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Abstract

We examine the role of angel investors in early venture financing using a new sample of 182 Series A preferred stock rounds. Our sample includes deals in which angels invest alone, those where they co-invest with venture capitalists (VCs), and deals in which VCs invest alone. We find that investor composition is strongly related to control rights, and deals with more angel investors have weaker control rights. Our broad results regarding outcomes and investor selection are consistent with a constrained matching explanation regarding how firms pair with investor types. Among smaller deals, matching is unconstrained, and outcomes are not correlated with investor composition. Among larger deals, VC participation is generally a necessary condition for raising capital, and firms for which this constraint binds experience inferior outcomes.

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I Introduction

Private equity investments of business angels represent the lion's share of investments in de-novo startups.[1] Yet, due to the paucity of data on angel financing (Fenn and Liang 1998; Prowse 1998), the nature of angels' investments in startups has largely been characterized based on survey evidence (Freear, Sohl, and Wetzel 2002; Wiltbank and Boeker 2007). For instance, the conventional wisdom is that angels tend to invest in early-stage deals, hold common stock, and exert influence through social networks rather than imposing formal control rights (Ibrahim 2007; Wilmerding 2003).

Our paper makes two primary contributions. First, although assortive matching is an established concept in the VC literature (cf., Sorensen 2007), our paper is the first to demonstrate liquidity constraints in the angel investment market and to suggest that these constraints may adversely affect entrepreneurial outcomes. We find that VC participation is generally a necessary requirement to finance larger deals. Thus, we hypothesize that entrepreneurs requiring larger deals face matching constraints, and those who match best with angel investors alone must accept a second-best match. We find that large deals with a high propensity to match with angel investors alone experience inferior outcomes. As predicted by this hypothesis, this result obtains for large deals, rather than for smaller deals where constraints are not likely to exist.

Second, and relatedly, our paper is the first to find evidence consistent with the predictions that control rights are allocated to the party whose marginal contribution to the project is greatest. We hypothesize that angels and VCs primarily differ on their abilities and disposition to influence firm behavior and investment patience. Consistent with this notion, we find that angel investors generally obtain weaker control rights than do VCs. Several theories predict that this should indeed be the case (e.g., Aghion and Tirole 1994), especially when VCs are able to contribute managerial effort that may improve the firm's prospects (Casamatta 2003; Hellmann 2002).[2] Our finding is important because despite this strong theoretical foundation, evidence in the existing literature has been elusive. The

[1] Extrapolating from the Survey of Small Business Finance, Fenn and Liang (1998) find that for every one firm that raises a venture capital investment, six raise an angel investment. Similarly, they note that approximately one-third of firms that go public were funded by venture capitalists and two-thirds by angels, and conservatively conclude that there are at least double the amount of angel investments as compared to venture capital investments.

[2] Hellmann and Puri (2000, 2002) document variance in product market strategy and top management team professionalization of VC-backed and non-VC-backed firms. Kaplan and Stromberg (2004) analyze venture capital contracts and find that investor rights vary with the expected and actual investor effort contribution. Dessein (2005) provides an alternative theory of control rights, attributing investor right allocation to signaling. An alternative, and perhaps complementary, explanation is that angels are more patient than VCs (Jovanovic and Szentes 2007). They may relinquish control to mitigate the entrepreneur's risk of premature liquidation especially when projects require longer time horizons (Lacetera 2008). Both interpretations are consistent with our premise that angels and VCs invest with heterogeneous control rights in equilibrium, a key finding in our paper. We discuss these alternative theories more in Section VII.

key limitation of existing studies, addressed by our study's examination of heterogeneous investor compositions, has been the two central contexts in which it has been tested: venture capital alone (Kaplan and Stromberg 2004) and research alliances (Higgins 2007; Lerner and Malmendier 2005; Lerner and Merges 1998).[3]

Although our results are strong, we note a key disclaimer. Our sample of stock purchase agreements and other legal documents are derived from the electronic records of the now defunct law firm Brobeck, Phleger & Harrison (Brobeck). This sample is comprised of high quality deals, as they are effectively certified by a prestigious law firm. This is supported by their higher incidence of successful liquidity events relative to other firms tracked by Venture Economics. Our angels are also more sophisticated than typical angels.[4] Our results thus might not generalize to very small or very risky transactions. On the other hand, our focus on these larger deals is also a virtue regarding our study's applicability to the study of venture capital, as more prestigious VCs limit attention to quality transactions. Indeed, using several measures of prestige, we confirm that the VCs in our sample are more prestigious than others in Venture Economics.

Our data include a rich set of controls, including risk, firm age, deal size, and control rights. With these controls in place, we report four central findings.

1. When firms raise smaller amounts of capital, they do so from either angels alone, VCs alone, or from both angels and VCs. In contrast, when larger investments are needed, VC participation is generally necessary, suggesting that matching is constrained.

2. In Series A rounds, angels almost always take preferred shares. Nevertheless, the presence of angels, either investing alone or alongside VCs, is associated with weaker cashflow and control rights. This result obtains for large and small deals alike.

3. Among smaller deals, angel-only deals have the lowest incidence of failure, and a similar incidence of IPOs and acquisitions. However, many of the surviving (non-failed) angel-only firms are less active.

4. When deals are large, those financed by VCs alone are more successful than those in which angels participate.

[3]There are few studies that explicitly compare VCs and angel investors, perhaps because identifying samples on the margin of VC and angel investment markets has been difficult. For example, Wong (2002) conditions on angel participation, and Kaplan and Stromberg (2003, 2004) condition on VC involvement. Similarly, analyses of private equity returns by Cochrane (2005), Hall and Woodward (2007), Hochberg, Ljungqvist, and Lu (2007), Kaplan and Schoar (2005), Ljungqvist and Richardson (2003), Moskowitz and Vissing-Jorgensen (2002) and Woodward and Hall (2004) are based on investments by VCs or small privately-held businesses. Wiltbank and Boeker (2007) present survey evidence on angel returns.

[4]The mean investment of $150,375 made by angels in our sample is large relative to the $10,000 average outside equity investment made by individuals as reported by Reynolds (2005). Shane (2008) reports that investments over $200,000 fall in the top one percentile of angel investments.

Finding 1 indicates that in Series A investment rounds, deal size segments the market. In particular, entrepreneurs who wish to raise funds from angels alone can do so only when their capital requirements are modest. This situation may arise if angel investors are liquidity constrained which limits the amount of money they are willing to invest in any particular deal. Alternatively, it may be more difficult to find angel investors if angels do not advertise their presence and / or an entrepreneur's network is limited. This finding has strong implications for the way in which we conduct our analyses. Although we report characteristics and results for the entire sample throughout the paper, we also analyze large and small deals separately. We then focus on a unified theory that can explain results in both subsamples.

The conventional wisdom that angels make smaller investments than do venture capitalists while obtaining weaker control and cashflow rights (Ibrahim 2007; Wiltbank and Boeker 2007; Wong 2002) is consistent with our findings. Moreover, Finding 2 provides unique evidence that control rights vary with investor composition.

Although alternative theories cannot be ruled out, our results for both small and large deals are most consistent with a simple theory of constrained matching. Founders requiring more investor patience, having greater managerial ability, or having a preference for retaining control match best with angel investors. Founders requiring managerial coaching or faster growth match best with VCs. Firms having some of both characteristics match best with mixed investors. This theory fits in well with our findings regarding control rights.

