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Clauses with Claws: Reducing Agency Costs in Late-Merging SPACs

Finance Working Paper N° 1017/2024
March 2026

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Abstract

Existing theory predicts that deadline driven agency distortions arise even under op- timal contracting. We show that ex-ante contract design can substantially attenuate these distortions in practice. Leveraging the unique institutional features of special purpose acquisition companies (SPACs), we re-examine the relationship between eco-nomic contracting and merger outcomes. We find that contingency clauses can mitigate high agency costs that become especially pronounced near the SPAC liquidation dead-line by aligning manager and shareholder interests. Late merging SPACs without such clauses underperform, with 9-11% lower merger announcement returns and 19% lower post-merger ROA. Notably, SPAC contingency clauses are only per-formative when agency costs are high, underscoring their importance in improving the quality of late SPAC mergers. These results provide a channel by which SPACs can be constructed to minimize agency costs born of the SPAC structure, informing regulatory policy.

Keywords: Special Purpose Acquisition Company, SPAC, Duration Analysis, Hazard Function, deSPAC Performance
JEL Classifications: G30, G34, G24

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Clauses with Claws: Reducing Agency Costs in Late-Merging SPACs *

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March 2, 2026

Abstract

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1. Introduction

A large theoretical literature in financial economics studies dynamic agency problems and intertemporal contracting, emphasizing that incentive distortions can intensify as agents approach the end of a contract horizon and that optimal contracts should be state-dependent instead of uniformly binding (Balasubramanian et al., 2018; Sun and Tian, 2018; Madsen, 2022; Ely et al., 2025). Empirical tests of these predictions, however, remain limited. In most corporate settings, deadlines are flexible, contracts are renegotiable, and incentive horizons are endogenous, making it difficult to observe how agency costs evolve over time or to identify when contractual protections are most effective.

We address this gap by studying special purpose acquisition companies (SPACs), a setting that offers a uniquely clean laboratory for examining dynamic agency conflicts and intertemporal contracting. SPACs are public shell corporations formed by sponsors with the exclusive purpose of merging with a private company, thereby taking the target company public.[1] SPAC sponsors are solely compensated by "promote shares", or equity ownership in the merged firm. There are two characteristics of the SPAC structure that are particularly useful for our research. First, SPACs have hard liquidation deadlines that are set at the time of their IPO and if no merger is completed before the deadline, the sponsors' payoffs collapse to zero. Second, key contractual provisions written in the SPAC IPO prospectuses are fixed *ex ante* prior to the merger. These institutional features sharply distinguish SPACs from traditional M&A settings and allow us to study how contract design disciplines agency costs as liquidation deadlines approach.

Besides the unique institutional features of SPACs, another reason we choose the SPAC market to study the relationship between economic contracting and mergers outcomes is that SPACs are economically important in their own right. In 2021, SPAC IPOs accounted for

[1] SPACs, often referred to as blank-check companies, can be thought of as a "blind pool" of capital, as investors do not know which operating company the SPAC managers will acquire (Tran, 2010). SPAC sponsors cannot declare any merger targets before the SPAC's IPO. As the SPAC is a shell company with no historical performance or assets, investors face significant uncertainty regarding the SPAC's future prospects (Lin et al., 2025).

58.6% of the total initial public offerings (IPO) market's proceeds (Dambra et al., 2023) and since then, SPACs have emerged as a prominent alternative to traditional IPOs in financial markets.[2] SPACs have remained important in the U.S. IPO market, with 63% of U.S. IPOs coming from SPACs in 2025.[3] Their scale and visibility raise a central question for asset pricing and corporate governance: when do SPACs create value for common shareholders, and when do design features transmit agency costs to them? Previous literature documents disappointing deSPAC (post-merger SPAC) equity returns (see, e.g., Lewellen 2009; Dimitrova 2017; Gahng et al. 2023; Kiesel et al. 2023; Dimic et al. 2025; Hansen 2025). Existing explanations, however, largely focus on average outcomes and provide limited insight into why some SPAC mergers destroy value while others do not. An exception to this is the study by Chiang et al. (2025), which documents that deSPAC performance is substantially stronger in South Korea, where sponsor contracts are more tightly aligned with public investors than in the United States. However, while Chiang et al. (2025) study differences in incentive alignment across broad institutional settings found in different countries, we focus on how contractual provisions operate within a given market and over the SPAC lifecycle. In this paper, we aim to explore the heterogeneity in poor deSPAC performance and identify specific contracting mechanisms that can ameliorate agency costs.

There are two main features of the SPAC design that could lead to poor deSPAC performance. First, both the choice of investing in a SPAC IPO and voting to approve proposed business combinations (and refraining from redeeming SPAC shares) depend not only on share performance, but also on the value of the IPO investors' (and sponsors') warrants. SPAC IPO units typically include a share *and* a fraction of a warrant (similar to a call option). These warrants become exercisable in the period after the deSPAC merger (typically at an exercise price of $11.50) until five years after the business combination. Gahng et al. (2023) find a one year deSPAC warrant buy-and-hold return of 72.2%. Thus, positive

[2]In 2022, more private companies went public through SPAC mergers than through traditional IPOs (Gahng et al., 2023). In 2023 and 2024, 43% of US IPOs were SPACs.

[3]From spacanalytics.com.

option value (from warrants) can offset poor share performance. Crucially, this option value is heavily dependent on the SPAC merging; in the absence of a merger, the warrants expire worthless. This can lead to shareholders who also hold warrants to approve equity-value-destroying business combinations. As warrants are only attached to shares in the primary IPO market, secondary market purchasers of SPAC shares do not benefit. While warrants are effective means of averting IPO investors from redeeming shares and convincing them to approve business combinations, this structure may align the incentives of managers more with those of warrant-holders and sponsors (as opposed to shareholders).

A second important feature of SPACs linked to agency costs is their liquidation deadline. As SPACs approach their liquidation deadline—the predetermined timeframe within which they must complete a merger—managers may compromise on the quality of the target company. Studies in other economic contexts show that explicit deadlines can lead agents to make suboptimal decisions (Liebman and Mahoney, 2017; Chan, 2018; Hüther, 2023; Terry, 2023). As the compensation of SPAC sponsors/managers, called a "promote", which is typically 20% of SPAC shares, is contingent on the SPAC merging with a target firm before the deadline, there are significant economic incentives for managers to engage in lower-quality mergers as deadlines loom. The agency costs transmitted to shareholders when SPACs merge under this deadline pressure are documented by Dimitrova (2017), who shows that late-merging SPACs suffer significantly lower returns. However, existing evidence largely treats this deadline effect as homogeneous, leaving open the question of whether poor outcomes are inevitable.

Recent theoretical work formalizes the intuition that deadline-induced incentive distortions can arise even in the absence of behavioral bias or poorly designed contracts. Feng et al. (2024) develop a dynamic agency model with endogenous search, motivated by settings such as SPACs, in which agents privately observe both the arrival and quality of investment opportunities. In their framework, optimal contracts feature investment thresholds that decline over time, leading to overinvestment that intensifies as deadlines approach. Importantly, this behavior emerges even under optimal contracting, highlighting that deadline-driven agency costs are a fundamental feature of finite-horizon search environments rather than an artifact of contract failure. This theory raises a natural empirical question: if deadline-induced distortions are inherent, can observed variation in real-world contract design meaningfully mitigate them?

We ask whether ex-ante contract design mitigates the deadline penalty empirically documented by prior studies (Dimitrova, 2017; Kiesel et al., 2023). Merger outcomes provide a natural lens through which to study these incentive distortions (Harford et al., 2012; Lin et al., 2025). Because SPAC sponsors' compensation is contingent on consummating a transaction, late-stage incentives are directly reflected in target selection and deal terms. If sponsors lower their acceptance thresholds as deadlines loom, this behavior should manifest in lower announcement returns and weaker post-merger operating performance. Conversely, if contracts successfully discipline sponsor behavior, late-stage mergers need not destroy value. Importantly, SPAC contracts offer substantial cross-sectional variation in incentive alignment. While the basic SPAC structure is standardized, IPO prospectuses differ meaningfully in the presence and strength of contingency clauses that either increase sponsors' equity exposure or limit the value of warrants. These provisions are set ex ante, prior to target search, and are largely fixed throughout the SPAC's lifecycle. This feature allows us to cleanly examine whether and when contract design mitigates deadline-induced agency costs, without confounding renegotiation or selection concerns.

Using a large sample of SPACs from 2009–2024, we identify and hand-collect the terms of six contractual provisions that frequently appear in SPAC IPO prospectuses. In a broad sense, these "contingency clauses" (contingent on the SPAC finding a merger partner) increase the equity exposure of sponsors/managers and/or limit the value of the SPAC warrants. We combine (i) duration analysis, which details managers' search pressure and merger timing in relation to the liquidation deadline, with (ii) event-study and operating-performance tests around the deSPAC. Two facts summarize our results. First, consistent with Dimitrova (2017), we show that late-merging SPACs underperform, earning roughly 8–11% lower merger-announcement returns. Second, we find that certain combinations of contingency clauses can entirely eliminate this negative late-merging effect. Crucially, these clauses are only value-enhancing for late mergers, consistent with clauses mitigating deadline-induced agency costs rather than mechanically boosting all deals.

Why does this matter? From a policy perspective, the deadline mechanism creates scope for value-destroying mergers that transfer wealth from common shareholders to sponsors and unit investors.[4] Our evidence that ex-ante contingency clauses neutralize the deadline penalty for late mergers suggests a contract-design margin that regulators and exchanges could encourage (or require) if SPACs are to align manger incentives more closely with common equity value. For issuers and underwriters, our results point to specific clause combinations that are most effective when search frictions push deals toward the deadline.

To clarify the economic mechanisms underlying our empirical results, we develop a simple model of SPAC managers' target-selection problem under time-varying incentives and contractual constraints. Our analysis provides the optimal minimum acceptable value of a potential merger partner for the manager. The model predicts that as the time to the SPAC's liquidation approaches, the optimal minimum value decreases, suggesting that managers may lower their standards for a potential target firm as deadlines loom. We then show that this effect is mitigated by contingency clauses via two complementary channels: *the sponsor equity alignment channel* and *the warrant value curtailment channel*. Through the equity alignment channel, contingency clauses mitigate incentives to pursue low-quality targets by decreasing sponsors' unconditional rents and increasing the extent to which their payoffs depend on deSPAC performance. Warrant value curtailment clauses (which lower the value of IPO unit investors' warrants) impact the optimal target quality indirectly through the proposed merger approval probability; investors become less willing to approve low-quality deals when smaller positive warrant returns cannot compensate for equity losses.

[4] A unit is made up of a Class A common share and a fraction of a warrant. More details are given in the next section on Institutional Details.

Using a comprehensive panel of SPACs with IPOs between 2009 and 2024 (1,231 SPACs), we conduct duration analysis inspired by our acquisition model and show that the probability of a SPAC merging increases at an increasing rate as the deadline approaches. This convexity of the hazard function provides *prima facie* evidence that SPAC managers become willing to engage in lower-quality deals and/or increase their search efforts as the maturity deadline approaches, consistent with the model's prediction. Moreover, duration analysis enables us to exploit information from our full sample of 1,231 SPACs, those that completed mergers and those that liquidated to model the time-to-merger process directly, providing a unified framework to study how deadline pressure shapes both the likelihood and quality of SPAC combinations.

We then test whether late-merging SPACs suffer lower merger-announcement returns. Consistent with Dimitrova (2017), SPACs that announce mergers close to their liquidation deadline earn 4–8% lower announcement CARs than non-late mergers. This result is qualitatively consistent with the findings of Dimitrova (2017), who analyzes a sample of 73 SPAC merger deals occurring between 2003 and 2008. This confirms the previously documented poor performance of late-merging SPACs persisted through the recent wave of SPAC IPOs.

We now turn to ex-ante contractual provisions that can better align sponsor incentives with common shareholders. We hand-collect six families of clauses that frequently appear in SPAC IPO prospectuses—(i) warrant lockup provisions, (ii) sponsor share lockup clauses, (iii) sponsor earnout forfeitures clauses, (iv) warrant exercise price change clauses (anti-dilutive), (v) make-whole provisions, and (vi) forward purchase agreements. These contingency clauses either increase sponsors' equity exposure or limit the value of warrants (for both sponsor and non-sponsor warrant holders). Conditioning on SPACs that ultimately merge, we repeat the duration analysis and find that SPACs with fewer protective clauses exhibit more convex (increasing at an increasing rate) pre-deadline merger hazard functions than those with more protective clauses, consistent with clauses raising acceptance thresholds and/or dampening deadline-driven deal closures.

We next test whether clauses are priced at merger announcement for late deals. Our event-study estimates show that, for late-merging SPACs, each additional protective clause in the IPO prospectus is associated with an increase of roughly 2% in announcement CARs. By contrast, late mergers without such clauses experience substantially more negative announcement returns: approximately twice the magnitude of the average late-merge discount, indicating that the late-penalty is concentrated among and driven by SPACs lacking protective terms. Importantly, the effect operates through the "interaction with lateness": contingency clauses have little to no effect for non-late mergers, consistent with clauses mitigating deadline-induced agency costs.

We then conduct heterogeneity tests to examine which specific ex-ante contractual provisions can better align sponsor incentives with common shareholders. Notably, no single clause has a statistically significant impact on merger announcement returns of late-merging SPACs (coefficients are positive but imprecise), but several combinations of two or three clauses are both statistically and economically meaningful. Strikingly, all effective combinations include a forward-purchase agreement, which commits the sponsor to buy equity at the deal closing (at a predetermined price), and at least one provision that curtails warrant value (make-whole and/or anti-dilution). The strongest triple (forward purchase + make-whole + anti-dilution) yields roughly 9%–11% higher announcement CARs for late mergers, bringing late-deal reactions in line with, or even above, those of non-late mergers. Consistent with our mechanism, these gains are specific to late mergers; estimates for non-late mergers are statistically insignificant.

Finally, we examine post-merger operating performance as a complementary lens. Although Return on Assets (ROA) is a noisy profitability measure for de-SPACs, the cross-sectional pattern mirrors that of the event-study results. Late mergers without restrictive clauses exhibit materially lower ROA, whereas the interaction of late merging with contingency clauses raises year one ROA by roughly 19% and year two ROA by roughly 21% per clause, relative to late merges without such protection. Together with the announcement results, this pattern points to real value effects rather than pure revaluation at the merger date.

Most closely related to our analysis is Dimitrova (2017), who analyzes a sample of 73 SPACs that went public between 2003 and 2008 which subsequently merged with a private firm. She finds that deals announced close to the SPAC liquidation deadline suffered 8.8% lower buy-and-hold abnormal returns. Though our samples do not overlap (ours covering the 2009-2024 period, considering 1231 IPOs and 625 mergers), we confirm that the late-merge penalty persists in the recent wave of SPAC IPOs. However, we show that this poor performance is not a universal property of late mergers. Instead, late merger outcomes are heterogeneous and predictable from prospectus design. When sponsors pre-commit meaningful equity (e.g., via forward purchase agreements) and when warrant value is curtailed (e.g., via make whole provisions), late mergers earn positive announcement returns that offset, and in many specifications exceed, the average late merger discount. Where such protections are absent, late merger abnormal returns are negative and hazard functions are convex, indicative of the agency costs captured before conditioning on contractual provisions. Moreover, we find no evidence that contingency clauses impact deSPAC performance for non-late-merging SPACs, highlighting their unique relationship with the intertemporal dynamics of agency costs throughout the SPAC lifecycle.

These findings also have regulatory and design implications. If the policy objective is to reduce agency costs borne by common shareholders without eliminating the SPAC channel, then pairing sponsor equity pre-commitment with warrant value limiting provisions is a practical approach. We also provide suggestive evidence that SPACs issuing no-warrant units avoid the late-merger discount. However, average effects outside the late merger region are mixed and the sample of no-warrant SPACs is too small to provide conclusive evidence. Overall, our results indicate that any reform that targets a single issue in isolation is likely to underperform; the interaction of multiple clauses in the face of a liquidation deadline is the key margin.

We contribute to the literature on economic contract design by highlighting how contingency clauses in SPAC merger agreements can align the incentives of SPAC managers with those of investors. Closely related is Chiang et al. (2025), whose findings highlight the importance of baseline incentive alignment in mitigating agency costs in SPACs. We complement this work by studying within-market variation in contract design and by showing that the effectiveness of contractual provisions is highly state-dependent, becoming most relevant as SPACs approach their liquidation deadlines. In particular, we find that contingency clauses matter little early in the SPAC lifecycle but play a central role in mitigating agency costs as liquidation deadlines approach. More generally, previous studies in the IPO and mergers and acquisitions literatures have documented that contingency clauses can improve firm outcomes.[5] Ahmad and Jelic (2014) find using a sample of 580 U.K. IPOs that firms with longer lockups lengths have higher survival rates compared to firms with shorter lockup periods. Given the temporal nature of our analysis, our study of contingency clauses also relates to studies concerning the behavior of agents as deadlines approach (Ariely and Wertenbroch, 2002; Toxvaerd, 2007; Bennett et al., 2015). We contribute to the finance literature on contingency clauses in two key ways. First, we provide the first study to explicitly document how different clauses influence performance disparities among deSPACs. Second, we identify a new effect of contingency clauses by examining their interaction with deadlines. Notably, across all our empirical analyses, we find that contingency clauses are effective only for SPACs that merge closest to the deadline, i.e., when agency costs are particularly high.

The extensive body of work on executive compensation examines how management contracts in private equity govern agency costs between fund managers and investors (e.g., Axelson et al., 2009; Phalippou, 2009; Phalippou and Gottschalg, 2009; Metrick and Yasuda, 2010; Robinson and Sensoy, 2013; Ewens et al., 2022). In the context of SPACs, the

[5]Early key studies include Houston and Ryngaert (1997), who utilize a sample of bank merger agreements and show that bidders experience higher merger announcement returns when they offer stock price collars in the merger offer. Kohers and Ang (2000) study 938 earnout offers made in merger transactions and find that acquirers using earnouts experience positive post-announcement abnormal returns. In IPOs, lockups may be seen as a commitment to alleviate moral hazard problems (Brav and Gompers, 2003).

lack of reputational constraints and the shorter lifespan of SPACs can intensify the pressure to find a partner firm, leading to more significant agency problems compared to private equity funds.

