PE for the Public: The Rise of SPACs*

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Abstract

A special purpose acquisition company (SPAC) allows sponsors to directly access public capital markets to raise funds to conduct acquisitions. Traditionally, such sponsors would raise capital by first tapping private markets to initiate a private equity (PE) fund. We present a unifying model of PE-to-IPO and SPAC financing. PE-to-IPO financing more efficiently separates high-quality from low-quality sponsors. SPAC financing more efficiently separates good acquisitions from bad acquisitions and is therefore preferred for funding firms subject to severe adverse selection. According to our model, the recent rise of intangible assets and technology companies can explain the increased use of SPAC financing.

Keywords: Special Purpose Acquisition Companies, Blank-Check Companies, Venture Capital, Private Equity, Entrepreneurial Finance, IPOs, Adverse Selection, Optimal Contracting.

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In 2010, the total proceeds from Special Purpose Acquisition Company (SPAC) issuance were \$104 million. By 2020, that number had risen to \$75.3 billion, representing more than 54% of all initial public offering (IPO) issuance (Gahng, Ritter, and Zhang (2021)). In comparison, new venture capital fundraising grew from \$19.6 billion in 2010 to \$74.5 billion in 2020 (National Venture Capital Association (2021)). Put differently, in 2010, new SPACs were negligible in aggregate size compared to new VC funds, and by 2020, new SPACs issuance was larger than new VC funds raised. This trend indicates a key change in how specialized equity investors access capital markets. Traditionally, a financial sponsor seeking to deploy specific knowledge or expertise to invest in private firms raises capital from private markets by initiating a VC or Private Equity (PE) fund. SPACs allow such a sponsor to access public capital markets directly. Why would a sponsor raise capital via a SPAC rather than the traditional private fund model? Why has the dramatic shift happened now?

To address these questions, we present a model of the capital-raising process for financial sponsors and firms based on two related adverse selection problems. First, the quality of firms in which a sponsor could invest is heterogeneous. Public and private market investors cannot observe a firm's quality, whereas sponsors can. Second, consistent with empirical evidence (Gompers, Gornall, Kaplan, and Strebulaev, 2020; Lin, Lu, Michaely, and Qin, 2021), sponsors vary in their ability to find viable acquisition targets. Expert sponsors have the opportunity to acquire good firms. In addition, as in Axelson, Strömberg, and Weisbach (2009), there are so-called fly-by-night operators who can attempt to represent themselves to the market as experts to raise financing but will never conduct a successful acquisition. To summarize, our model features separate adverse selection problems regarding firms and sponsors, and therefore sheds light on the complex conflicts of interests present in SPAC and traditional PE-to-IPO financing.

Our key result is that SPAC financing more effectively resolves adverse selection regarding firm type and PE-to-IPO financing more effectively resolves adverse selection regarding sponsor type. Consequently, a prospective financial sponsor prefers SPAC financing to the traditional PE-to-IPO approach for firms characterized by severe adverse selection. For example, technology firms, firms with high asset intangibility and uncertain revenue streams, or early-stage ventures could be more challenging for public markets to value. Expert financiers can then possess an informational advantage when acquiring such firms and anticipate better terms when organizing as a SPAC rather than a PE fund. Our model, therefore, offers a possible explanation for the recent increase in SPAC issuance relative to private capital activity: the rise of intangible capital intensive and technology firms has made SPAC financing more attractive.

As SPAC financing more effectively resolves firm type adverse selection, it is the preferred mode of financing for less profitable firms (i.e., firms with low but positive net present value) that cannot raise financing from the PE-to-IPO market. This result helps explain the poor post-acquisition performance of SPACs (Gahng et al., 2021; Klausner, Ohlrogge, and Ruan, 2020). In addition, SPAC financing requires less co-investment from the sponsor than PE-to-IPO financing, consistent with the view that SPAC sponsors effectively get "free shares" in the form of so-called "sponsor promotes." [1] In some cases in our model, SPAC financing is available to sponsors who invest zero of their own money, while PE-to-IPO financing is not.

[1] A recent news article on Reuters explains how SPAC sponsors typically put little investment themselves yet get a substantial amount of free shares in the consummated venture.

In our model, a sponsor can raise capital to profit from investing in private firms in two different modes. First, in line with the traditional approach, the sponsor can raise capital from private investors, acquire a firm, and subsequently sell that firm to public markets in an IPO. We call this process the PE-to-IPO financing structure. The sponsor acts as a PE General Partner (GP) in this case. Alternatively, the sponsor can issue a SPAC to raise capital directly from the public market before choosing a firm to acquire.

In either financing structure, we assume that the sponsor can write contracts with payoffs contingent on her decision to acquire a firm and the firm's terminal cash flow. Agreements signed in public markets are observable to all other agents. In contrast, those signed in private markets are only observable to the signatory parties. Otherwise, investors in both markets are identical in their preferences. In either case, we restrict attention to renegotiation-proof contracts and assume that renegotiation is publicly observable for public market contracts and not for private market ones. We assume that investors are short-lived. Early-stage investors (either public or private) demand liquidation in an interim round of financing in which the sponsor raises new funds from late-stage investors. In the case of the PE-to-IPO structure, this late-stage financing is the IPO of the acquired firm. In the case of the SPAC structure, late-stage financing is the secondary market for public SPAC shares after the SPAC has merged with a firm.

The two critical distinctions between the SPAC and PE-to-IPO financing structure are the timing when sponsors access public capital markets and the resulting conflicts of interest arising from this timing. In PE-to-IPO financing, the sponsor accesses public markets after raising capital from private markets and acquiring a firm. Accordingly, the sponsor's contract with public (i.e., late-stage) investors at the IPO can no longer provide incentives for the sponsor to reject negative net present value (NPV), that is, bad firms. Moreover, because public investors cannot observe the contract between the sponsor and early-stage investors or any renegotiation thereof, the sponsor and private (i.e., early-stage) investors have little incentive to agree to reject bad firms. If late-stage investors anticipate the sponsor has good incentives, they will pay a high price for SPAC shares in the secondary market. As a result, the early-stage investors and the sponsor will acquire a bad firm and sell it for a high price. Put differently, when considering a renegotiation of incentives, the early investors and the sponsor consider only the sum of their payoffs and not the total social surplus.

Although private capital markets admit the acquisition of some bad firms, they can effectively limit the participation of fly-by-night operators who raise financing but do not acquire a firm. The fact that private capital market contracts will often call for the sponsor to acquire a bad firm and therefore do not reward the sponsor for not acquiring any firm lowers the expected payoff for fly-by-night operators more than for the expert type because fly-by-night operators do not complete any acquisitions. In a sense, the sponsor can signal her type by writing a contract that calls for her to acquire a bad firm if given a chance. As a result, the PE-to-IPO financing approach features adverse selection regarding firms but resolves adverse selection regarding sponsors.

In contrast to the PE-to-IPO structure, the SPAC structure can provide the sponsor with incentives to forgo the acquisition of bad firms. Since the early-stage investors and the sponsor sign publicly observable contracts in a SPAC, any renegotiation at the time of acquisition considers total surplus. In particular, the early investors and the sponsor internalize the payoffs of late-stage investors who prefer not to acquire bad firms because they have NPV. At the same time, the sponsor must receive a payment if she fails to acquire a firm to have incentives to pass up the opportunity to acquire a bad firm. This payment, in turn, entices fly-by-night operators to raise early-stage capital in public markets. So while SPACs can effectively provide good incentives to sponsors, they can feature a lower-quality pool of sponsors in equilibrium. To summarize, the PE-to-IPO structure keeps fly-by-night operators out of the market but allows expert sponsors to acquire bad firms. In contrast, the SPAC structure features incentives for experts to screen out bad firms but attracts fly-by-night operators to the market.

Our model is consistent with concerns among regulators regarding the recent influx of SPAC sponsors. Many SPAC sponsors have previous experience in acquisitions. For example, Kohlberg, Kravis, and Roberts, one of the largest private equity fund managers, issued a SPAC in March of 2021 and raised $1.2 billion. However, other SPAC sponsors have little or no track record but have successfully raised significant investment capital using a SPAC. For example, on March 17, 2021, the *Wall Street Journal* reported that many celebrities, including professional athletes, musicians, and politicians, have issued SPACs (Ramkumar (2021)). This activity prompted the Securities and Exchange Commission (SEC) to issue an Investor Alert on March 10, 2021, warning public market investors not to invest in a SPAC solely based on a celebrity sponsor. While some celebrity sponsors will likely create value for their shareholders, their lack of track record means there is a greater chance that some lack the expertise to acquire firms. Our model rationalizes why these types of investors prefer to issue a SPAC rather than to raise a PE fund.

The sponsor chooses the optimal financing structure to reflect the trade-off between adverse selection regarding firms under PE-to-IPO financing and sponsors under SPAC financing. In light of this trade-off, firms and sponsors prefer SPAC financing over PE-to-IPO financing when adverse selection regarding firms is severe. In the same vein, SPAC financing is more valuable when adverse selection regarding the sponsor is mild, for instance, because the cost of setting up a fund and raising financing is high. To analyze the firm's choice between PE-to-IPO and SPAC financing, we extend our baseline model by assuming bargaining between the sponsor and the firm to determine the firm's acquisition price endogenously. The resulting acquisition price for a good firm depends on the adverse selection problem regarding firms and therefore is higher under SPAC financing. However, the presence of fly-by-night operators in the SPAC market lowers the likelihood of meeting an expert sponsor and, therefore, the probability of a successful acquisition. In contrast, fly-by-night operators do not enter the PE-to-IPO market, and good firms will always be successfully acquired, albeit at a lower price if they enter that market. Firms then prefer SPAC over PE-to-IPO financing when the firm adverse selection problem is severe. In this case, concerns about the acquisition price outweigh the risk of failing to find an expert sponsor.

Overall, our results suggest that SPAC financing is more valuable when adverse selection regarding firms is severe. In practice, agency conflicts and adverse selection on the firm-level could be a consequence of a firm's high asset intangibility, innovative business model, or uncertain technology. As a result, our results imply that firms operating in the technology sector with intangible assets and innovative business models are more likely to go public through an acquisition by a SPAC. Consequently, the recent rise of intangible capital (Corrado and Hulten (2010)) and technology firms, which may have caused more firm type adverse selection on average, could also explain the increase in SPAC financing and the decline in traditional IPOs

(Stulz (2020)).[2] Interpreted differently, our findings suggest that early-stage firms which tend to face more adverse selection than late-stage firms are more likely to go public via SPAC acquisitions than late-stage firms facing less adverse selection. Notably, SPAC financing strictly expands the set of firms that can go public as it is available to firms excluded from the traditional PE-to-IPO market (e.g., early-stage firms).

Because SPAC financing effectively resolves adverse selection over firm type, it is also available to firms with a low but positive net present value that would not have access to PE-to-IPO financing due to adverse selection. As such, our model also implies that SPAC financing is preferred over the traditional PE-to-IPO approach for less profitable firms (i.e., firms with a relatively low net present value) which are excluded from PE-to-IPO financing. This finding offers a potential explanation for the poor post-acquisition performance of SPACs observed in the data (Klausner et al., 2020; Gahng et al., 2021): on average, SPACs tend to acquire firms with relatively low profitability.

Regulation could address adverse selection problems that optimal contracts cannot fully resolve. That is, optimal regulation should address the two adverse selection problems inherent to SPAC and PE-to-IPO financing. In the traditional PE-to-IPO approach, (late) public investors are exposed to adverse selection regarding firms and the associated risk, but (early) private investors are not. As such, the regulation of traditional IPOs should protect mainly public investors. On the other hand, the regulatory goal should flip under SPAC financing where early investors face adverse selection regarding sponsors, but late investors do not. Therefore, optimal regulation of SPACs should mainly aim to protect the early SPAC investors at issuance.

Our model rationalizes several other features of the PE-to-IPO and SPAC financing structures. First, we endogenize the sponsor's co-investment and demonstrate that a sponsor's co-investment (per total investment) tends to be larger in SPAC financing than PE-to-IPO financing. In addition, given her co-investment, the sponsor would like to scale up the PE fund and acquire multiple firms under PE-to-IPO financing. Such an effect is not present under SPAC financing, where the sponsor prefers a smaller scale fund. The intuition behind this result is that the sponsor's co-investment is more effective at alleviating adverse selection in SPAC than PE markets, leading to a larger optimal sponsor co-investment per total investment under SPAC financing.

Another salient difference between PE-to-IPO and SPAC financing is that PE funds typically hold on to an acquired firm before selling it on public markets. Under SPAC financing, a firm becomes tradeable on public markets immediately after acquisition. Our model shows that the delay between firm acquisition and IPO in PE-to-IPO financing results from adverse selection regarding firms: the sponsor holds on to an acquired firm before selling it to the public to signal the firm's high quality. In contrast, since SPAC financing resolves adverse selection regarding firms, there is no need for the sponsor to hold on to an acquired firm before selling it, which speeds up the firm's process of going public relative to the traditional PE-to-IPO approach. Thus, SPAC financing offers a shorter waiting time to go public for firms.

Given the rise of SPAC issuance volume, many papers document empirical findings regarding this market,

[2]There is ample empirical evidence documenting the rise of intangible assets. See, for instance, Corrado and Hulten (2010) Kahle and Stulz (2017), Crouzet and Eberly (2018), Falato, Kadyrzhanova, Sim, and Steri (2020), or Crouzet and Eberly (2021).

such as Lewellen (2009), Jenkinson and Sousa (2011), Howe and O'Brien (2012), Cumming, Hass, and Schweizer (2014) and Dimitrova (2017) or, more recently, Klausner et al. (2020), Blomkvist and Vulanovic (2020), Gahng et al. (2021), and Lin et al. (2021). Our work relates to recent theories of SPACs (Bai, Ma, and Zheng, 2020; Banerjee and Szydlowski, 2021; Chatterjee, Chidambaran, and Goswami, 2016; Luo and Sun, 2021).[3] A critical difference between these papers and ours is that we also focus on sponsors' choice to become SPAC sponsors rather than a VC or PE fund general partner and the different conflicts of interest that arise in either setting. Our focus on the choice between the SPAC and PE-to-IPO structure allows us to address two important empirical findings in the literature directly. First, we predict that relative to traditional PE-to-IPO financing, SPAC financing can be costly for firms and their shareholders but deliver higher returns for SPAC investors and sponsors, in line with the findings of Gahng et al. (2021). Second, we also highlight that SPAC sponsors vary in their skills and quality, which gives rise to adverse selection regarding sponsors and imposes a large cost on SPAC financing. Consistent with this idea, Klausner et al. (2020) document that SPACs sponsored by large private equity funds produce higher returns for their shareholders. Related, Lin et al. (2021) show that SPAC sponsors' connections, network, and quality positively affect various metrics of SPAC performance. In the context of their paper, our analysis predicts that the effects of sponsor connections and quality on performance are stronger under SPAC than PE-to-IPO financing, and when the sponsor's co-investment is low, adverse selection regarding firm type is severe (e.g., due to high asset intangibility), or the cost of conducting an acquisition is high.

In contemporaneous work, Banerjee and Szydlowski (2021) highlight the possibility to redeem shares as one of the essential differences between SPAC and PE-to-IPO financing. Our work differs from theirs in several aspects. First, we focus on the agency and adverse selection problems inherent to SPAC and PE-to-IPO financing and characterize these two financing structures as optimal contracting problems. Second, we show that the nature of adverse selection differs between SPAC and PE-to-IPO financing, which endogenously pins down the choice between these two financing modes. Third, we provide a novel and different explanation for the rise of SPACs: the rise of intangibles.

In addition, our paper relates to theories on optimal IPO financing, such as Chemmanur and Fulghieri (1997, 1999). Further, our work relates to theories exploring the optimal structure of PE and VC financing, such as Casamatta (2003), Schmidt (2003), Axelson et al. (2009), Malenko and Malenko (2015), Piacentino (2019), Maurin, Robinson, and Strömberg (2020), and Gryglewicz and Mayer (2022), as well as empirical papers on PE and VC financing, such as Kaplan and Strömberg (2003, 2004) and Axelson, Jenkinson, Strömberg, and Weisbach (2013). Our paper contributes to this literature by comparing the traditional PE-to-IPO financing structure to the SPAC financing approach.