Importantly, this theory can explain the lack of a link between investor composition and outcomes for small deals (Finding 3), and the negative link between angel participation and outcomes for large deals (Finding 4). In particular, we find that all three matches are frequently observed among small deals (Finding 1). We infer that the matching process is not constrained when capital requirements are modest. Hence, no link to poor ex post performance is predicted because all matches are first best. Within the sample of larger deals, however, the rarity of observed angel-only financing suggests that founders face a constrained matching process in which angel-only financing is unlikely. Founders that would have matched best with angels alone must then settle for a second best match, likely to the nearest alternative, which is mixed investor groups. These mismatched firms might then underperform relative to those with a first best match. An empirical test measuring the propensity to prefer angel-only financing in the sample of large deals supports this theory. Although the constrained matching theory seems to be the best fit for our broad findings, it is important to note that we cannot rule out some important alternative theories, which we discuss in Section VII.

In the next several sections we describe our data and results. Given the sparesness of information about angels in the literature, we also provide an appendix that provides detailed descriptions of our sample firms, deals, and to the extent we are able, investor characteristics.

Section II summarizes a theory of constrained matching. Section III provides an overview of our data. Section IV summarizes our results regarding deal characteristics and control rights. Section V presents the relationship between investor composition and outcomes. Section VI expands our results in the context of our constrained matching theory. Section VII discusses robustness, and Section VIII concludes the paper.

II A Theory of Constrained Matching

We hypothesize that entrepreneurs and investors choose one another through a matching process (see Sorensen 2007 for a summary of evidence). We further assume that entrepreneurs seeking smaller deals (but not those seeking larger deals) are able to match efficiently with their first best investor type (angel-only, mixed, or VC-only). In particular, funding large deals exclusively with angels would require assembling a very large number of investors, as angels invest much smaller amounts than do Venture Capitalists (Wong 2002), which limits the likelihood of this occurring. We find (as does Wong) that large angel backed deals are indeed rare. This suggests that entrepreneurs seeking large amounts of capital face a constrained matching process. Firms that would have matched best with angels alone must match with mixed investor groups that include venture capitalists. These suboptimal matches might contribute to generating inferior outcomes.

In Section A (below), we discuss why some firms might match best with angels and others with VCs. In Section B, we explain how this matching hypothesis interacts with expected control right allocations, which in turn motivates our empirical framework.

A Motives for Matching

Various investors have different abilities and objective functions. For example, there is much evidence that VCs are more actively involved in the firm, and also less patient than angel investors. Some of this evidence (including Kaplan and Stromberg 2004, Lerner 1995, and Baker and Gompers 2003) derives from studies of venture capital firms in isolation.[5] In contrast, other studies derive indirect evidence based on studies of angels alone (Freear, Sohl, and Wetzel 1994; Freear et al. 2002; Prowse 1998). Wetzel (1983) and Freear et al. (1994) provide survey evidence that angels may have more extended time horizons than VCs. Alternatively, angels' preferences may be difficult to assess and consequently, their

[5]Lerner (1995) and Baker and Gompers (2003) find that VCs are generally active on portfolio company boards. In surveys, VCs also report being actively engaged (Gorman and Sahlman 1989, MacMillan, Kulow, and Khoylian 1988, Sapienza 1992, and Sapienza, Manigart, and Vermeir 1996). The evidence of relative VC impatience is more limited: partnership structures constrain investment horizons (Gompers and Lerner 2000; Jones and Rhodes-Kropf 2004; Sahlman 1990) and, together with the scarcity of VC labor resources, may lead to VC impatience (Jovanovic and Szentes 2007).

behavior is unpredictable. In such a case, entrepreneurs may demand stronger rights as a way to insure against consequences of potential incentive misalignment.

Other reasons why some entrepreneurs might match better with different investors include certification and the possibility of accelerating growth. Megginson and Weiss (1991) and Brav and Gompers (1997) suggest that by attracting high quality VC investments, entrepreneurs are able to certify their firms as having higher quality. This provides benefits later, for example, at the time of IPO, or when later round financing will be needed. Based on a comparison of VC-backed and non VC-backed firms, Hellmann and Puri (2000, 2002) find that VC financing is associated with quicker-to-market strategies. This faster financing is associated with increased professionalism and/or CEO replacement.

These studies support the foundations of a matching model in which some entrepreneurs can benefit more from VC involvement and prefer to match with VCs. Other founders might require patience to achieve longer term goals, or possess superior knowledge regarding their industry and prefer to match with more "hands-off" angel investors.

We conclude that the theoretical foundations underlying a simple matching theory of venture financing is well supported by the existing literature along many dimensions. We add the additional assumption that angels have more limited resources than VCs, and thus cannot fully finance larger deals. This leads directly to the prediction that angel-backed deals should be smaller, on average, than deals backed by VCs. Our second prediction is more subtle. If matching is constrained, in the sense that some entrepreneurs may benefit from matching with angels but their capital requirements dictate that they match with VCs, then these entrepreneurs will be unable to obtain a first best match. This leads to the prediction that such entrepreneurs should, on average, experience inferior outcomes as compared to those that are unconstrained.

B Matching and Control Rights

The theoretical literature explains the allocation of control rights in several ways: One stream argues that moral hazard concerns should lead to an allocation of control rights that minimizes monetary or labor underinvestment by the principal and cash-constrained agent, respectively (Aghion and Tirole 1994; Grossman and Hart 1986). The theoretical literature initially viewed this as indicating that control rights should be allocated to the entrepreneur, as an entrepreneur's effort allocation would be more difficult to specify upfront. More recent work suggests *VC*s may receive more cashflow rights as compensation for effort (Casamatta 2003). The financial contracting literature arrives at a similar conclusion, but instead hypothesizes that entrepreneurs enjoy private benefits from control of the project, whereas financiers are solely concerned with financial returns (Aghion and Bolton 1992). Alternatively, Dessein (2005) argues that entrepreneurs may give up formal control rights

as a mechanism to signal congruence of goals. Finally, if a project requires greater patience, it may be efficient for the financier to relinquish some rights as a mechanism to credibly commit to the project in the face of potential alternatives (Lacetera 2008).[6]

Consistent with the prediction that control rights should vary across investor groups in equilibrium, Kaplan and Stromberg (2004) provide some evidence in a study of VCs alone. The authors find that when a VC perceives that they can contribute substantially to the firm, they receive greater cashflow rights. When VCs' involvement with portfolio firms is expected to be more acrimonious (e.g., founder-CEO replacement), VCs receive greater control rights.

These arguments, coupled with the motives for matching described earlier, suggest the following prediction: the presence of angels should be associated with weaker control rights. In other words, the equilibrium choices of control and liquidation rights should reveal information about the optimality of a firm's match to angels alone, VCs alone, or mixed investor types. However, a second prediction also follows: In equilibrium, investor composition should not necessarily predict outcomes, unless the matching process is systematically constrained. Further, the degree of control and liquidation rights in deals in which some entrepreneurs face a limited investor pool should reveal the degree of mismatch.

This discussion motivates a two stage model to test the matching theory. The control and liquidation rights (and the fraction of the firm sold) may serve as empirical instruments for the propensity that a given firm matches best with certain investor groups including angel investors. This in turn permits us, after examining the propensity to match with angel investors in a first stage, to test in a second stage whether constrained / second best matching is associated with inferior outcomes. This leads to a final prediction: after controlling for the degree of mismatch, there should be no relation between investor composition and outcomes. Section VI documents the results of our tests of this prediction.