Our paper is also related to the extensive empirical literature concerning SPACs. We confirm that value destroying SPAC mergers are still prevalent using a comprehensive sample, consistent with most prior findings. Lewellen (2009) reports that SPAC stock returns yield a positive monthly four-factor alpha following target announcements but a negative alpha after the acquisition is completed. Jenkinson and Sousa (2011) document a cumulative return of -24% after six months for a sample of 43 SPACs.[6] Kiesel et al. (2023) find that while SPAC merger announcements initially trigger positive market reactions, this effect diminishes the later the announcement is made in the SPAC's lifetime. Boreiko and Lombardo (2024) analyze a sample of 24 SPACs listed on AIM Italia and find that while the long-term post-merger returns are still poor, Italian SPACs perform much better than their U.S. counterparts. Emm et al. (2024) document that in the U.S. market, SPACs take longer finding a foreign target firm than a domestic target. Lin et al. (2025) find that SPAC sponsors with higher PE network centrality take less time to find a target firm. Compared to the traditional IPO process, SPACs are less informationally efficient (Hori and Osano, 2024). Kim et al. (2022) find that post-merger SPACs are 9.4% more likely to restate their financial statements than IPO firms, suggesting lower financial reporting quality. Cohen et al. (2024) document that peer firms of SPAC combinations increase accrual-based earnings management while decreasing real-activity based earnings management. We contribute to this existing empirical SPAC literature by showing that, while *average* SPAC performance is indeed poor, conditioning on manager-shareholder incentive alignment (e.g., via contingency clause prevalence) can explain substantial heterogeneity in this unsatisfactory performance.

[6] Other interesting empirical studies include Hansen (2025), who finds that deSPAC firms underperformed traditional IPO firms by 25 percentage points. Groh et al. (2025) show that VC-backed firms that merge with SPACs underperform both non-VC-backed firms that merge with SPACs and those that go public through a traditional IPO. Nandy and Wen (2025) document that retail investors' interest in SPACs begins after the initial SPAC IPO and extends to after the SPAC completes its deSPAC combination.

Finally, our study provides new insights into the theoretical literature on SPAC design (e.g., Chatterjee et al., 2016; Gryglewicz et al., 2021; Gofman and Yao, 2022; Bai et al., 2021; Banerjee and Szydlowski, 2024; Feng et al., 2024) by modeling the economic incentives for SPAC managers to complete an acquisition before the expiration deadline. We show empirically that the presence of multiple restrictive contingency clauses can mitigate the negative effects of looming deadlines on the quality of SPAC mergers.

The rest of this paper is organized as follows. Section 2 describes key institutional details about SPACs. Section 3 presents our target acquisition model. Section 4 describes the data and contains a discussion of the different types of contingency clauses found in SPAC IPO prospectuses. Section 5 describes the empirical methodology we use to estimate the SPAC's hazard function. Section 6 presents our empirical results, and Section 7 concludes the paper.

2. Institutional Details of SPACs

SPACs raise capital via IPOs, and then seek a private operating firms with which to merge. Though SPACs have existed as far back as the 1990s, they experienced a surge in their growth between 2020 and 2022. Sponsors, often individuals or investment firms, set up the SPAC and take it public via an IPO. The sponsors place the capital raised from the IPO in an interest bearing escrow account (Dimitrova, 2017; Huang et al., 2023). The SPAC typically has between 18-24 months to find a suitable firm with which to merge, though automatic extensions of this timeframe are often specified in the IPO prospectus. The SPAC is not allowed to have a pre-identified target company. After a SPAC identifies a target firm, the SPAC's shareholders vote on whether or not to approve the merger. At the same time, the shareholders also often decide whether or not to redeem their shares. If the merger proposal is approved by shareholders the SPAC merges with the target firm, in what is termed the deSPAC transaction, and thus takes the private firm public. If the SPAC is not able to complete the merger before the deadline, the SPAC must liquidate and distribute the money from the escrow account to its public shareholders.

SPAC IPOs are unit offerings, where each unit is almost always priced at \$10 and is made up of a Class A common share and a fraction of a warrant. The warrant is a call option that allows the holder to buy a share or a fraction of a share at an exercise price (typically \$11.50) within five years after the merger. The SPAC units become unbundled after the IPO so that the shares and warrants trade separately. In our sample of SPACs that successfully complete a merger, approximately 90% have additional contingency clauses, typically short lockups and/or redemption clauses which impact the value and timing of exercise. In the event that a holder redeems their shares, they can still keep their warrants.

Due to the fact that shareholders may redeem their shares, there is uncertainty regarding the amount of cash available for a merger. Thus, the target company will often require a minimum amount of cash from the SPAC. To meet this threshold, the sponsor will frequently invite Private Investment in Public Equity (PIPE) investments. In addition to securing more cash, PIPE investments can also have a certification effect on the quality of the merger, which may convince SPAC investors to not redeem their shares. PIPE investments are an important source of financing for financially constrained firms. Lim et al. (2021) document that on average, PIPE investors hold the stock for 384 days and earn an abnormal return of 19.7%. If the shareholder chooses to not redeem his shares, then he will become a shareholder in the newly merged firm. Gahng et al. (2023) find that on average, investors earned an annualized return of 23.9% during the SPAC period, with even liquidated SPACs providing 2% return per year. However, the authors document that during the deSPAC period, the average one-year market-adjusted return is -30.7%.

Furthermore, there is a concurrent private placement during the SPAC IPO. SPAC sponsors typically purchase warrants at the time of IPO (Cumming et al., 2014), though some may instead buy units at a fair market price. SPACs typically pay 5.5% of the IPO proceeds to underwriters. Usually, 2% is paid at the time of the IPO and the rest is deferred until the successful completion of a merger. The proceeds from the private placement are used to cover the expense of the upfront underwriting commission. At IPO, the sponsor retains 20% of the shares as compensation. These shares are termed the "promote" and do not have redemption rights nor access to the escrow account (Dimitrova, 2017). Thus, all of the sponsor's compensation and over half of the underwriters' fees are contingent upon the successful completion of a combination with a target firm.

3. A Target Acquisition Model for SPACs

We employ an enhanced search model to the SPAC managers' target selection problem. The model predicts that as the time to the SPAC's expiration threatens, the optimal minimum value of a new business partner falls. We introduce, in this section, two channels of influence for contingency provisions to mitigate this possibility: an equity alignment channel and a warrant value curtailment channel. Our comparative static results establish a positive relationship between each of our contingency clause channels and the SPAC's optimal minimum acceptance threshold. Furthermore, we document an inverse relationship between the optimal minimum value of a new business partner "$m^*(t)$" and the hazard function, $h(t)$. Finally, using the chain rule, it is clear that increases in our contingency clause indices reduce the hazard functions of SPACs. This result signals the possibility of contingency clauses having a role in the empirical results that appear in Section 6.

3.1. Primitives, Timing, and Clause Bundle

Time is continuous, $t \in [0, a]$, where $a > 0$ is the SPAC's liquidation deadline. If no merger is completed by $t = a$, the sponsor's payoff is 0 and the continuation value satisfies $V(a; \theta) = 0$.[7]

Potential targets arrive for the SPAC's consideration according to a Poisson process with a rate $\lambda > 0$. Conditional on arrival at time t, target quality T is drawn from distribution

[7] Allowing discounting does not alter the signs of the results (see, e.g., Stokey and Lucas Jr 1989).

F with density f and support $[\underline{T}, \overline{T}]$ (with $-\infty < \underline{T} < \overline{T} \le \infty$).

Upon the arrival of a potential partner with quality T at time t, the sponsor may attempt to consummate a merger. The attempt is approved with probability

$$p(T;\theta_W) \in (0,1], \qquad \text{with } \frac{\partial p(T;\theta_W)}{\partial T} > 0,$$

where θ_W indexes contractual provisions in the SPAC IPO which curtail the value of public warrants (held by IPO unit investors). Naturally, p is increasing in target quality T (better targets face less investor resistance).

If the attempt is approved and the merger closes, the sponsor's closing-contingent payoff is

$$\Pi(T;\theta_E),$$

where θ_E indexes the contractual provisions in the SPAC IPO which increase equity exposure of sponsors to the merged firm. We assume $\Pi(\cdot;\theta_E)$ is continuously differentiable and strictly increasing in T, which simply means that higher-quality targets make the sponsor's post-merger equity stake more valuable.

For brevity, we write the entire clause bundle capturing both θ_W and θ_E as the vector $\theta = (\theta_E, \theta_W)$. These clauses operate through two channels:

1. **Equity-alignment channel.** Clauses such as sponsor share lockups, sponsor earnout forfeitures, and forward purchase agreements either reduce unconditional sponsor rents and/or push more of the sponsor's payoff onto performance of the newly merged firm. We encode this as $\partial\Pi(T;\theta_E)/\partial\theta_E \le 0$ for low or moderate value merger candidates.
2. **Warrant-curtailment channel.** Clauses that reduce public-warrant value (e.g., make-whole provisions, warrant lockups) do not pay the sponsor directly. Instead, by curtailing warrant value, they reduce investor support for low value merger candidates. We encode this as $\partial p(T;\theta_W)/\partial\theta_W \le 0$ for low or moderate value merger

candidates.[8,9]

These primitives set up a simple dynamic optimization problem. At any time t, the sponsor faces a trade-off: wait for a potentially better target (incurring ongoing cost vc but preserving the option to merge later) vs. attempt a merger with the current target (locking in a payoff if successful, or paying cost δ if the deal fails). This trade-off is resolved by an optimal minimum acceptance threshold $m^*(t)$: only targets with $T \geq m^*(t)$ are worth attempting.

3.2. *Sponsor Value, Attempt Payoff, and HJB*

Let $V(t;\theta)$ denote the sponsor's continuation value at time t under clause bundle θ. Define the incremental gain from attempting to merge on an arrival of quality T at time t:

$$\Delta(T;V,\theta) \;\equiv\; p(T;\theta_W)\big(\Pi(T;\theta_E)-V\big) \;-\; \big(1-p(T;\theta_W)\big)\delta. \tag{1}$$

The sponsor attempts to consummate a merger iff $\Delta(T;V,\theta) \geq 0$. Standard dynamic programming yields the following Hamilton-Jacobi-Bellman (HJB) equation

$$0 \;=\; \frac{\partial V(t;\theta)}{\partial t} \;-\; vc \;+\; \lambda\,\mathbb{E}\Big[\Delta\big(T;V(t;\theta),\theta\big)_+\Big], \qquad V(a;\theta)=0, \tag{2}$$

where $(x)_+ = \max\{x,0\}$ and the expectation is over $T \sim F$.[10] The HJB formalizes the sponsor's continuation value, with the first term $\partial V/\partial t$ capturing the erosion of the search's value as the deadline approaches, $-vc$ capturing the flow cost of waiting, and the last term $\lambda E[\Delta(\cdot)_+]$ adding the jump in value from potential target arrivals.

Lemma 3.1. *There exists a unique bounded, continuously differentiable solution $V(\cdot;\theta)$ to Equation 2. The optimal policy is a threshold: $m^*(\cdot;\theta)$ such that merger attempts occur iff*

[8] This is consistent with differential warrant and equity returns found by Gahng et al. (2023).

[9] Regularity conditions and channel monotonicities are detailed in Appendix B.

[10] Derivation available in Internet Appendix C.1.

$T \geq m^*(t;\theta)$. The margin $m^*(\cdot;\theta)$ satisfies the following expression[11]*.*

$$p\big(m^*(t;\theta);\theta_W\big)\Big(\Pi\big(m^*(t;\theta);\theta_E\big) - V(t;\theta)\Big) \;=\; \big(1 - p\big(m^*(t;\theta);\theta_W\big)\big)\,\delta. \tag{3}$$

Equation (3) shows that there exists a quality threshold $m^*(t)$ such that the sponsor attempts all mergers with $T \geq m^*(t)$ and rejects those with $T < m^*(t)$.[12]

Given the sponsors optimal threshold behavior under Lemma 3.1, we next define $G(T;V,\theta) \equiv \Delta(T;V,\theta)$. For $T > m^*$ and $G > 0$, Equation 2 can be rewritten as

$$\frac{\partial V(t;\theta)}{\partial t} \;=\; vc \;-\; \lambda \int_{m^*(t;\theta)}^{\infty} G\big(T;V(t;\theta),\theta\big)\, f(T)\, dT. \tag{4}$$

Here we define the coefficients of the closing-contingent payoff at $T = m^*(t;\theta)$. We break this payoff into two components: $\beta(\theta_E)$, which is how fast Π increases in T exactly at $m^*(\cdot)$ and $\psi(\theta_E)$, which captures the unconditional rent to the sponsor:

$$\beta(\theta_E) \;\equiv\; \frac{\partial \Pi(T;\theta_E)}{\partial T}\bigg|_{T=m^*(t;\theta)}, \qquad \psi(\theta_E) \;\equiv\; \Pi\big(m^*(t;\theta);\theta_E\big) - m^*(t;\theta)\,\beta(\theta_E).^{13} \tag{5}$$

Consequently, we can rewrite the margin condition in Equation 3 as

$$p(m^*;\theta_W)\big(\psi(\theta_E) + \beta(\theta_E)\,m^* - V\big) = (1 - p(m^*;\theta_W))\,\delta.$$

3.3. Intertemporal Behavior of the Optimal Minimum Acceptance Threshold

Proposition 3.2. *The optimal minimum acceptance threshold, m^*, is strictly falling on the interior.*[14]

[11] Proof available in Appendix B.

[12] This value threshold policy is a common feature of finite horizon search models (see, e.g., McCall 1970; Weitzman 1979; Van den Berg 1990).

[13] Economic rent is defined as the excess profit earned by a resource or a factor of production (i.e. a sponsor) than what is necessary to keep it in current use.

[14] Proof of Proposition 3.2 is available in Appendix B.

$$\frac{\partial m^*(t;\theta)}{\partial t} < 0 \textit{ for all } t \in [0,a). \tag{6}$$

Equation (6) displays the impact of diminishing merger opportunities upon $m^*(t)$ as the SPAC's expiration threatens and provides the rationale for sponsors to deviate from the original quality threshold assurances that were given to investors.[15]

3.4. The Impact of θ_E and θ_W Upon the Optimal Minimum Acceptance Value of a New Merger Partner

Proposition 3.3. *Equity alignment raises the optimal minimum acceptance value of a new merger partner.*[16]

$$\frac{\partial m^*(t;\theta)}{\partial \theta_E} = \frac{p\,\frac{\partial V(t;\theta)}{\partial \theta_E} - p\,\frac{\partial \Pi(m^*;\theta_E)}{\partial \theta_E}}{\left.\frac{\partial \Delta(T;V,\theta)}{\partial T}\right|_{T=m^*}} > 0. \tag{7}$$

Value matching and smooth pasting conditions ensure that $m^*(\cdot)$ and $V(\cdot)$ share an identical reaction to an increase in θ_E. However, the impact of $V(\cdot)$ upon $m^*(\cdot)$ is scaled by a positive fraction "$p(\cdot)$" and by "$\partial\Delta(\cdot)/\partial T$" also positive. The $[\partial\Pi(\cdot)/\partial\theta_E]$ is scaled by the same two positive variates and any inverse response of $\Pi(\cdot)$ to an increase in θ_E is reversed by the (-1). Consequently, the $\partial m^*(\cdot)/\partial\theta_E$ is positive regardless of the partial derivative of $\Pi(\cdot)$ with respect to θ_E only being weakly negative. Equity provisions θ_E reduce the sponsor's unconditional rent from any proposed merger and increases the sensitivity of the sponsor's payoff to target quality. The sponsor gets less guaranteed reward from closing a proposed merger and more of their payoff depends upon how well the new firm performs. Facing this tighter link between target quality and their contingent payoff, the sponsor demands a higher

[15] Our later empirics suggest that the $m(t)$ actually employed by sponsors frequently falls into shareholder value-destroying territory as expiration threatens (consistent with Dimitrova (2017)).

[16] Proof in Appendix B.

minimum optimal acceptance threshold value $m^*(t)$.

Proposition 3.4. *Warrant curtailment raises the optimal minimum acceptance value of a new merger partner.*[17]

$$\frac{\partial m^*(t;\theta)}{\partial \theta_W} = \frac{p\,\frac{\partial V(t;\theta)}{\partial \theta_W} - (\delta/p)\,\frac{\partial p(m^*;\theta_W)}{\partial \theta_W}}{\left.\frac{\partial \Delta(T;V,\theta)}{\partial T}\right|_{T=m^*}} > 0. \tag{8}$$

Value matching and smooth pasting conditions ensure that $m^*(\cdot)$ and $V(\cdot)$ share an identical reaction to an increase of θ_W. However, the impact of $V(\cdot)$ upon $m^*(\cdot)$ is scaled by a positive fraction "$p(\cdot)$" and by "$\partial\Delta(\cdot)/\partial T$" also positive. The $[\partial p(\cdot)/\partial\theta_W]$ is also scaled by these two positive variates and any inverse response of $p(\cdot)$ to an increase in θ_W is reversed by the (-1). Consequently, the $\partial m^*(\cdot)/\partial\theta_W$ is positive regardless of the partial derivative of $p(\cdot)$ with respect to θ_W only being weakly negative.

Corollary 3.5. *Though merger targets become available to SPAC sponsors according to a Poisson process with parameter λ, there is a constant probability $F(m^*)$ for some threshold m^*, that the appearance of a target firm will not result in a proposed acquisition by the SPAC. That is, the possible business partner may have a true value "T" that is less than the optimal threshold value that the SPAC's optimal acquisition strategy demands. With this in mind, a hazard function for SPAC targets arriving according to a Poisson and only being proposed for acquisition if their true value T is greater than "m^*", can be written as*

$$p(\lambda(1 - F(m^*))^p t^{p-1}.$$

The marginal impact of "m^*" upon $h(t)$ can be written as

$$p^2(\lambda(1 - F(m^*)))^{p-1} \cdot t^{p-1} \cdot (-\lambda f(m^*)) < 0.$$

This allows us to conclude that contingency clauses represented by θ_E and θ_W inversely affect

[17] Proof in Appendix B.

the hazard function $h(t)$ since

$$\frac{\partial h(t)}{\partial m^*} \cdot \frac{\partial m^*}{\partial \theta_i} < 0 \qquad \textit{for } i = E \textit{ and } W.$$ [18]

In conclusion, Section 3 has developed a search model that provides a rationale for SPAC managers to deviate from the original quality assurances that were given to investors. However our augmented model articulates a role for contingency clauses to push back against threats to the original optimal minimum acceptance threshold for a merger partner and establishes a basis for contingency provisions to appear on the RHS of our regressions in Section 6.