Most closely related to our work is Axelson et al. (2009) who develop a theory of leveraged buyouts

[3] Bai et al. (2020) develop a theory of segmented going-public markets and focus on the differences between investment banks as certification intermediaries in traditional IPOs and SPAC sponsors as non-bank certification intermediaries. Chatterjee et al. (2016) focus on the role of warrants in SPAC financing and show that these warrants play a unique role in limiting the level of risk of firms that the founder selects for acquisition. Luo and Sun (2021) study the timing structure of SPACs and show that as the SPAC's deadline approaches, the sponsor possesses incentives to acquire bad target firms. Unlike these papers, our paper compares SPAC and PE-to-IPO financing through the lens of optimal contracting theory. It characterizes both the sponsors' and firms' choices between SPAC and traditional PE-to-IPO financing.

and their financing structure based on agency conflicts between the private equity fund managers and their investors. Similar to our model, in Axelson et al. (2009), sponsors (i.e., PE funds) have the unique skills to identify target quality, giving rise to agency conflicts between sponsors and outside investors. However, the presence of fly-by-night operators restricts the set of contracts they can write with outside investors to resolve these agency conflicts. Notably, Axelson et al. (2009) show that in their setting, the PE fund optimally finances with debt and levered equity. Our paper differs from Axelson et al. (2009) in that it contrasts the traditional PE-to-IPO financing approach with SPAC financing.

Finally, our work contributes to the literature on intermediary incentives such as Diamond (1984) and Holmstrom and Tirole (1997), or, more recently, Hartman-Glaser, Piskorski, and Tchistyi (2012), Vanasco (2017), and Donaldson, Piacentino, and Thakor (2020). A major theme in this literature is to argue that intermediaries require incentives to take actions that align with the preferences of the investors. Vanasco (2017) discusses similar issues to us by showing that secondary market liquidity can affect primary market incentives to screen. The sponsor in our model is a type of intermediary. Our analysis shows that whether contracts are publicly observable by later-stage investors is an important determinant of intermediary incentives. Interestingly, we also show that the observability of contracts does not necessarily improve outcomes.

1 The Model

Time is discrete with three time periods, indexed by $t = 0, 1, 2$. An agent, whom we call a sponsor, raises funds from short-lived investors at time $t = 0$ to acquire a firm at time $t = 1$ that produces cash flows at time $t = 2$.

1.1 Preferences, Technology, and Information

All agents are risk-neutral, protected by limited liability, and zero outside option. There is no discounting. The sponsor is initially endowed with $A \geq 0$ dollars in assets she can invest. The outside investors have deep pockets. The sponsor maximizes the sum of expected payoffs over all three periods. In contrast, outside investors are short-lived: there are *early* investors, who maximize the sum of expected payoffs over $t = 0$ and $t = 1$, and there are *late* investors, who maximize the sum of expected payoffs over $t = 1$ and $t = 2$. Outside investors are competitive. When interacting with investors, the sponsor has full bargaining power.

The sponsor can either be an expert, in which case she will locate a single firm to acquire at time $t = 1$ at a cost $K > A$, or a fly-by-night operator, in which case she does not locate or acquire a firm. The modeling of fly-by-night operators follows Axelson et al. (2009) where fly-by-night operators try to earn money with the passive strategy to raise financing from outside investors without eventually acquiring a firm.[4] As in Axelson et al. (2009), we assume that there is an infinite supply of fly-by-night operators that can overwhelm

[4] Appendix C discusses an alternative model of fly-by-night operators in which fly-by-night operators can locate and acquire firms but only find bad firms. We show that our key results carry through under this alternative model specification.

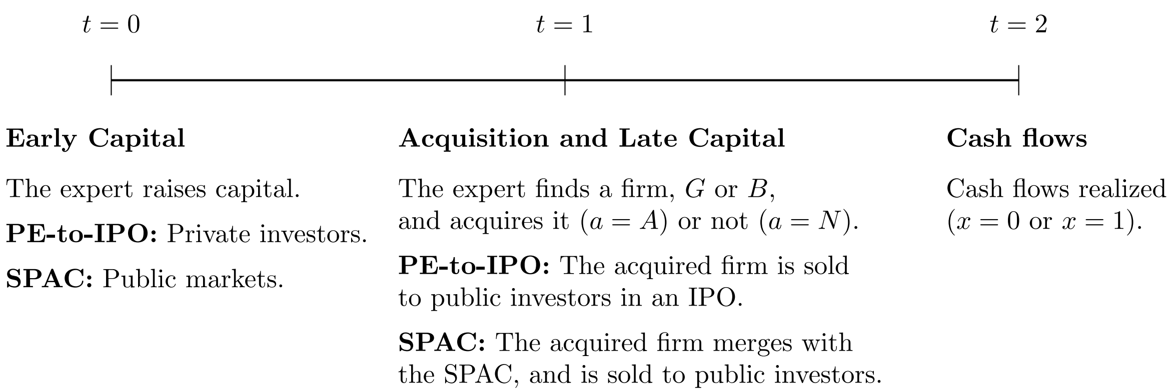

Figure 1: Timeline.

the market whenever it is possible to earn sufficiently high payoffs with this passive strategy.[5] The sponsor knows her type, but the investors do not.

If the sponsor is an expert, the firm she locates is good (G) with probability q and bad (B) with probability $1 - q$. A good firm produces cash flow 1 at date $t = 2$. A bad firm produces cash flow 1 with probability p and a cash flow 0 otherwise.[6] After the expert finds a firm and before she decides whether to acquire it, she observes its type, but investors do not. The type of firm is not contractible or verifiable.

As the sponsor does not possess sufficient assets to acquire a firm herself, she must raise funds from outside investors to conduct an acquisition. Importantly, there is a cost c to setting up a fund to conduct an acquisition. Thus, the sponsor must raise at least $K + c - A$ from early investors to have sufficient funds to acquire a firm.[7] Note that c is lost whether the sponsor eventually acquires a firm or not. We assume

$$p < K \leq 1 - \frac{c}{q}. \tag{1}$$

This assumption implies a good firm has sufficiently positive net present value (NPV), $q(1 - K) - c \geq 0$ so that the expected surplus from acquiring only good firms is positive, and a bad firm has negative net present value, $p - K < 0$.[8] Notice that $p < K$ ensures that the acquisition of a bad firm is a negative NPV investment even after the cost of locating a firm c is sunk.

1.2 Financing Contracts and Equilibrium Concept

To acquire a firm at time $t = 1$, the sponsor must raise financing from early investors at time $t = 0$, which we refer to as *early stage financing*. We consider two types of financing relationships between a sponsor and

[5] This specification is equivalent to assuming the ex-ante probability that the sponsor is an expert is sufficiently low.

[6] An equivalent formulation is that there are two types of firms (denoted 1 and 0): i) firms that produce cash flow 1 and ii) firms that produce cash flow 0. If the expert finds a firm of type 0, she perfectly recognizes its type. However, if the expert finds a firm of type 1, she misclassifies this firm as type 0 with probability p.

[7] One can interpret c as the legal costs associated with incorporating the fund, the costs of searching a viable acquisition target firm, the cost of conducting due diligence before an acquisition, or some cost of effort.

[8] We define the firm's NPV as expected cash flows minus the total cost of an acquisition, $K + c$.

early investors: i) the traditional PE-to-IPO model and ii) the SPAC model. In the traditional PE-to-IPO model, the sponsor, representing the general partners (GPs) of a venture capital or private equity fund, raises financing at time $t = 0$ from investors in private markets, representing the limited partners (LPs) of a venture capital or private equity fund. If the sponsor acquires the firm, she (partially) sells the firm to late investors via a traditional IPO, generating intermediate payoffs for both the sponsor and early private investors. This transaction is called *late stage financing*.

In the SPAC model, the sponsor raises financing from early investors in public markets at time $t = 0$ via a SPAC IPO. The sponsor may raise additional funds at $t = 1$ from late (public or private) investors, leading to payouts to early public investors and herself. Figure 1 illustrates the timing in both the PE-to-IPO and SPAC models.

We note that the only purpose of the assumption of short-lived outside investors is to ensure a need for an IPO in the PE-to-IPO approach. If investors maximized payoffs over all three periods, there would be no reason to have an IPO at $t = 1$ to raise additional funds. It would then be possible to fund acquisitions by raising capital from early private investors alone. Likewise, it would be possible to raise financing only from early public investors in the SPAC model, and the PE-to-IPO and SPAC financing approaches become identical. In what follows, we omit for convenience "early" and "late" to describe specific investors whenever no confusion is likely to arise.

We formulate the process of raising financing as a security design problem, in which the expert contracts with outside investors. Importantly, the PE-to-IPO and the SPAC financing model are identical in all aspects but one: in the SPAC model, all contracts are publicly observable, but in the PE-to-IPO model, they are not. Specifically, in the PE-to-IPO model, only the early investors and the sponsor can observe their initial contract and any renegotiation. The interpretation is that in the PE-to-IPO approach, the sponsor first raises financing from private investors under relatively few regulatory disclosure requirements before she conducts an IPO and raises financing from the public under stricter disclosure requirements. In contrast, in the SPAC financing approach, all contracts are written between the sponsor and public investors, and hence these contracts are publicly observable.

We assume the sponsor has full bargaining power in both the early and late-stage financing markets and that investors will purchase any security at a price that leaves them with a weakly positive payoff given their beliefs. We also assume that the sponsor has limited liability. She cannot promise more to early investors than the proceeds from the sale of new securities plus any remaining cash in the firm after the acquisition decisions. She also cannot promise more to late investors than the firm's terminal cash flow.

1.3 The Contracting Problem

We denote the payoffs to the security offered to early investors as $y_1(a)$ if an acquisition occurs and $y_1(n)$ if it does not. While it is possible that the sponsor raises more capital at time 0 than is necessary to conduct an acquisition, doing so would not increase her net payoff, so we restrict attention to securities y_1 such that the price investors are willing to pay is $P_0 = K + c - A$. We denote the payoff to the security offered to late investors if the firm produces a cash flow of 1 as y_2 and note that since the sponsor faces limited liability, she cannot offer any payoff in the event the firm produces cash flow 0. We denote the price that late investors pay for this security by P_1. Given a set of securities y_1, y_2 and a price P_1 and a probability θ that she acquires a bad firm if given the opportunity, the expert-type sponsor has the payoff

$$\begin{aligned} V(y_1, y_2, P_1; \theta) = {} & q(P_1 - y_1(a) + 1 - y_2) \\ & + (1-q)(\theta(P_1 - y_1(a) + p(1-y_2)) + (1-\theta)(K - y_1(n)) - A. \end{aligned} \tag{2}$$

If the sponsor does not acquire a firm, early investors are paid $y_1(n)$ dollars and the sponsor receives the remainder, $K - y_1(n)$ dollars. Notice that the sponsor's payoff is net of her co-investment of A dollars.

If a fly-by-night operator enters the market, she mimics an expert and raises financing of $K + c - A$ dollars from early investors at time $t = 0$ but eventually does not acquire a firm at $t = 1$, leading to payouts of $y_1(n)$ dollars to the early investors and payouts of $K - y_1(n)$ dollars to herself. That is, given a security y_1, any fly-by-night operator derives (net) payoff

$$W(y_1) = K - y_1(n) - A$$

from entering the market (which requires to co-invest A dollars); otherwise, if the fly-by-night operator stays out of the market, her payoff is zero. We denote by ϕ the probability that the sponsor is an expert. Note that ϕ is endogenous and depends on the entry decisions made by fly-by-night operators. Specifically,

$$\phi = \begin{cases} 1 & \text{if } W(y_1) < 0 \\ \hat{\phi} \in [0,1] & \text{if } W(y_1) = 0 \\ 0 & \text{if } W(y_1) > 0 \end{cases}$$

When $W(y_1) > 0$, fly-by-night operators find it strictly optimal to enter and, because their mass is unlimited, they overwhelm the market, leading to $\phi = 0$. When $W(y_1) < 0$, a fly-by-night operator strictly prefers not to enter the market. When $W(y_1) = 0$, fly-by-night operators are indifferent between entering and not entering the market, which is a necessary condition for $\phi = \hat{\phi} \in (0,1)$ to arise in equilibrium.

An equilibrium is a set of contracts (y_1, y_2) and actions θ that solve the following program

$$\max_{y_1, y_2} \quad V(y_1, y_2, P_1; \theta), \tag{3}$$

such that actions are incentive compatible, i.e.,

$$\theta \in \arg\max_{\hat{\theta} \in [0,1]} \left[\hat{\theta}(P_1 - y_1(a) + p(1-y_2)) + (1-\hat{\theta})(K - y_1(n)) \right], \tag{4}$$

and prices are such that investors break even

$$P_0 = K - A + c = \phi\big((q + (1-q)\theta)y_1(a) + (1-q)(1-\theta)y_1(n)\big) + (1-\phi)y_1(n) \tag{5}$$

$$P_1 = \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta}\right) y_2. \tag{6}$$

Note that in (6), the fraction $\frac{q+(1-q)\theta p}{q+(1-q)\theta}$ is the probability that the firm produces cash flows one, given the probability θ that the expert acquires a bad firm when given the opportunity. We restrict attention to contracts that are renegotiation proof. The only state in which renegotiation can improve payoffs is if the sponsor locates a bad firm. Given the contracts and incentives in place, there could be a mutual benefit among investors and the sponsor to reallocate payoffs and change incentives.

1.4 Renegotiation Proof Contracts

In our model, the distinction between the PE-to-IPO market and the SPAC market is the observability of contracts and their renegotiation, and thus the feasible types of renegotiation. In the PE-to-IPO market, the sponsor can *privately* renegotiate contracts with either group of investors.[9] While in the SPAC market, all renegotiation is publicly observable. We now provide a heuristic argument for the constraints that renegotiation proofness imposes on the contracting problem in either case. We present more formal arguments in Appendix A.

We focus on renegotiation proof contracts. In the PE-to-IPO market, it is not feasible to jointly renegotiate with all three parties because only private renegotiation is possible. As such, the most profitable renegotiation is between the sponsor and the early stage investors. Thus, to guarantee that renegotiation is not profitable, in other words, that the incentives given by the original contract are indeed optimal once the sponsor is faced with the decision to acquire a bad firm, we impose the following constraint

$$\theta \in \arg\max_{\hat{\theta}\in[0,1]} \Big[\hat{\theta}(P_1 - y_1(a) + p(1-y_2) + y_1(a)) + (1-\hat{\theta})(K - y_1(n) + y_1(n))\Big]. \tag{7}$$

The constraint in (7) states that sponsor and early stage investors cannot jointly profit by agreeing to change the sponsor's acquisition policy for bad firms. In other words, the decision to acquire a bad firm maximizes the joint surplus of the sponsor and early investors. The constraint simplifies to

$$\theta \in \arg\max_{\hat{\theta}\in[0,1]} \Big[\hat{\theta}(P_1 + p(1-y_2)) + (1-\hat{\theta})K\Big]. \tag{8}$$

In the SPAC market, it is feasible to jointly renegotiate with all three parties. Indeed, any two party renegotiation would be a special case of a three party renegotiation. Thus, to guarantee that renegotiation

[9] That is, if the sponsor privately renegotiates with early (private) investors, late (public) investors do not observe these renegotiations. In contrast, if the sponsor were to renegotiate with public investors, the outcomes of this renegotiation would be publicly observable.

is not profitable, we impose the following constraint

$$\theta \in \arg\max_{\hat{\theta}\in[0,1]} \Big[\hat{\theta}(P_1 - y_1(a) + p(1-y_2) + y_1(a) - P_1 + py_2) + (1-\hat{\theta})(K - y_1(n) + y_1(n))\Big]. \tag{9}$$

The constraint in (9) states that all three parties cannot jointly profit from changing the sponsor's acquisition policy for bad firms. The constraint simplifies to

$$\theta \in \arg\max_{\hat{\theta}\in[0,1]} \Big[\hat{\theta}p + (1-\hat{\theta})K\Big]. \tag{10}$$

1.5 Adverse Selection

Before discussing equilibrium, we introduce some terminology to describe the two adverse selection problems in our model. First, the early investors face an adverse selection of sponsors in the capital raising stage at time $t = 0$. The severity of this problem depends on the cost c of setting up a fund which is wasted if the early investors supply capital to a fly-by-night operator. We call this the sponsor adverse selection problem.

