidation deadline, is associated an average dilution of 44.89% from warrants and rights, and reports 36.98% redemption before merger, 2.13% at-risk capital for sponsors, and 14.55% PIPE ownership. Lastly, 38.50% of SPAC mergers involve cash payments.

5. Patterns of Underpricing

5.1. Histogram and Time-series of Underpricing

In this section, we present detailed comparisons of the patterns of underpricing between SPAC mergers and traditional IPOs. Figure 2 presents a histogram of the initial 1- (Panels A and B) and 21-day (Panels C and D) returns for the two groups. For 1-day underpricing, although SPAC mergers have higher average and standard deviation, IPOs exhibit higher skewness and kurtosis, suggesting extreme outliers of positive underpricing, and higher concentration in the right tail. However, interestingly, as we continue to examine initial 21-day returns, the distribution for the IPO subsample approaches normal while that of SPAC mergers deviates from it. In particular, both the skewness and kurtosis underpricing significantly declines from day 1 to day 21 for IPOs,

whereas the trends are reversed for SPAC mergers. By the end of the first 21-day trading period, both the skewness and kurtosis of SPAC mergers surpass those of IPOs.

This change in distribution is interesting. Several studies suggest that the initial trading days represent a price discovery and stabilization period (Hanley et al., 1993; Lowry et al., 2010; Ruud, 1993). Therefore, the patterns shown Figure 2 suggest that price stabilization takes longer for SPAC mergers than IPOs. This, once again, underscores the higher uncertainty inherent in the SPAC market.

Figure 3 presents the monthly time series of the initial 1- and 21-day return for IPOs, SPAC mergers, IPOs, and their difference. Specifically, for every month, we calculate the mean, median, and standard deviation of the initial 1- and 21-day returns for deals completed in that month in both markets. Because there are months in which there is only one or even no transaction, especially for SPAC mergers in earlier periods, the figure also presents the 2-month moving average of standard deviation.

Observing the first trading day, IPOs (Panel A) are consistently associated with positive initial returns, indicating underpricing, with notable spikes in September 2016 and December 2020. In comparison, first-day return for SPAC mergers (Panel B) is largely negative before 2020, suggesting overpricing. Positive initial returns or underpricing become dominant after 2020, with notable highs in April and September 2020. When putting initial returns of the two subsamples together, their difference (Panel C) shows that initial returns are overwhelmingly lower for SPAC mergers than IPOs before 2020, and become higher after 2020. This significant shift in the underpricing of SPAC mergers coincides the sharp rise in the number of transactions, suggesting an important structural change. As SPAC mergers rise in popularity to rival IPOs- perhaps

facilitated by the unprecedented fiscal and monetary support during the pandemic, underpricing behavior of SPAC mergers also begins to converge with that of their IPO counterparts.

Moreover, we observe a second pattern in underpricing as previously documented in Lowry et al. (2010). In particular, the authors find that, for traditional IPOs, periods of high average initial returns tend to also exhibit high cross-sectional variability of initial returns, indicating the co-occurrence of high underpricing and high dispersion of underpricing. They explain that both the size and variability of underpricing in IPOs are functions of uncertainty and, thus, are driven by the same determinants. We find the same pattern in our IPO subsample. More interestingly, this pattern also emerges for SPAC mergers after 2020. This is a second IPO-like characteristic that SPAC mergers have developed after 2020, and once again, points to a potential structural change that has assimilated the SPAC merger market to traditional IPOs. Initial 21-day returns (Panels D, E and F) present similar evidence. In the next section, we dig deeper into our investigation of a potential structural change using the Marvok Regime Switching Model.

5.2. Marvok Regime Switching Model for Structure Change in SPAC Mergers

As Figure 3 suggests overpricing (negative initial returns) for SPAC mergers before 2020, and underpricing (positive initial returns) afterwards, we use Markov Regime Switching Model to confirm a regime change during the sample period. The model regresses initial returns against a dummy variable indicating SPAC mergers. Table 3 shows two distinct regimes. In Regime 1, the SPAC merger dummy is associated with significantly lower initial returns, whereas in Regime 2, there is no statistically significant difference between SPAC mergers and IPOs. This echoes the patterns in Figure 3 that show the evolvement from overpricing to underpricing for SPAC mergers,

and reinforces the argument that a structural change has brought about an important IPO-like characteristic to the SPAC merger market.

To identify the timing of the structural change, we use a plot to show the mostly likely sequence of the regimes along the timeline. This informs us the best prediction of the hidden regime at all time points during the sample period. Figure 4 presents the result. The plot shows that Regime 1 covers most of the sample period, whereas Regime 2 becomes visibly concentrated after June 2020. Recall that there is no statistically significant difference in underpricing between SPAC mergers and IPOs in Regime 2. Thus, this result suggests the structural change that has assimilated SPAC mergers to IPOs occurred in June 2020. Therefore, in subsequent analyses, we divide the full sample into pre- and post-June 2020 periods. The pattern in Figure 4 may also justify the use of January or April 2020 as alternative timings of the structural change. We examine these alternatives in the robustness section.

5.3. Univariate Comparison of Underpricing pre- and post- Structural Change

Our first test that incorporates the structural change is a univariate T-test of initial 1- and 21-day underpricing for both markets. In Table 4, Panels and A and B show that moving from the pre- to post-June 2020 period, both markets experienced an increase in underpricing. However, the increase is much larger in magnitude and more statistically significant for SPAC mergers. For instance, measured by initial 21-day return, the increase in IPO underpricing is 6.31%, but the change is insignificant. In contrast, the reading for SPAC mergers is a significant increase from -10.85% (or overpricing) to 46.79% over the same period.

Panels C and D examine the difference in underpricing between the two markets for the pre- and post-June 2020 period. The results show that prior to June 2020, underpricing for IPOs surpasses that for SPAC mergers by a wide and significant margin. In contrast, after the structural change, SPAC mergers exhibit larger underpricing than IPOs, yet the difference between the two markets is less significant than the earlier period. Overall, the results in Table 4 corroborates the conclusion from Table 3 and the Markov Regime Switching Model that underpricing behavior of SPAC mergers starts to converge to, and to some extent, has surpassed that of traditional IPOs after June 2020.

6. Determinants of Underpricing

In this section, we investigate whether well documented determinants of IPO underpricing have the same effects on the underpricing of SPAC mergers. And since we have established evidence of a structural change, we run analyses for the pre- and post-June 2020 periods separately, and pay particular attention to whether the effects of these determinants are altered by the structural change. In specific, we start with the following OLS model:

$$Underprc_i = \alpha_0 + \alpha_1 LogAT_i + \alpha_2 LogAT * SPAC_i + \alpha_3 Age_i + \alpha_4 Age * SPAC_i + \alpha_5 NYSE_i + \alpha_6 NYSE * SPAC_i + \alpha_7 Risky_i + \alpha_8 Risky * SPAC_i + \alpha_9 UndRank_i + \alpha_{10} UndRank * SPAC_i + \alpha_{11} OriginOwn_i + \alpha_{12} OriginOwn * SPAC_i + \alpha_{13} UndFee_i + \alpha_{14} UndFee * SPAC_i + \alpha_{15} TransactionSize_i + \alpha_{16} TransactionSize * SPAC_i + \alpha_{17} Fin_i + \alpha_{18} Fin * SPAC_i + \alpha_{19} VIX_i + \alpha_{20} VIX * SPAC_i + Year\ Dummy_i + \varepsilon_i \quad (1)$$

where $Undrpc_i$ is measured by *Undprc1* and *Undprc21*. For each determinant, the coefficient of the variable itself (such as α_1) captures its effect on IPO underpricing, and the sum of the coeffeicints on the variable and its interaction with the *SPAC* dummy (for example, $\alpha_1 + \alpha_2$) measures its effect on underpricing of SPAC mergers. Therefore, the interaction terms capture the differential effects the determinants have on underpricing for SPAC mergers as opposed to IPOs.

Table 5 presents the results. Panel A shows, before June 2020, IPO underpricing is positively related to listing on NASDAQ or being a technology firm (*Risky*) and original shareholder ownership. The coefficient of *Risky* is consistent with the argument that underpricing is a compensation for firm risk. Original shareholder ownership can capture a firm's incentives to go public. The higher such incentives are, the more underpricing the firm might be willing to accept. There is also some evidence that listing on NYSE and higher underwriter fee lead to more underpricing, although the result is not consistently significant for both 1- and 21-day underpricing. To the extent that underwriter fee is indicative of the underwriter's reputation, its positive effect on underpricing is consistent with the certification theory. Moreover, underpricing is found to be negatively related to *VIX*. This finding is consistent with the evidence documented in the literature that high underpricing usually synchronizes with high IPO volume (He, 2007). The *VIX* index captures market volatility. Since fewer firms choose to go public in volatile markets, it leads to lower underpricing under high *VIX*.