4. Data

This section describes the construction of the SPAC/deSPAC data used in our analyses. General SPAC characteristics are obtained from SPACInsider.com (collection date August 19, 2024). Financial variables are collected from Compustat, and all stock price variables are collected from CRSP. We hand-collect contingency clause variables from the SPAC IPO prospectuses. Each prospectus is read, and the presence/terms of each identified contingency clause is recorded. We identify six contingency clauses that appear in SPAC prospectuses. Appendix A provides detailed descriptions for how we construct all variables.

4.1. Description of SPAC Sample

The SPAC sample consists of all SPACs with IPOs from the fourth quarter of 2009 until August of 2024. The earliest SPAC IPO date in our sample is November 11, 2009, while the latest SPAC IPO date is August 16, 2024. There are a total of 1,523 SPACs in the full sample. In estimating the hazard function, we exclude the SPACs that have completed their IPO application but have yet to go public, SPACs which withdrew their IPO application, and

[18] See Appendix B for proof.

the SPACs that abandoned their IPO applications. Such SPACs have not begun their search process for a target firm (in the case of SPACs that have recently filed IPO applications) or have decided to drop out before the beginning of search process (in the other two cases). A total of 1,231 SPACs remain that have either completed or are in the target search process (henceforth termed the "full sample"). Of these 1,231 SPACs, a total of 625 SPACs have successfully completed a business combination with a private operating firm.

Table 1 presents the summary statistics of the economic variables which help characterize the SPAC hazard functions. *Time to Merger* is a continuous variable that captures the number of days the SPAC has searched for a target firm. If the SPAC already completed a business combination, then *Time to Merger* captures how close to the deadline the SPAC finds a target firm. For still searching and liquidated SPACs, this is Time to Merger is censored. To compare SPACs with different initial timelines to merger, we normalize each search period to 365. More precisely, for SPAC i,

$$\text{Time to Merger}_i = \frac{\#\text{ of survival days}_i}{\text{Max. Days}_i/365} \tag{7}$$

where

$$\#\text{ survival days} = \begin{cases} \text{days from IPO to target ann. date} & \text{if } i \text{ has completed/announced a combination} \\ \text{days from IPO to liquidation date} & \text{if } i \text{ is liquidated} \\ \text{days from IPO to Aug 19. 2024} & \text{if } i \text{ is searching} \end{cases}$$

and *Max. Days* is the total number of days from the initial IPO date until the liquidation date and assumes the maximum number of extensions have been taken.

Because a SPAC is a blank-check company, which by definition has no business plan, the amount of capital raised via an IPO depends largely on the reputation of the sponsors (Dimitrova, 2017). Thus, IPO proceeds is an important economic variable that provides information on initial investor assessment of the quality of the SPAC. The mean IPO proceeds in our full sample is US $229.5 million. Recent research finds that management reputation has a positive association with the amount of capital raised by SPACs (Pawliczek et al., 2024). We construct two variables to proxy for the SPAC's reputation. First, following (Wei, 2023), we construct a variable, *Counts*, that enumerates the number of SPACs that the sponsor group raised previously. The mean number of previous SPAC deals for sponsors is less than 1; the vast majority of SPACs have sponsor groups with zero prior experience with SPACs, while sponsor groups that have previous experience with 1-4 SPACs make up 30% of the full sample. We next control for underwriter prestige. We construct an indicator variable called *UW_Ind* that equals one if the SPAC underwriter is one of the top seven underwriters.[19] 39% of SPACs in our full sample have a top underwriter.

The overallotment option is popular in traditional public offerings (Ritter and Welch, 2002) and is also included in public offerings of SPACs. The mean overallotment proceeds for the SPAC sample is $26.4 million. We construct a variable *UW_Ind* to capture underwriter prestige. Following Wei (2023), UW_Ind equals one if the SPAC underwriter is one of the top seven underwriters.[20] 39% of SPACs in our full sample have a top underwriter. SPAC investors have the opportunity to redeem their shares for a pro-rata trust value prior to the business combination. The redemption percent is an important determinant of the success of a merger as proposed acquisitions can fail if a large proportion of shareholders redeem their shares (Dimitrova, 2017). The average redemption percent in the full sample is 53.2%. Moreover, 42.9% of SPACs in the full sample had redemption percents greater than 80% and 4.2% of SPACs had a 100% redemption rate.

We also construct three variables to describe the target firm. *Domestic_Ind* is an indicator variable that equals one if the target firm is located in the United States. The SPAC may search for a target firm anywhere in the world. *Same_geo_Ind* is an indicator variable set to one if the target search is confined to the IPO geography. *Canceled_trg_Ind* equals one if the

[19] The top seven underwriters are Goldman Sachs, Morgan Stanley, JP Morgan, Citigroup, Barclays, Credit Suisse, and Deutsche Bank (Wei, 2023).

[20] The top seven underwriters are Goldman Sachs, Morgan Stanley, JP Morgan, Citigroup, Barclays, Credit Suisse, and Deutsche Bank.

SPAC had a target company it had announced a combination with but then subsequently terminated. We find that 41.3% of SPACs found targets from the United States. China is a distant second for the next most popular target location (3.0%), followed by the United Kingdom (1.7%). Interestingly, only 5.5% of SPACs came from the same region of their target firm. We find that 17.1% of SPACs had a terminated deal (i.e., their annouced merger proposal fell through).

Additionally, we control for external market conditions as such conditions may influence the success of the SPAC's search for a target firm. Market return data is downloaded from CRSP. We construct the variable *SP_mean* to represent the return of the S&P 500 Composite Index during the period from the SPAC's IPO date and the closing or liquidation date. We downloaded historical CBOE VIX Index data from the Chicago Board Options Exchange site. The variable *VIX_mean* is the mean of the monthly closing price of the Cboe VIX Index for the period between the SPAC's IPO and its closing or liquidation date.

4.2. Corporate Governance Control Variables

We include a battery of control variable for corporate governance practices. We downloaded information on insider ownership from 13F filings from Capital IQ WRDS. For each SPAC, we record its institutional ownership from the most recent quarter's 13F filing before its target firm combination date. Furthermore, we read each S-1 or prospectus for our sample of SPACs with completed mergers to gather information on whether the SPAC's CEO is also the Chairperson of the board, the proportion of the board's make-up by insiders, whether the CEO is a woman or not, and the proportion of the board that is made up by female members. As Panel C from Table 2 shows, the average institutional ownership in SPACs before combining with the target firm is 26.4%. On average, 37.7% of the board is made up of insiders. The vast majority of CEOs are men. Only 2.2% of CEOs in our sample are women. For average board, 13.1% of its members are female. Finally, 43.6% of CEOs in our sample hold the dual role of Chairperson of the board of directors.

4.3. Description of deSPAC Sample

While duration analysis allows us to use the full sample to estimate the hazard function, we next consider the sample of SPACs that successfully completed a business combination in order to analyze deSPAC performance. We test the deSPAC operating performance one year after the business combination date and two years after the business combination date. Table 2 Panel A presents the summary statistics of the primary variables used in our empirical analyses. All financial variables are sourced from Compustat. We winsorize accounting variables collected from Compustat at the 5% and 95% levels to minimize the impact of outliers on our results.[21] While there are a total of 625 SPACs that successfully completed a business combination, only 457 SPACs report first year return on assets (ROA) data (in Compustat). This disparity is primarily driven by both SPACs which are listed on OTC exchanges and a small number of recently merged SPACs. Panel A shows that the average first year ROA for deSPACs is negative at −31.5%. Panel B displays the summary statistics of key financial variables for the second year of the deSPAC.

In our sample, the average book-to-market ratio is low for both year 1 and year 2. Gahng et al. (2023) notes that prior to 2021, firms that went public via SPACs had higher median sales and were older than firms that went public via a traditional IPO. These trends were reversed during the SPAC wave in 2021. Consistent with Gahng et al. (2023), we find in our sample of SPACs that completed business combinations before 2021 that the mean book-to-market ratio is 0.012 while the mean book-to-market for SPACs that combined in 2021 and later to be −0.001. This is a statistically significant difference ($t = 2.209, p = 0.028$). Tangibility and leverage are all scaled by the total assets of the combined firm. Tangibility measures the amount of tangible assets the combined firm has relative to its total assets. The mean tangibility ratio is 0.224 in the first year and 0.247 in the second year. The leverage ratio is 0.297 in the first year and 0.343 in the second year.

[21] An alternative treatment of outliers is included in Internet Appendix C.5 for robustness.

4.4. Contingency Clause Data

We hand collect contingency clause information from SPAC IPO prospectuses for SPACs which successfully merge with a target firm. These contingency clauses are binding agreements that impact the profit/incentives of managers and sponsors. Notably, these contingency clauses are often reiterated in the deSPAC merger agreements, along with similar clauses that also restrict the profit/incentives of the private (target) firm owners. Though additional contingency clauses which restrict sponsors may infrequently appear in merger agreements, we focus primarily on those that appear in IPO prospectuses. This distinction allows us to examine how these clauses influence managers' choice to merge over the lifecycle of the SPAC, as the prospectus clauses are known to both shareholders and managers throughout the search process. We identify six important categories of contingency clauses: warrant lockups, share lockups, earnout forfeitures, warrant exercise price changes, make-whole provisions, and forward purchase agreements. Table 3 presents basic descriptive statistics on these six clauses.

Warrant Lockup Clause

Warrant lockup clauses define a period during which the holders of SPAC warrants (IPO investors and sponsors) are not allowed to exercise their warrants. The purpose of this restriction is to prevent early investors from flooding the market with shares immediately after the merger, and thus potentially negatively impacting the share price of the newly combined firm. Warrant lockups are designed to align the interests of these early investors with the long-term success of the company. Investors who keep their warrants can benefit from any potential appreciation of the stock price. The vast majority of deSPACs, over 85%, have warrant lockups in their prospectuses. Nearly all SPACs with a warrant lockup period have a 30-days post merger date, with only one exception with a 180-day lockup period.

Share Lockup Clause

The founder share lockup clause establishes a restriction period after the SPAC completes its business combination, during which the founders and sponsors of the SPAC are prohibited from selling or transferring their shares. In certain cases, the lockup period may be shortened if specific conditions are met, such as when a share price hurdle is exceeded for a sustained period of time. Most lockups persist for one year, and carry an earnout exception which releases shares from lockup if the share price exceeds $12/share 20 out of any 30 consecutive trading days. Share lockup clauses prevent founders/sponsors from immediately cashing out their shares post merger, incentivizing them to focus on creating sustained value for the deSPAC firm. As nearly every SPAC contains a share lockup clause (and those without have an earnout forfeiture clause which effectively serves the same purpose), we segment lockups based on their length ($\geq$ 1 year vs. $<$ 1 year) in our analysis. From Table 3, 78.4% of deSPACs in our sample had 1 year (or longer) share lockup clauses contained in their IPO prospectuses.

Earnout Forfeiture Clause

Under the earnout forfeiture clause, certain shareholders will lose or forfeit a portion of their shares if the newly merged company does not meet specific performance targets. In our data collection, we focus only on the earnout forfeiture clauses that specify shares of the sponsor that will be forfeited given that the combined firm does not reach the performance targets. Earnout forfeiture clauses are designed to restrict the payout of sponsors, contingent on the long-term success of the newly merged firm. Like share lockups, earnout forfeitures also prevent sponsors from immediately profiting from the merger. Only 4.2% of the sample of completed SPACs contain an earnout forfeiture clause in the IPO prospectus.[22]

[22]The percentage of sponsor earnout forfeitures in merger agreements is slightly higher. However, most merger agreement earnout forfeitures concern the private firm (target) owner shares.

Warrant Exercise Price Change Clause

The warrant exercise price change clause, when triggered, lowers the exercise price of warrants. These clauses are anti-dilutive in nature, and are triggered when managers issue more shares (as merger compensation to the private firm owners) at a low price. The low-price threshold is typically $9.20 and is only triggered if a certain percentage of new shares are issued (often an additional 50%-60% of IPO shares). If these conditions are met, the exercise price is adjusted downward based on the price of the newly issued shares (e.g., the new exercise price is 115% of newly issued share price). This discourages excessive and value-destroying dilution of the SPAC shares in pursuit of bad merger deals. These clauses also adjust warrant redemption hurdles if applicable (see, e.g., the make-whole clause), which may also limit the value of the warrants. 65% of the sample contains warrant exercise price change clauses (68% of SPACs that issue warrants).

Make-Whole Clause

The make-whole clause is a call provision specifying a share price range (always $10-$18) at which warrants may be "called" at the discretion of the firm. The call forces warrant holders to redeem their warrants (on a cashless basis) for a specified number of shares (determined by a warrant redemption table which may be found in the prospectus). This feature (borrowed from callable bond contracts) effectively restricts the time-value of the warrants and imposes an upper limit the implied volatility of the warrant option (as it becomes advantageous for the firm to call at volatilities higher than those inferred from the static redemption table). This feature restricts profits of warrant holders, making the deSPAC share performance relatively more important for both IPO investors and sponsors. 34% of the sample contains make-whole clauses (35% of SPACs that issue warrants).

Forward Purchase Agreement Clause

The forward purchase agreement is a contractual arrangement in which founders/sponsors commit to purchasing a specified number of shares on the day of merger consummation at a price of $10/share. These agreements provide additional promised capital which helps ensure the SPAC will have enough funds to complete the business combination, offsetting potential redemptions by public shareholders. As opposed to backstop agreements, the forward purchase shares must be purchased regardless of the SPAC's capital needs at the time of merger. These forward purchase shares are often subject to share lockups (specified in the merger agreement). Forward purchase agreements force sponsors to invest significant equity in the merged firm at the SPAC's base price ($10/share), clearly disincentivizing bad deals. Nearly 15% of sponsors enter forward purchase agreements at the time of IPO.

5. Methodology: Identifying Late-Mergers

In this section, we outline the methodology used to analyze the duration until a SPAC merges with a private firm. Duration analysis, which involves highly non-linear models, is employed as traditional regression methods are not suitable; instead of conditional means, our focus is on estimation of the probability of certain events. Economists have used this technique to investigate the length of commercial strikes, the length of an individual's unemployment, the time from inception to the dissolution of a business, the interval between recurring consumer purchases, the elapsed time between the purchase of a durable good and the use of a warranty on that good, etc.[23] Our empirical conclusions are primarily based on maximum likelihood estimates, focusing on the hazard rate, $h(d)$, which is directly inspired

[23] See for instance, Suárez and Utterback (1995); Baumöhl et al. (2019); Audretsch and Mahmood (1995) for the application of duration analysis to the survival of the firm. Cumming et al. (2014) use a Cox Proportional Hazard model to analyze the time between the SPAC target announcement and merger approval vote. Giot and Schwienbacher (2007); Cumming et al. (2017) are studies that apply duration analysis for venture capital exits. Harman and Zuehlke (2004) uses duration dependence to study asset pricing bubbles. Finally, see Katz and Meyer (1990) for a discussion on the relationship between unemployment duration and unemployment benefits and Glennon and Nigro (2005) for a study measuring the default risk of small business loans using duration analysis.

by the hazard rate results in Proposition 3.2 and Proposition ??. Crucially, this duration analysis provides us a means by which we can identify which SPACs merge late, using a more rigorous and theoretically grounded method than "time to liquidation deadline." In more detail, using the extensive sample of merged, searching, and liquidated SPACs, we are able to estimate hazard ratios for each SPAC which are conditional not only on this time to liquidation deadline, but also on a variety of relevant SPAC/market variables.

The hazard function, $h(d)$, is defined as the conditional probability of a SPAC merging in a small interval $[d, d + \Delta d]$ given it has remained unmerged up to time d. Formally, for a random time to a SPAC merger D, we define the probability density function $f(d)$ and the cumulative distribution function $F(d) = \text{Prob}(D \leq d)$. The survivor function is $\overline{F}(d) = \text{Prob}(D > d) = 1 - F(d)$. Thus, the hazard function is given by:

$$h(d) = \lim_{\Delta d \to 0} \frac{F(d + \Delta d) - F(d)}{\Delta d\, \overline{F}(d)} = \frac{f(d)}{\overline{F}(d)}. \tag{8}$$

Given the right hand side of Equation 8, $h(d)$ can be interpreted as instantaneous likelihood that a SPAC will successfully merge given it has not consummated a deal up until "d". The observations consist of a cross-section of SPAC durations, $d_1, d_2, d_3, \ldots, d_n$, where the d_i's may have different calendar time starting points. We collect data on the time from SPAC origination to termination.

We adopt the commonly-used Weibull distribution characterize our survival function for our empirical tests (based on goodness of fit, see Section 6). The Weibull survivor function is ($\overline{F}(d) = e^{-(\gamma d)^p}$, where γ is the scale parameter and p is the shape parameter. This gives the cumulative $F(d) = 1 - e^{-(\gamma d)^p}$ and the PDF $f(d) = p\gamma e^{-(\gamma d)^p}(\gamma d)^{p-1}$, yeilding the hazard function:

$$h(d) = p\gamma(\gamma d)^{p-1}. \tag{9}$$

SPACs with increasing hazard functions which increase in "d" have positive duration dependence, indicating that the likelihood of merging increases over time (i.e., $h'(d) > 0$). Conversely, decreasing hazard functions indicate negative duration dependence (i.e., $h'(d) < 0$).

In practice, SPAC data includes both merged and unmerged observations, necessitating the inclusion of censored data in the analysis. Our censored observations include both liquidated SPACs and SPACs which have completed their IPOs but have yet to either find a merger partner or be liquidated at their expiration date. These *liquidated* and *searching* SPACs influence the hazard function as they have indeed *survived* from their IPO date to their liquidation date or our data collection date, despite their lack of resolution.