The second adverse selection problem is faced by late investors when purchasing a firm at date $t = 1$. We call this the firm adverse selection problem. Observe that the difference between the net present value (NPV) of a good firm and that of an average firm is

$$\alpha = (1-q)(1-p). \tag{11}$$

When this difference is greater, either because good firms occur with a lower probability q or because bad firms succeed with a lower probability p, a sponsor with a good firm faces a greater cost of fully pooling with bad firms. Thus the difference between the NPV of a good firm and an average firm is one measure of the severity of the adverse selection problem.[10] However, this measure of the severity of the adverse selection problem faced by late investors does not take into account the equilibrium acquisition policy implemented by the sponsor. In equilibrium, the ex interim severity of the adverse selection problem faced by the late-stage investors is $\theta\alpha$, which depends on the expert sponsor's incentives to forgo the acquisition of bad firms and her resulting equilibrium strategy. The cost of these incentives depends on the sponsor assets A and the market structure.

Finally, note that adverse selection models often feature equilibrium multiplicity due to the indeterminacy of off-equilibrium beliefs. Throughout the paper, we apply the intuitive criterion to refine off-equilibrium beliefs.

2 Solution

This section characterizes the equilibrium in both the PE-to-IPO and SPAC markets. We begin by considering the late-stage financing market and derive some common results for both the PE-to-IPO and SPAC

[10] Tirole (2010) Chapter 6 refers to α as the adverse selection index. Also note that $1 - \alpha = q + (1-q)p$ is the expected payoff of an average firm.

settings. We then use these results to express the sponsor's problem as a set of incentive compatibility constraints. Using these constraints, we can then fully characterize the equilibrium in both markets.

2.1 Late Stage Financing and the Investors' Break-Even Constraint

A useful benchmark for our setting is the "first best" allocation in which the expert only acquires good firms, and there are no fly-by-night operators. As the expert extracts all surplus, her payoff under first best equals

$$V^{FB} = q(1-K) - c. \tag{12}$$

The following lemma shows that the first best obtains in both the PE-to-IPO and SPAC markets when the investor's co-investment (net worth) A is sufficiently large.

Lemma 1. *The first best obtains in either market if*

$$A \geq \overline{A} = \left(\frac{p}{1-p}\right)(1-K) + c, \tag{13}$$

that is, no fly-by-night operators enter, and no bad firms are acquired.

Intuitively, when the sponsor is wealthy, an expert can retain sufficient skin in the game to resolve all adverse selection problems. In particular, she can internalize both the cost c of raising initial capital and the value lost in acquiring a bad firm so that fly-by-night operators have no incentives to enter and no bad firms are acquired. In what follows, we restrict attention to $A < \overline{A}$ for the remainder of the analysis (unless otherwise noted).

After the sponsor acquires a firm, she can raise late-stage financing. Because the fly-by-night operator never acquires a firm, she never raises financing from late investors. Therefore, it suffices to consider a sponsor who is an expert when we analyze late-stage financing. We will now show there is no separating equilibrium in the late-stage financing market and that the sponsor will never raise excess financing at date $t = 1$. These two features of the late-stage financing market allow us to simplify the characterization of equilibrium by combining the break-even constraints of all the investors in the model.

First, to see why there does not exist a separating equilibrium, i.e., an equilibrium in which the sponsor offers a contract that depends on the type of firm she has to sell, note that there is no cost to a sponsor with a bad type firm to emulate that with a good type firm. Second, to see why the sponsor never raises excess financing in the late-stage market, note that she could use such funds to signal the quality of the asset she has to sell by offering to sell a smaller fraction of the cash flow. We leave the details of these arguments to the appendix and summarize the results in the lemma below.

Lemma 2. *There does not exist a separating equilibrium in the late-stage market. Moreover, the sponsor never raises excess financing in the late-stage market under the intuitive criterion. So, $P_1 = y_1(a)$ in any equilibrium.*

An immediate consequence of Lemma 2 is that we can simplify and combine the break-even constraints of early and late stage investors in equations (5) and (6) as follows

$$\underbrace{(1-\phi)y_1(n)+\phi((q+(1-q)\theta p)y_2+(1-q)(1-\theta)y_1(n))}_{\text{Expected net payouts to investors}} = \underbrace{K+c-A}_{\text{Funds contributed by investors}} . \tag{14}$$

That is, the difference between the total cost of acquisition and the amount contributed by the sponsor is equal to the expected amount promised to investors.

2.2 Incentive Compatibility

This section discusses the constraints that determine the sponsor's incentives in more detail. First, consider the incentives of an expert sponsor to acquire or reject a given firm. If the sponsor acquires a bad firm, she will receive the residual cash flow if the firm succeeds. If she does not, she will receive the difference between the cash she raised from early investors net of the cost c and the amount she owes to these investors if she fails to acquire a firm. Thus, it is incentive compatible for the sponsor to forgo the acquisition of a bad firm if

$$p(1-y_2) \leq K - y_1(n). \tag{15}$$

Similarly, it is incentive compatible for her to acquire a good firm if

$$1-y_2 \geq K - y_1(n). \tag{16}$$

Now consider the incentives for a fly-by-night operator to enter the market. Recall that fly-by-night operators never acquire a firm, so if one enters the market, she will receive the difference between the cash she raised from early investors net of the cost c and the amount she owes to these investors. If she stays out of the market, she can keep her initial assets. Thus, it is incentive compatible for a fly-by-night operator to stay out of the market if

$$K - y_1(n) \leq A. \tag{17}$$

2.3 Equilibrium in the PE Market

In this section, we analyze the equilibrium in the PE market and show that the sponsor acquires bad firms when she has less assets A of her own to invest and that fly-by-night operators will never enter. Therefore, we assume the expert sponsor will participate in the market for the time being.

To begin our analysis, we conjecture that the sponsor is a fly-by-night operator with probability zero, in that $\phi = 1$. Eventually, we verify this conjecture by showing that, indeed, fly-by-night operators earn negative payoffs from entering the PE market as financiers. There are three possible cases to consider, either the equilibrium calls for the sponsor to reject a bad firm, acquire a bad firm with some probability between zero on one, or accept a bad firm. We will show that the greater the sponsor's contribution A, the more she will internalize the consequences of acquiring a bad firm, and the better her incentives will be.

First suppose there exists an equilibrium in which the sponsor chooses to acquire a bad firm with probability one when such a firm arrives. In this case, $\theta = 1$, $P_1 = P_0 = K + c - A$, and the break even constraint for late investors becomes

$$(q + (1 - q)p)y_2 = P_1. \tag{18}$$

At the same time, the renegotiation proofness constraint (8) requires that $\hat{\theta} = \theta = 1$ so that[11]

$$q(1 - p)y_2 \geq K - p. \tag{19}$$

In other words, the amount sold to late investors must be large enough to compensate for the lower IPO price implied by the sponsor acquisition strategy. Substituting equation (19) into equation (18) and using $P_1 = K + c - A$ yields that an equilibrium in which $\theta = 1$ can exist only if

$$A \leq \hat{A} = p - \left(\frac{p}{1-p}\right)\left(\frac{K-p}{q}\right) + c. \tag{20}$$

Now suppose the sponsor has assets between $\hat{A}$ and $\overline{A}$. In this case, by definition of $\hat{A}$, it is not feasible to satisfy the investors' break-even constraint in equation (14), strictly satisfy the incentive constraint in equation (15) and the renegotiation proofness constraint (8). Thus, when A is between $\hat{A}$ and $\overline{A}$, the only possible equilibrium is for the sponsor to acquire a bad firm with some probability between zero and one. The equilibrium, in this case, is determined by the unique θ, $y_1(n)$, and y_2 such that the incentive constraint in equation (15) binds so that the sponsor is indifferent between acquiring a bad firm and not, the coalition of the sponsor and the early investors is indifferent between acquiring a bad firm and not

$$\left(\frac{q + (1-q)\theta p}{q + (1-q)\theta}\right) y_2 + p(1 - y_2) = K, \tag{21}$$

and the break-even constraint given in equation (14) holds.

We next argue that fly-by-night operators never have an incentive to enter the market under the equilibrium proposed above. When $A < \hat{A}$, then the contract stipulates $\theta = 1$, i.e., an acquisition occurs with probability one. Under these circumstances, the fly-by-night operator, who cannot conduct an acquisition, cannot mimic the expert and thus does not enter. Next, for $A \in (\hat{A}, \overline{A})$, the sponsor acquires a bad firm with probability $\theta \in (0, 1)$. Then, the incentive constraint (15), that the sponsor finds it privately optimal *not* to acquire a bad firm, must either bind or be violated. Renegotiation proofness implies that the sponsor and early investors must collectively at least weakly prefer to acquire a bad firm. That is, inequality (19)

[11] For a derivation, note that (8) implies $P_1 + p(1 - y_2) \geq K$ for $\theta = 1$ to be an equilibrium. Using (18) to substitute for P_1, we obtain

$$(q + (1 - q)p)y_2 + p(1 - y_2) \geq K$$

which simplifies to (19).

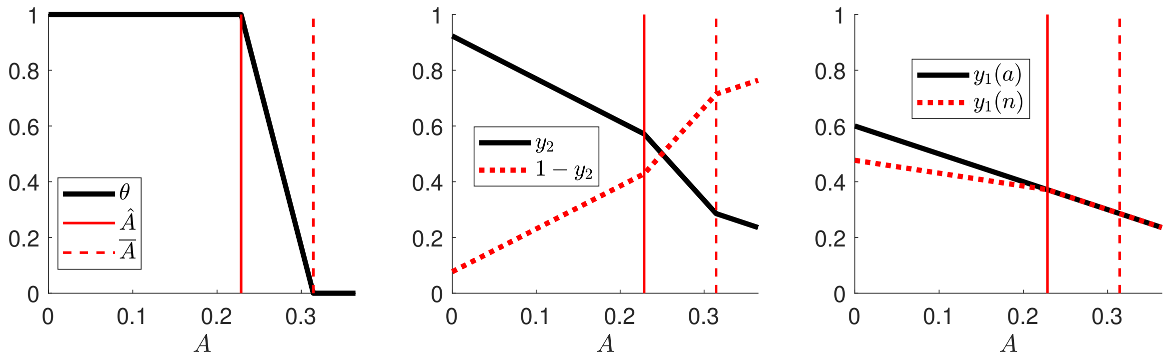

Figure 2: The optimal contract under PE-to-IPO financing as a function of expert net worth A. The vertical solid red line depicts $\hat{A}$ and the vertical dashed red line depicts $\overline{A}$. The parameters are $p = 0.3$, $c = 0.1$, $K = 0.5$, and $q = 0.5$.

must hold. Together with the investor break-even condition given in equation (14), this implies that[12]

$$K - y_1(n) \leq A - c < A$$

so that fly-by-night operators have no incentive to enter. This confirms that the PE market features $\phi = 0$ in equilibrium, and there is no adverse selection problem regarding expert type.

Intuitively, when the sponsor has a low net worth, late-stage investors anticipate that she will have an incentive to acquire bad firms, and the price in the IPO market must be low. Given this, the early-stage investors require a larger payoff if the sponsor fails to acquire a firm. This larger payoff, in turn, eliminates the incentive for fly-by-night operators to enter. In other words, the same payoffs that provide the expert with incentives to acquire bad firms also prevent fly-by-night operators from entering the market.

We collect our findings in the following proposition. Figure 2 provides a graphical illustration of the optimal contract and its dependence on expert co-investment A.

Proposition 1. *Assuming the expert sponsor participates, the unique equilibrium acquisition strategy for the expert sponsor in the private equity market is given by*

$$\theta = \begin{cases} 1 & \text{for } A \leq \hat{A} \\ \left(\frac{1}{K-p}\right)\left(\frac{q}{1-q}\right)\left(1 - K - \left(\frac{1-p}{p}\right)(A-c)\right) & \text{for } \hat{A} < A \leq \overline{A} \end{cases}$$

[12]The proposition below, in fact, shows that when $A < \hat{A}$, then $y_1(n) = K + c - A$ and the inequality below becomes $K - y_1(n) = A - c < A$.

with contracts

$$
y_1(n) = \begin{cases} K - p\left(1 - \frac{(K+c-A)}{q+(1-q)p}\right) & \textit{for } A \le \hat{A} \\ K + c - A & \textit{for } \hat{A} < A \le \overline{A} \end{cases}
$$

$$
y_1(a) = K + c - A
$$

$$
y_2 = \begin{cases} \frac{K+c-A}{q+(1-q)p} & \textit{for } A \le \hat{A} \\ 1 - \frac{A-c}{p} & \textit{for } \hat{A} < A \le \overline{A}. \end{cases}
$$

The threshold $\hat{A}$ is defined in (20). Security prices satisfy $P_0 = P_1 = K + c - A$. Fly-by-night operators never enter the private equity market, in that $\phi = 0$.

Note that while the equilibrium acquisition strategy is unique for all A, the equilibrium contracts are only unique for $\hat{A} \le A \le \overline{A}$. This is because for $A < \hat{A}$, $y_1(n)$ is an off-equilibrium payment, so we are free to choose any $y_1(n)$ so long as it implements the equilibrium strategy (e.g., $y_1(n) = K$).

2.4 The SPAC Market

In this section, we analyze equilibrium in the SPAC market. First, note that the renegotiation proofness constraint in equation (10), together with the assumption that $p < K$, implies that any equilibrium in the SPAC market calls for the sponsor to forgo the acquisition of bad firms. Intuitively, if an equilibrium involved the acquisition of bad firms, it would be publicly renegotiated with all investors to prevent the acquisition and increase the total surplus. Since the renegotiation constraint accounts for the effect that the sponsor's acquisition strategy has on the payoffs of all agents, any equilibrium must implement the socially optimal strategy for the expert sponsor.

Now consider the entry decision of fly-by-night operators. Suppose there exists an equilibrium in which fly-by-night operators prefer to stay out of the market. In this case, expert type sponsors must have incentives to forgo the acquisition of bad firms, i.e., (15) must hold

$$
p(1 - y_2) \le K - y_1(n),
$$

and fly-by-night operators must have incentives to stay out of the market, i.e.,

$$
K - y_1(n) \le A.
$$

These two constraints, together with the break-even constraint for the investors (i.e., (14)), imply that

$$
A \ge \tilde{A} = \left(\frac{p}{1-p}\right)\left(1 - K - \frac{c}{q}\right). \tag{22}
$$

Intuitively, if the sponsor has sufficient assets, she can bear enough of the deadweight costs c of forming a SPAC so that fly-by-night operators prefer to stay out of the market. That is, an expert sponsor can promise

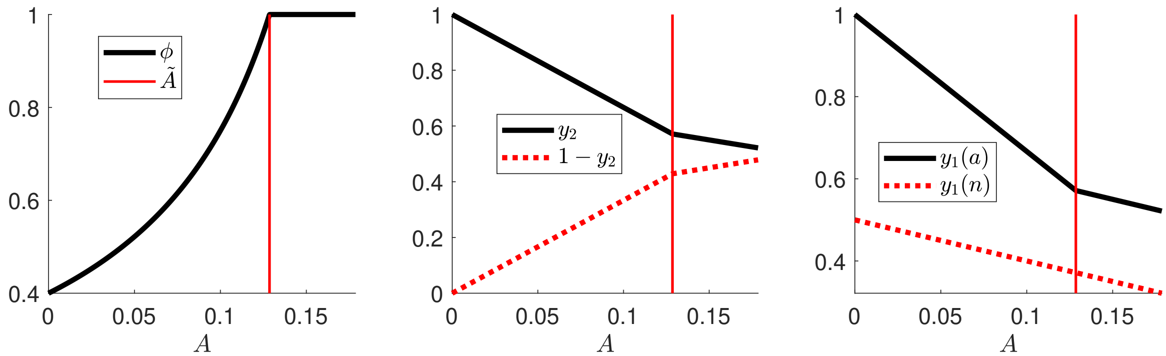

Figure 3: The optimal contract under SPAC financing as a function of expert net worth A. The vertical solid red line depicts $\tilde{A}$. The parameters are $p = 0.3$, $c = 0.1$, $K = 0.5$, and $q = 0.5$.

to return sufficient capital to investors in the event of failing to acquire a firm that fly-by-night operators prefer to stay out of the market. Note that $\tilde{A}$ is below the level of assets $\overline{A}$ given in equation (13).