In comparison to their effects on IPO underpricing, several determinants show significant differential impacts on the underpricing of SPAC mergers. For instance, listing on NYSE is associated with higher underpricing for SPAC mergers as opposed to IPOs. Similar effects are also observed for listing on NASDAQ or being a technology firm, financial firm, and *VIX*. Since *NASDAQ*, technology and finance sectors can all capture uncertainty, their positive impact on

underpricing for SPAC mergers relative to IPOs suggest, given their uncertain nature, SPAC mergers have to provide more investor compensation for risk. The coefficient on *VIX*SPAC* is also interesting. Since SPACs is usually perceived as vehicle to gain certainty in deal terms due to laxer disclosure requirements compared to IPOs, they might be particularly popular in volatile markets, leading to increased transactions relative to IPOs. And as discussed above, higher volume can lead to higher underpricing. In contrast, original shareholder ownership and underwriter fee are associated with significantly lower underpricing for SPAC mergers than IPOs. In fact, the combined coefficients of *OriginOwn* and *OriginOwn*SPAC* and of *UndFee* and *UndFee*SPAC* tell us that the net effects of original shareholder ownership and underwriter fee are negative on the underpricing of SPAC mergers before June 2020.

Panel B examines Model (1) for the post-June 2020 period. First, several determinants exhibit changes in their effects on IPO underpricing. For instance, there is evidence that larger firms (*LogAT*) and financial firms have lower underpricing, whereas transaction size has a positive effect. More interestingly, the determinants that show differential effects on the underpricing of SPAC mergers relative to IPOs no longer affect the former in significantly different ways. In particular, the interaction terms involving *NYSE*, *Risky*, *UndFee*, *Fin* and *VIX* all turned insignificant. Although *OriginOwn*SPAC* retains some significance, it is only at 10% level and for 1-day underpricing alone. The dissipation of differential effects of these determinants lends support to our argument that underpricing behavior of SPAC mergers has adopted IPO-like characteristics after the structural change, including its determinants. Nevertheless, SPAC mergers also have developed a standout feature- underwriter ranking has significantly positive effect on underpricing for SPAC mergers relative to IPOs. Since underwriter ranking captures the certification effect, this result suggests that firms that choose to go public via SPAC mergers are

willing to make greater concession in underpricing in exchange to be certified by a reputable underwriter. This could be attributed to the highly risky nature of these firms, which makes certification even more valuable. Overall, the results in Table 5 strongly reinforces our previous finding that the SPAC merger market has undergone a structural change that has converged it to traditional IPOs, not only in terms of underpricing pattern, but also its determinants.

7. Robustness Tests

7.1. Alternative Hidden Regimes

As a first robustness test, we examine the possibility of alternative hidden regimes. Specifically, we perform the Markov Regime Switching Model assuming three unique regimes instead of two. The results are presented in Table 6. Using 1-day underpricing, the model identifies only two regimes, including one in which SPAC merger underpricing is significantly lower that of IPOs, and another where there is no significant difference between the two markets. This is consistent with Table 3. Importantly, the model fails to identify a third distinct regime. When measuring underpricing with initial 21-day return, we find another state in which SPAC underpricing is significantly higher that of IPOs. But since this hidden state fails to consistently show up across both underpricing measures, we conclude that there are only two stable regimes present during the sample period.

7.2. Maximum Likelihood Estimation

One concern about the results of the base regression in Table 5 is the likelihood that an important OLS assumption is violated. In particular, according to Lowry et al. (2010), the average magnitude and cross-sectional variation of underpricing are driven by the same determinants, because both characteristics should reflect the level of uncertainty. This notion is confirmed in our data, as Figure 2 Panels A, B, D and E show a notable overlap between underpricing and its cross-sectional variation. This points to a problem of running Model (1) with OLS, where the error term is correlated with the independent variables.

To address this issue, we run Model (1) using maximum likelihood estimation (MLE) from Lowry et al. (2010), which is essentially weighted least squares estimation of Model (1), using the standard deviation of the error term, $\sigma(\varepsilon_i)$, as weights. We present the results in Table 7. The findings are strongly consistent with Table 5. Moving from pre- to post-June 2020 periods, all differential effects on underpricing of SPAC mergers relative to IPOs have disappeared. This can be seen in interaction terms involving *NYSE*, *Risky*, *UndFee*, *Fin* and *VIX*, as their significance diminish. Once again, *OriginOwn*SPAC* retains some significance, but only at 10% level and for 1-day underpricing alone. In addition, also consistent with Table 5, Table 7 shows that, after the structural change in June 2020, underwriter ranking starts to have significantly positive effect on the underpricing for SPAC mergers relative to IPOs. Overall, Table 7 adds strong support to our conclusion that after structural change in June 2020, underpricing behavior of SPAC mergers has evolved to parallel traditional IPOs.

7.3. Propensity Score Weighting

Another concern about the analyses so far is that the choice of going public via SPACs vs. IPOs is not random. Several studies have investigated how firm characteristics affect the decision to merger with SPACs (Bai, et al., 2023; Cummings et al., 2014; Kim et al., 2021; Kolv and Tykova, 2016; Vulanovic, 2017). To control for the un-randomness of SPAC mergers, we calculate propensity scores of merging with a SPAC for each observation, and weigh all observations with their respective inverse probabilities. Following Bai et al. (2023), we model the decision of merging with SPAC using the following Logit model:

$$SPAC = \beta_0 + \beta_1 LogAT + \beta_2 Age + \beta_3 Risky + \beta_4 Fin + \beta_5 Cash + \beta_6 Profit + \beta_7 Dividend + Year\ Dummies + \varepsilon \quad (2).$$

The standardized differences of independent variables in Model (2) between SPAC mergers and IPOs, before and after weighting by inverse probabilities are presented in Table 8, Panel A. For all variables except for *Cash*, the magnitude of standardized differences between the two groups are significantly diminished. More important, for all variables, including *Cash*, this magnitude is below the recommended limit of 0.25 in absolute value (Rubin, 2001; Stuart, 2010). In addition, the variance ratios between the two groups for all variables are within the recommended range of 0.5 and 2. Therefore weighting by inverse probabilities has achieved good balance in the weighted distributions of the independent variables between SPAC mergers and IPOs.

Subsequently, we run Model (1) using a weighted regression with the inverse probabilities as weights. The results presented in Table 8, Panels B and C are highly consistent with Tables 5 and 7. Again, variables that have significantly different effects on underpricing for SPAC mergers relative to IPOs before June 2020 affect the two markets in similar ways afterwards. This further

confirms our previous conclusion about the structural change, and the IPO-like characteristics it brings to the SPAC merger market.

7.4. Additional Analyses

For additional analyses, we investigate the potential effects of deal-specific characteristics of SPAC mergers, using the following model:

$$Underprc_i = \gamma_0 + \gamma_1 LogAT_i + \gamma_2 Age_i + \gamma_3 NYSE_i + \gamma_4 Risky_i + \gamma_5 UndRank_i + \gamma_6 OriginOwn_i + \gamma_7 UndFee_i + \gamma_8 TransactionSize_i + \gamma_9 Fin_i + \gamma_{10} VIX_i + Year\ Dummy_i + \varepsilon_i \quad (3).$$

As presented in Table 9, before June 2020, only the percentage of redemption by SPAC shareholders has a significant and negative relation with underpricing. This makes sense, as SPAC shareholders are more likely to pull out the deal as offer prices are higher. After June 2020, the effect of *Redemption* remains. In addition, percentage of sponsors' at-risk capital also exhibits a significantly negative effect. This is consistent with the idea that higher percentage of at-risk capital increases sponsors incentives to push deals through, even potentially at high offer price. There is also evidence that underpricing is negatively associated with the number days remaining before liquidation deadline, and the presence of a cash offer, and positively related to percentage of dilution and PIPE ownership, although these effects are only present for one underpricing measure.

We also test alternative timings of the structural change. Given Figure 4, one can potentially argue that the structural change occurred in January or April 2020. In untabulated tests, we repeat the analyses from Table 4 to 9 using these alternative dates. The results remain materially the same.

8. Conclusion

The market craze for SPACs that followed the massive economic stimulus during the pandemic has given rise to a growing body of literature that aims to understand this controversial species of shell companies that has largely eluded public attention until now. Existing studies on SPACs offer insights into the characteristics and direct costs of SPAC transactions, determinants of SPAC mergers, and their stock performance during both the SPAC and deSPAC periods. However, as an alternative vehicle to access the public market, one crucial aspect of SPAC merger transactions that has been largely overlooked is their implied underpricing. Since the market increasingly considers merging with a SPAC as an alternative to IPO, and underpricing is a major cost of IPO, a direct assessment of the implied underpricing associated with SPAC mergers is essential to compare the total costs between the two mechanisms of going public. In this paper, we aim to fill this gap in the literature by examining the pattern, evolvement, and determinants of underpricing associated with SPAC mergers compared to IPOs.