III Data Sources

We now provide a basic description of our data and associated summary statistics. For interested readers, we provide a more detailed description of our data and its summary statistics in an online appendix. The appendix fully captures information presented here and more, so a reader who completes the online appendix can continue reading from Section IV.A. The additional analysis in the online appendix broadly supports the applicability of our sample to the tests we examine in this paper.

[6]It has long been known that the potential for ex-post renegotiation (hold-up) can lead to ex-ante inefficiencies (Hart and Moore 1988). Rotemberg and Saloner (1994, 2000) demonstrate theoretically that the ability to commit to particular projects can increase incentives to provide effort.

Our data are derived from the electronic records of the now defunct law firm Brobeck, Phleger & Harrison (Brobeck), which was founded in 1926, and served clients primarily in California and the western United States (it also had offices in Austin and the East Coast). The firm's failure was induced by the Internet bust following a high debt growth strategy, and the firm ceased operations in February 2003. This data has been made available by a partnership with the National Digital Information Infrastructure Preservation Program of the Library of Congress and overseen by a blue-ribbon advisory council, a team of legal and technical experts, one of the authors of this study, and a August 9, 2006 decision by Judge Dennis Montali of the United States Bankruptcy Court, Northern District of California.[7]

We identify 182 Series A funding rounds from 1993 to 2002 with sufficient documentation, and an indication of deal closure.[8] Our data are collected from Stock Purchase Agreements, term sheets, Voting Agreements, Co-Sale documents, First Refusal Agreements, and Investor's Rights Agreements.[9] We combine these data with complete histories and outcomes based on public sources including Lexis-Nexis, Hoovers, SEC filings, the Internet Archive (archive.org), and Thomson Financial's Venture Economics. We further obtain a record of each firm's internet presence (from 1996 to present), its press releases, and articles about each firm in the popular press. This allows us to identify liquidations, bankruptcies, acquisitions, IPOs, and major company milestones including strategic alliances, product releases, and subsequent VC investments in the firms. For comparison, 111 of our 182 deals also appear in the Venture Economics database (but without the full information to which we have access).

A Investor Classification and Deal Size

We classify investors in the Series A deals into three major categories – founders, VCs, and angels. Founders are identified using a two stage process: (1) some are identified directly in the documents, and (2) they are otherwise identified using a three step rule. (1) the largest common shareholder is identified as a founder; (2) any other common shareholder holding at least 30% as many shares as the largest common shareholder is also a founder; and (3) any common shareholder holding the position of president or CEO is also a founder. For the 165 companies in our sample for which we have founder data, there were a total of 458

[7]This decision authorized the creation of a *Closed Archive* allowing a significant fraction of these records to be saved. The present work is an experimental project designed to test the feasibility of research under the proposed model. See http://brobeckclosedarchive.org/index.html.

[8]We define a Series A funding round as the first round in which preferred stock is issued. Some earlier common-only rounds exist, however we do not focus on them because they are relatively infrequent. Also, controlling for them does not change our study's results, and we generally do not observe many investors from these initial rounds investing again in the Series A round.

[9]The documents in the Brobeck corpus are very similar to the samples provided by the National Venture Capital Association on their website. See http://www.nvca.org/model_documents/model_docs.html.

founders, leading to an average of 2.78 founders per company. We identify venture capitalists primarily by cross-referencing investor names with those in the Venture Economics database, but we also label as VCs investors with names sharing a common word root with the term "venture". We label as angels all investors who are not otherwise classified as founders or VCs. This category consists of 2,528 different investors across 144 of our 182 sample firms, and is predominantly composed of individuals.[10]

We now summarize how we classify the investor composition of our 182 deals. The top panel of Figure 1 shows the distribution of investor composition for deals in our sample. Thirty-two deals (18% of our sample) rely solely on angel investments, 38 (21%) have only venture capital investment, and the other 112 deals (61%) draw upon both angel and VC investors. These mixed deals have a reasonably uniform distribution in participation by the two groups of investors. When they do participate, VCs systematically invest more money than angels. This suggests that deals involving VC investments are larger, which is indeed the case.

The bottom panel of Figure 1 shows the distribution of deal size, i.e., dollars invested in Series A deals, for three investor composition categories: angel-only, mixed, and VC-only deals. Angel-only deals are smaller (median $1.12 million compared to overall median of $3.5 million). Mixed deals are somewhat larger (median $4.49 million) than VC-only deals (median $3.53 million). While VC-only and mixed deals are large and small, only 3 of the 32 angel-only deals have sizes above the sample median. We conclude that VC participation is virtually a necessity for larger deals. These characteristics lead us to explore five subsamples in our analysis: three subsamples based on investor composition (angel-only, VC-only, and mixed deals), and two subsamples sorted on size (large and small deals).

B Summary Statistics

Table I displays basic firm and investor summary statistics for our sample, and for deals in Venture Economics (when available). Relative to deals in Venture Economics, our sample has a locational bias consistent with Brobeck's geographical footprint, with a much higher concentration in California (53% vs 36%), Texas (21% vs 6%), and Colorado (8% vs 2%). We use the Venture Economic Industrial Classifications (VEIC) to identify industries, and we hand-classify the 71 deals from our sample that were not in Venture Economics. Overall, 73% of our firms are in Information Technology, compared to 69% in Venture Economics. Our sample is quite similar to Venture Expert in terms of industry. Regarding timing, our sample over-represents deals in the most recent period of our study. Half of our Series A

[10]Individuals invest either directly in their name, or through trusts and other investment vehicles including companies set up for investment purposes. Although we cannot identify friends and family, we note that investors with the same name or ethnic origin as founders appear to be a relatively small proportion of the angels in our sample.

rounds occurred after March 2000 (when the Nasdaq index began its precipitous drop), as compared to 35% in Venture Economics. This may reflect Brobeck's planned high growth strategy in 2000 to 2002, or an increasing reliance on electronic record keeping. We control for these variables in all of our analyses.

With respect to deal size, the mean investment size for Series A deals in our sample is $6.14 million, which is smaller than the $7.15 million in Venture Economics. As discussed above, angel-only deals ($1.63 million) are statistically smaller than mixed deals ($7.56 million) or VC-only deals ($5.76 million). The size difference between VC-only and mixed deals is not statistically significant. The average post-money valuation of firms in our sample is $14.9 million, as compared to $24.4 million in Venture Economics. This number is also smaller for angel-only deals ($6.1 million). In terms of age, our sample is overwhelmingly composed of true start-ups (average age is 1.8 years), which is somewhat young relative to the average age of 3.1 years in Venture Economics. Angel-only deals are roughly three months older than VC-only deals (2.1 years vs 1.8 years), and four months older than mixed deals (1.7 years).

Although milestone data is not available in Venture Economics, most firms in our sample did not achieve milestones prior to Series A funding. Only 13% had products developed, and only 10% were in a strategic alliance. These findings are consistent with the young age of our firms. Overall, we believe our sample is quite representative of firms with Series A deals in Venture Economics along some dimensions such as industry, but are somewhat different in timing, size, age and location. Sample selection could affect our results if, for example, there are systematic differences in control rights across geographical locations, as suggested by Gupta (2000), or changes over time. Thus, we control for these characteristics in all of our later tests.