Now suppose that $A \leq \tilde{A}$ and the sponsor does not have sufficient assets to prevent fly-by-night operators from entering the market. Suppose the equilibrium investor payoffs $y_1(n)$ and y_2 leave the constraint in (15) slack so that the expert sponsor strictly prefers to forgo acquiring a bad firm. In this case, she could always offer a contract that promises a lower y_2 and a larger $y_1(n)$. Such a contract would leave investors better off and would preserve her incentives. Moreover, since the fly-by-night operator's payoffs are entirely determined by $y_1(n)$, such a contract would reduce the fly-by-night operator's payoffs even if investors responded by assigning a higher probability to the sponsor being an expert. Thus, the intuitive criterion implies that investors must believe that such a deviation could only have come from an expert sponsor, making the expert sponsor wish to deviate. As a result, the constraint (15) must bind for $A \leq \tilde{A}$. As in the PE-to-IPO market structure, there is a trade-off between the expert sponsor's incentives to only acquire good firms and the fly-by-night-operators incentives to enter the market. In this case, the payoffs that incentivize the expert sponsor to reject bad firms also entice the fly-by-night-operator to enter the market.

Now consider the incentives of fly-by-night operators to enter the market given by the constraint in (17). For $A \leq \tilde{A}$, it is not possible to keep fly-by-night operators out of the market, so this constraint must either bind or be violated. If it is violated, then fly-by-night operators would overwhelm the market. That is, the probability that investors meet a fly-by-night operator is $\phi = 1$. In this case, the only way to satisfy the break-even constraint for the investors would be to set $y_1(N) = K - A + c$, which would then leave fly-by-night operators with no incentive to enter the market. Thus, the constraint in (17) must bind. Moreover, the break-even constraint for the investors must also be satisfied with equality. We summarize the equilibrium in the proposition below. Figure 3 graphically illustrates the optimal contract under SPAC financing for different levels of A.

Proposition 2. *Assuming the expert sponsor participates, the equilibrium in the SPAC market calls for the expert sponsor to reject all bad firms, that is, $\theta = 0$. Moreover, the equilibrium is given by the first best allocation when $A > \tilde{A}$ in which case no fly-by-night operators enter and $\phi = 1$. When $A < \tilde{A}$ the equilibrium* *is given by the contracts*

$$y_1(n) = K - A, \quad \textit{and} \quad y_1(a) = y_2 = 1 - \frac{A}{p}.$$

Fly-by-night operators enter the market such that investors meet an expert sponsor with probability

$$\phi = \frac{cp}{q(p(1-K) - A(1-p))}.$$

The security prices satisfy

$$P_0 = K + c - A \quad \textit{and} \quad P_1 = 1 - \frac{A}{p}.$$

Finally, note that the SPAC financing contract described in our paper resembles many real-world features of SPACs. First, if the sponsor does not acquire a firm, the SPAC is liquidated, and the sponsor receives no more than her initial co-investment. Our model argues that this contractual feature is necessary to deter fly-by-night operators from the SPAC market. If SPAC sponsors were paid upon SPAC liquidation, fly-by-night operators would dominate the market for SPACs. Second, the SPAC raises financing from late investors at or shortly after the acquisition. In the model, these could be public investors and private investors, such as PIPEs (Private Investment in Public Equity). As documented in Gahng et al. (2021), PIPEs play a prominent role in SPAC acquisitions. Third, the sponsor is not paid for the acquisition but only when the firm performs sufficiently well (i.e., produces cash flows). Such a payout structure implements high-powered incentives for the SPAC sponsors, which could be achieved through granting the sponsor warrants (as is the case in practice). Fourth, interpreted broadly, the event that a SPAC returns capital to investors instead of acquiring a bad firm is also consistent with the practice that investors possess redemption rights. In other words, we can interpret the repayment to SPAC investors after finding a bad firm as investors redeeming their shares for cash so that the sponsor cannot acquire the firm.

2.5 Expert Payoffs and Participation

We assumed that the expert always enters the market in our characterization of the equilibrium above. To conclude the description of the equilibrium, we characterize the expert's incentives to participate in the SPAC and the PE market. In either market, the expert's participation constraint is $V^x \geq 0$ for $x \in \{PE, SPAC\}$, where V^x denotes the expert's payoff net of the co-investment at $t = 0$ under financing mode $x \in \{PE, SPAC\}$. Recall that we assume an outside option of zero.

First, we consider the PE market. Given the equilibrium we describe in Proposition 1, we can calculate the payoff of the expert sponsor conditional on entering the market. Her payoffs at time $t = 0$ are

$$V^{PE} = \begin{cases} 1 - \alpha - (K + c) & \text{for} \quad A \leq \hat{A} \\ \left(\frac{1-p}{p}\right) qA - \left(\frac{1-\alpha}{p}\right) c & \text{for} \quad \hat{A} \leq A \leq \overline{A} \\ q(1-K) - c & \text{for} \quad A \geq \overline{A}. \end{cases} \tag{23}$$

The threshold $\hat{A}$ is defined in (20). The left panel of Figure 4 plots the expert's payoff under PE-to-IPO financing as a function of her assets A. For $A < \hat{A}$, the expert acquires any firm with probability one, and

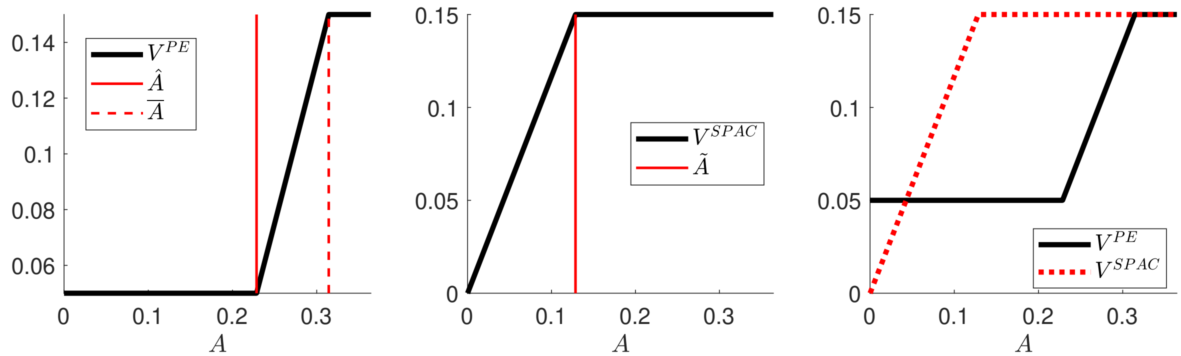

Figure 4: The expert's payoffs under the PE-to-IPO and SPAC models. The parameters are $p = 0.3$, $c = 0.1$, $K = 0.5$, and $q = 0.5$.

the adverse selection problem and her payoff do not change with A. As her assets A increase and exceed $\hat{A}$ (denoted by the vertical solid red line), her incentives to forgo the acquisition of bad firms increase, and the probability θ the expert acquires a bad firm decreases. Thus, when $\hat{A} \leq A \leq \bar{A}$, an increase in A mitigates adverse selection in the late-stage market and increases the sponsor payoff. Finally, when A exceeds $\overline{A}$ (denoted by the vertical dashed red line), the sponsor only acquires good firms, and there is no adverse selection in the late-stage market.

The expert sponsor enters the market as long as her payoffs from entry are positive. If $K \leq 1 - \alpha - c$, then the average firm is positive NPV, and the adverse selection problem is not too severe. In this case, $V^{PE} \geq 0$ for all A, and the expert sponsor enters the market. If $K > 1 - \alpha - c$, then the adverse selection problem over firms is more severe, and the expert will only enter the PE market if she has sufficient assets, in that

$$A \geq \underline{A} = \left(\frac{1 - \alpha}{(1 - p)q} \right) c. \tag{24}$$

Intuitively, when adverse selection over firms is severe, late-stage financing in the PE market will break down if the sponsor acquires bad firms with too high a probability. To prevent this, the expert requires incentives to forgo the acquisition of bad firms. These incentives require that she has enough assets to maintain sufficient skin-in-the-game. Otherwise, with low A (i.e., $A < \underline{A}$) and insufficient skin-in-the-game, the sponsor cannot raise funds via the PE-to-IPO approach.

Second, we analyze the SPAC market. Conditional on entry, the expert sponsor payoffs in the SPAC market are given by

$$V^{SPAC} = \begin{cases} \left(\frac{1-p}{p} \right) qA & \text{for} \quad A \leq \tilde{A} \\ q(1 - K) - c & \text{for} \quad A \geq \tilde{A} \end{cases} \tag{25}$$

Notably, V^{SPAC} is always positive for any level of A, implying that the expert always enters under SPAC financing. Figure 4 plots the expert's payoff under SPAC financing for different values of A (middle panel). When the expert's co-investment A lies below $\tilde{A}$ (denoted by the solid vertical red line), the SPAC market attracts fly-by-night operators, which worsens financing conditions in the early stage and reduces the expert's payoff. As the expert's net worth and co-investment A increase, it becomes more costly for fly-by-night operators to enter, so that ϕ decreases and the expert's payoff increases. Once $A \geq \tilde{A}$, there are no more fly-by-night operators, and the expert's payoff is at its maximum, $1 - K - \frac{c}{q}$.

As such, our analysis reveals that under certain circumstances (i.e., $\alpha > 1 - K - c$), SPAC financing is feasible even under a low level of sponsor co-investment A, while PE-to-IPO financing is not. Said differently, SPAC financing requires relatively low sponsor co-investment. The practice of granting promotes, that is, shares in the SPAC, to the sponsor at issuance is one potential implementation that would deliver positive profits to the sponsor even when she contributes almost no co-investment. We conclude this section with the following corollary.

Corollary 1. *The expert's payoff at time $t = 0$ (conditional on entry), denoted V^x for $x \in \{PE, SPAC\}$, can be characterized as follows:*

1. *Under PE-to-IPO financing, the expert's payoff at time $t = 0$ denoted V^{PE} is described in (23). If the adverse selection regarding firms is not too severe, that is, if $\alpha \leq 1 - K - c$, the expert's payoff V^{PE} is positive for any level of A, and she always enters the market. Otherwise, the expert's payoff is positive, and she enters the market if and only if $A \geq \underline{A}$.*

2. *Under SPAC financing, the expert's payoff at time $t = 0$ denoted V^{SPAC} is described in (25). The expert's payoff V^{SPAC} is positive for any level of A.*

3 Analysis

So far, we have shown that in the SPAC market structure, fly-by-night operators enter the market, but expert sponsors never acquire bad firms. On the other hand, in the PE-to-IPO market structure, fly-by-night operators never enter the market, but expert sponsors sometimes acquire bad firms. This difference in equilibrium outcomes between these two market structures follows from a tradeoff between the expert sponsor's incentives experts to acquire and the fly-by-night operator's incentives to enter.

To further analyze the model's implications, we begin with a discussion of which firms can obtain financing in each of the market configurations. We then consider the optimal choice of financing structure from the sponsor's standpoint. We then discuss if and when it is optimal to acquire more than one firm in one financing round. Finally, we conclude this section with a brief discussion of who bears adverse selection risk and potential regulatory solutions.

3.1 Under-investment and Over-investment

Adverse selection for experts and firms makes financing less efficient in both the PE and SPAC markets. As we show below, firm adverse selection in the PE market induces under-investment in late-stage financing for good firms, i.e., firms with positive NPV are not financed, and over-investment in bad firms, i.e., firms with negative NPV are financed. On the other hand, sponsor adverse selection in the SPAC market induces over-investment in early-stage financing, i.e., fly-by-night operators receive financing.

When the expected payoff for the sponsor in the PE-to-IPO market is negative, the sponsor will not enter, and there is under-investment in positive NPV firms. A direct application of Corollary 1 reveals that this inefficiency occurs whenever the amount of assets she has to co-invest, A, is small and the cost of acquiring firms, K, is large relative to the severity of the adverse selection problem, α. If $A \leq \underline{A}$ and $K > 1 - \alpha - c$, the expert stays out of the market. Intuitively, if the adverse selection problem over firms is severe or good firms do not have a high enough NPV, then the PE-to-IPO market cannot sustain financing for firms. Note that α decreases the probability of finding a good firm q. Hence, an alternative interpretation of this result is that the expert will only enter the PE-to-IPO market if the probability of finding a good firm is large enough. This contrasts with the SPAC market in which the expert will always enter, given parameters satisfy the assumption given in equation (1).

If the expert does enter the PE-to-IPO market, she can over-invest in negative NPV firms. A direct application of Proposition 1 shows that the sponsor will acquire bad firms whenever A is small, or K is large. Intuitively, whenever the sponsor has little skin in the gain relative to the funds needed to conduct acquisitions, the PE-to-IPO approach does not provide enough incentives for the sponsor to forgo the acquisition of negative NPV firms.

Now consider the entry of fly-by-night operators, which we interpret as a form of over-investment in fundraising. A direct application of Proposition 2 as shown in Figure 3 is that the likelihood the sponsor is a fly-by-night operator $1 - \phi$ decreases in the amount of assets, A, the sponsor has available to co-invest. We should note that the baseline model does not directly consider the impact of sponsors' fundraising on firms. In Section 4, we extend the model to study the firm's choice of the financing mode. It becomes apparent that the presence of fly-by-night operators in the SPAC market crowds out experts, decreasing the probability of successful acquisitions and leading to under-investment in firms.

Overall, our findings suggest that SPAC financing expands the set of firms that become available for public trading. SPACs enable access to public markets for firms that were previously excluded because of their high asset intangibility, large risk, severe adverse selection problems, or low net present value $1 - K$. According to our model, the rise of intangibles generating adverse selection problems may also be a reason underlying the decline of traditional IPOs (Stulz (2020)).[13]

3.2 PE-to-IPO vs. SPAC: The Sponsor's Choice

In this section, we analyze under what circumstances the expert sponsor prefers the SPAC mode over the PE-to-IPO approach. Given the two alternatives, the sponsor chooses to issue a SPAC if and only if its expected payoff exceeds the payoff from raising a PE fund, $V^{SPAC} > V^{PE}$, and chooses the PE-to-IPO approach otherwise. To determine which market provides the sponsor with a greater profit, we need to analyze the tradeoff between the firm adverse problem and the sponsor adverse selection problem. To do so, we will examine the sponsor's payoff in the two markets given the severity of the firm adverse selection problem α and the sponsor's assets A.

[13] There is abundant empirical evidence documenting the rise of intangible assets. See, for instance, Corrado and Hulten (2010), Kahle and Stulz (2017), Crouzet and Eberly (2018), Falato et al. (2020), or Crouzet and Eberly (2021).

We first consider the case when the firm adverse selection problem is not too severe. Specifically, we determine the sponsor's choice of market when $1-\alpha \geq K+c$ so that the NPV of the average firm is larger, or equivalently, the adverse selection problem α is smaller. In this case, when the sponsor has less assets A to co-invest, the sponsor adverse selection problem will dominate the firm adverse selection problem. For small values of A, an increase in A is more effective at resolving the incentive problems in the SPAC market than the PE-to-IPO Market. For example, note that the firm adverse selection problem is fully resolved in the PE-to-IPO market only for $A \geq \overline{A}$ while the sponsor adverse selection problem is fully resolved in the SPAC market for $A \geq \tilde{A}$, where $\tilde{A} < \overline{A}$. Comparing the sponsors value function in each market given by equations (23) and (25), we find that when $A < A_c$ where

$$A < A_c = \frac{p\big(1-\alpha-K-c\big)}{(1-p)q}, \tag{26}$$

the sponsor adverse selection problem dominates the firm adverse selection problem, and the sponsor will choose to enter the PE-to-IPO market. If $A \geq A_c$, the expert has enough assets to ameliorate the sponsor adverse selection problem and the firm adverse selection problem dominates, causing the expert to choose the SPAC market.

We next consider the case when the firm adverse selection problem is severe. In this case, the NPV of the average firm is negative, $1-\alpha < K+c$, and the PE-to-IPO market breaks down for low levels of A. As such, the expert will always prefer the SPAC market because it can operate even when A is small because A is more effective at alleviating the sponsor adverse selection problem. We summarize these results in the following proposition.