Using 200 completed SPAC mergers and a control sample of 537 IPOs from January 2016 to December 2021, we uncover important patterns and developments in underpricing for SPAC mergers. Our data reveals a structural change. The change not only coincides with the rise in popularity of SPAC mergers, but also has assimilated underpricing behavior in this market to that of traditional IPOs in several important ways. First, prior to the change, SPAC mergers are

predominantly overpriced, but underpricing becomes prevalent afterwards and has, to some extent, outsized that of IPOs. Second, structure change also brings about the tendency for large underpricing to occur in tandem with high variability of underpricing for SPAC mergers, a feature of IPO underpricing documented in Lowry et al. (2010). We use Markov Regime Switching Model to confirm the occurrence of the structural change, and identified the timing as June 2020. Moreover, our analyses of the determinants of underpricing show that, several determinants display strong differential effects on underpricing in the two markets before June 2020, after which point, such differential effects have largely disappeared. This suggests that even the effects of underpricing determinants have started to converge after the structural change. All in all, our examination of underpricing paints a big picture in which, as SPAC mergers rise in popularity to rival IPOs, they have adopted important IPO-like characteristics. This conversion lends strong support to the efficiency of the going-public market in eliminating arbitrage opportunities, as increased transactions involving SPACs have largely removed the pricing difference between the two markets. We use a number of alternative tests to establish robustness. Our findings remain strongly consistently.

Overall, our study provides an in-depth analysis of the indirect cost of underpricing for SPAC mergers. In so doing, we differ from existing studies that focus on the characteristics and direct costs of SPAC transactions, determinants of SPAC mergers, and stock performance in both the SPAC and deSPAC periods. Our study fills in the research void by complementing extant studies and providing a complete picture of the total costs of SPAC mergers. Thus, we offer vital practical insights into the cost-benefit tradeoffs of going public via SPACs as an alternative vehicle for accessing the public market.

Data Appendix. Variable Construction

Variables	*Description*
Common variables	
Underprc1	For IPOs, (Closing price of the 1st trading day - offer price)/offer price For SPAC mergers, (Closing value of the 1st trading day of shares held by non-target shareholders - net cash received by target company)/net cash received by target company
Underprc21	For IPOs, (Closing price of the 21st trading day - offer price)/offer price For SPAC mergers, (Closing value of the 21st trading day of shares held by non-target shareholders - net cash received by target shareholders)/net cash received by target shareholders
SPAC	Dummy variable indicating SPAC mergers
LogAT	Nature log of total assets prior to IPO or SPAC merger consummation
Age	Age of the company at time of IPO or SPAC merger consummation
NYSE	Dummy variable indicating company being listed on the NYSE
Risky	Dummy variable indicating technology company or listing on the NASDAQ
UndRank	Numerical ranking of underwriters from Loughran and Ritter (2021)
OriginOwn	Percentage of shares held by original shareholders of the private company going public
UndFee	For IPOs, gross spread For SPAC mergers, the sum of IPO underwriter commission and deferred underwriter commission
TransactionSize	For IPOs, natural log of the total value of IPO offering in millions For SPAC merger, natural log of total consideration paid in millions
Fin	Dummy variable indicating financial company
Cash	Cash scaled by total assets
Profit	Net income scaled by total assets
Dividend	Common share dividend scaled by total assets
VIX	CBOE S&P 500 volatility index
SPAC-specific variables	
DayRemain	Number of days remaining before deal closing deadline
Dilution	Fraction of shares that can be exchanged by exercising warrants and rights
Redemption	Fraction of shares redeemed before merger consummation
AtRisk	Sponsor's private placement in warrants as a percentage of SPAC IPO proceeds
PIPE	Percentage of shares of the merged company held by PIPE investors
CashOffer	Dummy variable indicating merger involving cash payment

References

Alti, A. (2005). IPO Market Timing. *Review of Financial Studies*, 18(3), 1105-1138.

Bai, J., Ma, A., & Zheng, M. (2023). Segmented Going-Public Markets and the Demand for SPACs. *Working Paper*.

Bajo, E., & Raimondo, C. (2017). Media Sentiment and IPO Underpricing. *Journal of Corporate Finance*, 46, 139-153.

Beatty, R. P., & Welch, I. (1996). Issuer Expenses and Legal Liability in Initial Public Offering. *Journal of Law and Economics*, 39(2), 545-602.

Berger, R. (2008). SPACs: An Alternative Way to Access the Public Market. *Journal of Applied Corporate Finance*, 20(3), 68-75.

Blankespoor, E., Hendricks, B. E., Miller, G. S., & Stockbridge, D. R. Jr. (2022). A Hard Look at SPAC Projections. *Management Science*, 68(6), 4742-4753.

Blomkvist, M., Nocera, G., & Vulanovic, M. (2021). Who Are the SPAC CEOs? *Working Paper.*

Bodowes, K. (2021). Flipping the Coin: Are SPACs Post-Merger Value Creating or Value-Destroying? An Empirical Study on the Value Effects of Special Purpose Acquisition Companies in the United States. *Working Paper*.

Booth, J. R., & Chua, L. (1996). Ownership Dispersion, Costly Information and IPO Underpricing. *Journal of Financial Economics*, 41(2), 291-310.

Bradley, D. J., & Jordan, B. D. (2002). Partial Adjustment to Public Information and IPO Underpricing. *Journal of Financial and Quantitative Analysis*, 37(4), 595-616.

Brennan, M. J., & Franks, J. (1997). Underpricing, Ownership and Control in Initial Public Offerings of Equity Securities in the U.K. *Journal of Financial Economics*, 45(3), 391-413.

Brenner, V. C., & Schroff, W. K. (2004). Reverse Merger or IPO? *Strategic Finance*, 85(11), 46-52.

Butler, A. W., Keefe, M., Kieschnick, R. (2014). Robust Determinants of IPO Underpricing and Their Implications for IPO Research. *Journal of Corporate Finance*, 27, 367-383.

Carter, R. B., & Manaster, S. (1990). Initial Public Offering and Underwriter Reputation. *Journal of Finance*, 45(4), 1045-1067.

Carter, R. B., Dark, F. H., & Singh, A. K. (1998). Underwriter Reputation, Initial Returns and the Long-Run Performance of IPO Stocks. *Journal of Finance*, 53(1), 285-311.

Chambers, D. & Dimson, E. (2009). IPO Underpricing over the Very Long Run. *Journal of Finance*, 64(3), 1407-1443.

Chong, E., Zhong, E., Li, F., Li, Q., Agrawal, S., & Zhang, T. (2021). Comprehensive Study of Special Purpose Acquisition Company (SPAC): An Investment Perspective. *Working Paper*.

Cooney, J. W., Singh, A. K., Carter, R. B., & Dark, F., H. (2001). 2001, "IPO Initial Returns and Underwriter Reputation: Has the Inverse Relationship Flipped in the 1990s? *Working Paper*.

Cumming, D., Hass, L. H., & Schweizer, D. (2014). The Fast Track IPO – Success Factors for Taking Firms Public with SPACs. *Journal of Corporate Finance*, 47, 198-213.

Da, Z., Engelberg, J., & Gao, P. (2011). In Search of Attention. *Journal of Finance*, 66(5), 1461-1499.

Dambra, M., Even-Tov, O., & George, K. (2022). Are SPAC Revenue Forecasts Informative? *Working Paper*.

Dimic, N., Lawrence, E. R., & Vulanovic, M. (2023). The Determinants of IPO Withdrawals: Evidence from SPACs. *The Accounting Review*, 98(7), 121-152.

Dimitrova, L. (2017). Perverse Incentives of Special Purpose Acquisition Companies, the "Poor Man's Private Equity Funds". *Journal of Accounting and Economics*, 63(1), 99-120.

Floros, I. V., & Sapp, T. R. A. (2011). Shell Games: On the Value of Shell Companies. *Journal of Corporate Finance*, 17(4), 850-867.

Gahng, M., Ritter, J. R., & Zhang, D. (2023). SPACs. *Review of Financial Studies,* Forthcoming.

Ghiaie, H., & Ressico, F. (2021). SPACs and Sustainability in the Investment Market After the COVID-19 Pandemic. *ESCP Impact Paper No. 2021-32-EN.*

Hanley, K. W. (1993). The Underpricing of Initial Public Offerings and the Partial Adjustment Phenomenon. *Journal of Financial Economics*, 34(2), 231-250.

Hanley, K. W., Kumar, A. A., & Sequin, P. J. (1993). Price Stabilization in the Market for New Issues. *Journal of Financial Economics*, 34(2), 177-197.