C Investor Characteristics

Panels B and C of Table I summarize investor characteristics pre-Series A, and after accounting for the Series A financing, respectively. In the online appendix, we further discuss the legal forms used to construct investor variables, as well as more information regarding our sample's investors. The average firm has 2.78 founders, and smaller firms and firms that have only angel investors in Series A have fewer founders on average. Roughly one quarter of our firms have pre-Series A common rounds, however it is important to note that this variable is not related to the composition of investors in the Series A financing, confirming our broader finding that our results regarding control rights and outcomes are not associated with ex-ante financings including seed rounds.

Panel C confirms our important finding that angels invest in smaller deals: only 3 of the 91 large deals are angel-only deals, compared to 29 of the 91 small deals. On average,

12.8 angels invest in angel-only deals, 4.8 VCs invest in VC-only deals, and a total of 14.5 investors participate in mixed-deals. Also consistent with angels not having as much capital as VC firms, more angel investors are needed to fund an angel-only round. Mixed deals are larger, and thus should be expected to have more investors. In mixed deals, 23.4% of the investment comes from angels, and the balance from VCs.

Approximately 70% of our sample angels appear as individuals in the records. Most of the 10% of investors we categorize as "small company" are also likely to be individuals investing through corporate vehicles for tax and estate-planning purposes. Together, these two categories make up over 80% of the dollars invested by angels in the mixed and angel-only Series A deals. "Companies" and "others" (which include universities, non-profits, and governments) play relatively minor roles.[11]

Since most of the VCs investing in Brobeck deals ("Brobeck VCs") are included in the Venture Economics database, we conduct an in-depth comparison relative to the other VCs tracked by Venture Economics. The results are formally discussed in our online appendix, but we summarize them here. Brobeck VCs are weighted toward US-based funds (especially California), early stage funds (but not seed stage funds), and older private equity firms. VC firms investing in Brobeck deals have higher prestige, as measured using many proxies from the existing literature. These include each VC's IPO rate, funds under management, and centrality.[12] Although the prestige difference between Brobeck VCs and Venture Expert VCs is large, we find far less variation in prestige within the Brobeck sample. VCs in large vs small Brobeck deals do not differ along this dimension, and Brobeck VCs investing in VC-only deals have only slightly higher prestige than those in mixed deals. In unreported tests, we control for VC prestige in all of our key tests, and we find that prestige does not explain any of our results. We conclude that Brobeck's reputation allowed it to attract uniformly higher quality investors, and that prestige does not explain any of our cross sectional findings.

IV Deal Characteristics

We turn now to deal structure. As before, interested readers should refer to our online appendix for more detail. Table II summarizes the rights associated with the Series A preferred stock based on a review of the closing documents. Gompers (1997) and Kaplan and Stromberg (2003) document that preferred stock is typically differentiated from common stock through superior cashflow rights, voting rights, board representation, liquidation rights, redemption rights, and anti-dilution provisions. Our sample's variation is indeed along these dimensions.

[11] See the online appendix for more details.

[12] See Ivanov, Krishnan, Masulis, and Singh (2008), Piskorski and Anand (2007), and (Bonacich 1972), for example, for references.

We classify board seats as being assigned to common shareholders using a two step procedure. First, in many cases, the documents identify which board seats are designated by common shareholders or Series A shareholders. Second, in some cases individuals are designated, and we used a fuzzy name matching algorithm to link these seats to specific investors. As shown in Table II, common and preferred shareholders have roughly the same representation (46% versus 54%) in our sample. Not surprisingly, firms with VC-only and mixed Series A deals have more board seats assigned to preferred shareholders, as do larger deals, likely due to the higher VC participation in those deals.

Turning to cashflow rights, preferred shareholders sometimes have stronger claims in the form of cumulative dividend rights. With regular dividends, an annual payment, often a percentage of investment (generally 8%), is paid conditional on a positive shareholder vote. With cumulative dividend rights, this amount accumulates each year. This clause is present in only 9% of our deals, and never appears in angel only deals. Cumulative dividends are investor-friendly, and provide a strong incentive for an accelerated exit. Its prevalence in VC-only deals is consistent with the notion that VCs are less patient investors.

The variable *Liquidation* is a dummy indicating whether preferred shareholders have special liquidation cashflow rights going beyond their initial investment. A value of zero indicates that, after preferred shareholders receive their initial investment, all remaining proceeds upon liquidation go to common shareholders. When the *Liquidation* dummy takes a value of one, preferred shareholders have cashflow rights beyond their initial investment, and in all cases but two, they share these additional cashflows equally with common shareholders (in the two cases, all remaining proceeds go to preferred shareholders up to a specified cap). This variable's mean indicates that 42% of our sample deals provided strong liquidation rights to Series A investors. *Cap on Preferred*'s mean indicates that 47% of these stricter deals had an upper limit on the amount that can be paid to preferred shareholders. Because many preferred liquidation rights are capped, it is important to note that when the company value upon liquidation is high, preferred stockholders will waive their liquidation rights and convert their stock to common. Also note that the liquidation preference in angel-only deals is much less favorable towards investors, which foreshadows a key result of our paper.

Finally, the table shows that preferred shareholders have the right to redeem their shares at will in about one quarter of our deals, typically after a period of time and usually conditional on a Series A majority or super-majority vote. Such a right would be invoked when a firm is not performing well, and is considered to be an investor-friendly term. Angels investing on their own seldom receive such a redemption right in their stock purchase agreements.

A Determinants of Deal Characteristics

Table III reports the results of probit models predicting the likelihood of investor-friendly cumulative dividend and liquidation rights. Table IV reports the results of an OLS model predicting the fraction of board seats allocated to common shareholders, and a probit model predicting the likelihood of redemption rights. All independent variables are standardized (except dummy variables), and we report marginal effects for all probit models in order to give our reported coefficients simple economic interpretations (how much one standard deviation of a given variable impacts the dependent variable).

Table III and Table IV both illustrate that angel investors are associated with more founder friendly deal terms and here we provide evidence in support of Finding 2. In particular, angel-only status implies an 8% lower likelihood of having cumulative dividends for Series A investors, a 33% lower likelihood of having strong liquidation privileges, and a 22% reduced likelihood of having redemption features. In contrast, a larger VC share of the Series A round is associated with a higher likelihood of both liquidation and redemption rights (significantly so for large deals).

We also find evidence in Table IV that angel-only financings cede 16% greater board control to common shareholders (significant at the 10% level for the whole sample, and almost significant for smaller firms). The table also shows, intuitively, that common shareholders receive greater board control (roughly 12% more per standard deviation) when a smaller fraction of the firm is being sold.

Finally, some additional results emerge in Table III and Table IV. Biotechnology firms are associated with 23% more board control for common shareholders, especially for smaller deals (30% more). This might be due to the more knowledge-intensive nature of this business. We also find that investors in firms that previously announced product releases (i.e., mature firms) are roughly 56% more likely to seek cumulative dividend rights when deals are large. Dividend rights strengthen incentives to speed up the commercialization and exit process, and this may only be effective after the uncertainty associated with product development is resolved. Deals in which Brobeck invested had stronger liquidation rights, suggesting that they either encouraged terms that were more investor-friendly, or they were more likely to invest when terms appeared to be more favorable to investors. Redemption rights appear to be less frequent in deals involving Californian companies.