Proposition 3. *Suppose $A < \overline{A}$ and define A_c by equation (26). Then, $A_c < \tilde{A}$ and the following holds:*

1. *If the NPV of the average firm is positive, $1-\alpha \geq K+c$, then $A_c \geq 0$ and the sponsor prefers PE-to-IPO financing if $A < A_c$ and SPAC financing otherwise.*
2. *If the NPV of the average firm is negative, $1-\alpha \leq K+c$, then $A_c < 0$ and the sponsor prefers a SPAC financing for all A.*

The threshold A_c is defined in Equation (26).

Figure 5 numerically illustrates the results of Proposition 3 by plotting the payoffs under PE-to-IPO financing (solid black line) and SPAC financing (dotted red line) against q (upper left panel), against p (upper right panel), against c (lower left panel), and against K (lower right panel). Indeed, the expert prefers PE-to-IPO financing whenever q or p are high, i.e., when firm adverse selection $\alpha = (1-q)(1-p)$ is low. Otherwise, the expert prefers SPAC financing when firm adverse selection is severe. Moreover, the expert prefers PE-to-IPO financing if and only if the cost of setting up a fund and raising money c and the cost of acquiring the firm K is low.

The severity of adverse selection could be related to firm characteristics, such as assets tangibility and business model. In particular, we expect agency conflicts and the adverse selection problem to be more severe when the firm's business model is intangible (Ward (2020)), innovative, or unproven, which could be

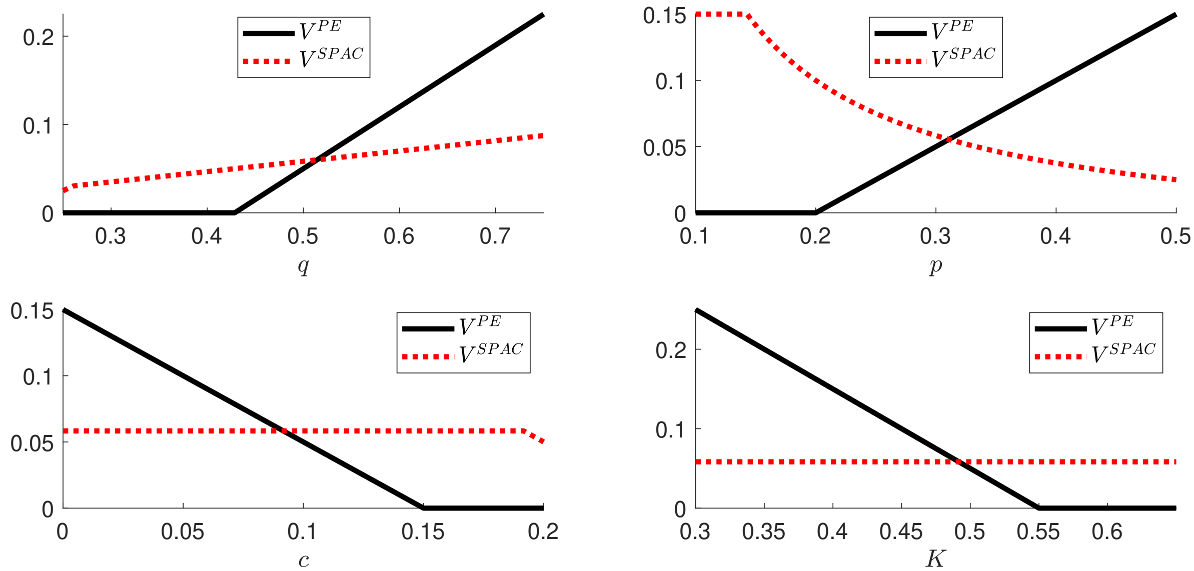

Figure 5: The expert's choice between the PE-to-IPO and SPAC model. The parameters are $A = 0.05$ $p = 0.3$, $c = 0.1$, $K = 0.5$, and $q = 0.5$.

the case for technology firms and R&D heavy firms. The model then predicts that all else equal, the SPAC approach is more suitable for sponsors focusing on acquiring innovative firms with high asset intangibility, such as technology firms. Therefore, the rise of intangibles and technology firms (Corrado and Hulten (2010); Kahle and Stulz (2017); Falato et al. (2020)), and the commensurate increase of experts looking to invest in such firms could also explain the rise in SPAC financing and the recent decline in traditional IPO activity (Stulz (2020)). This argument is similar to the one we make in the previous section demonstrating that firms subject to greater adverse selection can only access public markets via SPACs. Interpreted over the firm's life cycle, our analysis also suggests that SPAC financing is preferred for early-stage firms, which tend to face more adverse selection than later-stage firms. In contrast, PE-to-IPO financing is preferred for firms in their later stages. That is, our findings suggest a market segmentation in which early-stage and technology-intensive firms choose to go public via SPACs, and later-stage firms choose to go public via traditional IPOs.

Finally, note that according to the lower right panel of Figure 5 and Proposition 3, the sponsor prefers SPAC if the cost of financing K relative to the firm's potential cash flow of 1 is high, that is, if the net present value of a good firm $1 - K$ is sufficiently low. In a similar vein, SPAC financing is also the preferred mode of financing for low values of p, which, all else equal implies both severe adverse selection and a relatively low net present value for the average firm. Taken together, we find that SPAC financing tends to be preferred over PE-to-IPO financing for less profitable firms (i.e., firms with relatively low NPV). Interpreted broadly, this finding indicates that SPACs tend to acquire firms with relatively low profitability and rationalizes their poor post-acquisition performance observed in the data (Klausner et al., 2020; Gahng et al., 2021).

3.3 Optimal Fund Size

So far, our analysis has assumed that a PE or SPAC fund acquires only one firm. More generally, our baseline compares the PE-to-IPO model and SPAC model for a fixed fund scale. However, PE funds typically acquire a portfolio of firms, while SPACs do not. As we show, our model explains this organizational choice based on the agency conflicts and adverse selection inherent to these two financing models. In particular, we show that the expert benefits from scaling up the fund under the PE-to-IPO model, which we interpret as acquiring a portfolio of firms or acquiring larger firms. In contrast, scaling up is not beneficial under the SPAC model.

Suppose that at inception at time $t = 0$, the expert can decide on the scale $n \in [1, N]$ of her investment, given fixed net worth A. Here, N is an exogenous limit on the scale, reflecting that the size of a SPAC and PE fund cannot be infinite. When $n > 1$, a firm produces cash flows n or zero (instead of cash flow 1 or zero). The cost of setting up the fund and the cost of acquisition scale accordingly and become nc and nK, respectively, so that the total cost is $n(K + c)$ when the expert chooses the scale n. Setting $n = N = 1$ yields the baseline of our model. Notice that we can interpret n as the number of firms the sponsor acquires (under PE-to-IPO or SPAC financing). For instance, when $n = 1$, the sponsor acquires one firm, and when $n > 1$, the sponsor acquires a portfolio of firms. In what follows, we denote the expert's expected payoff under financing mode $x \in \{PE, SPAC\}$ as a function of A and n, i.e., $\hat{V}^x(A, n)$.

Under our specification, one project with scale n and expert co-investment A is equivalent to n independent projects with scale 1 and expert co-investment A/n per project. That is, the expert's payoff scales with n as follows:

$$\hat{V}^x(A, n) = nV^x(A/n, 1). \tag{27}$$

In addition, we assume that scaling up entails some cost $\varepsilon(n - 1)$ with $\varepsilon > 0$, which could related to the costs of paying attention or exerting effort. The optimal scale n^x under financing mode $x \in \{SPAC, PE\}$ is determined according to

$$n^x = \arg\max_{n \in [1,N]} \left[\hat{V}^x(A, n) - \varepsilon n\right] \tag{28}$$

In what follows, we consider the limit $\varepsilon \to 0$. The sole purpose of introducing the infinitesimal cost of scaling ε is to break the ties in case of indifference.

Our first result is that the sponsor does not benefit from scaling up the fund when $A < \tilde{A}$ under SPAC financing. That is, the optimal scale for a SPAC is $n^{SPAC} = 1$. The intuition underlying this result is as follows. Notice that the expert's co-investment in SPACs effectively mitigates the adverse selection problem over expert type. These effects are so strong that the sponsor would like to maximize the co-investment per scale A/n to reduce adverse selection. When $A > \tilde{A}$, the expert chooses the scale such that $A/n = \tilde{A}$ but does not scale up further, leading to a similar bound on the optimal scale.

In contrast, the sponsor prefers to scale up her PE fund when firm adverse selection is mild (i.e., $\alpha < 1 - K - c$). Thus, according to our model, a PE fund benefits from scaling up when firm adverse selection is mild. The reason is that when the expert's co-investment is low ($A < \hat{A}$), it does not mitigate the severity of firm adverse selection, as the expert acquires both good and bad firms with probability one. As such, reducing the co-investment per scale, A/n, does not exacerbate firm adverse selection. In turn, the sponsor optimally scales up the fund, reducing her co-investment A/n per firm and increasing her payoff.

Our model, therefore, explains why PE funds typically acquire a portfolio of firms, while SPACs are designed to conduct a single acquisition. This explanation stems from the specific adverse selection and agency problems these two financing modes suffer. Our model also predicts that all else equal, PE funds should be larger than SPAC firms in dollar terms. We summarize our results in the following corollary.

Corollary 2. *Consider the limit $\varepsilon \to 0$, $1 - K > \frac{c}{q}$, and $A < \overline{A}$. The optimal scale, denoted $n \in [1, N]$, satisfies:*

1. *In SPAC financing, the optimal scale $n^{SPAC} = \max\{\tilde{n}^{SPAC}, 1\}$ with $\tilde{n}^{SPAC} = \min\left\{A/\tilde{A}, N\right\}$.*
2. *In PE-to-IPO financing, the optimal scale is either $n^{PE} = 1$ or $n^{PE} = N$. If $\alpha < 1 - K - c$ and N is sufficiently large, the expert chooses $n^{PE} = N$. If $\alpha \geq 1 - K - c$, the expert chooses $n^{PE} = 1$.*

3.4 Risk, Adverse Selection, and Regulation

Regulation of the access to the public stock market traditionally aims at i) reducing agency conflicts between involved parties and ii) limiting the risk exposure of certain investors, in particular, retail investors. To evaluate regulatory proposals regarding SPACs, it is crucial to understand what type of investors are most exposed to risk and agency problems inherent to SPACs. It is also important to recognize how this exposure to risk and agency problems differs from the traditional PE-to-IPO approach.

We start by considering the PE-to-IPO approach. The generic outcome (for $A < \overline{A}$) features (at least partial) pooling for firms. As such, late investors—who are public investors in the PE-to-IPO approach—are exposed to the adverse selection problem and bear the associated uncertainty of whether the firm turns out good or bad. In contrast, early investors—who are private investors in the PE-to-IPO approach—have relatively low exposure to risk and agency problems. Given public investors' exposure to agency problems (firm adverse selection) and risk, certain regulations are in place to protect public investors who participate in an IPO.

Next, we analyze the SPAC financing approach. Recall that in a SPAC, only good firms get acquired, so late investors are not exposed to agency problems and the risk whether the firm turns out good or bad. In contrast, early investors are exposed to sponsor adverse selection and, in particular, to the risk that there is no acquisition at all (either due to adverse selection or because the expert cannot locate a good firm). As such, early investors—who are public investors in the SPAC approach—are most exposed to agency problems and uncertainty. As a result, our model suggests that optimal regulation of SPACs should mainly target the protection of early investors.

As the SPAC financing approach suffers from an adverse selection problem for sponsors, regulation could address this problem more directly. For example, regulation could require that SPAC sponsors co-invest at least a minimum amount because such co-investment effectively mitigates sponsor adverse selection. In contrast, in the PE-to-IPO approach, co-investment is not as effective at mitigating firm adverse selection. Hence, a minimum investment level is not necessarily helpful in addressing agency problems.

4 PE-to-IPO vs. SPAC: The Firm's Choice

In this section, we endogenize the acquisition price of a firm. We assume that at time $t = 1$ when the sponsor finds a firm, the firm and the sponsor (who forms a coalition with early investors) determine the acquisition price K according to Nash bargaining. The firm's bargaining weight is $\eta \in [0, 1]$, and the sponsor's bargaining weight is $1 - \eta$. The firm must raise at least $\underline{K}$ dollars to become operational, leading to the constraint $K \geq \underline{K}$. We assume that $\underline{K} > p$, so a bad firm has a negative NPV and cannot lower its price until it becomes a positive NPV firm.

The acquisition price is determined through bargaining after the sponsor has learned the firm type but before signing the contract with late investors.[14] In bargaining, the sponsor forms a coalition with early investors and maximizes their joint surplus. Bargaining results in acquisition prices K^{PE} and K^{SPAC} in the PE-to-IPO and SPAC modes, respectively. The acquisition price K^x for $x \in \{PE, SPAC\}$ is publicly observable, and the sponsor is flexible in raising money from early investors at time $t = 1$. Specifically, the sponsor raises $K^x + c - A$ dollars from early investors with a contract that specifies an acquisition price K^x.[15] As in the baseline, fly-by-night operators, conditional on their entry, mimic the expert and raise $K^x + c - A$ dollars too but eventually do not acquire any firm.

We assume that if the sponsor finds a bad firm and would like to acquire this firm, she must pay the same price K^x as for acquiring a good firm. The intuition is that because the acquisition price K^x is publicly observable, any deviation from this price reveals that the sponsor acquires a bad firm. Alternatively, we could assume that the bad firm is non-strategic, does not engage in Nash bargaining, and demands the same acquisition price as a good firm does (which is akin to mimicking the good firm).

We now discuss how Nash bargaining determines the acquisition price. For this sake, suppose the sponsor has found a good firm at $t = 1$. If she does not acquire a good firm, the joint payoff of the sponsor and early investors becomes $-c$. On the other hand, if she acquires the good firm, the joint payoff of the sponsor and early investors becomes $1 - K - c + y_1^x(a) - y_2^x$, where $y_1^x(a) = P_1$ is the dollar amount raised from late investors after acquisition y_2^x denotes the payment too late investors (after cash flows at $t = 2$) in financing mode $x \in \{PE, SPAC\}$. Thus, the surplus differential is $1 - K - y_2^x + y_1^x(a)$. On the other hand, the firm obtains K dollars if it is acquired and zero dollars otherwise. The surplus differential for the firm is K. Therefore, K^x determined through Nash bargaining solves the optimization problem:

$$K^x = \arg\max_{K \geq \underline{K}} \Big[K^\eta (1 - K - y_2^x + y_1^x(a))^{1-\eta} \Big]. \tag{29}$$

If there does not exist a solution K^x to (29) in which the sponsor's participation constraint $V^x \geq 0$ is satisfied, we set K^x to the largest value of K, which implements $V^x = 0$. In other words, we solve (29)

[14] We show in Appendix B that it does not affect our key findings whether bargaining occurs after or before the expert learns firm type. Specifically, in Appendix B, we solve the Nash bargaining in case the expert does not know the firm type at the time of bargaining. Thus, our results are robust to changes in the information structure just before/after the bargaining.

[15] Technically, the sponsor raises financing from early investors at $t = 0$ before bargaining over the price. However, we assume that the sponsor can raise additional capital or return capital $t = 1$ after bargaining with the firm. For instance, if the acquisition price is higher than expected, the sponsor could raise the missing funds from early investors. Late investors, in turn, provide financing only after the acquisition.