We also include various economic determinants in our model, which are reflected in the scale parameter as $\gamma_i = e^{-x_i\beta}$, where x_i is a vector of economic variables characterizing the i-th SPAC, and β represents the impact of each variable. We follow the process outlined by **?** for implementation. This leads to the maximization of the following log-likelihood function

$$\ln L(\beta, \sigma|\text{data}) = \sum \left[\phi_i \left(\frac{\ln d_i - x_i'\beta}{\sigma}\right) - \phi_i \ln \sigma - \exp\left[\frac{\ln d_i - x_i'\beta}{\sigma}\right]\right], \tag{10}$$

where $\phi_i = 1$ if the SPAC has merged and $\phi_i = 0$ if it has been censored. We detail the derivation of Equation 10 in Internet Appendix C.1. This form is consistent with censored-data likelihood functions described by **?** and **?**. From this, we can obtain estimates for the Weibull parameters and produce the estimated hazard ratios for each SPAC i. These hazard ratios are used in subsequent analysis as our primary measure for late-merging SPACs.

6. Empirical Results

In this section, we present our empirical analyses of SPAC and deSPAC performance, focusing on the likelihood of mergers and the outcomes of deSPACs. Our theoretical model suggests that agency costs can be exacerbated as the liquidation deadline approaches. If this misalignment of incentives influences the behavior of SPAC managers then it should be revealed by the data. In particular, Proposition 3.2 predicts that if managers are lowering the threshold of m as the SPAC's expiration looms then the likelihood of a merger and the threat of a low-quality deSPAC both become elevated, which would be documented by $h'(d) > 0$. On the other hand, conscientious individuals and their organizations often work harder when faced with imminent deadlines. This enhanced effort could also explain higher $h'(d)$s near SPAC expiry, thus performance outcomes become a relevant margin for detailing the effect.

6.1. *Duration Analysis and Late-Merging Performance*

Hazard functions are essential for understanding the likelihood of SPAC mergers over time. We compared multiple duration models and found that the Weibull distribution best fits our data, with a log-likelihood of -857.717 (see Table 4).[24] A comprehensive test of the legitimacy of our estimated coefficients, which are interpreted as hazard ratios, is provided by the likelihood ratio (LR) test. Formally, let $L(\tilde{\beta}, \tilde{\sigma}^2)$ represent the maximum of the log-likelihood when the restrictions of the null hypothesis ($x'\beta = 1$) are imposed, and let $L(\hat{\beta}, \hat{\sigma}^2)$ represent the maximum of the log-likelihood function without these restrictions. Asymptotically, the LR test statistic is given by:

$$-2\left[L(\tilde{\beta}, \tilde{\sigma}^2) - L(\hat{\beta}, \hat{\sigma}^2)\right] \sim \chi^2_m$$

where m denotes the degrees of freedom. A realization of the LR statistic close to zero suggests that the model's estimated coefficients explain very little of the behavior of the dependent variable. In our case, the LR statistic of 993.2 significantly exceeds the 99.9% critical value of 78.7 for 44 degrees of freedom, rejecting the null hypothesis and confirming the explanatory power of our model.

We implement the duration analysis described in Section 5, estimating the hazard func-

[24] On the basis of the log-likelihood function, the other distributions evaluated that were judged to be inferior to the Weibull (and ultimately discarded) include inverse normal, log-logistic, Gompertz, lognormal, and generalized gamma.

tion given as $\hat{h}_i(d) = \hat{p}e^{-x_i'\hat{\beta}}(e^{-x_i'\hat{\beta}}d)^{\hat{p}-1}$. Table 4 documents an estimate for $\hat{p}$ for our full sample, which represents 1,231 SPACs between 2009 and 2024. Variable definitions and data source information may be found in Appendix A. The estimate for $\hat{p}$ is statistically significant with a realization of 2.113. A $\hat{p} > 2$ means that as the time to SPAC maturity falls, the likelihood of a new business combination increases at an increasing rate. Figure 1 plots the average hazard function for the full sample of SPACs based on this estimate. The positively sloped figure shows slight convexity and demonstrates that a disproportionate number of mergers occur late in the SPAC's term of existence.

Given that $h'(d) > 0$, we next examine the relationship between hazard ratios and deSPAC success. The predicted hazard ratios are unique to each SPAC and their individual parameters influencing the duration analysis. These provide a better measure of the "lateness" of merging, as it conditions this lateness on several relevant predictive economic variables in a highly non-linear model. Thus, we use these hazard ratios to determine whether this documented positive duration dependence is an artifact of managers reducing m in the face of the liquidation deadline (as predicted by Proposition 3.2).

We begin by calculating unconditional cumulative abnormal returns (CARs) surrounding the merger announcement dates over several event day windows to provide a baseline. Table 5 shows that the average CARs for our sample of deSPACs are positive across all event windows with an announcement effect of around 5%. The asset pricing model used for calculation is the Carhart four-factor model with an estimation window of up to 100 days. We require a minimum number of three observations to estimate the CARs.[25] We share Dimitrova (2017)'s interpretation of positive event window CARs: "A positive CAR does not necessarily indicate the SPAC acquisition was a good one. The SPAC deal may still be value destroying, but not as value destroying as the market expected (Dimitrova 2017, pp. 107)."

[25]Longer estimation windows and stricter estimation restrictions do not materially impact the estimated CARs (though they would limit our sample size), as pre-announcement SPAC returns are extremely stable given the redemption option.

We then consider the impact of late-merging, as measured by the predicted hazard ratios. We again estimate CARs around three different event windows, each using the Carhart four factor asset pricing model (Carhart, 1997). In all our linear regression analyses, we include firm-level control variables obtained from Compustat and hand-collected corporate governance variables. For newly merged firms, we control fo the ratio of debt to total assets, the ratio of property, plant, and equipment to total assets, and the market return (S&P 500). We also control for several relevant SPAC characteristics, including he percentage of public SPAC shares redeemed, a domestic (US) indicator, and a *Same_geo* indicator (if intended target geography is same as IPO geography). Additionally, we control for corporate governance characteristics, including whether the SPAC's CEO is the same as the board's Chairperson, the proportion of institutional ownership from the latest quarter's 13F filings, the proportion of insiders on the SPAC's board, whether the SPAC's CEO is a woman or not, and the proportion of the SPAC's board members who are female. See Appendix Table A.1 for variable definitions. To account for time-specific shocks and time-invariant industry unobservable characteristics that may affect our OLS estimation, we include industry-fixed effects and year-fixed effects. We cluster robust standard errors at the target industry level. Our regression model takes the general form of

$$Outcome_i = \beta_0 + \beta_1 Hazard\_90th\_Ind_i + X_i'\Gamma + \eta_{ind} + \eta_t + \epsilon_i \tag{11}$$

where our variable of interest, $Hazard\_90th\_Ind$, is a dummy variable equal to 1 if the SPAC merges with a hazard ratio in the tenth (highest) decile.[26] We include controls, X_i' (as detailed above), target industry fixed effects, η_{ind}, and year fixed effects, η_t.

This CAR specification confirms the results of Dimitrova (2017); late-merging SPACs perform worse than their earlier-merging counterparts. Table 6 presents the CARs (condi-

[26]The hazard function for each SPAC is computed according to $\hat{h}_i(d) = \hat{p}\hat{\gamma}(\hat{\gamma}d)^{(\hat{p}-1)}$ (see Equation 9) where $\hat{p}$ is a consequence of minimizing the $\ln L(\beta, \sigma|\text{data})$ and has a statistically significant realization of 2.113 (see Table 4). The estimate for $\hat{\gamma}$ is given by $e^{-x_i'\hat{\beta}}$ with each SPAC$_i$ being customized by the product of the row and column vector, $x_i'\hat{\beta}$. The $\hat{h}_i(d)$ attached to each deSPAC is ranked according to its magnitude and then segmented into deciles with the largest hazard ratios sorted into the tenth decile.

tional on the control variables specified above) at different event windows around the SPAC's announcement of a target firm. The coefficient for $Hazard\_90th\_Ind$ is consistently negative (-4% to -8%) and significant across all three event windows, confirming that the poor performance of late-merging SPACs persists through the recent surge in SPAC activity.

6.2. The Impact of Contingency Clauses

In this section, we now consider changes in SPAC contracts as a possible source of heterogeneity that may impact both the SPAC hazard function and deSPAC performance. The SPAC formation process is characterized by the IPO prospectus, containing contractual clauses (contingency clauses) that influence the structure and payout to all SPAC stakeholders. Such clauses include warrant lockups, share lockups, earnout forfeitures, warrant exercise price changes, make-whole provisions, and forward purchase agreements. Section 4 describes each of these contingency clauses and the collection process.

Some prospectuses contain what may be called "boilerplate" contingency clauses. The terms of these clauses do not vary significantly and are often copied word-for-word from previous SPAC offerings. Other SPACs enjoy a wider and more unique variety of contingency clauses. The number of contingency clauses in IPO prospectuses ranges from 0 to 6 (of the 6 clauses identified), with an average of slightly less than 3. To perform initial tests, we create indicator variables, CC02_Ind for SPACs with zero, one, or two clauses and CC3+_Ind for those with three or more clauses.

To answer our research question concerning the types of contracting mechanisms can ameliorate agency costs, our next set of analyses investigate the role of contingency clauses in reducing the documented poor performance of late-merging SPACs. Column (1) of Table 7 shows duration analysis results for the subsample SPACs that merged with minimal contingency clauses, indicating significant positive duration dependence with a $\hat{p}$ estimates of 3.346. Column (2) shows duration analysis results for the subsample of SPACs which merged with multiple contingency clauses, indicating a significant positive $\hat{p}$ of 2.573. Figure 2 depicts these representative hazard functions. The red dotted line depicts the hazard function for SPACs with three or more contingency clauses in their prospectuses, while the blue solid line depicts the hazard function for SPACs with two or fewer contingency clauses. Notably, the hazard function characterized by more contractual provisions is remarkably less convex compared to the hazard function representing SPACs with fewer provisions. This supports the idea that when managers are subject to more contingency clauses they work actively throughout the life of the SPAC to find a target company, while unconstrained managers make a "last ditch" effort to find a merger partner.

We then test if these clauses are priced in merger announcement returns for late-merging SPACs. We regress CARs on a constructed continuous variable, *CC_Count* $\in [0, 6]$, which represents the number of contingency clauses that appear in the SPAC's IPO prospectus. Table 8 presents the results of this specification. Crucially, we observe that the non-interacted contingency clause variable is not performative. However, the interaction between *CC_Count* and *Hazard_90th_Ind* is positive and significant for both the 3-day event window (Column 1, 95% confidence level) and the 7-day event window (Column 2, 95% confidence level). The coefficients of 0.022 ([-1,+1] window) and 0.023 ([-3,+3] window) can be interpreted roughly as an additional 2% announcement return for each added contingency clause for late merging SPACs. These results imply that the prevalence of contingency clauses mitigates agency costs associated with merging close to the liquidation deadline. The interaction coefficient is insignificant for the [-10,+10] event window.[27]

6.3. *Contingency Clause Horse Race*

Next, we attempt to isolate the specific clauses that are the most effective in aligning the interests of managers and investors. To this end, we conduct a "horse race" to determine which clauses are impactful. We repeat the same analysis conducted in Table 8 on the [-1,+1] event window, replacing the variable of interest, *CC_Count*, with individual clauses

[27] The [-10,+10] window estimations suffer from noise due to conflicting events (primarily new information released post-announcement).

and every feasible combination of two or three clauses. Table 9 presents a matrix that shows the coefficients for the interaction term between the tenth decile hazard indicator and all combinations of two (of the six identified) contingency clauses. The diagonal of the matrix represents the interactive impact of each single clause (with *Haz_90th_Ind*). The diagonal displays positive coefficients, none are statistically significant. For combinations of two, we find two pairs of clauses are most effective: (i) the forward purchase agreement clause paired with the warrant exercise change clause and (ii) the forward purchase agreement clause paired with the make-whole clause. Both are significant at a 95% confidence level, with abnormal returns of 8.1% and 7.5%, respectively.

We then consider combinations of three contingency clauses. Of the 20 unique combinations, only five specifications yield an interaction coefficient that is significant at the 95% confidence level. Presented in Table 10, these combinations are: (i) warrant lockup, warrant exercise change clause, and forward purchase agreement (8.1%**), (ii) warrant lockup, make-whole provision, and forward purchase agreement (7.5%**), (iii) share lockup, warrant exercise change clause, and forward purchase agreement (7.4%**), (iv) share lockup, make-whole provision, and forward purchase agreement (7.5%**), and (v) warrant exercise change clause, make-whole provision, and forward purchase agreement (9.5%**). Notably, every single one of these combinations includes a forward purchase agreement. Also, every combination has either a warrant exercise price change clause or a make-whole provision, and the statistically (and economically) strongest combination contains all three.

The strongest combination of three contingency clauses (warrant exercise change, make-whole, and forward purchase) is tested against all three CAR event windows in Table 11. As in the previous specifications, this contingency clause combination only impacts CARs for late merging deSPACs in the highest hazard decile (i.e., the non-interacted clause term remains insignificant). The interaction coefficient of 9.5% (for the [-1,+1] window) grows to 11.0% for the [-3,+3] window, though it becomes insignificant for the [-10,+10] window. The magnitude of these coefficients is also greater than the negative effect of late merging (the

Hazard_90th_Ind coefficients), providing some evidence that late merging SPACs that are heavily protected by the correct contingency clauses actually perform slightly better than similar SPACs which merge earlier.

Regardless of the specification, forward purchase clauses are highly performative when paired with other contingency clauses which curtail the value of warrants. The pre-commitment of sponsors to purchase a large equity stake at $10/share creates an obvious alignment of their interests with those of equity holders, consistent with the equity-alignment channel discussed in Section 3.[28] The importance warrant exercise change provisions and the make-whole provisions is more subtle. These impact the value of warrants, both public warrants and warrants held by sponsors (if applicable).

As discussed previously, SPAC warrants are effectively call options which become very valuable in the event the SPAC merges. Thus, warrants give IPO investors incentives to a) vote to approve proposed merger combinations and b) abstain from redeeming their shares (as a critical mass of redemptions may kill a proposed merger). This behavior allows managers to push through bad mergers, which are detrimental to regular equity holders (those that do not also hold warrants). For example, make-whole clauses clearly limit the value of warrants (see Section 4), as the call option of the firm restricts their time value and the associated redemption table puts an upper limit on their implied volatility. It is, therefore, intuitive that limited warrant value makes IPO unit investors (holding both equity and warrants) more sensitive to equity performance, indicative of the warrant-curtailment clause channel described in Section 3).

Warrant exercise price change provisions are anti-dilutive in nature, but their impact on the value of warrants is less clear. In one respect, they lower the exercise price when the clause is triggered, which makes warrants more valuable. However, this also lowers the redemption price hurdles found in make-whole provision (as well as any non-make-whole redemption hurdle), which clearly limits warrant value. Either effect may be restrictive for

[28]In the context of our model, forward purchase agreements both lower ϕ (unconditional sponsor rents), by requiring sponsors to bear the cost of the purchase, and increase β by increase deSPAC equity exposure.

sponsors, through both the equity alignment channel (dilution of sponsor stake) and warrant curtailment channel (via mechanical price-hurdle effect). A cursory search through completed SPAC deals reveals no instances in which this clause is triggered, which is consistent with this interpretation.

6.4. Other Measures

Given these warrant-related results, we next examine the relatively small proportion of SPACs that do not issue warrants in their IPO units. Of the 625 completed SPACs in our sample, 34 did not issue warrants (5.44% of the sample). Table 12 details the impact of *No_Warrants_Ind* on announcement returns. Late merging SPACs with no warrants have higher announcement returns, with positive and significant interaction coefficients for all three event window specifications. However, unlike with other contingency clauses, the incidence of no warrants appears to have a negative and marginally significant effect on announcement returns for non-late-merging SPACs. Thus, while the presence of warrants may indeed be detrimental when agency costs are high (i.e., late merging SPACs), their absence from SPAC contracts is not necessarily beneficial on average. Given this and the limited sample of no-warrant SPACs, we refrain from making conclusory interpretations based on this result.

We also examine the operational performance of SPACs post-combination. Table 13 documents the impact of contingency clauses on deSPAC ROA. We include two additional accounting controls in this analysis, controlling for the tangibility of assets and leverage ratio of the deSPAC firm. We exclude firms with total assets under $5 million (6 observations), and winsorize accounting variables at the 5% level to limit the impact of outlier observations. Column (1) tests year 1 deSPAC performance and column (2) test year 2 deSPAC performance. Our results are consistent with the earlier CAR results. Notably, the coefficients for *CC_Count* are insignificant for both one and two years after the SPAC completes its business combination. Importantly, however, the interaction between *CC_Count* and the tenth decile hazard function indicator, $Hazard\_90th\_Ind$, is highly predictive of ROA. Late merging SPACs that merge under the protection of additional contingency clauses enjoy a 18.9% higher year 1 ROA (significant at a 90% confidence level) and a 21.3% higher year 2 ROA (significant at a 99% confidence level). This mitigates the adverse effects of merging late (which is captured by the non-interacted *Hazard_90th_Ind* in columns 1 and 2). The non-interacted *Hazard_90th_Ind* coefficient in columns 1 and 2 is negative and significant, implying that the negative effects of merging late are driven almost entirely by firms without binding contingency clause protections. While ROA is a noisy measure of profitability (especially for young, newly-listed, firms), these descriptive empirical patterns mirror our earlier event-study results.

Taken together, our empirical results give credence to the strength of our duration analysis (see Figure 1 and Figure 2). Highly convex hazard functions (representing those SPACs without contingency clauses) provide a visual representation of agency costs of late merging SPACs without adequate contingency clause protection, costs which are confirmed by our analysis of merger announcement returns and deSPAC ROA. Conversely, the incidence of multiple contingency clauses lessens this convexity from the hazard functions and manifests positive announcement returns and deSPAC performance compared to other late-merging SPACs. This is consistent with the hypothesis that late merging SPACs without the protection of binding contingency clauses underperform, driven by managers lowering M^* in the face of their liquidation deadlines. Crucially, it is not the mere presence (or lack thereof) of contingency clauses that explain performance, but rather their interactions with the timing of the merger relative to the SPAC expiration deadline. This presents an intuitive interpretation of the results: SPAC contingency clauses only matter when agency costs are high, representing a potentially relevant margin for regulation of SPACs.