V Outcomes

In Table V, we provide some descriptive statistics regarding the outcomes of the 182 firms in our sample as compared to 9,902 firms in Venture Economics that recorded an initial financing during the comparable 1993-2002 time period. We further condition the Venture

Economics comparison sample on US-based venture capital investment targets founded after 1967 with the first investment not labeled as buyout, acquisition, other or unknown. Outcome variables of the Venture Economics sample are as reported in that database, but weighted to reflect the distribution of deal origination dates in the Brobeck sample. We identify acquisitions and IPOs in our sample through archival sources such as press releases, as does Venture Economics for their universe of firms.[13]

"Non-exited survival" for our firms is defined as the firm still being an ongoing private concern, and an independent company, as of March 2008. This status is based on the web and other public sources. "Active" non-exited survival means that the firm also issued at least one press release (in Lexis/Nexis) or updated its website (as determined from archive.org) between January 2005 and March 2008 (surviving firms are otherwise classified as "inactive").[14] Failure for firms in our sample indicates that the firm is not surviving and did not experience a positive liquidity event. Outcome variables for the Venture Economics sample are as reported in that database. Since firm failure is often a silent event, only liquidity events are reported reliably in Venture Economics. Finally, we use Venture Economics to identify which of our firms received a subsequent round of financing involving at least one VC investor.

The success of the firms in our sample closely parallels that for the Venture Economics firms. In our sample, 31% of the firms experience a successful liquidity event (IPO or acquisition), 28% are non-exited surviving firms, and the remaining 41% are failures. While the precise figures shown in Table V for our sample and the Venture Economics data differ somewhat, the only statistically significant difference between them is that the incidence of acquisitions for our sample (26%) is approximately 50% higher than that for the Venture Economics firms (17%). Looking across the different subsamples in Table V, there are a number of statistically significant differences in failure (larger and angel-only companies have lower incidences of failure) and in non-exited survival (angel-only are more likely to survive, though some of this is explained by a higher incidence of "inactive" survival). We will shortly examine these differences more carefully using multivariate regressions.

Finally, note that roughly half of the firms in our sample and three-quarters of those in Venture Economics have a subsequent financing round documented in Venture Economics (and thus involving at least one VC), but for angel-only firms, the fraction is much lower. Since it is known that the majority of companies having an IPO do not have VC backing,

[13]Since we are unable to accurately value companies that have been acquired or continue as private companies, we cannot ascertain investors returns. Thus, we focus on determining the success of the companies in terms of survival and profitable exits, rather than measuring the magnitude of investment returns (Gompers, Kovner, Lerner, and Scharfstein 2007).

[14]While it is possible that some firms may wish to "fly under the radar" by not making press releases and not keeping an updated website, we expect that this is unlikely given that visibility has a positive effect on the ability to raise capital in private and public markets.

it is possible that many of the firms in our sample with angel-only Series A rounds simply continue to eschew VC financing over time. However, in unreported multivariate probit regressions, we find that while the incidence of future VC-backed financing is negatively related to angel-only Series A financing, the relationship is not statistically significant upon controlling for other factors. We find that the incidence of future VC financing is higher when the fraction sold at the time of the Series A round is higher (potentially indicating a more capital intensive business), the firm is older at the time of the Series A round, there are no product releases before the Series A round (suggesting perhaps that the firm is not able to self-finance quite as quickly), and the firm is not in the IT industry.

We conduct multivariate probit regressions to further analyze the relationship between investor composition and success. Table VI displays the marginal effects for probit models for the full sample as well as the large and small deal subsamples and it is here that we document support for Findings 3 and 4. In columns one, three, and six, the dependent variable is a dummy set equal to one for firms experiencing an IPO or an acquisition, and zero otherwise. We find that VC-only financed firms are more likely to experience these successful liquidity events, but only in the sample of large deals. The effect is also economically large, as the coefficient has a marginal effect of 46%.[15]

In columns two, four, and seven, the dependent variable is survival, which is a dummy variable set equal to one for firms experiencing IPOs or acquisitions, and for firms that are still an ongoing private concern as of March 2008 (i.e., our "non-exited survival" firms documented in Table V). We find that firms financed by angels alone are 33% more likely to survive relative to other firms, and 43% more likely to survive among smaller deals (both significant at the 1% level). However, it is important to note that if VCs are more likely to shut down marginally performing firms, then the survival of angel backed firms and VC backed firms may not be strictly comparable (Jovanovic and Szentes 2007). As an alternative in column five, we thus examine the small deal subsample (where there are angel-only deals) in greater detail, and we adjust our definition of survival based on activity levels, and we reclassify firms experiencing "inactive" survival as failures. We find that angel-only deals are not more likely to survive relative to deals with VC-backing in this specification.[16] This

[15]We conduct many additional (not reported) robustness checks to ensure that our categorization of angel investors (e.g. angel investment groups, corporations, and Brobeck itself) does not affect our results. These tests uniformly produce results consistent with those displayed. In addition, we examine the impact of using cutoffs other than 100% when categorizing deals as angel-only or VC-only to see whether our results depend on the strict purity investor identification. Since the lowest VC share in the mixed deal group is 26.3%, there are no "near angel-only deals". In contrast, there are a number of mixed deals that have relatively minor angel participation ("near VC-only deals"); for instance, there are 62 deals that have at least 95% VC share Series A participation, which is dramatically larger than the 38 that are pure VC-only deals. Hence, there is some clustering near the VC-only extreme. In examining robustness to these less stringent definitions of "VC-only", we find only minor effects to our results.

[16]We also conduct ordered probit regressions based on the assumption that IPO/Acquisitions are more successful than surviving firms, which in turn are more successful than failing firms. We find results that

suggests that while angel-only firms are more likely to survive, this relationship is driven by firms surviving in an inactive state. This might arise if these firms indeed require greater patience, or if angel investors are less likely to force these generally unsuccessful firms to liquidate.

VI Evidence of Matching

To explore whether the inferior performance of large mixed deals relative to large VC-only deals (Finding 4) is due to second-best matching by investors and entrepreneurs, we employ a two stage Probit model. In stage one, we estimate the propensity that a deal will be financed exclusively by angels using the sample of small deals where matching appears unconstrained. In stage two, we use the fitted coefficients from the stage one model to compute the propensity that a firm would have matched with angel-only financing in the sample of large deals where matching appears constrained. We then explore whether this proxy for mismatched deals explains our broader findings regarding outcomes.

We report the results of this analysis in Table VII. The first-stage probit model (Column 1) predicts the likelihood that deals are financed exclusively by angels for the small deal subsample. If investors and firms match efficiently, then the deal terms should indeed be associated with the type of investor, but not with outcomes. These characteristics are also required of valid empirical instruments. Our results support the admissibility of the first stage model. Three of four deal terms significantly predict the likelihood of an angel-only match (Column 1), and none of these variables significantly predicts outcomes (Column 2).

In the remaining four columns we report the results of the Stage 2 analysis. In Columns 3 and 4, we first examine this question under the additional assumption of revealed preference, and we assume that an entrepreneur who would have matched with angel-only financing will always choose a mixed deal as the second-best option (deals financed exclusively by VCs are assumed to not be mismatched). Thus, we compute the propensity of angel-only financing as the predicted value from the stage one model, which is then set to zero for VC-only transactions. We call this first propensity measure "Angel-only Propensity x Mixed Dummy". We then relax this revealed preference assumption in Columns 5 and 6 by allowing positive angel-only propensity scores for VC-only transactions.