Huang, V. (2022). SPACs Surpass Traditional IPOs during the Pandemic. But What's Next? *Euromonitor International,* January 26. https://www.euromonitor.com/article/spacs-surpass-traditional-ipos-during-the-pandemic.-but-whats-next

Ibboston, R. G., Sindelar, J. L., & Ritter, J. R. (1994). The Market's Problem with Initial Public Offerings. *Journal of Applied Corporate Finance*, 7(1), 66-74.

Kang, H. C., & Lee, S. (2023). SPACs and the COVID-19 Pandemic: Evidence from Korea. *Working Paper.*

Kim, H., Ko, J., Jun, C., & Song, K. (2021). Going Public through Mergers with Special Purpose Acquisition Companies. *International Review of Finance*, 21(3), 742-768.

Klausner, M., Ohlrogge, M., & Ruan, E. (2022). A Sober Look at SPACs. *Yale Journal of Regulation*, 38, 228-303.

Kolb, J., & Tykvova, T. (2016). Going Public via Special Purpose Acquisition Companies: Frogs Do Not Turning into Princes. *Journal of Corporate Finance*, 40, 80-96.

Lamont, D. (2021). The Pros, Cons and Incentives Behind the SPAC-Craze Sweeping Markets. *Magazine des Professions Financières et de l'Économie,* December, 33-38.

Li, X., Wang, S. S., & Wang, X. (2019). Trust and IPO Underpricing. *Journal of Corporate Finance*, 56, 224-248.

Lin, C., Lu, F., Michaely, R., & Qin, S. (2022). SPAC IPOs and Sponsor Network Centrality. *Working Paper.*

Liu, X., & Ritter, J. R. (2011). Local Underwriter Oligopolies and IPO Underpricing. *Journal of Financial Economics*, 102(3), 579-601.

Loughran, T., & McDonald, B. (2013). IPO First-Day Returns, Offer Pricing Revisions, Volatility, and Form S-1 Language. *Journal of Financial Economics*, 109(2), 307-326.

Loughran, T., & Ritter, J. R. (2002). Why Don't Issuers Get Upset About Leaving Money on the Table in IPOs? *Review of Financial Studies*, 15(2), 413-444.

Loughran, T., & Ritter, J. R. (2004). Why Has IPO Underpricing Changed Overtime? *Financial Management,* 33(3), 5-37.

Lowry, M., & Schwert, G. W. (2002). IPO Market Cycles: Bubbles or Sequential Learning? *Journal of Finance*, 57(3), 1171-1200.

Lowry, M., Officer, M. S., & Schwert, G. W. (2010). The Variability of IPO Initial Returns. *Journal of Finance*, 65(2), 425-465.

Marcato, G., Milcheva, S., & Zheng, C. (2018). Market Integration, Country Institutions and IPO Underpricing. *Journal of Corporate Finance*, 53, 87-105.

Murray, J. S. (2020). The Regulation and Pricing of Special Purpose Acquisition Corporation IPOs. *Working Paper.*

Nielsson, U., & Wojcik, D. (2016). Proximity and IPO Underpricing. *Journal of Corporate Finance*, 38, 92-105.

Nilsson, G. O. (2008). Incentive Structure of Special Purpose Acquisition Companies. *European Business Organization Law Review*, 19, 253-274.

Peng, X., Jia, Y., Chan, K. C., & Wang, X. (2021). Let Us Work Together: The Impact of Customer Strategic Alliances on IPO Underpricing and Post-IPO Performance. *Journal of Corporate Finance*, 67, 101899.

Ritter, J. R. (1984). The Long-Run Performance of initial Public Offerings. *Journal of Finance*, 46(1), 3-27.

Ritter, J. R. (1987). The Cost of Going Public. *University of Michigan Working Paper.*

Rubin, D. B. (2001). Using Propensity Scores to Help Design Observational Studies: Application to the Tobacco Litigation. *Health Services and Outcome Methodology*, 2, 169-188.

Rubinstein, J. L., & Nussen, D. (2021). Prime Time for SPACs. https://www.whitecase.com/insight-our-thinking/prime-time-spacs.

Rudd, J. S. (1993). Underwriter Price Support and the IPO Underpricing Puzzle. *Journal of Financial Economics*, 34(2), 135-151.

S&P Global Market Intelligence (2022). A Focused Study on SPACs. https://www.spglobal.com/marketintelligence/en/mi/research-analysis/a-focused-study-on-spacs.html.

Stoughton, N. M., & Zechner, J. (1998). IPO-Mechanisms, Monitoring and Ownership Structure. *Journal of Financial Economics*, 49(1), 45-77.

Stuart, E. A. (2010). Matching Methods for Causal Inference: A Review and a Look Forward. *Statistical Science*, 25(1), 1-21.

Tunic, S. M. (1988). Anatomy of Initial Public Offerings of Common Stock. *Journal of Finance*, 43(4), 798-822.

Unlu, E., Ferris, S. P., & Noronha, G. (2004). IPO Underpricing Over Time: Evidence from the U.K. *Applied Economics Letters*, 11(1), 5-9.

Vulanovic, M. (2017). SPACs: Post-Merger Survival. *Managerial Finance*, 43(6), 679-699.

Figure 1. Number of IPOs and SPAC Mergers by Year

This figure presents the number of SPAC mergers and IPOs by year, for the full sample from January 2016 to December 2021.

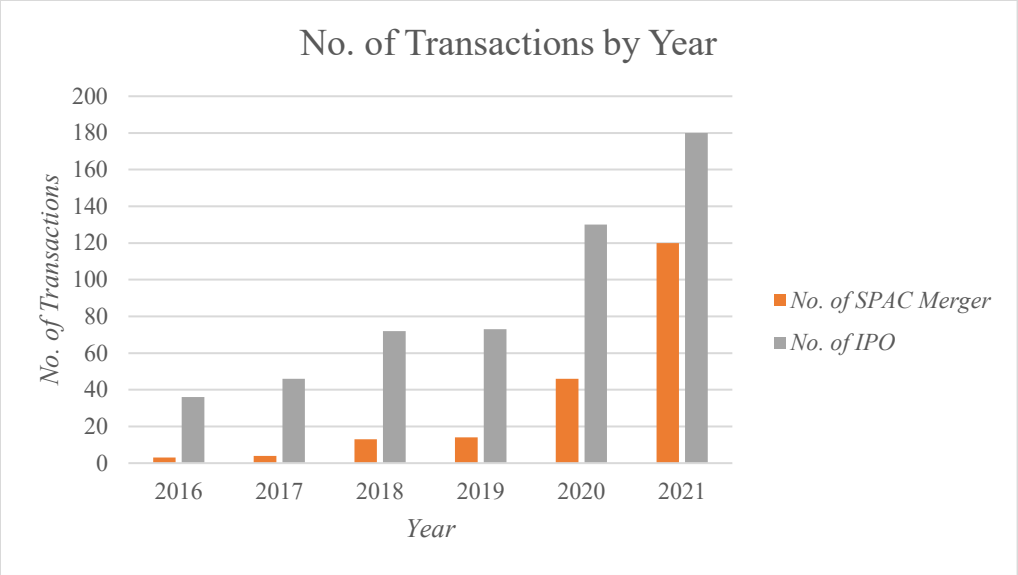

Figure 2. Histogram of Initial Returns

This figure presents the histogram of initial 1- and 21-day returns for SPAC mergers and IPOs.