7. Conclusion

Our study sharpens the role of approaching maturity deadlines on SPAC managers' decision-making processes and the resulting quality of the combined firms. Our target acquisition model demonstrates that aspects of the SPAC design–sponsors' compensation which is contingent on merging before a liquidation deadline–lead to managers lowering the minimum acceptable value of the target firm. We use duration analysis to document that as SPACs near their maturity deadlines, the probability of completing a merger increases at an accelerating rate. The convex hazard function (depicting the probability the SPAC finds a merger partner as the deadline approaches) provides a visual representation of agency costs which plague late-merging SPACs.

We confirm that the poor announcement returns for late-merging SPACs documented by Dimitrova (2017) persist in a modern sample. Then, using a novel hand collected dataset, we find that this poor performance is driven by SPACs with inadequate contractual protections. We show that contingency clauses which appear in the SPAC IPO prospectuses can mitigate the agency costs associated with merging late, while late-stage mergers without binding contingency clauses tend to underperform significantly. Each additional contingency clause in the SPAC's prospectus leads to a more than 2% increase in the SPAC's CARs, but only for late-merging SPACs; the prevalence of contingency clauses for non-late-merging SPACs does not significantly impact announcement returns. This implies that certain contingency clauses matter only when SPACs merge late, when managers are most incentivized to act against shareholders' interests.

This matters from both an academic and regulatory viewpoint. First, we identify heterogeneity in the perviously documented poor-performance of late-merging SPACs, showing it is not uniform and is driven primarily by SPACs lacking certain contractual provisions. This allows for a more nuanced perspective about the value and costs of SPACs as a useful alternative to traditional public listing: while many SPACs are regarded as as mechanisms for grift, tools exist which can limit (or even eliminate) this. From a policy perspective, we provide regulators specific insight into which tools are most effective towards this end. This is especially important, as the role of SPAC managers as agents of equity shareholders is befuddled by the existence of SPAC warrants and the structure of sponsors' payout.

Our findings contribute to the literature on SPACs by documenting the critical role of contingency clauses in SPAC IPOs. Contingency clauses which curtail the value of warrants reduce agency costs for late-merging SPACs, as IPO unit investors (warrant holders and shareholders) become less likely to approve low-quality deals. Likewise, contingency clauses which increase the equity cost or exposure of sponsors/managers also raise the quality standards of managers. Our event study analysis reveals the most effective provisions to be combinations of warrant exercise price change clauses, make-whole provisions, and forward purchase agreements. Notably, all effective combinations of clauses all include a forward purchase contract. Forward purchase clauses, which both increase exposure and the cost (at the margin) of sponsors' equity, are consistently effective when combined with other contingency clauses that reduce the value of public warrants, such as the make-whole and warrant exercise price change clauses.

We also find that the post-merger operational performance for the combined SPACs suffer without the presence of contingency clauses. Late-merging SPACs with minimal contingency clauses protection suffer a first year ROA 18.9% lower than their late-merging peers that have more contingency clauses. This under-performance extends to the second year of operating performance, where the ROA for late-merging SPACs with fewer binding provisions are 21.3% lower than SPACs with multiple contingency clauses in their prospectuses. These results demonstrate that the agency costs of merging late are driven primarily by SPACs without adequate contingency clause protection. Moreover, these contingency clauses are only performative when agency costs are high, as measured by elevated hazard rates as merger deadlines loom.

We are the first study to offer direct evidence that these provisions are instrumental in enhancing the performance of late-merging SPACs, by providing structural constraints that help maintain managerial discipline and align their interests with investors. Future research should investigate the long-term effects of these contingency clause provisions on the sustainability and growth of deSPAC firms, and provide a more comprehensive understanding of their role in SPAC transactions. Finally, examining other governance mechanisms that can complement contingency clauses in addressing agency problems in SPACs would be a valuable avenue to further inform SPAC policy.

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Fig. 1. Hazard functions: Full sample from 2009-2024

These figures show the hazard function implied by the duration analysis provided by Table 4. The hazard function is the likelihood the SPAC will merge at "d" given it has not found a new business partner up until that time. The x_i's were set at their sample mean value for each element of the vector x_i. The positively sloped and slightly convex curve suggests a disproportionate number of mergers were consummated near the end of the SPAC's life. Panel (a) provides $\hat{h}(d)$ if the new business produces operating income for at least one year. Panel (b) details $\hat{h}(d)$ for deSPACs that produced operating income for at least two years.

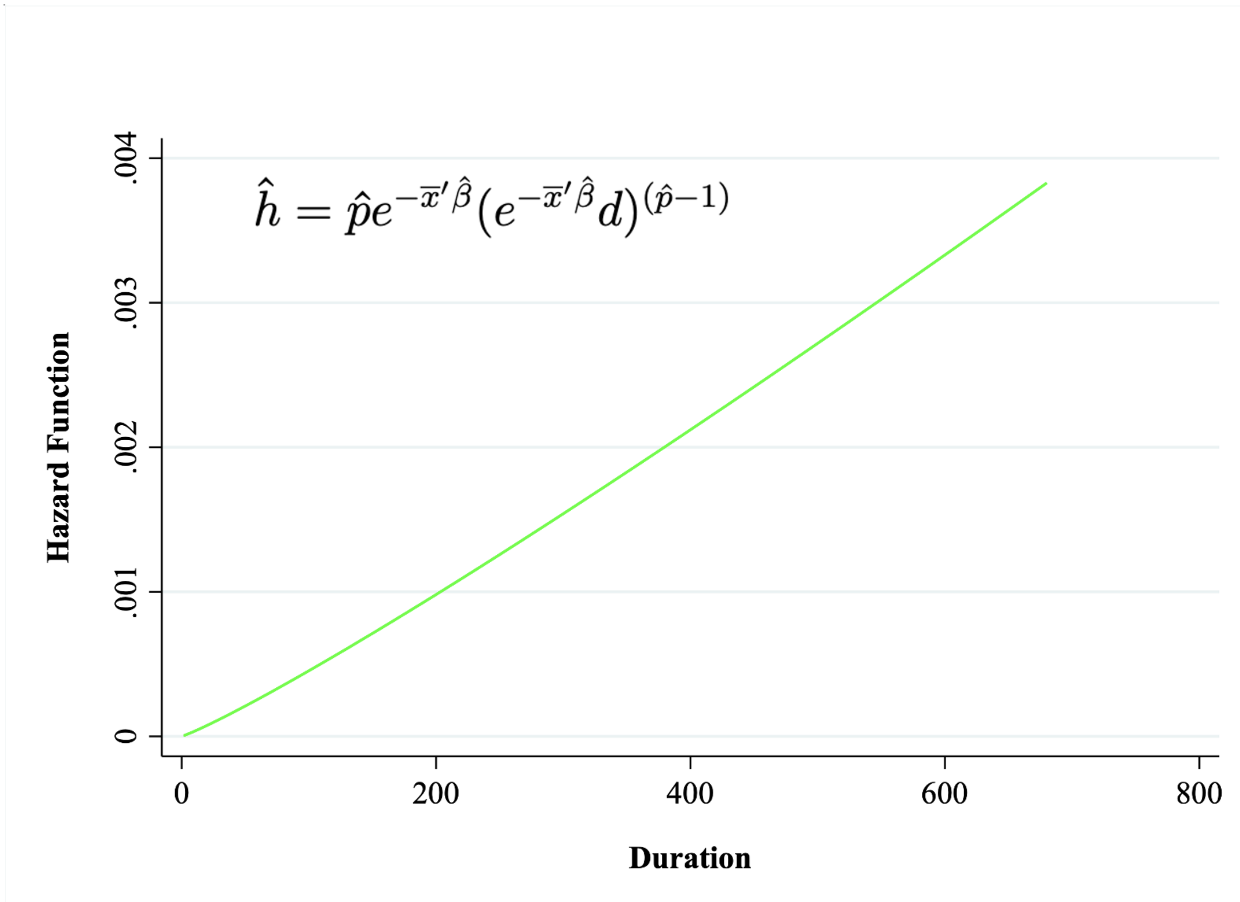

Fig. 2. Hazard functions by number of contingency clauses

This figure shows the hazard functions implied by the duration analyses provided by Table 7 Column (1) (zero, one, or two contingency clause(s)) and Table 7 Column (2) (three or more contingency clauses) for the full sample of deSPACs. The blue solid line plots the hazard function for the sample of SPACs with 0-2 contingency clauses in their prospectuses. The red dotted line plots the hazard function for the sample of SPACs with three or more contingency clauses in their prospectuses. The hazard function is the likelihood the SPAC will merge at "d" given it has not found a new business partner up until that time. For each of the hazard functions illustrated below, the x_i's were set at their sample mean value for each element of the vector x_i. Note that the hazard function is extremely convex for the sample of SPACs with completed mergers that had less than three contingency clauses.

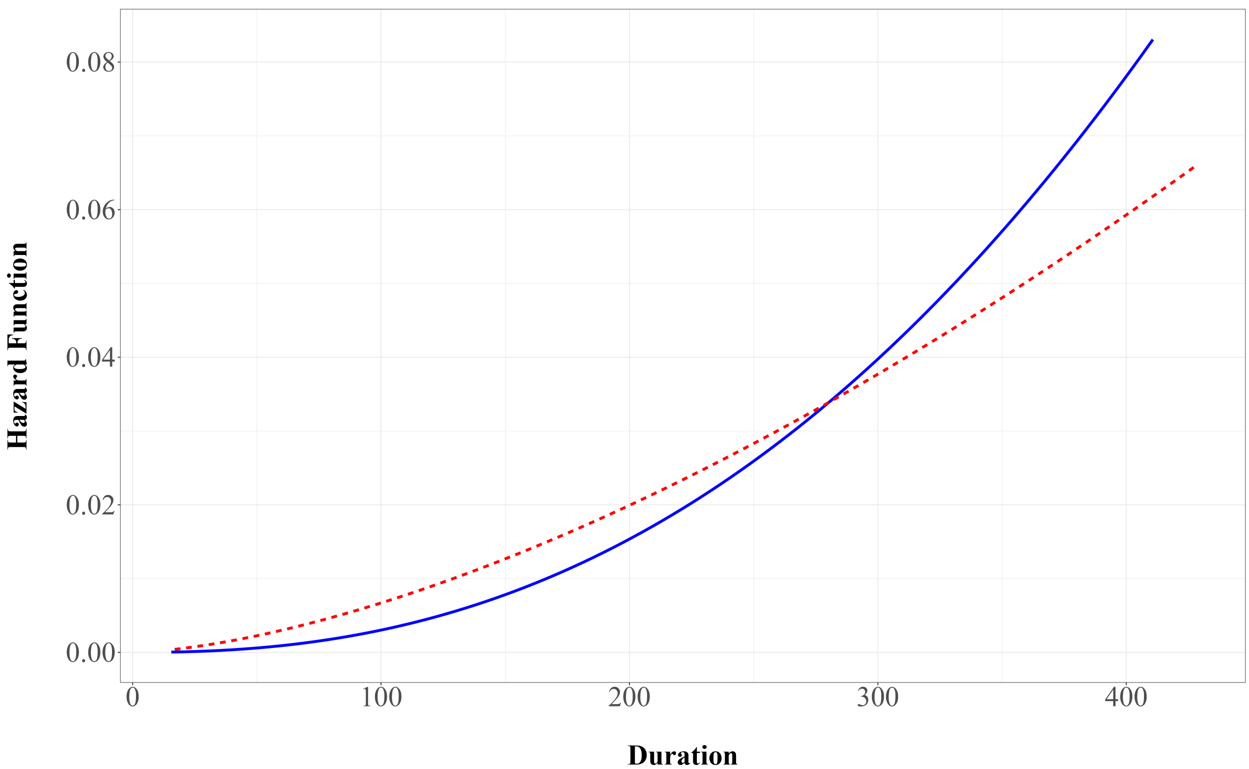

Table 1: Summary Statistics: SPACs

This table presents the descriptive statistics for our sample of SPACs. The total number of SPACs in all stages of the SPAC life span is 1,231. Detailed description of the data sources and calculation of all variables are provided in Section 4.

Panel A: SPAC Variables

	N	Mean	Median	St. Dev.	Min	Max
IPO Proceeds ($mm)	1231	229.517	200.000	194.513	16.500	4000.000
Counts	1231	0.894	0.000	1.803	0.000	14.000
Overallotment Proceeds ($mm)	1231	26.452	24.000	24.241	0.000	270.000
UW_Ind	1231	0.393	0.000	0.489	0.000	1.000
Redemption Percent	1231	0.532	0.700	0.417	0.000	1.000
Domestic_Ind	1231	0.413	0.000	0.493	0.000	1.000
Same_geo_Ind	1231	0.055	0.000	0.229	0.000	1.000
Canceled_trg_Ind	1231	0.171	0.000	0.376	0.000	1.000
VIX_mean	1231	20.773	21.441	2.962	11.450	33.312
SP_mean	1231	0.137	0.107	0.144	−0.221	0.750

Panel B: SPAC Status (as of Aug. 19, 2024)

	N	Proportion
Completed	625	0.508
Liquidated	402	0.327
Searching	103	0.084
Announced	101	0.082

Panel C: Market Value of deSPACs by Closing Year ($mm)

	MV		MV		MV
2011	22.024	2016	6599.125	2021	341 104.831
2012	178.391	2017	6525.716	2022	49 507.647
2013	1624.944	2018	8801.465	2023	34 776.336
2014	456.300	2019	13 389.429		
2015	1646.099	2020	157 002.043	**Total MV:**	621.636 (Billion)

Table 2: Summary Statistics: Key Financial Variables

This table presents the descriptive statistics for our sample of deSPACs. The total number of SPACs that have successfully completed the search for a target firm is 625. The number of deSPACs that have at least one accounting variable for the first (second) year of operation is 458 (364). Panel A presents descriptive statistics for the relevant financial accounting variables for the sample of deSPACs for the first year of operation. Panel B reports the descriptive statistics for the relevant financial accounting variables for the sample of deSPACs for the second year of operation.

	N	Mean	Median	St. Dev.	Min	Max
Panel A: Year 1						
ROA	458	−0.315	−0.156	0.479	−1.790	0.108
Book-to-market	455	0.001	0.013	0.013	−0.031	0.034
Leverage	456	0.297	0.196	0.308	0.000	1.000
Tangibility	447	0.224	0.107	0.263	0.004	0.900
S&P 500 Return	457	0.135	0.242	0.186	−0.194	0.296
Redemption Percent	457	0.609	0.760	0.369	0.000	1.000
Domestic	457	0.812	1.000	0.391	0.000	1.000
Same_geo	457	0.107	0.000	0.310	0.000	1.000
Panel B: Year 2						
	N	Mean	Median	St. Dev.	Min	Max
ROA	364	−0.295	−0.182	0.364	−1.291	0.086
Book-to-market	362	0.007	0.003	0.019	−0.028	0.064
Leverage	363	0.343	0.281	0.326	0.003	1.132
Tangibility	354	0.247	0.143	0.250	0.008	0.872
S&P 500 Return	363	0.032	0.095	0.213	−0.194	0.296
Redemption Percent	363	0.542	0.650	0.369	0.000	1.000
Domestic	363	0.826	1.000	0.379	0.000	1.000
Same_geo	363	0.116	0.000	0.320	0.000	1.000
Panel C: Corporate Governance Variables						
Instit_own	461	0.264	0.330		0.000	1.075
Insider_own	460	0.377	0.128		0.000	1.000
Fem_board_prop	460	0.131	0.158		0.000	1.000
Fem_CEO_Ind	461	0.022	0.146		0.000	1.000
CEO_Chairman	461	0.436	0.496		0.000	1.000

Table 3: Summary Statistics: Contingency Clauses

This table presents the descriptive statistics for our sample of the six contingency clauses that consistently appear in the SPAC IPO prospectuses.