In Column 3, we test whether "Angel-Only Propensity x Mixed Dummy" negatively predicts the IPO or acquisition outcome. The results show strong support for the hypothesis that large deals that should have matched with angels alone experience inferior outcomes. This result is highly significant at the 1% level with a t-statistic of -3.03. In Column 4, we show that the VC-only coefficient indeed becomes insignificant (relative to Column 6

are consistent with those of the probit regressions reported in Table VI.

of Table XIII) when we control for the propensity to be angel-only financed. The size of the VC-only coefficient declines by more than half from 0.46 to 0.22 while the propensity variable remains significant at the 5% level.

The "Angel-Only Propensity" negatively predicts the IPO or acquisition outcome dummy when the revealed preference assumption is relaxed (Column 5). However, this variable alone does not subsume the significance of the VC-only dummy. However, the VC-only dummy is subsumed under the slightly stronger assumption that the influence of mismatch will be more severe for mixed deals. In Column 6, we test this by adding the Angel-Only Propensity x Mixed Dummy cross term. This cross-term is significant at the 10% level, and importantly, subsumes both the VC-only dummy and the angel-only propensity level. We note that the loss of significance for the VC-only dummy and the Angel-Only Propensity level in the presence of the cross term is not just statistical; the former coefficient declines by one half and the latter switches sign (although it is close to zero). Finally, in unreported tests, we confirm that weaker control rights do predict outcomes directly, but only in the sample of mixed deals where the link to angel-only propensity is higher. We conclude that the support for the matching hypothesis is strong.

VII Robustness

There are several potential alternative explanations for our results that we consider. Perhaps the most plausible alternative is that large VC-only deals have a higher degree of quality, and that VCs exclude angels from high-quality deals. This hypothesis is consistent with Finding 4 in which VC-only deals outperform mixed deals, and also explains why we only observe differential outcomes in the large deal sample, where incentives might be stronger. Most important for this alternative is the role played by deal quality, and the ability of VCs to perceive this quality early in the investor selection process, allowing them to potentially exclude other investors.

Two of our findings are less consistent with this alternative explanation than with the matching hypothesis. First, this alternative assumes that VC-only deals are better than all mixed deals and hence is not consistent with our finding that once we control for the propensity to be angel-only financed, then investor composition, and in particular the VC-only dummy, no longer predicts outcomes. Second, one might expect that entrepreneurs have greater bargaining power when deals have higher quality, and hence they should use this power to generate stronger entrepreneurial rights. However, VC-only deals have the *strongest* investor rights (Finding 2). Thus, this explanation must rely on the additional assumption that some entrepreneurs are willing to give up control to maximize the probability of good outcomes. This premise is not implausible: Hsu (2004) finds that entrepreneurs, at times,

accept inferior rights if they believe it will increase success probabilities. Although these findings favor the matching theory, we acknowledge that this evidence is indirect.

Relatedly, it is possible that VC-only deals outperform in the large deal sample because they reflect certification from higher quality VCs, and not higher quality matches or higher firm quality. Higher quality VCs may simultaneously demand more investor friendly terms, and due to their greater abilities, are also able to better guide the project post-financing. Hsu (2004) finds evidence that entrepreneurs will pay more for high status VCs. However, additional tests reveal that Finding 4 cannot be attributed to certification. Based on a number of measures including age, size, successful exit rates of investments targets, and centrality (Piskorski and Anand 2007), we do find that VCs investing on their own have slightly higher prestige than those co-investing with angels. However, the difference in prestige between VCs investing in VC-only and mixed deals is rather small relative to the very large difference in prestige between VCs investing in Brobeck deals relative to the non-Brobeck VCs in Venture Economics (see online appendix). Hence, it is perhaps not surprising that (in unreported regressions) we find that the prestige of the VCs investing in a company is not significantly related to control rights, liquidation rights or outcomes. Moreover, the VC-only variable remains significant when we include various controls for prestige and ability.[17]

The poor performance of large mixed deals may also be attributable to "deal messiness". For example, some VCs report that inexperienced angels may be difficult to deal with, and lead to unpredictable hazards in later financing rounds or at exit (Freear et al. 1994). Inconsistent with this hypothesis, we do not find differences in outcomes in the small deals subsample and it is unclear why deal messiness would afflict large but not small deals.[18]

The superior performance of VC-only deals might also arise if some deals require more managerial effort than others, and if VCs seek to disallow angels from free-riding when the cost of their managerial effort is high. This hypothesis is consistent with the stronger control rights we observe for VC-only deals, as greater control might be necessary to leverage the effectiveness of this effort. This greater effort, in turn, can explain the superior outcomes we observe, and can also explain why these outcomes are only superior for larger deals where the incentives to provide effort are greatest. It is important to note, however, that the role played by effort is also consistent with matching as some firms can benefit more from VC effort than others, and thus choose VC-only financing. Hence, it is difficult to test

[17] We use a variety of different prestige variables constructed from the statistics in the online appendix, as well as an index based on these measures. The VC prestige for each of the 150 firms' Series A deals in which there is non-zero VC investment is based on a dollar weighted average or an equal weighted average of the prestige scores for the VCs investing in the deal.

[18] Moreover, we might expect that not only the presence, but also the number of angels in a deal would increase its "messiness". However, we do not find a relationship between the number, or proportion, of angels in a deal and outcomes in either the small-deal or large-deal samples.

whether effort can explain our results in a scenario in which matching does not. Although we cannot rule out this alternative, it is not consistent with our finding that once we control for the propensity to be angel-only financed, then investor composition, and in particular the VC-only dummy, no longer predicts outcomes.

VIII Conclusion

This experimental project stemming from the proposed Brobeck archive provides a unique opportunity to better understand the role of angels in financing startups. Two unique features of our sample make it ideally suited to examine how VCs and angels interact when both groups are active investors in the same group of transactions. First, our sample offers a high degree of heterogeneity in investor composition. Second, entrepreneurs in these deals have a meaningful choice between both investor types. We consider a constrained matching hypothesis, and focus on the relationship between investor composition, deal terms, and outcomes. Our paper makes two primary contributions.

First, although assortive matching is an established concept in the VC literature, our paper is the first to suggest that this matching is constrained, and that these constraints can dramatically affect outcomes. We find that entrepreneurs requiring larger amounts of capital rarely match with angel investors alone despite evidence from a propensity model suggesting they should. This is likely due to angel investors being cash constrained, and so VC participation is a necessary condition for financing larger deals (hence large entrepreneurs face a constrained matching process).

We find that deals that are most likely to have binding constraints experience inferior outcomes. As predicted by the constrained matching hypothesis, this result only obtains among larger deals, where constraints exist, but not among smaller deals where no constraints are likely to exist. It is important to note that our results do not imply that VCs destroy value. Quite to the contrary, VCs provide a valuable alternative because these deals – and most larger deals – would not even be feasible without VC participation.

Second, our paper is the first to find evidence consistent with the prediction that control rights should be allocated to the party whose marginal contribution to the project is greatest, as first hypothesized by Aghion and Tirole (1994). In particular, we find that VCs obtain stronger control rights in Series A financings relative to angel investors, consistent with VC participation in managing the firms they invest in. However, although angels accept weaker control rights, contrary to conventional beliefs, we also find that angels still utilize rather sophisticated contractual instruments even when they invest alone.