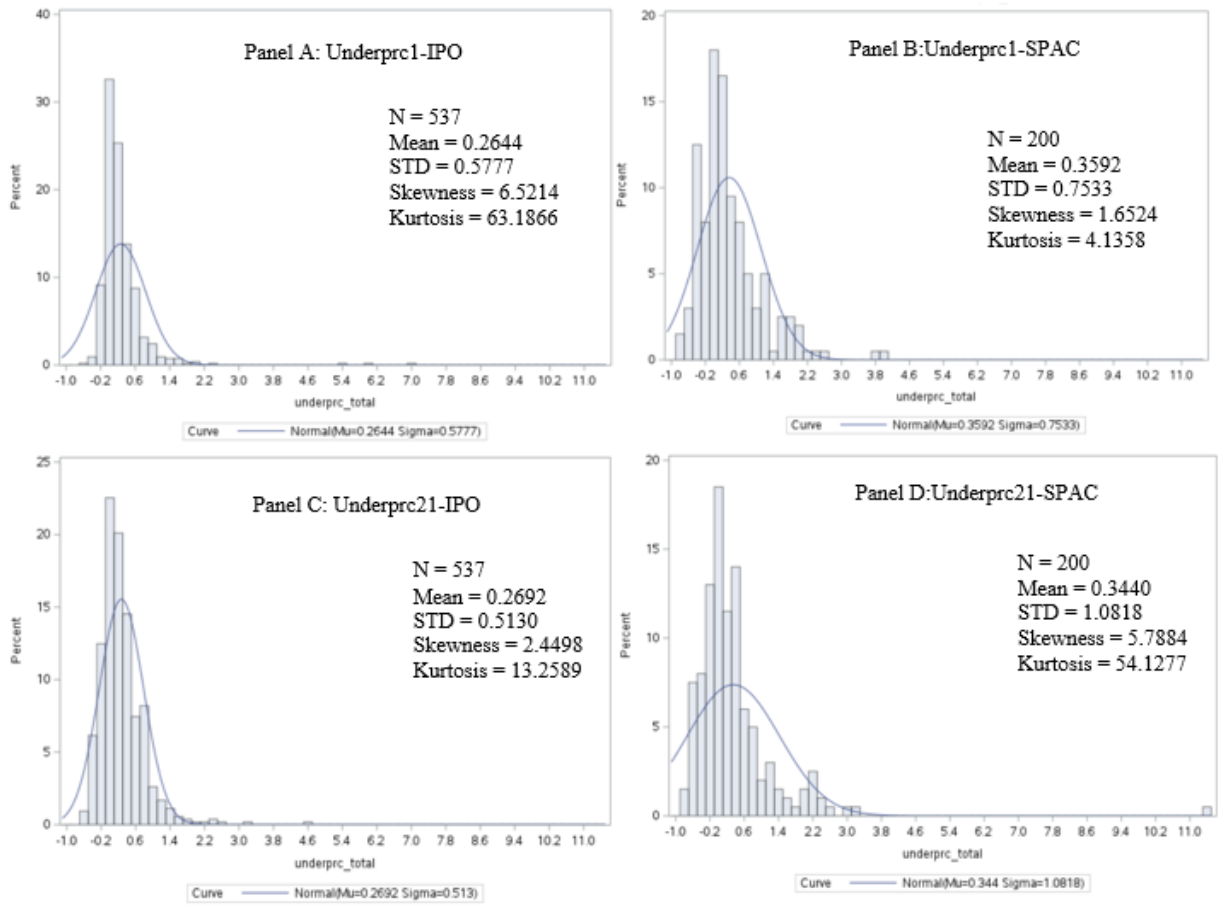

Figure 3. Time Series of Underpricing: SPAC Mergers vs. IPOs

This figure presents the monthly time series of the initial 1- and 21-day return for the sample period, for IPOs, SPAC mergers, and their differences. For every month in the sample, we calculate the mean, median, and standard deviation of the initial 1- and 21-day returns for deals completed in that month, as well as the two-month moving average of these statistics.

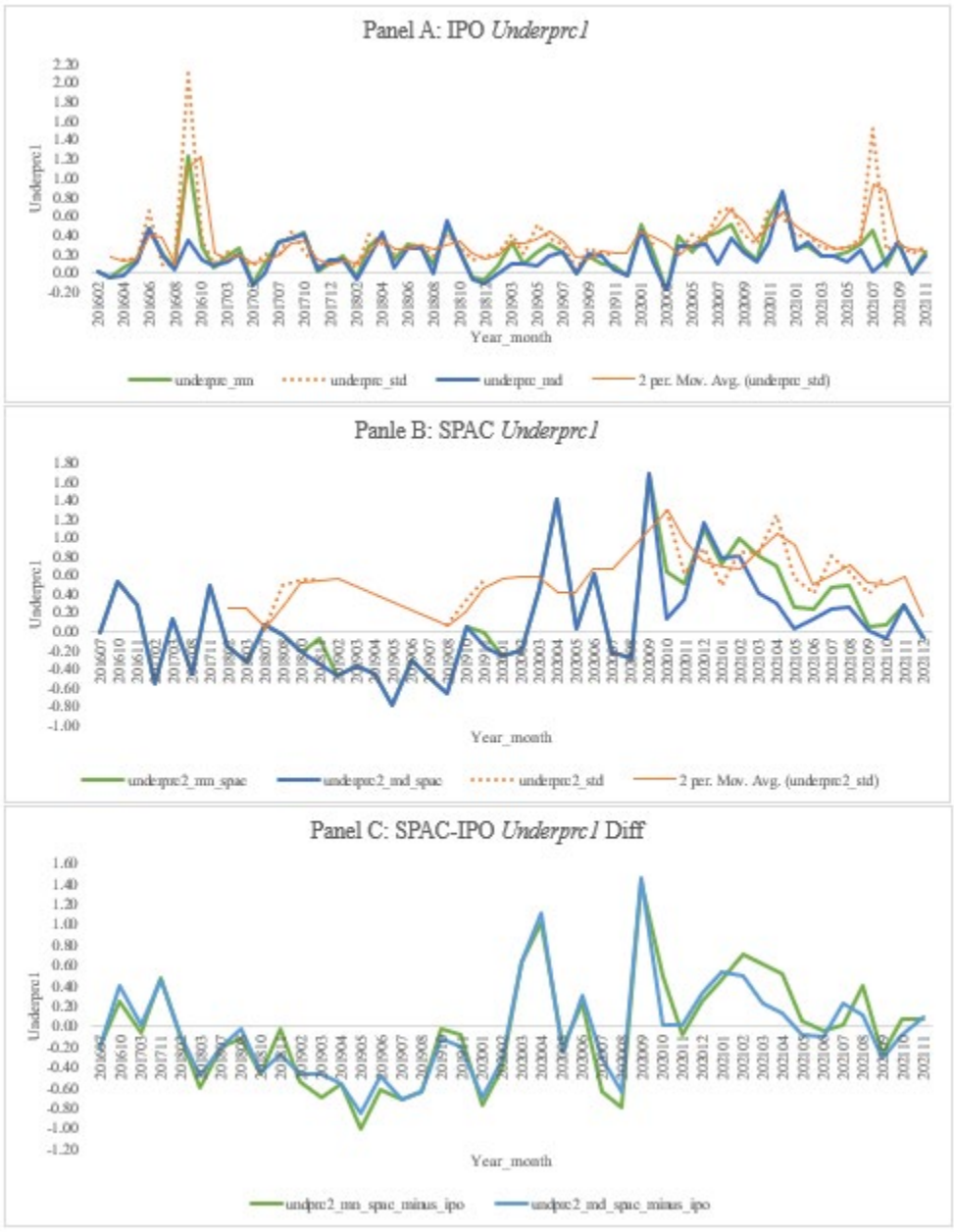

Figure 3. Time Series of Underpricing: SPAC Mergers vs. IPOs (Continued)

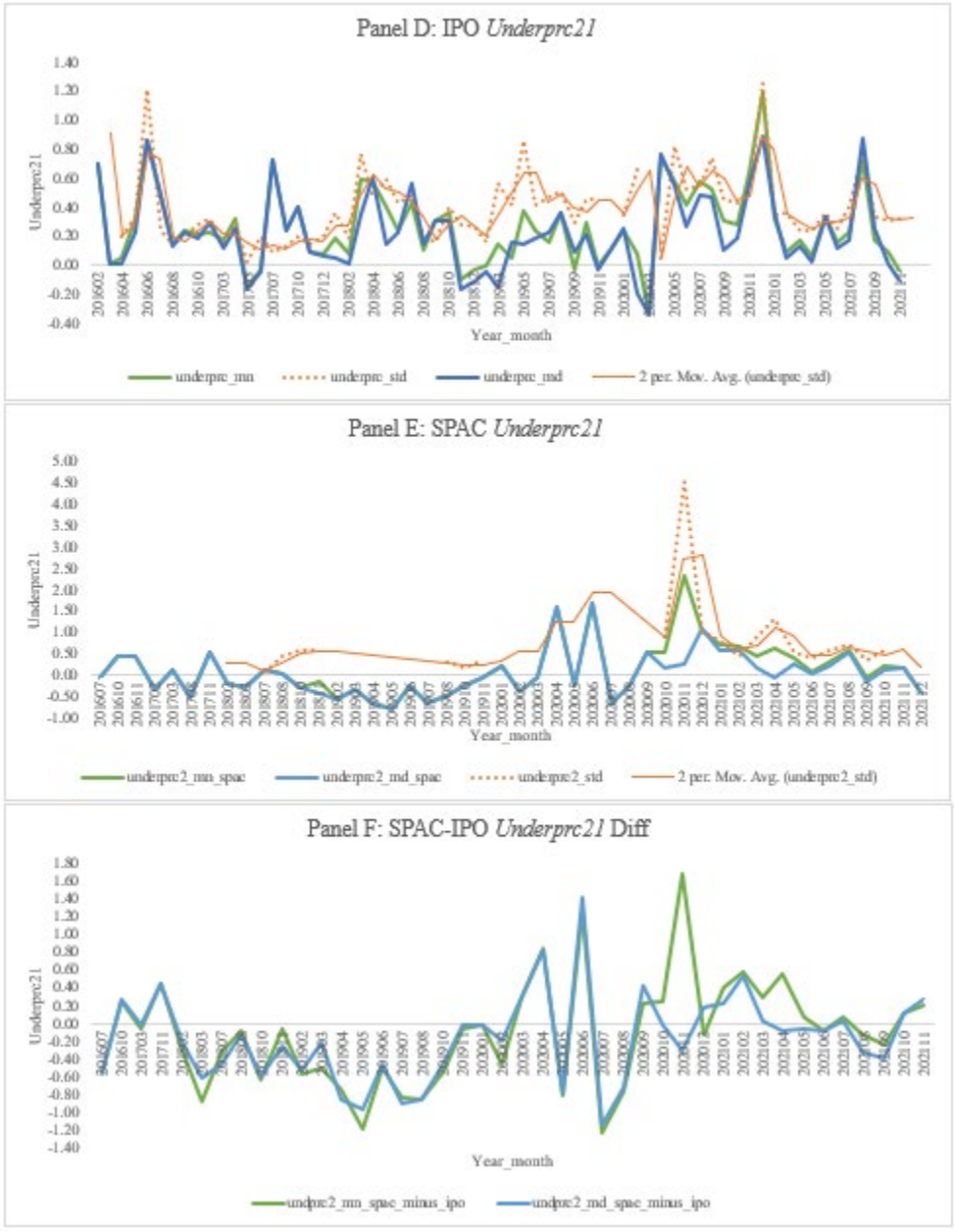

Figure 4. Hidden Regime Plot

This figure plots the mostly likely sequence of hidden regimes for time points during the sample period.