	N	Mean	St. Dev.
Warrant_Lockup_Ind	625	0.854	0.353
Sponsor_Share_Lockup_Ind ($\geq$ 1 year)	625	0.784	0.412
Earnout_Forfeiture_Ind	621	0.042	0.200
Warrant_Ex_Price_Change	625	0.650	0.477
Make_Whole_Ind	625	0.336	0.473
Forward_Purchase_Ind	625	0.142	0.340

Table 4: Duration analysis for full sample: 2009-2024

This table presents the hazard ratios, $\hat{h}(d)$, for the determinants of SPAC's time to merger or until the SPAC's duration has been censored on the right-hand side. The hazard function is the likelihood the SPAC will merge at "d" given it has not found a new business partner up until that time. Standard errors are shown in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Full Sample
IPO Proceeds ($mm)	0.999
	(0.000)
UW_Ind	1.011
	(0.097)
Redeem_perc	2.197***
	(0.286)
Canceled_trg_Ind	0.268***
	(0.038)
Domestic	4.206***
	(0.425)
Same_geo	1.075
	(0.153)
Over Allotment Proceeds ($mm)	1.001
	(0.003)
VIX_mean	0.900***
	(0.023)
SP500_mean	0.857
	(0.286)
Counts	1.109***
	(0.022)
Industry FEs	Yes
Year FEs	Yes
$\hat{p}$	2.113***
	(0.066)
Log likelihood	-857.717
N	1,231

Table 5: Mean Values of CARs

This table presents the summary statistics for the cumulative abnormal returns (CARs) over various event windows surrounding the SPAC's announcement of a target firm. The CARs are calculated using the Carhart (1997) four-factor model, with 100 days for the estimation window, 3 days as the gap time, and 3 days as the minimum needed days. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	N	Mean	Std. Err.	t-stat
$[-1, +1]$	461	0.050***	0.007	6.855
$[-3, +3]$	458	0.052***	0.008	6.178
$[-10, +10]$	451	0.052***	0.011	4.857

Table 6: Dmitrova Replication

This table present event-study results consistent with the findings of Dimitrova (2017); late-merging SPACs are associated with negative CARs (dependent variable). The event windows estimated are $[-1,+1]$ (Column 1), $[-3,+3]$ (Column 2), and $[-10,+10]$ (Column 3) days around the merger announcement. Standard errors are shown in parentheses. The key independent variable is an indicator variable, *Hazard_90th_Ind* that equals 1 if the deSPAC's corresponding SPAC's estimated hazard function falls in the tenth decile of the estimated hazard functions. Robust standard errors are shown in parentheses and are clustered at the target industry level. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	[-1, +1]	[-3, +3]	[-10, +10]
Hazard_90th_Ind	-0.040***	-0.054***	-0.081**
	(0.011)	(0.016)	(0.028)
Instit_own	-0.008*	-0.015***	-0.016*
	(0.005)	(0.004)	(0.008)
Insider_own	-0.011	-0.006	-0.006
	(0.012)	(0.011)	(0.011)
Fem_board_prop	-0.012**	-0.012***	-0.001
	(0.005)	(0.004)	(0.012)
Fem_CEO_Ind	0.011	0.017	0.009
	(0.020)	(0.018)	(0.046)
CEO_Chair_Ind	0.001	0.008	0.016
	(0.012)	(0.020)	(0.023)
Domestic	0.016	0.017	0.030
	(0.010)	(0.017)	(0.022)
Same_geo	0.036*	0.023	0.065**
	(0.021)	(0.018)	(0.029)
Redeem_perc	-0.044***	-0.061***	-0.062***
	(0.008)	(0.011)	(0.014)
SP500_Ret	0.100***	0.151**	0.197**
	(0.033)	(0.053)	(0.093)
Intercept	0.031***	0.026	0.004
	(0.009)	(0.017)	(0.021)
Industry FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
R-Squared Adjusted	0.12	0.12	0.11
N	397	394	387

Table 7: Duration analysis for SPACs by prevalence of contingency clauses

This table presents the hazard ratios for the determinants of SPAC's time to merger for the subsample of completed SPACs with either [0,2] contingency clauses (Column 1) or [3,∞] contingency clauses (Column 2) in their merger agreement. The hazard function is the likelihood the SPAC will merge at "*d*" given it has not found a new business partner up until that time. Standard errors are shown in parentheses. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	0-2 CCs	3+ CCs
IPO_Proceeds_mm	0.998*	1.000
	(0.001)	(0.001)
UW_Ind	1.263	1.022
	(0.321)	(0.127)
Redeem_perc	0.400***	0.122***
	(0.117)	(0.027)
Canceled_trg_Ind	0.384***	0.505**
	(0.103)	(0.139)
Domestic	0.808	1.051
	(0.144)	(0.137)
same_geo	1.072	0.764
	(0.276)	(0.154)
Overallotment_Proceeds_mm	1.018***	1.002
	(0.006)	(0.004)
VIX_mean	0.909**	0.894***
	(0.040)	(0.031)
SP_mean	0.206***	1.311
	(0.124)	(0.665)
Counts	1.047	1.031
	(0.037)	(0.030)
Industry FEs	Yes	Yes
Year FEs	Yes	Yes
$\hat{p}$	3.346***	2.573***
	(0.177)	(0.103)
Log-likelihood	-91.591	-244.092
N	237	388

Table 8: Event Study results- impact of contingency clauses on late merging deSPACs

This table presents the event study results detailing regressions of SPAC merger announcement CARs on independent variables. The event window estimated is $[-1, +1]$ (Column 1), $[-3, +3]$ (Column 2), and $[-10, +10]$ (Column 3) days around the merger announcement. Standard errors are shown in parentheses. The key independent variable is an interaction term between the indicator variable, *Hazard_90th_Ind* that equals 1 if the deSPAC's corresponding SPAC's estimated hazard function falls in the tenth decile of the estimated hazard functions, and the continuous variable *CC_Count* that equals the number of contingency clauses in the IPO prospectus. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	[-1, +1]	[-3, +3]	[-10, +10]
Hazard_90th_Ind*CC_Count	0.022**	0.023**	0.037
	(0.009)	(0.009)	(0.035)
Hazard_90th_Ind	-0.109***	-0.126***	-0.195
	(0.028)	(0.035)	(0.114)
CC_Count	0.011	0.016	0.016
	(0.009)	(0.012)	(0.017)
Instit_own	-0.007	-0.013**	-0.014*
	(0.005)	(0.005)	(0.008)
Insider_own	-0.012	-0.008	-0.009
	(0.012)	(0.011)	(0.011)
Fem_board_prop	-0.016**	-0.017***	-0.006
	(0.006)	(0.006)	(0.014)
Fem_CEO_Ind	0.013	0.021	0.013
	(0.018)	(0.018)	(0.049)
CEO_Chair_Ind	0.005	0.014	0.023
	(0.013)	(0.019)	(0.021)
Domestic	0.010	0.010	0.022
	(0.008)	(0.012)	(0.021)
Same_geo	0.036*	0.022	0.064*
	(0.018)	(0.017)	(0.032)
Redeem_perc	-0.046***	-0.062***	-0.064***
	(0.008)	(0.011)	(0.015)
SP500_Ret	0.024***	0.036***	0.046**
	(0.006)	(0.012)	(0.018)
Intercept	0.017	0.006	-0.011
	(0.029)	(0.041)	(0.051)
Industry FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
R-Squared Adjusted	0.12	0.13	0.12
N	396	393	386

Table 9: Contingency Clause Matrix- Combination of Two

This table presents a matrix displaying the interaction coefficients between coincidence of two contingency clauses and SPACs with hazard rates in the tenth decile. The diaginal displays this effect for individual contingency clauses. The dependant variable for all specifications is the cumulative abnormal returns from a three day, $[-1, +1]$, event window surrounding SPAC merger announcements. The asset pricing model used for estimation is the Carhart four-factor model. Standard errors are shown in parentheses. Though only the interaction coefficients are displayed, each coefficient is drawn from a full estimation including all previous control variables, industry fixed effects, and year fixed effects. The interaction of two contingency clauses is captured by a contrived dummy variable which equals one if a SPAC merges under the constraints of both clauses (or one clause, in the case of the diagonal). Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Warrant Lock.	Share Lock.	Earnout For.	Warrant Ex. Change	Make-Whole	Forward Pur.
Warrant Lock.	0.063					
	(0.040)					
Share Lock.	0.021	0.001				
	(0.026)	(0.026)				
Earnout For.	0.040	0.037	0.039			
	(0.057)	(0.056)	(0.057)			
Warrant Ex. Change	0.027	0.017	NA	0.021		
	(0.025)	(0.021)		(0.024)		
Make-Whole	0.010	0.010	NA	0.017	0.010	
	(0.032)	(0.032)		(0.026)	(0.032)	
Forward Pur.	0.042	0.033	NA	**0.081****	**0.075****	0.042
	(0.029)	(0.030)		(0.031)	(0.027)	(0.028)

Table 10: Contingency Clause Combinations of Three

This table presents a the effects of different combinations of three contingency clauses on CARs. The coefficient of interest is an interaction between an indicator representing coincidence of three contingency clauses and SPACs with hazard rates in the tenth decile. The dependant variable for all specifications is the cumulative abnormal returns from a three day, $[-1, +1]$, event window surrounding SPAC merger announcements. The asset pricing model used for estimation is the Carhart four-factor model. Standard errors are shown in parentheses. For brevity, we only display combinations that yield statistical significance at the 95% confidence level. Though there are 20 possible combinations of 3-way contingencies, only five of these yield this level of statistical significance. The interaction of three contingency clauses is captured by an indicator variable (Comb3_CC) which equals one if a SPAC merges under the constraints of all three clauses. Industry and year fixed effects are included in all model specifications. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively. To facilitate readability, each column label contains initials representing the combination of different contingency clauses. **WL: Warrant Lockup**, **SL: Share Lockup**, **EF: Earnout Forfeiture**, **WE: Warrant Exercise Price Change**, **MW: make-whole**, and **FP: Forward Purchase Agreement**.

	WL/WE/FP	WL/MW/FP	SL/WE/FP	SL/MW/FP	WE/MW/FP
Hazard_90th_Ind*Comb3_CC	0.081**	0.075**	0.074**	0.075**	0.095**
	(0.031)	(0.027)	(0.034)	(0.027)	(0.035)
Hazard_90th_Ind	-0.050***	-0.048***	-0.048***	-0.048***	-0.048***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Comb3_CC	-0.015	0.003	-0.016	0.003	-0.023
	(0.026)	(0.045)	(0.027)	(0.045)	(0.035)
Instit_own	-0.008	-0.008	-0.008	-0.008	-0.007
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Insider_own	-0.012	-0.012	-0.012	-0.012	-0.012
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Fem_board_prop	-0.011**	-0.012**	-0.012**	-0.012**	-0.012**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Fem_CEO_Ind	0.001	0.003	0.002	0.003	0.001
	(0.021)	(0.020)	(0.021)	(0.020)	(0.020)
CEO_Chair_Ind	0.001	0.002	0.001	0.002	0.001
	(0.012)	(0.011)	(0.012)	(0.011)	(0.011)
Domestic	0.015	0.014	0.016	0.014	0.015
	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)
Same_geo	0.038*	0.038*	0.037*	0.038*	0.038*
	(0.020)	(0.020)	(0.021)	(0.020)	(0.021)
SP500_Ret	0.018**	0.020*	0.017**	0.020*	0.016*
	(0.007)	(0.010)	(0.007)	(0.010)	(0.008)
Redeem_perc	-0.045***	-0.045***	-0.045***	-0.045***	-0.045***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Intercept	0.047***	0.047***	0.047***	0.047***	0.047***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
R-Squared Adjusted	0.11	0.11	0.11	0.11	0.11
N	397	397	397	397	397

Table 11: Event Study results- Coincidence of Warrant Exercise Clause, make-whole Clause, and Forward Purchase Agreement

This table presents the event study results detailing regressions of SPAC merger announcement CARs on independent variables. The event window estimated is $[-1, +1]$ (Column 1), $[-3, +3]$ (Column 2), and $[-10, +10]$ (Column 3) days around the merger announcement. Standard errors are shown in parentheses. The key independent variable is an interaction term between the indicator variable, *Hazard_90th_Ind* that equals 1 if the deSPAC's corresponding SPAC's estimated hazard function falls in the tenth decile of the estimated hazard functions, and the indicator variable *All_WE_MW_FP* that equals 1 if warrant exercise clauses, make-whole clauses, and forward purchase agreements all appear in the IPO prospectus/merger agreement. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	[-1, +1]	[-3, +3]	[-10, +10]
Hazard_90th_Ind*All_WE_MW_FP	0.095**	0.110**	0.054
	(0.035)	(0.045)	(0.075)
Hazard_90th_Ind	-0.048***	-0.063***	-0.084***
	(0.011)	(0.017)	(0.026)
All_WE_MW_FP	-0.023	-0.027	-0.043
	(0.035)	(0.045)	(0.056)
Instit_own	-0.007	-0.014***	-0.016*
	(0.005)	(0.004)	(0.008)
Insider_own	-0.012	-0.007	-0.007
	(0.012)	(0.011)	(0.010)
Fem_board_prop	-0.012**	-0.011**	-0.000
	(0.005)	(0.005)	(0.013)
Fem_CEO_Ind	0.001	0.005	0.003
	(0.020)	(0.017)	(0.049)
CEO_Chair_Ind	0.001	0.008	0.016
	(0.011)	(0.020)	(0.023)
Domestic	0.015	0.017	0.031
	(0.010)	(0.016)	(0.022)
Same_geo	0.038*	0.025	0.066**
	(0.021)	(0.017)	(0.028)
SP500_Ret	0.016*	0.025*	0.029
	(0.008)	(0.013)	(0.021)
Redeem_perc	-0.045***	-0.062***	-0.063***
	(0.008)	(0.011)	(0.014)
Intercept	0.047***	0.050***	0.033**
	(0.010)	(0.014)	(0.015)
Industry FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
R-Squared Adjusted	0.11	0.12	0.11
N	397	394	387

Table 12: Event Study results- No Warrants

This table presents the event study results detailing regressions of SPAC merger announcement CARs on independent variables. The event window estimated is $[-1, +1]$ (Column 1), $[-3, +3]$ (Column 2), and $[-10, +10]$ (Column 3) days around the merger announcement. Standard errors are shown in parentheses. The key independent variable is an interaction term between the indicator variable, *Hazard_90th_Ind* that equals 1 if the deSPAC's corresponding SPAC's estimated hazard function falls in the tenth decile of the estimated hazard functions, and the indicator variable *No_Warrants_Ind* that equals 1 if the SPAC does not issue warrants. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	[-1, +1]	[-3, +3]	[-10, +10]
Hazard_90th_Ind*No_Warrants_Ind	0.084**	0.155***	0.227***
	(0.034)	(0.041)	(0.068)
Hazard_90th_Ind	-0.044***	-0.061***	-0.091***
	(0.011)	(0.016)	(0.028)
No_Warrants_Ind	-0.058*	-0.098**	-0.163**
	(0.028)	(0.038)	(0.077)
Instit_own	-0.008	-0.014***	-0.014
	(0.005)	(0.005)	(0.010)
Insider_own	-0.010	-0.005	-0.004
	(0.011)	(0.010)	(0.009)
Fem_board_prop	-0.012**	-0.012**	-0.001
	(0.005)	(0.005)	(0.013)
Fem_CEO_Ind	0.017	0.027	0.026
	(0.020)	(0.020)	(0.048)
CEO_Chair_Ind	0.004	0.012	0.022
	(0.012)	(0.020)	(0.024)
Domestic	0.016	0.017	0.030
	(0.010)	(0.015)	(0.019)
Same_geo	0.036	0.022	0.063**
	(0.022)	(0.019)	(0.029)
SP500_Ret	0.019***	0.028***	0.037**
	(0.006)	(0.010)	(0.017)
Redeem_perc	-0.045***	-0.062***	-0.065***
	(0.008)	(0.010)	(0.013)
Intercept	0.048***	0.051***	0.038**
	(0.009)	(0.013)	(0.013)
Industry FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
R-Squared Adjusted	0.12	0.13	0.13
N	397	394	387

Table 13: Operating performance of deSPACs

This table presents the regression results of the post-merger operational performance for SPACs that successfully completed a merger transaction. The dependent variable is return on assets (ROA) of the deSPAC firm. The two key independent variable are the interactions between *Hazard_90th_Ind* and *CC_Count*, which is a continuous variable from $[0, 6]$ describing the number of contingency clauses documented in the SPAC's prospectus. Column 1 test year 1 deSPAC ROAs (and controls), while column 2 test year 2 deSPAC ROAs (and controls). Robust standard errors are shown in parentheses and are clustered at the target industry level. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	Year 1	Year 2
Hazard_90th_Ind*CC_Count	0.189*	0.213***
	(0.104)	(0.068)
Hazard_90th_Ind	-0.674*	-0.491**
	(0.375)	(0.199)
CC_Count	-0.010	0.080*
	(0.034)	(0.042)
Instit_own	0.077	0.116
	(0.208)	(0.156)
Insider_own	-0.036	-0.016
	(0.037)	(0.040)
Fem_board_prop	-0.046	-0.039
	(0.037)	(0.063)
CEO_Chair_Ind	-0.042	-0.056
	(0.067)	(0.069)
Fem_CEO_Ind	-0.015	0.064
	(0.313)	(0.291)
Domestic	-0.006	-0.064
	(0.109)	(0.124)
Same_geo	-0.085	-0.099
	(0.142)	(0.182)
SP500_Ret	-0.283***	0.146
	(0.069)	(0.146)
Tangibility	0.021	0.041
	(0.082)	(0.099)
Redeem_perc	-0.149***	-0.253***
	(0.032)	(0.059)
Leverage	-0.105*	-0.031
	(0.058)	(0.077)
Intercept	0.122	-0.169
	(0.105)	(0.189)
Industry FEs	Yes	Yes
Year FEs	Yes	Yes
R-Squared Adjusted	0.22	0.22
N	436	343

Appendix A. Data and Variables

Name	Data Source	Description
Counts	SPACInsider (Constructed)	Number of SPACs that have been raised by the same sponsor group in the past.
IPO proceeds ($mm)	SPACInsider	The amount of capital raised by investors at the SPAC IPO, in millions of dollars.
Redeem_perc	SPACInsider	The percentage of public SPAC shares redeemed.
UW_Ind	Wei (2023) (Constructed)	An indicator variable that equals 1 if the SPAC IPO underwriter is one of the top 7 underwriters: Goldman Sachs, Morgan Stanley, JP Morgan, Citigroup, Barclays, Credit Suisse, and Deutsche Bank.
Canceled_trg_Ind	SPACInsider (Constructued)	Indicator variable equal to 1 if there the SPAC had a target company where the SPAC had initially announced a combination with and then terminated.
Domestic	SPACInsider (Constructed)	Indicator variable equal to 1 if the deSPAC geography is in the United States.
Same_geo	SPACInsider (Constructed)	Indicator variable equal to 1 if IPO Geography, which is the place the SPAC intends to search for a target company, is the same as that of the deSPAC geography.
Over allotment proceeds ($mm)	SPACInsider	The amount of capital raised in the over allotment, where the maximum is 15% of IPO proceeds.
VIX_mean	CBOE	Mean of the monthly closing price of the Cboe VIX Index between the SPAC's IPO date and closing/liquidation date.