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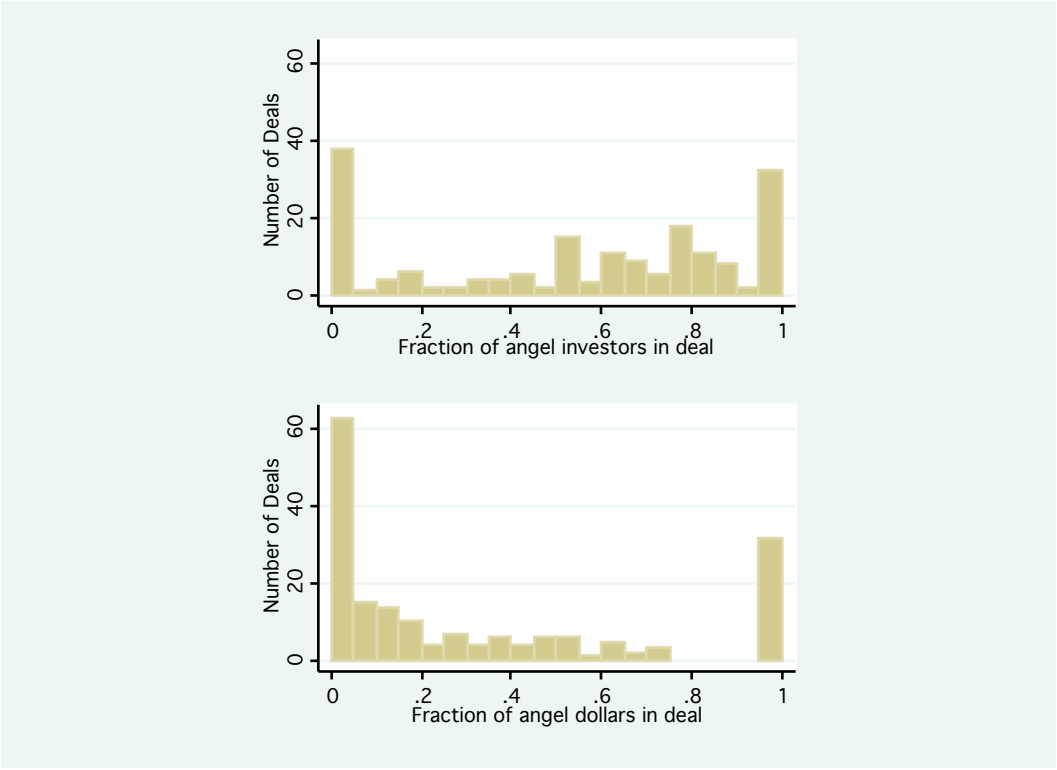
Figure 1: **Angel share of deals by number of investors and dollars.**

The figure depicts how deals vary in their investor composition and size. Top panel: frequency of different investor compositions (fraction of angel investors in deal), unweighted and weighted by investment amounts. Bottom panel: distribution of deal sizes for each category of investor compositions. Both graphs are based on the entire sample (182 firms).



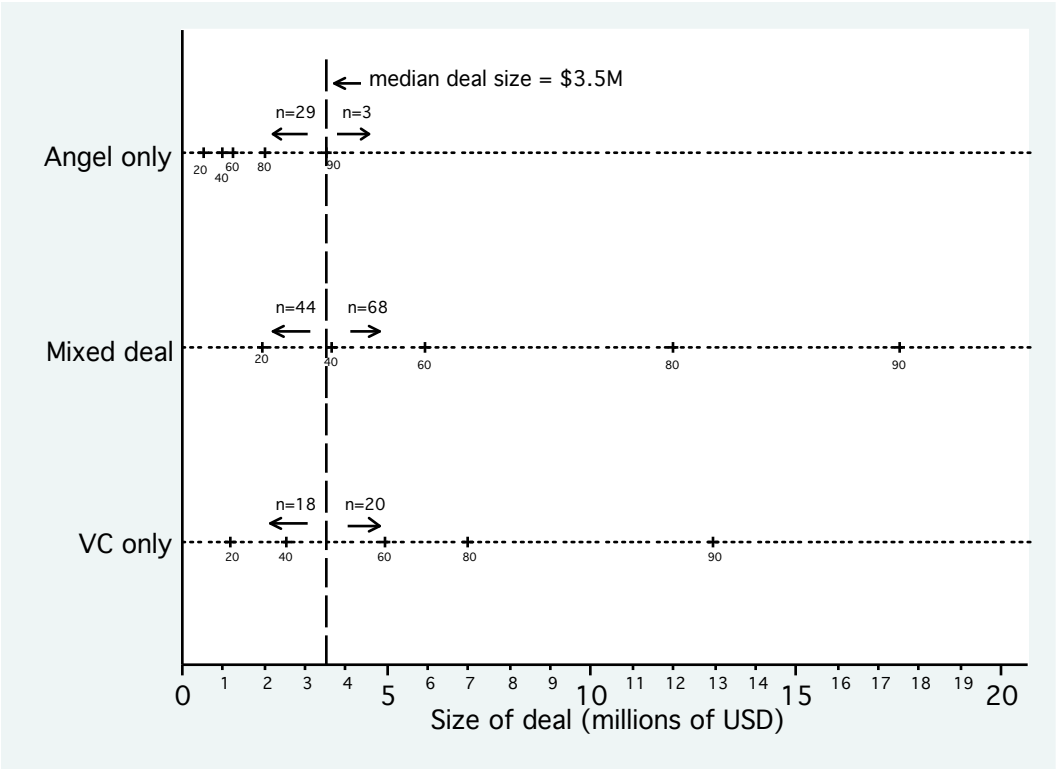


Table I: Summary Statistics

The table displays mean characteristics with standard deviations in parentheses. Demographic information shown in Panel A includes location (state dummies which are based on location of company headquarters) and industry classifications, based upon Thomson Financial Venture Economic's proprietary industrial codes (VEIC). *IT Firm* indicates an information technology firm. *Medical/Bio–Tech Firm* indicates firms classified as "Medical/Health/Life Sciences." For deals that did not appear in Venture Economics, classifications were determined according to Brobeck records and public archival sources. Firm characteristics shown in Panel B, such as time period dummies, are based on the date of first closing. *Size* (and its natural log *Log Size*) is measured based on investment dollars, while *Post-Money Valuation* reflects valuation subsequent to the investment in the firm. *Firm Age* is the number of years between the firm's founding date and the date its Series A preferred stock issue closes (computed as number of days divided by 365.25). *Strategic Alliance* and *Product Release* indicate whether the firm issued a press release describing an alliance or product prior to the observed round. *Company matter* takes the value of 1 if Brobeck did not label the representation "Venture Financing/Investor Side." The Venture Economics sample includes US-based private equity investment targets founded after 1967 with the first investment between 1993 and 2002. Private Equity disbursements labeled as buyout, acquisition, other or unknown were eliminated. Statistics of the Venture Economics sample are weighted to reflect the distribution of deal origination dates in the Brobeck sample, period dummies notwithstanding.