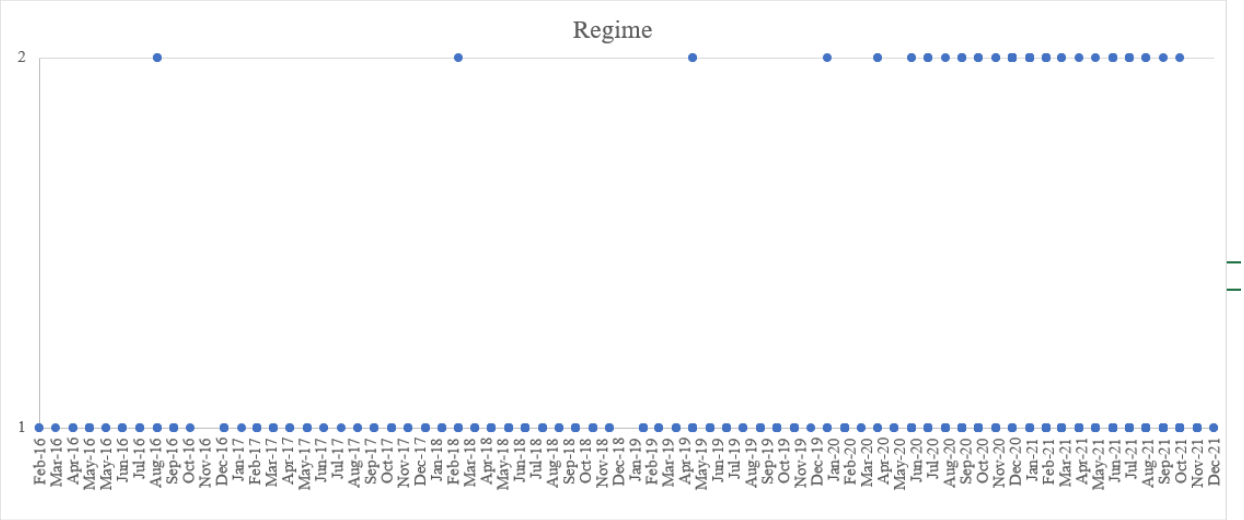

Table 1. Industry Distribution

This table presents the number of IPOs and SPAC mergers in each industry.

SIC1	*Description*	*No. of IPO*	*No. of SPAC Merger*
0	Agriculture, Forestry, And Fishing	0	3
1	Mining	8	8
2	Construction	244	29
3	Manufacturing	75	47
4	Transportation, Communications, Electric, Gas, and Sanitary Services	8	9
5	Wholesale Trade	22	12
6	Retail Trade	37	19
7	Finance, Insurance, and Real Estate	121	52
8	Services	21	13
9	Public Administration	1	8

Table 2. Summary Statistics and Univariate Comparison of Firm Characteristics

This table reports the summary statistics for IPOs (Panel A) and SPAC mergers (Panel B) in the sample, and T-test comparison of firm characteristics between the two groups (Panel B). Variable descriptions are provided in Data Appendix.

Panel A: IPOs						
Variable	*N*	*Mean*	*Std Dev*	*Lower Quartile*	*Median*	*Upper Quartile*
Underprc1	537	0.2644	0.5777	-0.0013	0.1535	0.3889
Underprc21	537	0.2692	0.5130	-0.0482	0.1848	0.4745
LogAT	537	5.7592	1.5642	4.8899	5.7003	6.7407
Age	537	10.6127	12.2737	4.0000	7.0000	13.0000
NYSE	537	0.2048	0.4040	0.0000	0.0000	0.0000
Risky	537	0.8622	0.3450	1.0000	1.0000	1.0000
UndRank	537	5.3387	4.0081	0.0000	8.0010	9.0010
OriginOwn	537	0.7472	0.1882	0.7045	0.7922	0.8686
Undfee	537	0.0663	0.0103	0.0650	0.0700	0.0700
TransactionSize	537	4.9438	1.2207	4.3175	5.0106	5.5576
Fin	537	0.0484	0.2148	0.0000	0.0000	0.0000
Cash	537	0.2981	0.3815	0.0000	0.0000	0.6609
Profit	537	-0.2139	0.2794	-0.3026	-0.1630	-0.0239
Dividend	537	0.0028	0.0325	0.0000	0.0000	0.0000
VIX	537	0.1886	0.0653	0.1422	0.1728	0.2227
Panel B: SPAC Mergers						
Variable	*N*	*Mean*	*Std Dev*	*Lower Quartile*	*Median*	*Upper Quartile*
Underprc1	200	0.3592	0.7533	-0.1103	0.1606	0.6437
Underprc21	200	0.3440	1.0818	-0.1718	0.1273	0.5182
LogAT	200	4.9910	1.7338	3.8640	4.9445	6.0626
Age	200	13.5850	15.1244	6.0000	9.0000	15.0000
NYSE	200	0.3400	0.4749	0.0000	0.0000	1.0000
Risky	200	0.6950	0.4616	0.0000	1.0000	1.0000
UndRank	200	4.1131	3.8305	0.0000	5.0010	8.0010
OriginOwn	200	0.6420	0.1829	0.5435	0.6784	0.7795
Undfee	200	0.0553	0.0059	0.0550	0.0550	0.0550
TransactionSize	200	6.5857	1.1896	5.9479	6.7405	7.2855
Fin	200	0.1000	0.3008	0.0000	0.0000	0.0000
Cash	200	0.2727	0.3557	0.0000	0.0385	0.6231
Profit	200	-0.2308	0.3504	-0.3312	-0.1252	-0.0208
Dividend	200	0.0099	0.0661	0.0000	0.0000	0.0000
VIX	200	0.1965	0.0567	0.1615	0.1805	0.2232
DayRemain	200	253.3450	192.6001	54.5000	267.0000	428.5000
Dilution	200	0.4489	0.2500	0.3333	0.3333	0.5000
Redemption	200	0.3698	0.3587	0.0008	0.2867	0.7267
At_risk	200	0.0213	0.0176	0.0000	0.0250	0.0299
PIPE	200	0.1455	0.1196	0.0666	0.1314	0.1903
CashOffer	200	0.3850	0.4878	0.0000	0.0000	1.0000

Table 2. Summary Statistics and Univariate Comparison of Firm Characteristics (continued)

Panel C: T-test				
Variable	*IPO*	*SPAC*	*Diff*	*T-stat*
LogAT	5.7592	4.9910	0.5060***	(5.75)
Age	10.6127	13.5850	-2.9723***	(-2.74)
NYSE	0.2048	0.3400	-0.1352***	(-3.85)
Risky	0.8622	0.6950	0.1672***	(4.66)
UndRank	5.3387	4.1131	1.2256***	(3.81)
OriginOwn	0.7472	0.6420	0.1052***	(6.80)
Undfee	6.6280	5.5333	1.0946***	(18.02)
TransactionSize	4.9438	6.5857	-1.6419***	(-16.35)
Fin	0.0484	0.1000	-0.0516**	(-2.22)
Cash	0.2981	0.2403	0.0578*	(1.88)
Profit	-0.2139	-0.2315	0.0176	(0.71)
Dividend	0.0028	0.0102	-0.0074	(-1.54)

Table 3. Markov Regime Switching Model-Two Regimes

This table reports results of Markov Regime Switching Model, assuming two hidden regimes. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

	Two Regimes	
	Underprc1	*Underprc21*
SPAC (Regime 1)	-0.1339***	-0.1646***
	(-3.93)	(-4.43)
SPAC (Regime 2)	-0.0512	0.3738
	(-0.20)	(1.19)
N	737	737