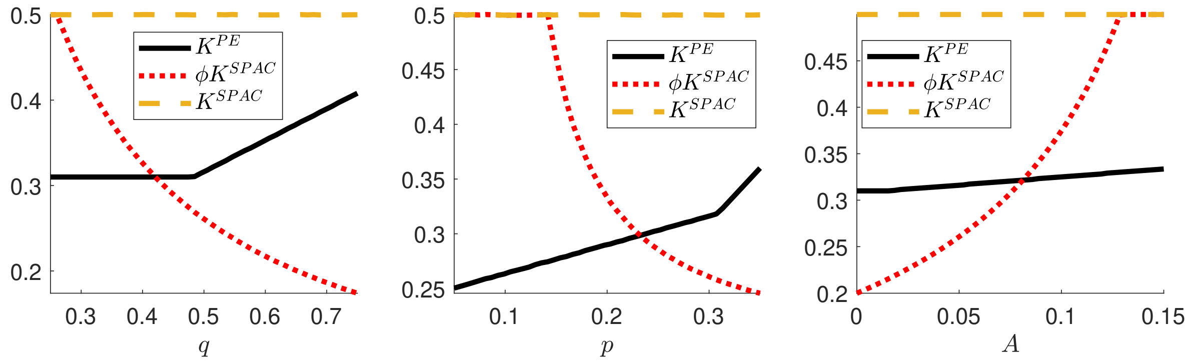

Figure 6: The firm's choice between the PE-to-IPO and SPAC model. The parameters are $A = 0.05$ $p = 0.3$, $c = 0.1$, $\underline{K} = 0.32$, $\eta = 0.5$, and $q = 0.5$.

subject to $V^x \geq 0$.

Importantly, contract quantities such as y_2^x and $y_1^x(a)$ depend on the equilibrium value of K, and are described in Propositions 1 and 2 respectively. In the PE-to-IPO mode, the objective (29) simplifies to

$$K^{PE} = \arg\max_{K \geq \underline{K}} \left[K^\eta (1 + c - A - y_2^{PE})^{1-\eta} \right], \tag{30}$$

where $y_1^{PE}(a) = K + c - A$ and y_2^{PE} is characterized in Proposition 1. In the SPAC mode, $y_2^{SPAC} = y_1^{SPAC}(a)$ and (29) simplifies to

$$K^{SPAC} = \arg\max_{K \geq \underline{K}} \left[K^\eta (1 - K)^{1-\eta} \right], \tag{31}$$

which readily yields the solution $K^{SPAC} = \max\{\underline{K}, \eta\}$.

Having endogenized and characterized the firm's acquisition price, we analyze the good firm's choice between PE-to-IPO and SPAC financing. We assume that the bad firm behaves non-strategically and always mimics the good firm. We consider that when the firm chooses the PE-to-IPO approach, it gets acquired at $t = 1$ with probability one, leading to payoffs K^{PE} under PE-to-IPO financing. Intuitively, there are no fly-by-night operators as sponsors in the PE market, so there is no inefficiency in matching good firms and sponsors.

Unlike the PE market, the SPAC market features fly-by-night operators, which causes inefficiency in matching sponsors to good firms. Each firm is randomly matched with a sponsor, and it meets a fly-by-night operator with probability $1 - \phi$ and an expert with probability ϕ. The acquisition fails if the firm meets a fly-by-night operator. Notice that ϕ is an equilibrium quantity that depends on the value of K^{SPAC}.[16] The expected payoff a good firm derives under SPAC financing equals ϕK^{SPAC}. Hence, the firm chooses the SPAC market whenever $\phi K^{SPAC} > K^{PE}$ and the PE market otherwise.[17]

Figure 6 numerically depicts K^{PE} (solid black line), K^{SPAC} (dashed yellow line), and ϕK^{SPAC} (dotted

[16]Because in the PE-to-IPO model $\phi = 1$, we omit the superscript $SPAC$ to highlight that ϕ denotes the probability that the firm meets a fly-by-night operator in the SPAC market.

[17]Without affecting our key implications, we can assume that in case of indifference, the firm chooses the PE market to break ties.

red line) for different values of q, p, and A, assuming that the firm has bargaining power $\eta = 0.5$. Notice that the acquisition price under SPAC financing K^{SPAC} always weakly exceeds the acquisition price under PE-to-IPO financing K^{PE}. Thus, conditional on meeting an expert in the SPAC market, the good firm obtains a higher acquisition price than in the PE market. The intuition is that the SPAC market implements separation of good and bad firms, which allows a good firm to obtain its fair market price upon acquisition. Conversely, a good firm is pooled with bad firms in the PE market, generating a discount in the acquisition price. However, as the SPAC market attracts fly-by-night operators (so that there is sponsor adverse selection), it is less likely in the SPAC market than the PE market to meet an expert sponsor and to be successfully acquired in the first place.

As a result, the firm's choice between PE-to-IPO and SPAC financing trades off a higher likelihood of meeting an expert with a lower acquisition price conditional on meeting an expert in the PE market relative to the SPAC market. Figure 6 illustrates that given sufficient bargaining power, the firm prefers the PE market if p and q are large or, in other words, when the adverse selection problem (as captured by $\alpha = (1-q)(1-p)$) is mild. In addition, the firm prefers the PE market if expert co-investment A is low.

These findings imply that firms with high asset intangibility, firms with unproven business models, or innovative firms—which tend to suffer from relatively severe adverse selection problems when seeking financing—prefer to go public via a SPAC rather than the traditional PE-to-IPO approach. Notably, these results are in line with the ones obtained in Section 3.2. Recall that according to Section 3.2, Figure 5, and Proposition 3, given an exogenous acquisition price $K = K^{SPAC} = K^{PE}$, the expert prefers the PE-to-IPO market when adverse selection $\alpha = (1-q)(1-p)$ is mild or when A is low.

However, there can be situations where the sponsor and firm preferences between SPAC and PE-to-IPO financing diverge. In particular, Proposition 4 shows that when the firm's bargaining power is low and firm adverse selection α is severe, the firm prefers PE-to-IPO financing, but the sponsor may prefer SPAC financing instead, leading to conflicts of interest.[18] Intuitively, when the firm's bargaining power in determining contract terms with the sponsor is low, the sponsor seizes the surplus from firm type separation in SPAC markets and effectively expropriates the firm under SPAC financing. Note that this result is consistent with empirical findings of Gahng et al. (2021) that relative to traditional PE-to-IPO financing, SPAC financing can be costly for firms and their shareholders but deliver higher returns for SPAC investors and sponsors, To conclude this section, we summarize the results above in the following proposition.

Proposition 4. *Consider the model in which the acquisition price is determined by Nash bargaining. Under financing mode $x \in \{PE, SPAC\}$, the acquisition price K^x solves (29). Under SPAC financing, (29) simplifies to (31), with solution $K^{SPAC} = \max\{\underline{K}, \eta\}$. Under PE financing, (29) simplifies to (30). It holds that $K^{SPAC} \geq K^{PE}$.*

Suppose that $A < \left(\frac{p}{1-p}\right)\left(1 - \underline{K} - \frac{c}{q}\right)$, i.e., the expert's net worth is not sufficient to fully resolve sponsor type adverse selection in the SPAC market when $K = \underline{K}$. When the firm's bargaining power η is sufficiently low, the firm strictly prefers PE-to-IPO financing. When η is sufficiently low, and the firm's

[18] Our modeling does not take a stance on which financing mode is chosen in such a situation, but in practice, this likely depends on the relative bargaining power (η).

adverse selection is severe in that $\alpha > 1 - \underline{K} - c$, the expert strictly prefers SPAC financing, but the firm strictly prefers PE-to-IPO financing.

5 Delays in Going Public

The analysis so far has assumed that the timing at which a firm goes public is exogenous. In particular, our analysis has shed light on *whether* but not *when* a firm is taken public via the PE-to-IPO and SPAC financing approach. The timing question is relevant because PE funds and SPACs have different duration in practice. PE funds tend to hold portfolio firms for an extended time before conducting the IPO. In contrast, SPACs make firms public without delay.

In this section, we endogenize the timing at which a firm is taken public. For this purpose, we consider that after acquiring a firm, the sponsor can sell the firm immediately to late investors or hold the firm for another "period" before selling the firm to late investors. When the sponsor delays selling the firm, some information about the firm's quality becomes public. Specifically, if the firm is bad, its type becomes publicly observed with probability κ. For simplicity, we assume that there is no direct signal about firm quality when the firm is good. However, the fact that a firm's quality is not revealed as bad serves as a positive signal, generating evidence for uninformed late investors that the firm is good.

Under this alternative model specification, the sponsor can signal high firm quality by holding on to the firm before selling it to later investors. To make the setting interesting, we assume that waiting before selling the firm to late investors is costly and generates private (non-pecuniary) costs δ to the sponsor.

We first consider the case of SPAC financing. Recall that according to Proposition 2, SPAC financing implements separation between good and bad firms. As any firm acquired under SPAC financing is good, holding the firm for another period is always inefficient, as late investors know firm quality with certainty. Hence, there is no point in signaling. As signaling by holding on to the firm is costly for the sponsor, the sponsor refrains from doing so.

Next, we study the timing of going public in the PE-to-IPO setting. Recall that when $A < \overline{A}$, the PE market features (partial) pooling of good and bad firms. Therefore, conditional on finding a good firm, the sponsor might wait to take this firm public to signal that the firm's quality is good. When the firm is not revealed as a bad firm, waiting generates evidence for uninformed late investors that the firm is good.

The decision to hold the acquired firm before conducting an IPO is made at time $t = 0$, just after acquiring the firm. Let $w \in \{0, 1\}$ denote the sponsor's publicly-observable decision to wait. Notice that w must be the same regardless of whether the sponsor takes a good or bad firm to the public. If the sponsor held on to a good firm but not to a bad firm, she would reveal a bad firm's quality, which cannot be optimal as the bad firm has a negative NPV. Observing the sponsor's decision to wait and that the firm is not revealed as bad during the waiting period, late investors update their beliefs that the firm is good according to Bayes' rule. That is, given w and the equilibrium probability θ that the sponsor acquires a bad firm if, given the opportunity, late investors believe that with probability

$$\hat{q}(w) = \frac{q}{q + (1-q)(1-w\kappa)\theta}, \tag{32}$$

the firm is good, provided the firm is not revealed as bad during the waiting period. Clearly, $\hat{q}(w)$ increases with waiting w. It follows that the price P_1 late investors pay for the security that pays y_2 when the firm produces cash flows 1 is

$$P_1 = (\hat{q}(w) + (1-\hat{q}(w))p)y_2 = (p + (1-p)\hat{q}(w))y_2,$$

which, for a given y_2, increases in w.

Now, suppose the sponsor has found a good firm. Then, her payoff in the late stage is

$$1 - y_2 - w\delta = 1 - \frac{P_1}{p + (1-p)\hat{q}(w)} - w\delta,$$

where δ is the cost of waiting to take the firm public. As $\hat{q}(w)$ increases with w, it follows that choosing $w = 1$ and waiting is optimal as long as δ is sufficiently small. So as not to reveal herself, a sponsor who has acquired a bad firm must then do the same and wait too.

As a result, there can be an optimal delay between a firm's acquisition and the date at which it is taken public in the PE-to-IPO model. The mechanism is that a PE sponsor with a good firm can gradually reveal the firm quality by holding it before approaching the public market and thus reduce the adverse selection problem in the IPO stage. Our model rationalizes delays between firm acquisition and the IPO that are observed in the data and are consistent with the design of PE funds. Crucially, similar delays do not arise in the SPAC financing model. In practice, SPAC financing allows the firm to be publicly tradeable immediately after the acquisition. Our model implies that this feature of SPAC financing is optimal.

6 Testable Implications and Conclusion

In the last decade, SPAC issuance has grown to exceed the fundraising of traditional IPOs. We present a model that explains why SPAC financing has become attractive relative to the conventional PE-to-IPO approach. In the model, a sponsor raises financing from outside investors to acquire a firm. Under SPAC financing, the sponsor raises these initial funds from public investors, while under PE-to-IPO financing, the sponsor raises funds from private investors. Crucially, our model features a two-dimensional adverse selection problem over firm and sponsor types. SPAC financing more efficiently separates expert sponsors from fly-by-night operators. In contrast, PE-to-IPO financing more efficiently separates good acquisitions from bad acquisitions.

We derive several empirical implications and predictions based on our analysis, which we gather below.

1. *Firms that go public via a SPAC have more intangible assets and tend to be riskier than firms that go public via the PE-to-IPO approach.*

In our model, SPAC financing is preferred by the expert or a good firm if adverse selection is high. Firms subject to severe adverse selection are excluded from the traditional PE-to-IPO financing but not SPAC financing. In particular, this finding also suggests that firms that go public via a SPAC tend to be in an earlier stage of their life cycle than firms that go public via a traditional IPO.

2. *Firms that go public via a SPAC are less profitable than firms that go public via the PE-to-IPO approach.*

   Firms with low but positive NPV (i.e., firms characterized by large acquisition cost retaliative to expected profits) do not have access to PE-to-IPO financing, yet they can access SPAC financing. As a result, firms with lower NPV, that is, less profitable firms, prefer going public via a SPAC. This prediction is consistent with some evidence of poor post-acquisition performance of SPACs (Klausner et al., 2020; Gahng et al., 2021).

3. *For firms with low bargaining power, SPAC financing can deliver higher returns to SPAC investors and sponsors compared to the PE-to-IPO financing, but lower returns to the acquired firm's shareholders.*

   When the firm's bargaining power is low and firm type adverse selection is severe, the expert prefers SPAC financing, but the firm prefers the PE-to-IPO approach to go public. In particular, the firm strictly prefers PE-to-IPO financing when its bargaining power is low.

4. *Average sponsor quality is higher in PE funds than in SPACs. There is more variation in sponsor quality in SPACs than in PE funds.*

   This prediction follows from the result that fly-by-night operators enter the SPAC market but not the PE market in equilibrium. Because SPAC markets suffer from sponsor adverse selection and PE markets do not, the variation in sponsor quality is larger in the SPAC market. This also suggests that it can be easier to discern the positive relationship between sponsor quality and performance in the SPAC market (see Lin et al. (2021) for empirical evidence along these lines).

5. *Sponsor co-investment is larger in the traditional PE-to-IPO approach than in SPACs.*

   The prediction follows from our finding that regardless of the level of co-investment, SPAC financing is always feasible, whereas PE-to-IPO financing requires sufficiently large co-investment. As such, our results imply that relative to the traditional PE-to-IPO approach, SPAC financing allows the sponsor to minimize her investment and thus obtain high returns.

6. *All else equal, PE funds are larger than SPACs and tend to acquire more firms.*

   The expert benefits from scaling up the fund under PE-to-IPO financing but not under SPAC financing because dividing the sponsor's co-investment across multiple firms has a smaller effect on incentives in the PE-to-IPO market than in the SPAC market.

7. *All else equal, a firm's acquisition price is higher under SPAC financing than PE-to-IPO financing. The likelihood of being acquired is lower under SPAC financing.*

   When the acquisition price of the firm is endogenous, a good firm, conditional on being acquired, obtains a higher price in the SPAC market than in the PE market. The reason is that the SPAC market features separation between good and bad firms and therefore allows a good firm to demand its fair value upon acquisition. However, fly-by-night operators in the SPAC market limit the probability that a firm matches with an expert sponsor.

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A Proofs

A.1 Proof of Lemma 1

Recall that

$$\overline{A} = \left(\frac{p}{1-p}\right)(1-K) + c,$$

Suppose $A \geq \overline{A}$. The threshold $\overline{A}$ is the solution to investors' break-even constraint (14) under $\theta = 0$ and $\phi = 1$, that is,

$$qy_2 + (1-q)y_1(n) = K + c - A,$$

whereby

$$p(1-y_2) = K - y_1(n),$$

i.e., the sponsor finds it privately optimal not to acquire a bad firm, and

$$P_1 + p(1-y_2) = K,$$

i.e., early investors and the sponsor find it jointly optimal not to acquire a bad firm with $P_1 = y_2$.

SPAC financing. Note that in the SPAC market, the renegotiation constraint in (9) (or equivalently (10)) immediately implies that $\theta = 0$ for all A since $K > p$. For the expert to possess private incentives not to acquire a bad firm, it must be that

$$K - y_1(n) \geq p(1-y_2). \tag{33}$$

For fly-by-night operators not to have incentives to enter, it must be that

$$K - y_1(n) \leq A. \tag{34}$$

Combining the two inequalities, we obtain

$$A \geq p(1-y_2). \tag{35}$$

The break-even constraint for investors (14) becomes

$$qy_2 + (1-q)y_1(n) = K + c - A \quad \Longleftrightarrow \quad A = K + c - qy_2 - (1-q)y_1(n).$$

As such, using that $y_2 \geq 1 - A/p$ (see (35)) and $y_1(n) \geq K - A$, we obtain

$$A = K + c - qy_2 - (1-q)y_1(n) \leq K + c - q\left(1 - \frac{A}{p}\right) - (1-q)(K-A).$$

Above inequality is satisfied for $A \geq \overline{A}$. Thus, the SPAC market achieves first best for $A \geq \overline{A}$.