SP_mean	CRSP	The return of the S&P500 Index between the SPAC's IPO date and closing/liquidation date. Let time 0 be the SPAC's IPO date. Then $SP\_mean = \Pi_{t=0}^{\text{Closing/Liq. Date}}(1+sptrn)-1.$
SP500_ret	CRSP	The annual return of the S&P 500 Index.
Return-on-Assets (ROA)	Compustat	The annual net income scaled by total assets.
Leverage	Compustat	Long-term debt plus debt in current liabilities, scaled by total assets.
R&D	Compustat	Research & development expenses to total assets.
Tangibility	Compustat	Property, plant and equipment to total assets.
Instit_own	Compustat	Proportion of institutional ownership from the SPAC's most recent 13F filing
Insider_own	SEC Edgar	Proportion of the SPAC's board constituted by non-independent directors
Fem_board_prop	SEC Edgar	Proportion of the SPAC's board that is made up by female board members
CEO_Chair_Ind	SEC Edgar	An indicator variable equal to 1 if the SPAC's CEO is the same as the Chairman of the Board
Fem_CEO_Ind	SEC Edgar	An indicator variable equal to 1 if the SPAC's CEO is female

Appendix B. Assumptions and Proofs

Our analysis relies on these following assumptions:

Assumption 1 (Regularity)**.**

(i) f *is continuous on* $[\underline{T}, \overline{T}]$ *and* $f(m^*) > 0$ *at any interior threshold* m^**.*

(ii) $p(\cdot;\cdot)$ *is continuously differentiable with* $\frac{\partial p(T;\theta_W)}{\partial T} > 0$ *for all relevant* (T, θ_W) *and* $p(T;\theta_W) \in (0, 1]$*.*

(iii) $\Pi(\cdot;\theta_E)$ *is continuously differentiable in* T *and* θ_E*, with* $\frac{\partial \Pi(T;\theta_E)}{\partial T} > 0$ *for all relevant* T*.*

Assumption 2 (Channel monotonicities)**.**

(i) Equity alignment: for the low–moderate T *region relevant at the acceptance margin,* $\frac{\partial \Pi(T;\theta_E)}{\partial \theta_E} \leq 0$ *and* $\frac{\partial^2 \Pi(T;\theta_E)}{\partial T\, \partial \theta_E} \geq 0$ *(stronger alignment weakly reduces the level and weakly increases the marginal sensitivity of the sponsor payoff).*

(ii) Warrant curtailment: for low–moderate T*,* $\frac{\partial p(T;\theta_W)}{\partial \theta_W} \leq 0$ *(stronger curtailment weakly lowers approval where quality is weak).*

Proof of Lemma 3.1.

Existence/uniqueness and differentiability are standard for finite-horizon DPP (e.g., Stokey and Lucas Jr (1989)). For fixed (t, θ),

$$\frac{\partial \Delta(T;V,\theta)}{\partial T} = \frac{\partial p(T;\theta_W)}{\partial T}\big(\Pi(T;\theta_E) - V + \delta\big) + p(T;\theta_W)\,\frac{\partial \Pi(T;\theta_E)}{\partial T}.$$

At $T = m^*$, Equation 3 implies $\Pi(m^*;\theta_E) - V = \delta(1-p)/p$, so

$$\left.\frac{\partial \Delta(T;V,\theta)}{\partial T}\right|_{T=m^*} = \frac{\delta}{p}\,\left.\frac{\partial p(T;\theta_W)}{\partial T}\right|_{T=m^*} +\ p(m^*;\theta_W)\ \left.\frac{\partial \Pi(T;\theta_E)}{\partial T}\right|_{T=m^*} \ >\ 0,$$

since $\frac{\partial p}{\partial T} > 0$ and $\frac{\partial \Pi}{\partial T} > 0$. Thus $\Delta(\cdot)$ crosses zero once from below, yielding a unique cutoff and completing the proof. $\square$

Proof of Proposition 3.2.

Let $H(m^*, V, \theta) \equiv \Delta(m^*; V, \theta)$ and note that the margin condition (Equation 3) is $H\big(m^*(t;\theta), V(t;\theta), \theta\big) =$

0. By Assumption 1 and Lemma 3.1,

$$\frac{\partial H}{\partial m^*} = \frac{\partial \Delta(T; V, \theta)}{\partial T}\bigg|_{T=m^*} = \frac{\delta}{p(m^*; \theta_W)} \; \frac{\partial p(T; \theta_W)}{\partial T}\bigg|_{T=m^*} + p(m^*; \theta_W) \; \frac{\partial \Pi(T; \theta_E)}{\partial T}\bigg|_{T=m^*} \equiv \Delta_T(m^*) \; > \; 0,$$

and $\frac{\partial H}{\partial V} = -\,p(m^*; \theta_W) < 0$. Totally differentiating $H(m^*(t; \theta), V(t; \theta), \theta) = 0$ with respect to t and applying the implicit function theorem,

$$\frac{\partial m^*(t; \theta)}{\partial t} = -\frac{\frac{\partial H}{\partial V} \frac{\partial V(t;\theta)}{\partial t}}{\frac{\partial H}{\partial m^*}} = \frac{p(m^*; \theta_W)}{\Delta_T(m^*)} \frac{\partial V(t; \theta)}{\partial t}. \tag{A.1}$$

Next, rewrite the HJB (Equation 2) using the reservation rule (so that $\Delta(\cdot)_+ = \Delta(\cdot)\, \mathbf{1}\{T \geq m^*\}$):

$$\frac{\partial V(t; \theta)}{\partial t} = vc - \lambda \int_{m^*(t;\theta)}^{\infty} \Delta\big(T; V(t; \theta), \theta\big)\, f(T)\, dT. \tag{A.2}$$

On the interior search region, $\Delta(T; V(t; \theta), \theta) > 0$ for all $T > m^*(t; \theta)$ and $f(m^*) > 0$ by Assumption 1, so the integral in Equation A.2 is strictly positive. Therefore $\frac{\partial V(t;\theta)}{\partial t} < 0$, and substituting into Equation A.1 with $p > 0$ and $\Delta_T(m^*) > 0$ yields:

$$\frac{\partial m^*(t; \theta)}{\partial t} < 0.$$

□

Proof of Proposition 3.3. Intrinsic to our proof of Proposition 3.3 is the relationship between the value of the search and the optimal minimum acceptance threshold of a merger target. In a continuous time finite horizon search model, the partial derivative of the value function $V(t, m^*(t, \alpha), \alpha)$ with respect to any exogenous factor α (such as θ_E) is identical to the partial derivative of the optimal threshold $m^*(t, \alpha)$ with respect to α

$$\frac{\partial V(\cdot)}{\partial \alpha} = \frac{\partial m^*(\cdot)}{\partial \alpha}. \qquad (i)$$

The equality (i) is a direct result of the value matching and the smooth pasting conditions.

The value matching condition states that at the optimal boundary, the value of the search equals the reward of stopping

$$V(t, m^*(t, \alpha), \alpha) = m^*(t, \alpha) \qquad (ii)$$

and ensures the continuity of the searcher's wealth at the moment they transition from searching to stopping. Taking the partial derivative of the left hand side (LHS) and the right hand side (RHS) of the value matching condition yields

$$\frac{\partial V(t, m^*)}{\partial \alpha} + \left(\frac{\partial V(t, m^*)}{\partial m} \cdot \frac{\partial m^*(t)}{\partial \alpha} \right) = \frac{\partial m^*(t)}{\partial \alpha}.^{29} \qquad (iii)$$

The smooth pasting condition simply maintains that the marginal value of an offer at the boundary is "1" and it ensures that the decision to stop the search is mathematically and economically optimal by eliminating any "jumps" or "kinks" in the expected wealth

$$\frac{\partial V(t, m^*)}{\partial m} = 1. \qquad (iv)$$

Substituting the smooth pasting condition into (iii) produces

$$\frac{\partial V}{\partial \alpha} + (1)\frac{\partial m^*}{\partial \alpha} = \frac{\partial m^*}{\partial \alpha}. \qquad (v)$$

A knee jerk reaction to (v) would be to cancel the common term $\frac{\partial m^*}{\partial \alpha}$ on both sides of (v). But in this context a total derivative is required to maintain the point of tangency in this dynamic equilibrium and it establishes

$$\frac{\partial V(t, m^*)}{\partial \alpha} = \frac{\partial m^*(t)}{\partial \alpha}. \qquad (vi)$$

[29]The cautious reader may suspect that the first term inside the left hand parentheses is a typographical error and that our intent was to apply the chain rule in terms of $m^*(t)$. But $m^*(t)$ is not an independent input variable of the value function, it is a location in state space. $m^*(t)$ is simply the specific coordinate where we choose to evaluate that slope to ensure it satisfies the smooth pasting condition. The $\partial V/\partial m(t)$ is a spatial measurement of the slope at a single moment in time.

In particular, you equate the total derivative of $V(\cdot)$ involving two variates to the derivative of $m^*(\cdot)$ involving only one variate because the sink or the enhancement in $V(\cdot)$ for "$-dt$" or for "dt" involves both a horizon and a vertical change but the change in $m^*(t)$ involves only a horizontal decrease or increase. The equality in (vi) ensures that for a unit of value lost or gained due to $d\alpha$, the searcher's optimal threshold retreats or advances at exactly the same rate to sustain optimality.

With the relationship between the value of the stopping and the value of continuing the search in mind, let $H(m^*, V, \theta) = \Delta(m^*; V, \theta)$ and by the implicit function theorem we have

$$\frac{\partial m^*(\cdot)}{\partial \theta_E} = \frac{-\frac{\partial H}{\partial V}\frac{\partial V}{\partial \theta_E} - \frac{\partial H}{\partial \theta_E}}{\frac{\partial H}{\partial m^*}} = \frac{p(\cdot)\frac{\partial V}{\partial \theta_E} - p(\cdot)\frac{\partial \Pi(m^*;\theta_E)}{\partial \theta_E}}{\frac{\partial \Delta(\cdot)}{\partial T}\,|_{T=m^*}}, \qquad (vii)$$

using

$$\frac{\partial H}{\partial m^*} = \left.\frac{\partial \Delta}{\partial T}\right|_{T=m^*}, \ \frac{\partial H}{\partial V} = -p(\cdot) \quad \text{and} \quad \frac{\partial H}{\partial \theta_E} = p(\cdot)\frac{\partial \Pi(m^*;\theta_E)}{\partial \theta_E}.$$

The equity alignment clause bundle θ_E captures the impact of sponsor share lockups, sponsor earnout forfeitures, and forward purchase agreements. The intent of these contingency provisions is to reduce sponsor rent and/or to push more of the sponsor's payoff onto the performance of the newly merged firm. Clearly, though θ_E may be adverse to the sponsor's closing contingent payoff, the provisions increase the value of the search $V(\cdot)$. In particular, $\frac{\partial \Pi()}{\partial \theta_E} \leq 0$ using Assumption 2(i) with $\frac{\partial V}{\partial \theta_E} > 0$, and recall from expression (vi) we have

$$\frac{\partial V(t, m^*)}{\partial \theta_E} = \frac{\partial m^*(t)}{\partial \theta_E}. \qquad (viii)$$

Interpreting (vii), though $m^*(\cdot)$ and $V(\cdot)$ share an identical reaction to an increase of θ_E, the impact of $V(\cdot)$ upon $m^*(t)$ is scaled by a positive fraction "$p(\cdot)$" and by "$\partial\Delta(\cdot)/\partial T$" also positive. The $[\partial\Pi/\partial\theta_E]$ is scaled by the same two positive variates and any inverse response of $\Pi(\cdot)$ to an increase in θ_E is reversed by the (-1). Consequently, $\partial m^*(\cdot)/\partial\theta_E$ is positive regardless of the partial derivative of $\Pi(\cdot)$ with respect to θ_E only being weakly negative. $\square$

Proof of Proposition 3.4. Intrinsic to our proof of Proposition 3.4 is the relationship between the value of the search and the optimal minimum acceptance threshold of a merger target. In a continuous time finite horizon search model, the partial derivative of the value function $V(t, m^*(t, \alpha), \alpha)$ with respect to any exogenous factor α (such as θ_W) is identical to the partial derivative of the optimal threshold $m^*(t, \alpha)$ with respect to α

$$\frac{\partial V(\cdot)}{\partial \alpha} = \frac{\partial m^*(\cdot)}{\partial \alpha}. \qquad (i)$$

The equality (i) is a direct result of the value matching and the smooth pasting conditions.

The value matching condition states that at the optimal boundary, the value of the search equals the reward of stopping

$$V(t, m^*(t, \alpha), \alpha) = m^*(t, \alpha) \qquad (ii)$$

and ensures the continuity of the searcher's wealth at the moment they transition from searching to stopping. Taking the partial derivative of the left hand side (LHS) and the right hand side (RHS) of the value matching condition yields

$$\frac{\partial V(t, m^*)}{\partial \alpha} + \left(\frac{\partial V(t, m^*)}{\partial m} \cdot \frac{\partial m^*(t)}{\partial \alpha} \right) = \frac{\partial m^*(t)}{\partial \alpha}.^{30} \qquad (iii)$$

The smooth pasting condition simply maintains that the marginal value of an offer at the boundary is "1" and it ensures that the decision to stop the search is mathematically and economically optimal by eliminating any "jumps" or "kinks" in the expected wealth

$$\frac{\partial V(t, m^*)}{\partial m} = 1. \qquad (iv)$$

[30] Refer to footnote 29.

Substituting the smooth pasting condition into (iii) produces

$$\frac{\partial V}{\partial \alpha} + (1)\frac{\partial m^*}{\partial \alpha} = \frac{\partial m^*}{\partial \alpha}. \qquad (v)$$

A knee jerk reaction to (v) would be to cancel the common term $\frac{\partial m^*}{\partial \alpha}$ on both sides of (v). But in this context a total derivative is required to maintain the point of tangency in this dynamic equilibrium and it establishes

$$\frac{\partial V(t, m^*)}{\partial \alpha} = \frac{\partial m^*(t)}{\partial \alpha}. \qquad (vi)$$

In particular, you equate the total derivative of $V(\cdot)$ involving two variates to the derivative of $m^*(\cdot)$ involving only one variate because the sink or the enhancement in $V(\cdot)$ for "$-dt$" or for "dt" involves both a horizon and a vertical change but the change in $m^*(t)$ only involves only a horizontal decrease or increase. The equality in (vi) ensures that for a unit of value lost or gained due to $d\alpha$, the searcher's optimal threshold retreats or advances at exactly the same rate to sustain optimality.

With the relationship between the value of stopping and the value of continuing the search in mind, let $H(m^*, V, \theta) = \Delta(m^*; V, \theta)$ and using the implicit function theorem provides us with

$$\frac{\partial m^*}{\partial \theta_W} = \left(-\frac{\partial H}{\partial V}\frac{\partial V}{\partial \theta_W} - \frac{\partial H}{\partial \theta_W}\right) / \frac{\partial H}{\partial m^*} \qquad (vii)$$

furthermore

$$\frac{\partial H}{\partial \theta_W} = \frac{\partial p(\cdot)}{\partial \theta_W}\left(\Pi(\cdot) - V + \delta\right). \qquad (viii)$$

At the margin, $\Pi(m^*; \theta_E) - V = \delta(1-p)/p$ so that $\frac{\partial H}{\partial \theta_W} = \left(\frac{\delta}{p}\right)\frac{\partial p(m^*;\theta_W)}{\partial \theta_W}$. Substituting this result into our expression for $\partial m^*/\partial\theta_W$ yields

$$\frac{\partial m^*}{\partial\theta_W} = \frac{p\frac{\partial V(t;\theta)}{\partial\theta_W} - \left(\frac{\delta}{p}\right)\frac{\partial p(m^*;\theta_W)}{\partial\theta_W}}{\left.\frac{\partial\Delta(T;V,\theta)}{\partial T}\right|_{T=m^*}}. \qquad (ix)$$

Warrant curtailment provisions, θ_W, discourage the approval of low quality deals. By design, these clauses (warrant lockups or make whole provisions) make the SPAC's public warrants less valuable, so IPO unit investors cannot rely on warrant value to offset equity losses in poor mergers.

In particular, we have $\frac{\partial p()}{\partial\theta_W} \leq 0$ by Assumption 2(ii) with $\frac{\partial V()}{\partial\theta_W} > 0$, and recall from expression (vi)

$$\frac{\partial V(t,m^*)}{\partial\theta_W} = \frac{\partial m^*(t)}{\partial\theta_W}. \qquad (x)$$

Interpreting (ix), though $m^*(\cdot)$ and $V(\cdot)$ share an identical reaction to an increase of θ_W, the impact of $V(\cdot)$ upon $m^*(t)$ is scaled by a positive fraction "$p(\cdot)$" and by "$\partial\Delta(\cdot)/\partial T$" also positive. The $[\partial p(\cdot)/\partial\theta_W]$ is also scaled by two positive variates and any inverse response of $p(\cdot)$ to an increase in θ_W would be reversed by the (-1). Consequently, the $\partial m^*/\partial\theta_W$ is positive regardless of the partial derivative of $p(\cdot)$ with respect to θ_W only being weakly negative. □

Proof of Corollary 3.5. Recall for the Poisson with parameter λ, the probability of a merger target arrival is given as

$$Prob(\#\text{ of arrivals}) = \frac{e^{-\lambda}(\lambda)^{\#\text{ of arrivals}}}{(\#\text{ of arrivals})!}$$

and the likelihood of zero arrivals of merger candidates within the life of the SPAC is

$$\frac{e^{-\lambda a}(\lambda a)^0}{0!}$$

if the SPAC expires at "a". This implies that the likelihood of one or more arrivals over the life of the SPAC is $1 - e^{-\lambda a}$. So what this means is that, if say $Y_a \equiv 1$ if and only if at least one arrival takes place and if we let X be the time to that candidate arrival, we have

$$
\begin{aligned}
Prob(X \leq a) &= [1 - Prob(X > a)] \\
Prob(X \leq a) &= [1 - Prob(Y_a = 0)] \\
Prob(X \leq a) &= 1 - e^{-\lambda a}.
\end{aligned}
$$

At this point, it is clear, though the probability of target arrivals is given by a Poisson distribution the likelihood of one or more arrivals taking place within the life of SPAC is given by the cumulative distribution of the exponential function $F(t) = Prob(X \leq t) = 1 - e^{-\lambda t}$. To have the cumulative Poisson probability of candidate target arrivals collapse, to the exponential, is disconcerting. In particular, the hazard functions are heavily relied upon in our empirics and the hazard function of the unadorned exponential is less than accommodating. Our consternation stems from the intertemporal behavior of the exponential's $h(t)$, given by

$$
\begin{aligned}
h(t) &= \frac{f(t)}{S(t)} \\
h(t) &= \frac{f(t)}{(1 - F(t))} \\
h(t) &= \frac{\lambda e^{-\lambda t}}{(1 - (1 - e^{-\lambda t}))} \\
h &= \lambda.
\end{aligned}
$$

A time invariant hazard function is totally at odds with the theme of this paper and provides no meaningful way for us to demonstrate the role of our contingency provisions to influence SPAC performance. Furthermore, we believe the shape of a SPAC's hazard function should be an empirical result not the consequence of an underdeveloped survival function.