Table 4. Univariate Comparison of Underpricing before and after Structural Change

This table reports results of univariate T-test of initial 1- and 21-day underpricing for IPOs and SPAC mergers, before and after June 2020. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

Panel A: IPO					**Panel B: SPAC**			
Variable	*Before June 2020*	*Post June 2020*	*Diff*	*T-stat*	*Before June 2020*	*Post June 2020*	*Diff*	*T-stat*
Underprc1	0.2096	0.3114	-0.1018**	(-2.10)	-0.0595	0.4739	-0.5334***	(-5.29)
Underprc21	0.2352	0.2983	-0.0631	(-1.42)	-0.1085	0.4679	-0.5764***	(-4.55)
Panel C: Difference before June 2020					**Panel D: Difference after June 2020**			
Variable	*IPO*	*SPAC*	*Diff*	*T-stat*	*IPO*	*SPAC*	*Diff*	*T-stat*
Underprc1	0.2096	-0.0595	0.2691***	(3.57)	0.3114	0.4739	-0.1625**	(-2.23)
Underprc21	0.2352	-0.1085	0.3437***	(3.76)	0.2983	0.4679	-0.1696*	(-1.73)

Table 5. Determinants of Underpricing-OLS

This table reports the OLS estimation of Model (1) before and after June 2020, in Panels A and B, respectively. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

Panel A: Before June 2020		
	Underprc1	*Underprc21*
LogAT	0.0419	-0.0049
	(0.49)	(-0.12)
*LogAT*SPAC*	-0.0361	0.0101
	(-0.35)	(0.17)
Age	0.0005	0.0028
	(0.28)	(0.86)
*Age*SPAC*	0.0019	-0.0039
	(0.69)	(-0.88)
NYSE	0.1377*	0.0585
	(1.89)	(0.54)
*NYSE*SPAC*	0.6928***	0.3494**
	(3.36)	(2.05)
Risky	0.2324**	0.1823*
	(2.06)	(1.71)
*Risky*SPAC*	0.3867	0.4547*
	(1.60)	(1.91)
UndRank	0.0011	-0.0022
	(0.22)	(-0.32)
*UndRank*SPAC*	-0.0079	0.0049
	(-0.50)	(0.25)
OriginOwn	0.1886*	0.3519**
	(1.68)	(2.38)
*OriginOwn*SPAC*	-0.6990**	-0.8247***
	(-2.48)	(-2.71)
UndFee	0.0263	0.0726**
	(0.69)	(2.30)
*UndFee*SPAC*	-0.2183***	-0.1499*
	(-3.89)	(-1.85)
TransactionSize	-0.0239	0.0931
	(-0.16)	(1.48)
*TransactionSize*SPAC*	0.0489	0.1152
	(0.33)	(1.12)
Fin	-0.1529	-0.0124
	(-0.66)	(-0.11)
*Fin*SPAC*	0.6682**	0.1579
	(2.37)	(0.98)
VIX	-0.0086**	-0.0124**
	(-2.42)	(-2.18)
*VIX*SPAC*	0.0502***	-0.0121
	(4.97)	(-1.15)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.1245	0.1791
N	291	291

Table 5. Determinants of Underpricing-OLS (continued)

Panel B: After June 2020		
	Underprc1	*Underprc21*
LogAT	-0.1155*	0.0061
	(-1.92)	(0.15)
*LogAT*SPAC*	0.0881	-0.0400
	(1.24)	(-0.58)
Age	0.0012	-0.0017
	(0.46)	(-0.72)
*Age*SPAC*	-0.0037	-0.0023
	(-0.84)	(-0.47)
NYSE	-0.3561	0.0377
	(-1.47)	(0.37)
*NYSE*SPAC*	0.4329	0.2266
	(1.34)	(0.95)
Risky	-0.5443	-0.0239
	(-1.20)	(-0.20)
*Risky*SPAC*	0.6165	0.0155
	(1.23)	(0.05)
UndRank	0.0008	-0.0029
	(0.13)	(-0.39)
*UndRank*SPAC*	0.0386**	0.0405*
	(2.50)	(1.71)
OriginOwn	0.2685*	0.3236*
	(1.79)	(1.75)
*OriginOwn*SPAC*	-0.6790*	-0.5475
	(-1.92)	(-1.20)
UndFee	0.0777	0.0856***
	(1.27)	(2.69)
*UndFee*SPAC*	-0.0708	-0.0280
	(-0.73)	(-0.36)
TransactionSize	0.1792***	0.1304***
	(3.31)	(3.01)
*TransactionSize*SPAC*	-0.1112	0.0006
	(-1.32)	(0.00)
Fin	-0.2421**	-0.2647**
	(-2.58)	(-2.46)
*Fin*SPAC*	0.1583	0.0913
	(0.88)	(0.43)
VIX	-0.0201***	-0.0212***
	(-3.03)	(-3.25)
*VIX*SPAC*	0.0119	0.0257
	(0.59)	(1.04)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.0571	0.1112
N	446	446

Table 6. Markov Regime Switching Mode- Three Regimes

This table reports results of Markov Regime Switching Model, assuming three hidden regimes. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

	Three Regimes	
	Underprc1	*Underprc21*
SPAC (Regime 1)	-0.3354***	6.7113***
	(-6.39)	(6.10E+7)
SPAC (Regime 2)	-0.0495	-0.1771***
	(-0.88)	(-4.86)
SPAC (Regime 3)	-0.2537	0.2447
	(-0.60)	(1.50)
N	737	737

Table 7. Determinants of Underpricing-MLE

This table reports the MLE estimation of Model (1) before and after June 2020, in Panels A and B, respectively. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

Panel A: Before June 2020		
	Underprc1	*Underprc21*
LogAT	0.0435	-0.0034
	(0.50)	(-0.08)
*LogAT*SPAC*	-0.0385	0.0083
	(-0.37)	(0.14)
Age	0.0006	0.0030
	(0.34)	(0.90)
*Age*SPAC*	0.0017	-0.0043
	(0.59)	(-0.92)
NYSE	0.1365*	0.0584
	(1.87)	(0.54)
*NYSE*SPAC*	0.6791***	0.3615**
	(3.17)	(2.07)
Risky	0.2324**	0.1839*
	(2.07)	(1.72)
*Risky*SPAC*	0.3914	0.4527*
	(1.57)	(1.88)
UndRank	0.0008	-0.0025
	(0.17)	(-0.36)
*UndRank*SPAC*	-0.0064	0.0047
	(-0.39)	(0.24)
OriginOwn	0.1918*	0.3564**
	(1.71)	(2.41)
*OriginOwn*SPAC*	-0.6912**	-0.8317***
	(-2.43)	(-2.74)
UndFee	0.0280	0.0744**
	(0.70)	(2.30)
*UndFee*SPAC*	-0.2257***	-0.1453*
	(-3.86)	(-1.77)
TransactionSize	-0.0237	0.0929
	(-0.15)	(1.45)
*TransactionSize*SPAC*	0.0620	0.1131
	(0.41)	(1.10)
Fin	-0.1575	-0.0176
	(-0.67)	(-0.16)
*Fin*SPAC*	0.6849**	0.1662
	(2.36)	(1.00)
VIX	-0.0085**	-0.0122**
	(-2.37)	(-2.14)
*VIX*SPAC*	0.0483***	-0.0121
	(4.66)	(-1.15)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.1065	0.1640
N	291	291

Table 7. Determinants of Underpricing-MLE (continued)

Panel B: After June 2020		
	Underprc1	*Underprc21*
LogAT	-0.1160*	0.0065
	(-1.92)	(0.16)
*LogAT*SPAC*	0.0879	-0.0419
	(1.22)	(-0.60)
Age	0.0012	-0.0016
	(0.47)	(-0.67)
*Age*SPAC*	-0.0039	-0.0029
	(-0.83)	(-0.54)
NYSE	-0.3500	0.0401
	(-1.47)	(0.39)
*NYSE*SPAC*	0.4293	0.2244
	(1.34)	(0.95)
Risky	-0.5360	-0.0204
	(-1.19)	(-0.17)
*Risky*SPAC*	0.6093	0.0136
	(1.23)	(0.04)
UndRank	0.0006	-0.0030
	(0.10)	(-0.40)
*UndRank*SPAC*	0.0385**	0.0407*
	(2.50)	(1.72)
OriginOwn	0.2699*	0.3264*
	(1.81)	(1.76)
*OriginOwn*SPAC*	-0.6960*	-0.5696
	(-1.95)	(-1.24)
UndFee	0.0791	0.0887***
	(1.30)	(2.73)
*UndFee*SPAC*	-0.0677	-0.0257
	(-0.68)	(-0.32)
TransactionSize	0.1820***	0.1325***
	(3.38)	(3.03)
*TransactionSize*SPAC*	-0.1104	0.0044
	(-1.31)	(0.04)
Fin	-0.2432***	-0.2636**
	(-2.61)	(-2.45)
*Fin*SPAC*	0.1627	0.0969
	(0.90)	(0.46)
VIX	-0.0202***	-0.0210***
	(-3.05)	(-3.21)
*VIX*SPAC*	0.0117	0.0254
	(0.58)	(1.03)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.0569	0.1118
N	446	446