PE-to-IPO financing. Now, consider the PE-to-IPO market and suppose that $\theta > 0$ and $\phi < 1$. This implies the following incentive compatibility and renegotiation constraints

$$p(1-y_2) \geq K - y_1(n)$$

$$\left(\frac{q + (1-q)\theta p}{q + (1-q)\theta}\right) y_2 + p(1-y_2) \geq K$$

and the investor break even constraint

$$A = K + c - \phi(q + (1-q)\theta)y_2 + (\phi(1-q)(1-\theta) + (1-\phi))y_1(n).$$

Combining these three expressions gives

$$A \leq \left(\frac{p}{1-p}\right)\left(1 - K - \theta\left(\frac{1-q}{q}\right)(K-p)\right) + c < \overline{A}$$

a contradiction. Note this argument applies to the case of $\phi = 1$ and $\theta > 0$ as well. It remains to show that there does not exist an equilibrium with $\theta = 0$ and $\phi < 1$ for $A > \overline{A}$. To see this, note that $\theta = 0$ and $\phi < 1$ implies

$$p(1-y_2) \leq K - y_1(n)$$
$$K - y_1(n) = A$$
$$A = K + c - \phi q y_2 + (1-\phi q)y_1(n).$$

Combining these three equations gives

$$A \leq \tilde{A} < \overline{A},$$

a contradiction.

A.2 Proof of Lemma 2

In this proof, we call a sponsor who has acquired a good firm a "good type sponsor" and a sponsor who has acquired a bad firm a "bad type sponsor."

First, we show that a separating equilibrium does not exist in the late stage. Suppose to the contrary there is a separating equilibrium, in which good type (i.e., the sponsor who has acquired a good firm) and bad type (i.e., the sponsor who has acquired a bad firm) signal their type. Let $y_2 > 0$ be what the bad type offers to late investors and $\hat{y}_2 > 0$ be what the good type offers to late investors. The bad type then raises $P_1 = py_2$ dollars and the good type raises $\hat{P}_1 = \hat{y}_2$ dollars from late investors. In this separating equilibrium, the bad type sponsor must not have incentives to mimick the high type, in that

$$py_2 + p(1-y_2) \geq \hat{y}_2 + p(1-\hat{y}_2).$$

Note that this constraint does not depend on the payments to early investors, in that the sponsor maximizes the joint surplus of herself and early investors in the late stage. This implies

$$p \geq p + \hat{y}_2(1-p)$$

which is a contradiction due to $p < 1$ and $\hat{y}_2 > 0$. As a result, there does not exist a separating equilibrium in the late stage.

Second, we show that according to the intuitive criterion, any equilibrium features $y_1(a) = P_1$. Suppose that there exists a (pooling) equilibrium y_1 and y_2 in which $P_1 > y_1(a)$ and $\theta > 0$. The equilibrium price reads then according to (6)

$$P_1 = \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta}\right) y_2,$$

given late investors' belief of the probability θ that the expert has acquired a bad firm if given the opportunity. In this pooling equilibrium, the good type sponsor (i.e., the sponsor who has acquired a good firm) derives payoff $P_1 - y_1(a) + 1 - y_2$ and the bad type sponsor (i.e., the sponsor who has acquired a bad firm) derives payoff $P_1 - y_1(a) + p(1 - y_2)$.

Consider the off-equilibrium action in which the good type sponsor offers $\hat{y}_2 < y_2$ such that

$$\hat{P}_1 := \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta} \right) \hat{y}_2 = y_1(a).$$

Thus, offering $\hat{y}_2$ instead of y_2, the good type sponsor raises $\hat{P}_1$ from late investors, which she uses to pay early investors in that $\hat{P}_1 = y_1(a)$.

Next, rewrite

$$P_1 = \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta} \right) y_2 = y_1(a) + \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta} \right) (y_2 - \hat{y}_2) < y_1(a) + (y_2 - \hat{y}_2),$$

where the inequality uses that $\theta > 0$ (pooling equilibrium). Hence, $-\hat{y}_2 > P_1 - y_2 - y_1(a)$. The good type sponsor's derives under this deviation payoff

$$\hat{P}_1 - y_1(a) 1 - \hat{y}_2 = 1 - \hat{y}_2 > P_1 - y_1(a) + 1 - y_2,$$

so the good type sponsor would strictly benefit from this deviation.

Next, suppose the bad type sponsor mimics the good type's deviation described above. Note that

$$P_1 = \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta} \right) y_2 = y_1(a) + \left(\frac{q + (1-q)\theta p}{q + (1-q)\theta} \right) (y_2 - \hat{y}_2) > y_1(a) + (y_2 - \hat{y}_2)p,$$

so that $-p\hat{y}_2 < P_1 - y_1(a) - py_2$. The bad type sponsor's payoff from mimicking the good type is

$$\hat{P}_1 - y_1(a) + p(1 - \hat{y}_2) = p(1 - \hat{y}_2) < P_1 - y_1(a) + p(1 - y_2),$$

so the bad strictly prefers not to deviate. As a result, under the intuitive criterion, late investors attach favorable beliefs to the above deviation. That is, under the intuitive criterion, $y_1(a) < P_1$ is not an equilibrium, and it must be that $y_1(a) = P_1$.

A.3 Proof of Proposition 1

First we show that for any $A < \overline{A}$, there does not exist an equilibrium with $\theta = 0$. Indeed, suppose to the contrary $\theta = 0$ for $A < \overline{A}$. Then, the constraint in (15) states that

$$p(1 - y_2) \leq K - y_1(n),$$

i.e., the sponsor must find it privately optimal not to acquire a bad firm. Rearranging yields $y_1(n) \leq K - p(1 - y_2)$. The renegotiation proofness constraint (8) states that

$$y_2 + p(1 - y_2) \leq K,$$

which can be written as $y_2 \leq \frac{K-p}{1-p}$, and the break even constraint for the investors states that

$$A = K + c - qy_2 - (1 - q)y_1(n).$$

Combining these three relations gives

$$\begin{aligned}
A &\geq K + c - qy_2 - (1-q)(K - p(1-y_2)) \\
&= K + c - (1-q)(K-p) - (q + (1-q)p)y_2 \\
&\geq K + c - (1-q)(K-p) - (q+(1-q)p)\left(\frac{K-p}{1-p}\right) \\
&= \left(\frac{p}{1-p}\right)(1-K) + c = \overline{A},
\end{aligned}$$

which yields a contradiction.

Next, consider $A \leq \hat{A}$. Note that the proposed acquisition strategy in Proposition 1, $\theta = 1$, solves the expert sponsor's problem given $y_1(n) = K + c - A$ and $y_2 = (K + c - A)/(q + (1-q)p)$ since

$$\begin{aligned}
p(1-y_2) &= p\left(1 - \frac{K+c-A}{q+(1-q)p}\right) \\
&= K - y_1(n).
\end{aligned}$$

Next, the proposed acquisition strategy also solves the renegotiation proofness problem given in Equation (7) since

$$\begin{aligned}
(q+(1-q)p)y_2 + p(1-y_2) &= K + c - A + p\left(1 - \frac{K+c-A}{q+(1-q)p}\right) \\
&= K + c + p\left(1 - \frac{K+c}{q+(1-q)p}\right) - \left(\frac{(1-p)q}{q+(1-q)p}\right)A \\
&\geq K,
\end{aligned}$$

where the inequality uses that

$$A \leq \hat{A} = p - \left(\frac{p}{1-p}\right)\left(\frac{K-p}{q}\right) + c.$$

Finally, note that the investors break even given $\theta = 1$ and $y_2 = (K + c - A)/(q + (1-q)p)$ since

$$(q + (1-q)p)y_2 = K + c - A.$$

Thus, the proposed strategies and prices constitute an equilibrium for $A \leq \hat{A}$.

Next, we show that for $A < \hat{A}$ there cannot be an equilibrium with $\theta < 1$. Suppose that $\theta < 1$ for $A < \overline{A}$. Thus, $0 < \theta < 1$, so that the incentive compatibility constraint and the renegotiation proofness constraint must both bind, in that

$$\begin{aligned}
p(1-y_2) &= K - y_1(n) \\
\left(\frac{q+(1-q)\theta p}{q+(1-q)\theta}\right)y_2 + p(1-y_2) &= K.
\end{aligned}$$

Note that the breakeven constraint must also bind, so that

$$(q + (1-q)\theta p)y_2 + (1-q)y_1(n) = K + c - A.$$

Solving these three equations gives

$$\begin{aligned} A &= \left(\frac{p}{1-p}\right)\left(\left(\frac{1}{K-p}\right)\left(\frac{q}{1-q}\right)\left(1-K+c\left(\frac{1-p}{p}\right)\right)-\theta\right) \\ &\geq \left(\frac{p}{1-p}\right)\left(\left(\frac{1}{K-p}\right)\left(\frac{q}{1-q}\right)\left(1-K+c\left(\frac{1-p}{p}\right)\right)-1\right) \\ &= \hat{A}, \end{aligned}$$

a contradiction. Thus, the unique equilibrium acquisition strategy for $A \leq \hat{A}$ is $\theta = 1$.

Next, we show that for $\hat{A} < A < \overline{A}$, there cannot be an equilibrium with $\theta = 1$. Indeed, suppose $\theta = 1$. Then, we must have the following renegotiation constraint and break even condition

$$\begin{aligned} (q+(1-q)p)y_2 + p(1-y_2) &\geq K \\ (q+(1-q)p)y_2 &= K + c - A. \end{aligned}$$

Combining these equations gives

$$A \leq p - \left(\frac{p}{1-p}\right)\left(\frac{K-p}{q}\right) + c = \hat{A},$$

a contradiction. Thus, for $\hat{A} \leq A < \overline{A}$, we must have $0 < \theta < 1$, and the equilibrium must be determined by the argument provided in the text.

A.4 Proof of Proposition 2

That the sponsor rejects all bad firms immediately follows from the renegotiation constraint for the SPAC market, that is, (10). We next show for $A > \tilde{A}$ there does not exist an equilibrium in which the fly-by-night operator enters the market. Suppose $\phi < 1$, then the fly-by-night operator's incentive compatibility constraint must bind

$$K - y_1(n) = A.$$

As we argue in the text, the expert's incentive compatibility constraint to forgo the acquisition of bad firms must also bind

$$p(1-y_2) = K - y_1(n).$$

Combining these equations with the investor's break-even constrain then implies

$$A = \left(\frac{p}{1-p}\right)\left(1-K-\frac{c}{q\phi}\right) < \tilde{A},$$

a contradiction, where $\tilde{A}$ is defined in (22). Finally observe that for $A \leq \tilde{A}$ the equilibrium proposed in this proposition solves the binding incentive compatibility constraint for the expert sponsor to forgo the acquisition of bad firms, the binding entry condition of the fly-by-night operator, and the investor's break even constraint.

A.5 Proof of Corollary 1

Follows by direct calculation inserting the expressions from Proposition 1 and 2 into (2) which describes the expert's payoff at time $t = 0$. We provide details on how to calculate the expert's payoff at $t = 0$ more intuitively.

PE-to-IPO Financing. First, consider $A < \hat{A}$. Then, by Proposition 1, $\theta = 1$. Thus, the total surplus at $t = 0$ is $q + (1-q)p - K - c$. As the expert can extract total surplus from outside investors (i.e., early and late investors), her payoff equals total surplus, in that $V^{PE} = q + (1-q)p - K - c$.

Second, consider $A \geq \overline{A}$. Then, the expert only acquires good firms, and $\theta = 0$ (see Lemma 1). Thus, the total surplus at $t = 0$ is $q(1-K) - c$. As the expert can extract total surplus from outside investors (i.e., early and late investors), her payoff equals total surplus, in that $V^{PE} = q(1-K) - c$.

Third, consider $\hat{A} < A < \overline{A}$. Then, the expert acquires a bad firm with some probability $\theta \in (0,1)$, which requires the expert to be indifferent between acquiring and not acquiring a bad firm. Thus, one can calculate the expert's payoff "as if" the expert never acquired a bad firm (and obtains $K - y_1(n) = A - c$ dollars from doing so). Thus,

$$V^{PE} = qy_2 + (1-q)(A-c) - A = \frac{q(A-c)}{p} + (1-q)(A-c) - A$$
$$= \left(\frac{q + (1-q)p - p}{p}\right) A - \left(\frac{q + (1-q)p}{p}\right) c = \left(\frac{(1-p)q}{p}\right) A - \left(\frac{q + (1-q)p}{p}\right) c,$$

as desired.

SPAC Financing. First, consider $A < \tilde{A}$. Then, according to Proposition 2, $1 - y_2 = \frac{A}{p}$ and $1 - y_1(n) = A$. And, the expert never acquires a bad firm, so that

$$V^{SPAC} = q(1-y_2) + (1-q)(1-y_1(n)) - A = \frac{qA}{p} + (1-q)A - A = \frac{q(1-p)A}{p}.$$

Second, consider $A \geq \tilde{A}$. Then, according to Proposition 2, the "first best allocation" is achieved, which implies

$$V^{SPAC} = q(1-K) - c,$$

as the expert can extract the full surplus.

A.6 Proof of Proposition 3

To start with, observe that $\tilde{A} < \overline{A}$ and, by (23) and (25), $V^{SPAC} > V^{PE}$ for $A \in [\tilde{A}, \overline{A})$. Consider $A \in [\hat{A}, \overline{A})$. If $A \geq \tilde{A}$, then $V^{SPAC} > V^{PE}$. If $A \in (\hat{A}, \overline{A})$ and $A < \tilde{A}$, it follows from (23) and (25):

$$V^{SPAC} - V^{PE} = \left(\frac{(1-p)q}{p}\right) A - \left(\frac{(1-p)q}{p}\right) A + \left(\frac{q + (1-q)p}{p}\right) c$$
$$= \left(\frac{q + (1-q)p}{p}\right) c > 0,$$

where the first inequality uses $V^{SPAC} = \left(\frac{(1-p)q}{p}\right) A$. Taken together, we therefore have $V^{SPAC} > V^{PE}$ for $A \in [\hat{A}, \overline{A})$.

Take now $A < \hat{A}$. First, consider $\alpha \geq 1 - K - c$. By (23), it follows that $V^{PE} \leq 0$ for $A \leq \hat{A}$, while $V^{SPAC} \geq 0$ for any $A \geq 0$ (see (25)), and this inequality is strict for $A > 0$. Thus, $V^{SPAC} > V^{PE}$ for any $A \in (0, \hat{A})$ and, by our previous results, $V^{SPAC} > V^{PE}$ for any $A \in (0, \overline{A})$.[19]

Second, consider $\alpha < 1 - K - c$. Then, $V^{PE} > 0$ for any A. As $V^{SPAC} = 0$ for $A = 0$, there exists — by continuity — an interval $[0, A_c)$ with $A_c > 0$ on which $V^{PE} > V^{SPAC}$. Note that when $A \in (\hat{A}, \overline{A})$, $\frac{\partial V^{PE}}{\partial A} = \frac{q(1-p)}{p}$, and, when $A < \tilde{A}$, then $\frac{\partial V^{SPAC}}{\partial A} = \frac{q(1-p)}{p}$. For $A \notin [\hat{A}, \overline{A}]$, $\frac{\partial V^{PE}}{\partial A} = 0$ and, for $A > \tilde{A}$, $\frac{\partial V^{SPAC}}{\partial A} = 0$. Because $V^{PE} < V^{SPAC}$ for $A \in [\hat{A}, \overline{A})$ and because both V^{PE} and V^{SPAC} (weakly) increase

[19]There is equality if $\alpha = 1 - K - c$ and $A = 0$. If $\alpha > 1 - K - c$, $V^{PE} < 0 \leq V^{SPAC}$ for any $A \leq \hat{A}$.

with A, there exists — by continuity — unique $\tilde{A}_c \in (0, \overline{A})$ such that for $A = \tilde{A}_c$, $V^{PE} = V^{SPAC}$. Without loss of generality, set $A_c = \tilde{A}_c$. Thus, the threshold A_c satisfies

$$\left(\frac{(1-p)q}{p}\right) A_c = q + (1-q)p - K - c \quad \Longleftrightarrow \quad A_c = \frac{p\big(q + (1-q)p - K - c\big)}{(1-p)q} = \frac{p\big(1 - \alpha - K - c\big)}{(1-p)q}.$$

As a result, $V^{SPAC} > V^{PE}$ for $A \in (A_c, \overline{A})$, and $V^{SPAC} < V^{PE}$ for $A \in [0, A_c)$, which was to show. Finally, by direct calculation, we obtain

$$\tilde{A} - A_c = \left(\frac{p}{1-p}\right)\left(1 - K - \frac{c}{q}\right) - \frac{p\big(q + (1-q)p - K - c\big)}{(1-p)q} = \frac{p(1-q)(K-p)}{q(1-p)} > 0,$$

so $A_c < \tilde{A}$.