Fortuitously, the survival function of the exponential distribution is easily generalized. In particular, rewriting $S(t) = e^{-\lambda t}$ as $S(t) = e^{(-\lambda t)^p}$ results in a time varying hazard function and provides us with the flexibility that our empirical investigation demands. Recasting the survival function of the exponential as $S(t) = e^{(-\lambda t)^p}$ is a legitimate transformation. In particular, the new cumulative distribution would be

$$F(t) = 1 - S(t)$$

or

$$F(t) = 1 - e^{(-\lambda t)^p}$$

and, we would have the intuitive result at $t = 0$ of

$$F(t = 0) = 1 - 1 = 0.$$

If $t \to \infty$ then for the generalized survival function would yield a cdf of

$$F(t) = 1 - e^{(-\lambda t)^p}$$

or

$$F(t) = 1 - 0 = 1,$$

another sensible result. The generalized survival function produces a pdf of $\frac{\partial F(t)}{\partial t} = (\lambda p) \cdot e^{-(\lambda t)^p} \cdot (\lambda t)^{p-1}$ and its forthcoming hazard function would be

$$h(t) = \frac{f(t)}{S(t)} = \frac{\lambda p(\lambda t)^{p-1} e^{-(\lambda t)^p}}{e^{-(\lambda t)^p}} = \lambda p(\lambda t)^{p-1}.$$

Clearly, our generalized hazard function is time varying and readily identified as a Weibull hazard function. Whether the Weibull $h(t)$ is increasing or decreasing across time is an empirical question which will be resolved by the magnitude of an estimate of p, $\hat{p}$.

If the optimal minimum acceptance threshold of "m^*" is recognized then the customized hazard function becomes

$$p[\lambda(1-F(m^*))]^p t^{p-1}.$$

The marginal impact of "m^*" upon the customized $h^*(t)$ can be written as

$$p^2(\lambda(1-F(m^*)))^{p-1}t^{p-1}(-\lambda f(m^*)) < 0.$$

This allows us to conclude that contingency clauses, represented by θ_E and θ_W, inversely affect our stylized hazard function $h^*(t)$ since

$$\frac{\partial h^*(t)}{\partial m^*} \cdot \frac{\partial m^*}{\partial \theta_i} < 0 \quad \text{for } i = E \text{ and } W.$$

$\square$

Appendix C. Internet Appendix

C.1. Internet Appendix Proofs

Derivation of HJB Equation 2.

Fix $\theta = (\theta_E, \theta_W)$ and time $t \in [0, a)$. Over a small interval $[t, t + dt)$:

(i) with probability $1 - \lambda\, dt + o(dt)$ no target arrives;

(ii) with probability $\lambda\, dt + o(dt)$ exactly one target arrives (the probability of two or more arrivals is $o(dt)$ under Poisson arrivals).

The sponsor pays the flow cost $vc\, dt$ during $[t, t + dt)$. The HJB (Equation 2) follows.

Let $V(t; \theta)$ denote the continuation value at time t before any arrival in $[t, t + dt)$. Condition on the two Poisson outcomes.

(1) No arrival (probability $1-\lambda\, dt+o(dt)$). The sponsor only pays the flow cost and continues searching at $t + dt$:

$$\text{value contribution} \;=\; -\, vc\, dt \;+\; V(t + dt; \theta).$$

(2) One arrival (probability $\lambda\, dt + o(dt)$). Draw $T \sim F$. Upon seeing T, the sponsor chooses to <u>attempt</u> or <u>wait</u>. If she <u>waits</u>, the value is $V(t+dt; \theta)$. If she <u>attempts</u>, the expected value (conditional on T) is

$$\underbrace{p(T; \theta_W)\, \Pi(T; \theta_E)}_{\text{closes, process ends}} \;+\; \underbrace{\big(1 - p(T; \theta_W)\big)\Big(V(t + dt; \theta) - \delta\Big)}_{\text{fails, pay } \delta\text{, continue}}.$$

Relative to waiting, attempting delivers the incremental gain

$$p(T; \theta_W)\,\big(\Pi(T; \theta_E) - V(t + dt; \theta)\big) \;-\; \big(1 - p(T; \theta_W)\big)\delta \;=\; \Delta\big(T; V(t + dt; \theta), \theta\big),$$

matching Equation 1 evaluated at $V = V(t + dt; \theta)$. Optimally, the sponsor takes the <u>max</u>

of {wait, attempt}:

$$\text{value contribution} \;=\; -\,vc\,dt \;+\; \mathbb{E}_T\Big[V(t+dt;\theta) \;+\; \max\big\{\Delta\big(T;V(t+dt;\theta),\theta\big),\,0\big\}\Big]\,.$$

Combining the two Poisson cases and using the law of total expectation,

$$\begin{aligned} V(t;\theta) =\;& (1-\lambda\,dt)\Big(-\,vc\,dt + V(t+dt;\theta)\Big) \\ &\quad +\;\lambda\,dt\,\mathbb{E}_T\big[-vc\,dt + V(t+dt;\theta) + \max\big\{\Delta\big(T;V(t+dt;\theta),\theta\big),\,0\big\}\big] \;+\; o(dt) \\ =\;& -vc\,dt \;+\; V(t+dt;\theta) \;+\; \lambda\,dt\,\mathbb{E}_T\big[\max\big\{\Delta\big(T;V(t+dt;\theta),\theta\big),\,0\big\}\big] \;+\; o(dt), \end{aligned}$$

since $(1-\lambda\,dt)+\lambda\,dt = 1$ and $dt\cdot o(dt) = o(dt)$.

Rearrange and divide by dt:

$$\frac{V(t;\theta)-V(t+dt;\theta)}{dt} \;+\; vc \;-\; \lambda\,\mathbb{E}_T\big[\max\big\{\Delta\big(T;V(t+dt;\theta),\theta\big),\,0\big\}\big] \;=\; \frac{o(dt)}{dt}.$$

Use the first-order expansion $V(t+dt;\theta) = V(t;\theta) + \frac{\partial V(t;\theta)}{\partial t}\,dt + o(dt)$ and continuity of $\Delta(\cdot)$ to replace $V(t+dt;\theta)$ inside Δ by $V(t;\theta)$ in the limit. Taking $dt \downarrow 0$ yields

$$-\frac{\partial V(t;\theta)}{\partial t} \;+\; vc \;-\; \lambda\,\mathbb{E}_T\big[\max\big\{\Delta\big(T;V(t;\theta),\theta\big),\,0\big\}\big] \;=\; 0,$$

or equivalently

$$0 \;=\; \frac{\partial V(t;\theta)}{\partial t} \;-\; vc \;+\; \lambda\,\mathbb{E}_T\Big[\Delta\big(T;V(t;\theta),\theta\big)_+\Big],$$

which is Equation 2. The boundary condition $V(a;\theta) = 0$ holds because at $t = a$ there is no time to search or attempt further; if unmerged, the sponsor's payoff is 0 by the model's terminal condition.

Note on Discounting: If discounting at rate ρ is included, multiply continuation terms by $(1-\rho\,dt)$ in the above display; the limit adds a term $-\rho\,V(t;\theta)$ to the HJB's left-hand side. This does not impact the sign of our subsequent comparative statics and is therefore excluded for brevity. $\square$

Derivation of Equation 4 from Equation 2.

By the reservation rule, $\Delta(T; V(t;\theta), \theta)_+ = \Delta(T; V(t;\theta), \theta)\, \mathbf{1}\{T \geq m(t;\theta)\}$. Taking expectations over $T \sim F$ with density f,

$$\mathbb{E}[\Delta(T; V(t;\theta), \theta)_+] = \int_{m(t;\theta)}^{\overline{T}} \Delta(T; V(t;\theta), \theta)\ f(T)\, dT.$$

Substitute this into Equation 2, rearrange, and use $G \equiv \Delta$ to obtain Equaiton 4. $\square$

C.2. Derivation of Equation 10 from Section 5

Derivation. Typically we would find ourselves maximizing the log of the likelihood function with respect to our two Weibull parameters, γ and p:

$$\ln L(\gamma, p) = \sum_{\text{all observations}} \ln f(d|\gamma, p). \tag{IA.1}$$

However, recognizing that many of our SPACs are observed before they have either merged or matured yields the following objective function:

$$\ln L(\gamma, p) = \sum_{\text{uncensored observations}} \ln f(d|\gamma, p) + \sum_{\text{censored observations}} \ln \overline{F}(d|\gamma, p). \tag{IA.2}$$

The reader should note that the pdf of the SPACs that have been censored have been replaced by the only knowledge that we have about them, that is, their survival which yields $1 - F(d|\gamma, p)$. Furthermore given that $f(d) = h(d)\overline{F}(d)$, the expression for Equation IA.2

can be written as

$$\ln L(\gamma, p) = \sum_{\text{uncensored observations}} \ln h(d|\gamma, p) + \sum_{\text{all observations}} \ln \overline{F}(d|\gamma, p). \tag{IA.3}$$

The computation complexity of maximizing the likelihood function with respect to γ and p in Equation IA.2 or in Equation IA.3 necessitates a transformation of variables. Consequently, we eschew using $f(d) = p\gamma e^{-(\gamma d)^p}(\gamma d)^{p-1}$ as the basis for our interpretations of $h(d)$ and $\overline{F}(d)$ in our MLE estimation of $\ln L(\gamma, p)$. Rather we use $f(w) = e^{(w-e^w)}$ to represent the RHS of $\ln L(\gamma, p)$ in obtaining the maximum likelihood estimates $\hat{\gamma}$ and $\hat{p}$.

Rewriting $(\gamma d)^p$ as e^w we have $d = \frac{1}{\gamma}e^{w/p}$ so that the Jacobian of our change of variable transformation is $\frac{1}{\gamma p}e^{w/p}$ and immediately we can begin rewriting $f(d)$ as $f(w)$:

$$f(w) = p\gamma e^{-(\gamma d)^p}(\gamma d)^{p-1}\frac{1}{\gamma p}e^{w/p}. \tag{IA.4}$$

Cancelling yields

$$f(w) = e^{-(\gamma d)^p}(\gamma d)^{p-1}e^{w/p}$$

or

$$f(w) = e^{-e^w}(\gamma d)^{p-1}e^{w/p}$$

or

$$f(w) = e^{-e^w}\left(\frac{e^w}{\gamma d}\right)e^{w/p}. \tag{IA.5}$$

Recall $e^w = (\gamma d)^p$ or $e^{w/p} = \gamma d$. Substituting, we have

$$f(w) = e^{-e^w}\left(\frac{e^w}{\gamma d}\right)\gamma d \tag{IA.6}$$

or, finally,

$$f(w) = e^{w-e^w}. \tag{IA.7}$$

The probability density function for W will be used to interpret the two entries on the RHS of Equation IA.3. In particular, $h(d)$ becomes $h(w)$ which equals e^{w} and $\overline{F}(d)$ is replaced by $\overline{F}(w)$ which equals $e^{-e^{w}}$. The maximum likelihood estimation of

$$\ln\, L(\gamma,p)=\sum_{\text{uncensored observations}}\ln h(w\mid\gamma,p)+\sum_{\text{all observations}}\ln\overline{F}(w\mid\gamma,p) \tag{IA.8}$$

is relatively straightforward.

However, the role of economic determinants of SPAC behavior is not explicitly considered. This situation is easily remedied in the duration literature by substituting for the location parameter γ. In particular,

$$\gamma_i=e^{-x_i'\beta} \tag{IA.9}$$

where the x_i's are a vector of economic variables that characterize the ith SPAC's behavior. The β_i's record the impact of each regressor. Now, rather than

$$e^{w_i}=(\gamma_i d_i)^p \tag{IA.10}$$

or

$$w_i=p\ln(\gamma_i d_i), \tag{IA.11}$$

consequently, we have

$$\begin{aligned} w_i&=p\ln\left(e^{-x_i'\beta}d_i\right)\\ w_i&=p(-x_i'\beta+\ln d_i)\\ w_i&=\frac{\ln d_i-x_i'\beta}{\sigma}\quad\text{where }\sigma=p^{-1}. \end{aligned} \tag{IA.12}$$

At this point, the model is best thought of as

$$\ln d_i=x_i'\beta+\sigma w_i \tag{IA.13}$$

in which case we are trying to minimize the sum of the squared deviations of $\ln d_i$ from $x_i'\beta$, that is, the sum of the squared deviations of w_i for some σ. The Jacobian of yet another change in variables from w_i to $\ln d_i$ would simply be

$$\frac{dw_i}{d\ln\, d_i} = \frac{1}{\sigma} \tag{IA.14}$$

so that we are now dealing with the following likelihoods

$$f\left(\frac{\ln d_i - x_i'\beta}{\sigma}\right)\frac{1}{\sigma} = f(\ln d_i|x_i, \beta, \sigma) \tag{IA.15}$$

$$\overline{F}\left(\frac{\ln d_i - x_i'\beta}{\sigma}\right) = \overline{F}(\ln d_i|x_i, \beta, \sigma) \tag{IA.16}$$

and the log likelihood for the desired data becomes

$$\ln L(\beta, \sigma|\text{data}) = \sum_{\text{all observations}} [\phi_i \ln f(\ln d_i|\cdot) + (1-\phi_i)\ln \overline{F}(\ln d_i|\cdot)] \tag{IA.17}$$

where $\phi = 1$ if the SPAC has merged and $\phi = 0$ if it has been censored. While our log likelihood function in terms of w_i was

$$\ln L(w) = \sum [\phi_i(w_i - e^{w_i}) + (1-\phi_i)e^{w_i}] \tag{IA.18}$$

we now have as the log likelihood of the observed data

$$\ln L(\beta, \sigma|\text{data}) = \sum \left[\phi_i\left(\frac{\ln d_i - x'\beta}{\sigma}\right) - \phi_i \ln\sigma - \exp\left[\frac{\ln d_i - x'\beta}{\sigma}\right]\right]. \tag{IA.19}$$

This completes the derivation of Equation 10.

□

C.3. Note on Delta Method

In linear regression models, tests of statistical significance are performed on standardized variates given by

$$\frac{\hat{\theta} - \theta}{\widehat{SE}(\hat{\theta})}$$

where $\hat{\theta}$ is the estimator, θ is the hypothesized mean and $SE(\hat{\theta})$ is the standard error of the estimator. When the linear predictors are transformed then tests of significance are often performed using the "delta method"

$$\frac{f(\hat{\theta}) - f(\theta)}{f'(\hat{\theta})\widehat{SE}(\hat{\theta})}$$

where $f(\cdot)$ corresponds to the transformation. Asymptotically the two calculations yield identical standardized variates. Tables 1, 5 and 6, in our paper, report hazard ratios $f(\hat{\theta})$ and their standard errors $f'(\hat{\theta})\widehat{SE}(\hat{\theta})$. However, we provide the results of significance tests performed on the z's offered by the linear model, i.e., by $\frac{\hat{\theta}-\theta}{\widehat{SE}(\hat{\theta})}$ due to the superior small sample properties of the linear coefficients.

C.4. Discussion of True Value of Target Firm

Within the target industry, private firms considered in cross section create a pdf for "T",

$$f(t) = \frac{1}{\sqrt{2\pi\sigma_t^2}} e^{-(t-\mu)^2/2\sigma_t^2} \qquad \text{for } -\infty < t < \infty$$

which clearly has unbounded support. Though not likely, it is conceivable that a private firm has a true value "t" that is negative. However, the cautious reader should keep in mind that the probability of a negative realization of "T" can be made arbitrarily small with the appropriate choice of the statistical parameters that characterize the density function of target firms in a given industry.

C.5. *Impact of Compustat Variable Outliers*

In our main specifications, we winsorize Compustat variables at the 5% and 95% levels. This includes ROA, leverage, tangibility, and book-to-market ratios. We are hesitant to do this, as outliers can be informative. However, several extreme observations significantly impact conditional mean calculations, calling into question economic interpretation of the results. While most observations of ROA are between -100% and +100%, several significant outliers occur in the left tail. For example, the lowest (non-winsorized) ROA observation is -2,662%, which is simply a product of very low total assets. As the winsorized variables still display a slightly fat left tail, there remains both the concern that outliers are still overly impacting our results, and the concern that the winsorized outliers should be more informative.

To address both these issues, we employ a rank transformation technique as a robustness check. We map each non-winsorized Compustat variable onto a rank vector space with a length equal to the regression sample size (N). For each variable, the lowest observation is mapped to 1 and the highest observation is mapped to N. This method ensures each outlier observation is considered as its relative importance (ranked linearly against the peer observations). A common practice in machine learning algorithms, rank transformation does not involve subjective cutoffs/weightings used by other methods (e.g., winsorization or robust regression). Other recent applications of rank transformation within finance literature include Gu et al. (2020), Kozak et al. (2020), Freyberger et al. (2020), and Freyberger et al. (2024).

We repeat the ROA analysis found in Table 13 substituting rank transformed variables for the Compustat variables. These results are contained in Table **??**. As ROA_Rank is the dependent variable, the coefficients can be roughly interpreted as the marginal effects of incidence compared to the median ROA. The positive and significant (95% confidence level) coefficient of 78.047 on the interaction between 10th hazard decile indicator and CC3+_Ind suggests that such firms enjoy higher ROAs. This can be roughly interpreted as moving

78 firm observations (or $\frac{78.047}{441} = 17.7\%$) above the conditional median firm (conditional on all other covariates). Likewise, the year 2 interaction coefficient is 65.324, indicating a $\frac{65.324}{349} = 18.7\%$ movement above the conditional median. Though this is not particularly useful in determining the economic magnitude of the effect on ROA, it confirms that the sign and significance of our results are not driven by outlier observations. As with the previous ROA analyses, the non-interacted contingency clause variables remain insignificant.

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