Table 8. Determinants of Underpricing-Propensity Score Weighting

This table reports analyses on the determinants of underpricing using propensity score weighting. Panel A presents the standardized differences of independent variables in Model (2) between SPAC mergers and IPOs, before and after weighting by inverse probabilities. Panel B and Panel C presents results of weighted regression with the inverse probabilities as weights using Model (1), for periods before and after June 2020, respectively. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

Panel A: Standardized Differences

		Standardized Difference	*Variance Ratio*
LogAT	*Unweighted*	-0.4652	
	Weighted	0.1244	1.0306
Age	*Unweighted*	0.2158	
	Weighted	0.0623	0.7763
Risky	*Unweighted*	0.4111	
	Weighted	-0.0316	0.9475
Fin	*Unweighted*	-0.1978	
	Weighted	0.0051	0.9789
Cash	*Unweighted*	-0.1590	
	Weighted	-0.2480	0.6941
Profit	*Unweighted*	-0.0556	
	Weighted	0.0099	1.3575
Dividend	*Unweighted*	0.1438	
	Weighted	-0.0178	0.8251
Yr16	*Unweighted*	0.2647	
	Weighted	-0.1089	1.3795
Yr17	*Unweighted*	0.2967	
	Weighted	-0.1516	1.447
Yr18	*Unweighted*	0.2323	
	Weighted	-0.0256	1.0584
Yr19	*Unweighted*	0.2183	
	Weighted	0.1237	0.7096
Yr20	*Unweighted*	0.0285	
	Weighted	0.0063	0.9923

Table 8. Determinants of Underpricing-Propensity Score Weighting (continued)

Panel B: Before June 2020		
	Underprc1	*Underprc21*
LogAT	0.0491	-0.0075
	(0.56)	(-0.19)
*LogAT*SPAC*	-0.0280	0.0318
	(-0.26)	(0.57)
Age	0.0013	0.0042
	(0.68)	(1.25)
*Age*SPAC*	0.0022	-0.0031
	(0.83)	(-0.71)
NYSE	0.1315*	0.0647
	(1.79)	(0.58)
*NYSE*SPAC*	0.6671***	0.2721
	(3.39)	(1.65)
Risky	0.2444**	0.1885*
	(2.20)	(1.74)
*Risky*SPAC*	0.4045*	0.4266*
	(1.72)	(1.92)
UndRank	-0.0003	-0.0036
	(-0.07)	(-0.53)
*UndRank*SPAC*	0.0094	0.01505
	(0.56)	(0.73)
OriginOwn	0.2018*	0.3624**
	(1.78)	(2.47)
*OriginOwn*SPAC*	-0.7468**	-0.8083**
	(-2.36)	(-2.54)
UndFee	0.0244	0.0757w**
	(0.54)	(2.25)
*UndFee*SPAC*	-0.2425***	-0.1387*
	(-4.11)	(-1.78)
TransactionSize	-0.0351	0.0902
	(-0.22)	(1.40)
*TransactionSize*SPAC*	0.0460	0.0772
	(0.31)	(0.79)
Fin	-0.1837	-0.0299
	(-0.76)	(-0.27)
*Fin*SPAC*	0.7707**	0.1430
	(2.54)	(0.88)
VIX	-0.0085**	-0.0123**
	(-2.33)	(-2.15)
*VIX*SPAC*	0.0547***	-0.0101
	(5.64)	(-1.00)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.0685	0.1142
N	291	291

Table 8. Determinants of Underpricing-Propensity Score Weighting (continued)

Panel C: After June 2020		
	Underprc1	*Underprc21*
LogAT	-0.0844*	0.0067
	(-1.70)	(0.16)
*LogAT*SPAC*	0.0840	-0.0221
	(1.31)	(-0.35)
Age	0.0002	-0.0018
	(0.10)	(-0.71)
*Age*SPAC*	-0.0030	-0.0016
	(-0.82)	(-0.34)
NYSE	-0.1694*	0.0539
	(-1.92)	(0.51)
*NYSE*SPAC*	0.2420	0.2530
	(1.10)	(0.99)
Risky	-0.1870	-0.0032
	(-1.32)	(-0.03)
*Risky*SPAC*	0.2299	0.0363
	(0.94)	(0.11)
UndRank	-0.0008	-0.0040
	(-0.11)	(-0.53)
*UndRank*SPAC*	0.0349**	0.0370
	(2.16)	(1.64)
OriginOwn	0.2599*	0.3144*
	(1.84)	(1.70)
*OriginOwn*SPAC*	-0.6836**	-0.6368
	(-1.97)	(-1.44)
UndFee	0.0518	0.0906***
	(1.37)	(2.79)
*UndFee*SPAC*	-0.0064	-0.0131
	(-0.09)	(-0.18)
TransactionSize	0.1651***	0.1366***
	(3.80)	(3.10)
*TransactionSize*SPAC*	-0.1398*	-0.0212
	(-1.85)	(-0.20)
Fin	-0.2135**	-0.2599**
	(-2.39)	(-2.24)
*Fin*SPAC*	0.0712	0.0662
	(0.42)	(0.30)
VIX	-0.0221***	-0.0211***
	(-3.71)	(-3.22)
*VIX*SPAC*	0.0284	0.0263
	(1.40)	(1.04)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.0640	0.1139
N	446	446

Table 9. Effects of SPAC Merger-Specific Variables-MLE

This table reports the MLE estimation of Model (3) before and after June 2020, for using the SPAC merger sample, in Panels A and B, respectively. Variable descriptions are provided in Data Appendix. T-statistics are reported in parentheses. ***,**, and * denotes significance levels at 1%, 5%, and 10%, respectively.

Panel A: Before June 2020		
	Underprc1	*Underprc21*
LogAT	-0.0056	-0.0540
	(-0.18)	(-1.41)
Age	0.0020	-0.0018
	(1.42)	(-0.62)
NYSE	0.6496***	0.4811***
	(3.66)	(2.79)
Risky	0.5265**	0.5889**
	(2.65)	(2.34)
UndRank	0.0119	0.0110
	(0.99)	(0.67)
OriginOwn	-0.684*	-0.2157
	(-1.94)	(-0.42)
UndFee	-0.0783	-0.0671
	(-1.14)	(-0.68)
TransactionSize	0.0220	0.0917
	(0.35)	(1.18)
Fin	0.2157**	0.0323
	(2.46)	(0.21)
VIX	0.0307***	-0.0251***
	(3.42)	(-3.34)
DayRemain	-0.0000	0.0009
	(0.00)	(1.59)
Dilution	0.0315	0.2043
	(0.20)	(1.39)
Redemption	-0.6042***	-0.4955**
	(-3.37)	(-2.07)
At_risk	1.8707	-2.8878
	(1.05)	(-0.89)
PIPE	-0.7197	-0.1009
	(-1.68)	(-0.23)
CashOffer	-0.0796	0.1365
	(-0.72)	(1.03)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.5798	0.4328
N	43	43

Table 9. Effects of SPAC Merger-Specific Variables-MLE (continued)

Panel B: After June 2020		
	Underprc1	*Underprc21*
LogAT	-0.0347	-0.0364
	(-0.95)	(-0.76)
Age	-0.0002	-0.0005
	(-0.07)	(-0.13)
NYSE	0.0103	0.1354
	(0.05)	(0.58)
Risky	-0.0684	-0.1548
	(-0.33)	(-0.53)
UndRank	0.0354***	0.0343*
	(2.85)	(1.70)
TargetOwn	0.7287	1.5954
	(1.21)	(1.54)
Undfee	0.0484	0.0129
	(0.53)	(0.12)
TransactionSize	-0.0117	-0.0726
	(-0.18)	(-0.84)
Fin	-0.0504	0.0959
	(-0.31)	(0.48)
VIX	-0.0103	-0.0021
	(-0.60)	(-0.10)
DayRemain	-0.0006*	0.0009
	(-1.76)	(1.10)
Dilution	0.4152	0.6742***
	(1.15)	(1.71)
Redemption	-1.3552***	-1.4260***
	(-6.19)	(-4.64)
At_risk	-10.8356**	-13.3240***
	(-2.45)	(-3.18)
PIPE	1.0811	2.8801**
	(1.22)	(2.11)
CashOffer	-0.1354	-0.4060***
	(-1.16)	(-2.97)
Year Dummies	*Yes*	*Yes*
Robust Standard Errors	*Yes*	*Yes*
Adjusted R^2	0.2791	0.1928
N	157	157