A.7 Proof of Corollary 2

Recall that $A < \overline{A}$, so — due to $n \geq 1$ — $A/n < \overline{A}$.

We start with SPAC financing. Using relation (27) and (25), we obtain that

$$\hat{V}^{SPAC}(A, n) = n\left(\left(\frac{1-p}{p}\right)\frac{qA}{n}\right) = \left(\frac{1-p}{p}\right) qA,$$

when $\frac{A}{n} < \tilde{A}$. As such,

$$\frac{\partial \hat{V}^{SPAC}(A, n)}{\partial n} = 0 \quad \text{for} \quad \frac{A}{n} < \tilde{A}.$$

Next, note that because $1 - K > \frac{c}{q}$:

$$\frac{\partial \hat{V}^{SPAC}(A, n)}{\partial n} > 0 \quad \text{for} \quad \frac{A}{n} > \tilde{A}.$$

As a result, when $\frac{A}{n} < \tilde{A}$ and $n < N$, it is (weakly) optimal to reduce n, i.e., to increase A/n. When $\frac{A}{n} > \tilde{A}$, it is strictly optimal to increase n, i.e., to decrease A/n. As such, if $n \in (1, N)$, it must be that $\frac{A}{n} = \tilde{A}$, so $n = \frac{A}{\tilde{A}}$. If $\frac{A}{\tilde{A}} < 1$, then $n = 1$. If $\frac{A}{\tilde{A}} > N$, then $n = N$.

Taken together, we have

$$n^{SPAC} = \max\{\tilde{n}^{SPAC}, 1\} \quad \text{with} \quad \tilde{n}^{SPAC} = \frac{A}{\tilde{A}} \quad \wedge \quad N.$$

In particular, when $A < \tilde{A}$, we have $n^{SPAC} = 1$. And, when N is sufficiently large, we have $n^{SPAC} = \max\{A/\tilde{A}, 1\}$.

Next, we study PE-to-IPO financing. Using (27) and (23), we obtain

$$\frac{\partial \hat{V}^{SPAC}(A, n)}{\partial n} = sign(1 - \alpha - K - c) \quad \text{for} \quad \frac{A}{n} < \hat{A},$$

and

$$\frac{\partial \hat{V}^{SPAC}(A, n)}{\partial n} < 0 \quad \text{for} \quad \frac{A}{n} > \hat{A}.$$

We distinguish two cases.

First, consider $1 - \alpha - K - c \leq 0$. Then, $\frac{\partial V^{PE}(A,n)}{\partial n} \leq 0$. Thus, $n^{PE} = 1$.

Second, consider $1 - \alpha - K - c > 0$. For $A/n < \hat{A}$, the sponsor has strict incentives to increase n, i.e., to decrease A/n. For $A/n > \hat{A}$, the sponsor has strict incentives to decrease n, i.e., to increase A/n. Thus, either $n = N$ or $n = 1$. Suppose that N is sufficiently large so that $A/N < \hat{A}$. Then, setting $n^{PE} = N$ is optimal if and only if

$$N(q + (1-q)p - K - c) > \left(\frac{1-p}{p}\right) qA - \left(\frac{1-\alpha}{p}\right) c,$$

where the left-hand-side is the payoff for $n = N$ (when $A/N < \hat{A}$) and the right-hand-side is the payoff for $n = 1$ (when $A > \hat{A}$). which is satisfied for N sufficiently large. This concludes the proof.

A.8 Proof of Proposition 4

The main text argues that $K^x = K$ is determined by the optimizations in (30) and (31), respectively. Next, notice that according to Proposition 1, $y_2^{PE} \geq K + c - A$. As a result,

$$1 + c - A - y_2^{PE} \leq 1 - K.$$

It follows directly from (30) and (31) that $K^{SPAC} \geq K^{PE}$, where the inequality is strict if $1+c-A-y_2^{PE} <$ and $\eta > \underline{K}$.

Notice that when $\eta \to 0$, then $K^x \to \underline{K}$ for $x \in \{PE, SPAC\}$, as the expert possess full bargaining power in the limit $\eta \to 0$. In the limit $\eta \to 0$, the model solution becomes the one from the baseline with $K = \underline{K}$. Clearly, when $\phi < 1$ in the limit $\eta \to 0$, then the firm strictly prefers PE-to-IPO financing. Also, notice that when $\eta \to 0$ and $K \to \underline{K}$, then

$$\tilde{A} \to \left(\frac{p}{1-p}\right)\left(1 - \underline{K} - \frac{c}{q}\right).$$

By assumption, $A < \tilde{A}$ holds in the limit $\eta \to 0$, so $\lim_{\eta \to 0} \phi < 1$. By continuity, the firm then strictly prefers PE-to-IPO financing when $\eta \geq 0$ is sufficiently low.

According to Corollary 3 with $K = \underline{K}$, the expert strictly prefers SPAC financing over PE-to-IPO financing in the limit $\eta \to 0$ if and only if $\alpha > 1 - K - c$. That is, for η sufficiently small, the expert strictly prefers SPAC financing if and only if $\alpha > 1 - K - c$.

B Nash Bargaining before firm type becomes known to expert

Suppose that Nash Bargaining occurs before the expert learns the firm type. As in the main text, we consider that a bad firm behaves non-strategically and mimicks the good firm. We study Nash Bargaining for SPAC and PE-to-IPO financing separately.

SPAC financing. At time $t = 1$ when the expert meets a firm but does not know firm type yet, the joint continuation surplus of expert and early investors reads

$$q(1 - K - y_2 + P_1) = q(1-K),$$

as $P_1 = y_2 = y_1(a)$ according to Proposition 2. As a result, the optimal K^{SPAC} determined in Nash Bargaining solve

$$K^{SPAC} = \arg\max_{K \geq \underline{K}} \left(q^{1-\eta}(1-K)^{1-\eta} K^{\eta}\right).$$

The solution is $K^{SPAC} = \max\{\eta, \underline{K}\}$.

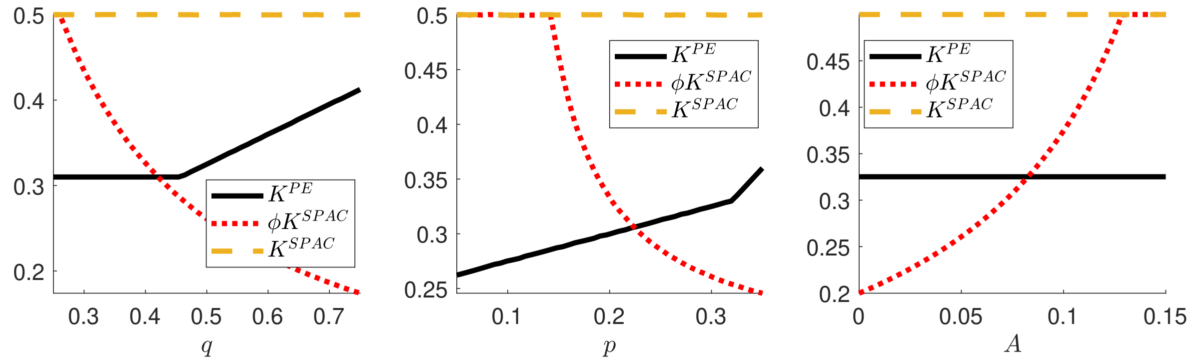

Figure 7: The firm's choice between the PE-to-IPO and SPAC model. The parameters are $A = 0.05$ $p = 0.3$, $c = 0.1$, $\underline{K} = 0.32$, $\eta = 0.5$, and $q = 0.5$.

PE-to-IPO financing. At time $t = 1$ when the expert meets a firm but does not know firm type yet, the joint continuation surplus of expert and early investors reads

$$q(1 - K - y_2 + P_1) + (1 - q)\theta(p(1 - y_2) - K + P_1) = V^{PE} + c,$$

as there are no fly-by-night operators in the PE-to-IPO market. Recall that V^{PE} is characterized in (23). As a result, the optimal K^{PE} determined in Nash Bargaining solve

$$K^{PE} = \arg\max_{K \geq \underline{K}} (V^{PE} + c)^{1-\eta} K^{\eta}.$$

The firm prefers SPAC financing over IPO financing if $\phi K^{SPAC} > K^{PE}$.

Figure 7 numerically depicts K^{PE} (solid black line), K^{SPAC} (dashed yellow line), and ϕK^{SPAC} (dotted red line) for different values of q, p, and A. Note that the patterns in Figure 7 are similar to the ones in Figure 6. First, conditional on meeting an expert sponsor, the acquisition value of a good firm is higher under SPAC than PE-to-IPO financing, but the likelihood of meeting an expert sponsor is lower under SPAC financing due to the presence of fly-by-night operators. That is, $K^{SPAC} > K^{PE}$, but not necessarily $\phi K^{SPAC} > K^{PE}$ Second, the firm prefers SPAC financing over PE-to-IPO financing in that $\phi K^{SPAC} > K^{PE}$ for low values of p, q and high values of A. The firm prefers PE-to-IPO financing otherwise.

C Alternative Model of Fly-By-Night Operators

This section discusses an alternative model of fly-by-night operators and shows how it affects our results. Specifically, we assume that fly-by-night operators locate a bad firm with probability one (instead of not locating a firm at all). Searching and finding a firm (or acquiring a firm) causes private dis-utility $\kappa \geq 0$ (possibly, $\kappa = 0$) to fly-by-night operators, which captures that — unlike skilled sponsors — fly-by-night operators would have to exert more effort to be able to find a firm in the first place. Note that this new model of fly-by-night operators encompasses the one of the baseline in which κ is chosen sufficiently large to discourage fly-by-night operators from trying to acquire a firm.

SPAC financing. A first observation is that this change in assumptions has no effects on the contracts and payoffs under SPAC financing. The fly-by-night operators, conditional on entering the market, follow the same strategy as in the baseline under SPAC financing: they raise $K + c - A$ dollars at $t = 0$ from early investors with their own co-investment of A dollars, do not search or acquire a firm, and exit at time $t = 1$ with payoff $1 - y_1(n)$ where $y_1(n)$ is described in Proposition 2. Note that anticipating that they never acquire a firm, fly-by-night operators avoid the dis-utility κ and do not locate a firm in the first place. Crucially, fly-by-night operators enter in equilibrium if and only if $A < \tilde{A}$, with $\tilde{A}$ from (22).

We conclude that the optimal contracts, payoffs, and results under SPAC financing remain unchanged relative to the baseline under this alternative model of fly-by-night operators.

PE-to-IPO financing. Next, we sketch the solution under PE-to-IPO financing. To do so, recall Proposition 1, characterizing the equilibrium with the baseline modeling of fly-by-night operators. Consider $A \geq \hat{A}$, with $\hat{A}$ from (20).

Then, as long as $A < \overline{A}$, the optimal contract stipulates randomization between acquiring and not acquiring a bad firm, conditional on finding one. As such, any sponsor who has found a bad firm is indifferent between acquiring it or not acquiring it. The payoff of a sponsor net of her co-investment A — conditional on finding a bad firm — reads $K - y_1(n) - A = -c < 0$. This (weakly) exceeds the payoff of a fly-by-night operator who by assumption never finds a good firm and possibly incurs disutility κ for searching for and acquiring a firm. As such, the fly-by-night operator earns a negative payoff from entering when $A \geq \hat{A}$. Therefore, as in the baseline, fly-by-night operators do not enter, just as in the baseline model. Thus, under this alternative model of fly-by-night operators, the results are unchanged relative to the baseline when $A \geq \hat{A}$. In particular, recall that when $K + c > q + (1-q)p$ (i.e., $\alpha > 1 - K - c$), then there is no market and equilibrium for $A < \hat{A}$ in that any types of sponsors do not derive positive payoffs from entering and thus stay out (see (23) and Corollary 1).

Now, consider that $K + c \leq q + (1-q)p$ (i.e., $\alpha \leq 1 - K - c$). Under these circumstances, the sponsor always derives positive payoffs in the baseline (see Corollary 1). And, the passive strategy of entering the market and not acquiring a firm does not yield positive payoffs. As such, if fly-by-night operators enter, they also search for a firm and so incur the dis-utility κ.

Fly-by-night operators, who always find bad firms, might potentially derive positive payoff from mimicking the sponsor and thus might have incentives to enter the market when $A < \hat{A}$. If so, fly-by-night operators raise funds at $t = 0$, find a bad firm at $t = 1$, and acquire this firm. Under the equilibrium payoffs from Proposition 1, this strategy yields payoff for fly-by-night operators (net the co-investment A) of $p(1 - y_2) - A$

$$p(1 - y_2) - A - \kappa = p\left(1 - \frac{K + c - A}{q + (1-q)p}\right) - A - \kappa.$$

It is possible to show that the above payoff is positive as long as

$$A \leq \frac{p\big(q + (1-q)p - K - c\big)}{(1-p)q} = \frac{p\big(1 - \alpha - K - c\big)}{(1-p)q} - \frac{\kappa(p + q(1-p)}{q(1-p)} = A_c - \frac{\kappa(1-\alpha)}{q(1-p)},$$

where the right-hand-side involves $A_c = \frac{p\big(1-\alpha-K-c\big)}{(1-p)q}$ from (26). Thus, as long as $A \geq A_c - \frac{\kappa(1-\alpha)}{q(1-p)}$, fly-by-night operators do not enter the market under PE-to-IPO financing under both modeling approaches. The threshold A_c is strictly smaller than $\tilde{A}$. Thus, for $A \in (A_c - \frac{\kappa(1-\alpha)}{q(1-p)}, \tilde{A})$, the PE-to-IPO approach resolves sponsor adverse selection by precluding entry of fly-by-night operators, while fly-by-night operators enter the SPAC market under these circumstances. Said differently, similar to our findings in the baseline, the SPAC market continues to be more prone to sponsor type adverse selection than the PE market. By contrast, the SPAC market resolves firm type adverse selection, while the PE-to-IPO financing mode does not and calls for $A < \hat{A}$ for an acquisition of bad type firms.

For $A < A_c - \frac{\kappa(1-\alpha)}{q(1-p)}$, however, fly-by-night operators possess strict incentives enter the market under the contract terms from Proposition 1. Thus, it must be that in equilibrium, investors meet a sponsor with endogenous probability ϕ. This endogenous probability ϕ as well as payouts y_2 are then determined to solve

$$\Big[(1-\phi)p + \phi\big(q + (1-q)p\big)\Big]y_2 = K + c - A,$$

which is investors' break-even constraint, and

$$p(1 - y_2) - \kappa = A, \tag{36}$$

which ensures that fly-by-night operators are indifferent between entering and not entering (otherwise, they would overwhelm the market).

Concluding remarks. We conclude that our results are robust to an alternative model of fly-by-night operator. Specifically, we find that the results under SPAC financing remain unchanged. Under PE-to-IPO financing, fly-by-night operators might enter for sufficiently low levels A. Nonetheless, compared with SPAC financing, PE-to-IPO financing better separates good sponsors from fly-by-night operators but is worse at resolving firm type adverse selection.

Finally, instead of assuming that fly-by-night operators only find bad firms, one could assume stipulate that they find a bad firm with probability $1 - q_L$ and a good firm with probability q_L, whereby $q_L < q$ and q is the probability that an expert sponsor finds a good firm. We expect our qualitative results to carry through as long as $q > q_L$.