Variable	All Deals	Small Deals	Large Deals	Angel-Only Deals	VC-Only Deals	Mixed Deals	Venture Economics Deals
Panel A: Demographics and Basic Firm Characteristics at time of Series A financing							
California Dummy	0.529 (0.50)	0.587 (0.49)	0.479 (0.50)	0.565 (0.50)	0.423 (0.50)	0.552 (0.50)	0.360 (0.48)^{a}
IT Industry	0.731 (0.44)	0.670 (0.47)^{b}	0.791 (0.40)^{b}	0.750 (0.44)	0.658 (0.48)	0.750 (0.43)	0.692 (0.46)^{a}
Medical/Bio–Tech Industry	0.115 (0.32)	0.121 (0.32)	0.110 (0.31)	0.156 (0.36)	0.158 (0.37)	0.089 (0.28)	0.127 (0.33)
1998 to 3/2000 Dummy	0.341 (0.47)	0.429 (0.49)^{a}	0.253 (0.43)^{a}	0.406 (0.49)	0.289 (0.46)	0.339 (0.47)	0.384 (0.49)
Post 3/2000 Dummy	0.495 (0.50)	0.341 (0.47)^{a}	0.648 (0.48)^{a}	0.438 (0.50)	0.500 (0.50)	0.509 (0.50)	0.345 (0.48)^{a}
Size (Series A Millions)	6.139 (7.92)	1.554 (0.90)^{a}	10.72 (9.11)^{a}	1.633 (1.53)^{a}	5.756 (8.93)	7.556 (8.19)	7.15 (12.15)^{b,*}
Firm Age (years)	1.795 (4.23)	1.924 (5.03)	1.674 (3.34)	2.069 (4.48)	1.831 (3.60)	1.702 (4.39)	3.14 (4.7)^{a,‡}
Strategic Alliance	0.104 (0.30)	0.066 (0.25)^{b}	0.143 (0.35)^{b}	0.031 (0.17)^{a}	0.105 (0.31)	0.125 (0.33)	N/A
Product Release	0.126 (0.33)	0.110 (0.31)	0.143 (0.35)	0.125 (0.33)	0.158 (0.37)	0.116 (0.32)	N/A
Panel B: Pre Series A Investor Characteristics							
Pre Series A Angel Ownership	0.076 (0.15)	0.076 (0.14)	0.076 (0.16)	0.066 (0.10)	0.091 (0.20)	0.074 (0.14)	N/A
Number of Founders	2.775 (2.46)	2.374 (1.54)^{a}	3.176 (3.08)^{a}	1.969 (1.06)^{a}	2.895 (3.64)	2.964 (2.22)	N/A
Pre Series A Common Round	0.253 (0.43)	0.286 (0.45)	0.220 (0.41)	0.219 (0.42)	0.263 (0.44)	0.259 (0.44)	N/A
Panel C: Series A Investor Characteristics							
Angel-Only	0.176 (0.38)	0.319 (0.46)^{a}	0.033 (0.18)^{a}	1.000 (0.00)	0.000 (0.00)	0.000 (0.00)	N/A
VC-Only	0.209 (0.40)	0.198 (0.40)	0.220 (0.41)	0.000 (0.00)	1.000 (0.00)	0.000 (0.00)	N/A
Fraction Sold	0.462 (0.22)	0.363 (0.15)^{a}	0.561 (0.23)^{a}	0.303 (0.16)^{a}	0.436 (0.24)^{b}	0.516 (0.21)	N/A
% Angel Series A	0.319 (0.36)	0.464 (0.40)^{a}	0.174 (0.24)^{a}	0.996 (0.01)^{a}	0.000 (0.00)^{a}	0.234 (0.21)	N/A
% Founder Series A	0.001 (0.00)	0.002 (0.01)	0.001 (0.00)	0.004 (0.01)	0.000 (0.00)^{a}	0.001 (0.00)	N/A
% VC Series A	0.679 (0.36)	0.533 (0.41)^{a}	0.825 (0.24)^{a}	0.000 (0.00)^{a}	1.000 (0.00)^{a}	0.764 (0.21)	N/A
# Investors	12.12 (13.4)	10.80 (14.4)	13.45 (12.3)	12.81 (20.7)	4.763 (5.62)^{a}	14.42 (11.9)	N/A
Brobeck Investor Dummy	0.236 (0.42)	0.165 (0.37)^{a}	0.308 (0.46)^{a}	0.063 (0.24)^{a}	0.079 (0.27)^{a}	0.339 (0.47)	N/A
# Firms in Group	182	91	91	32	38	112	9901

* a, b, and c denote significant differences in means at the 1%, 5%, and 10% levels, respectively. The footnotes depicted in columns 2 and 3 are based on tests of differences in means across small versus large firms (column 2 vs 3). The footnotes depicted in column 4 (angel-only) are based on tests of angel-only deals versus mixed deals (column 4 vs column 6). The footnotes depicted in column 5 (VC-only) are based on tests of VC-only deals versus mixed deals (column 5 vs column 6).
* 9,345 observations; † 3,791 observations; ‡ 9,498 Observations

Table II: Summary Statistics for Cashflow and Control Rights

The table displays mean characteristics with standard deviations in parentheses. *Warrants Dummy* is one if warrants were issued in the Series A Financing. *Options Dummy* is one if an option plan was set up concurrent with the Series A Financing. *# closings* is the number of separate executed closings under the Series A terms (*Multiple Closings* indicates more than one). *Average Days to Second Closing* is the days between the first and second closings. All preceding variables are taken from the electronic record of the closing documents in the Brobeck corpus. *Billed Hours* reflects the total billed hours associated with Brobeck's representation of either the company or its investors in the deal. Control rights in Panel B and terms are extracted from closing documents from the Brobeck corpus. *% Common BOD Seats* is the share of board seats held by common shareholders (from the "voting rights agreement", or when specific parties are named, by cross-referencing with investors). *Cumulative Dividend Flag* is a dummy equal to one if preferred shareholders have a right to dividends that accumulate over the time of their investment. *Liquidation Flag* is a dummy equal to one when preferred shareholders have liquidation rights exceeding the value of their initial investment. *Cap on Preferred* is a dummy equal to one if these additional preferred stock liquidation rights are capped at a multiple of the initial investment. *Redeemable Flag* is a dummy equal to one when preferred shareholders can demand that the firm repurchase their shares. *Delayed Redemption* is a dummy equal to one if preferred stockholders' redemption rights are time-delayed. *% Series A Req. to Vote* is the percentage of Series A shareholders required to invoke a redemption.

Variable	All Deals	Small Deals	Large Deals	Angel-Only Deals	VC-Only Deals	Mixed Deals
% Common BOD Seats	0.464 (0.33)	0.579 (0.33)^a	0.359 (0.29)^a	0.675 (0.31)^a	0.522 (0.39)	0.398 (0.29)
Cumulative Dividend Flag	0.088 (0.28)	0.044 (0.20)^a	0.132 (0.34)^a	0.000 (0.00)^a	0.158 (0.37)	0.089 (0.28)
Liquidation Flag	0.418 (0.49)	0.374 (0.48)	0.462 (0.50)	0.125 (0.33)^a	0.579 (0.50)	0.446 (0.49)
Cap on Preferred	0.474 (0.50)	0.441 (0.50)	0.500 (0.50)	0.500 (0.57)	0.364 (0.49)	0.520 (0.50)
Redeemable Flag	0.236 (0.42)	0.209 (0.40)	0.264 (0.44)	0.031 (0.17)^a	0.368 (0.48)	0.250 (0.43)
Delayed Redemption	0.225 (0.41)	0.209 (0.40)	0.242 (0.43)	0.031 (0.17)^a	0.368 (0.48)	0.232 (0.42)
% Series A Req. to Vote	57.55 (8.40)	57.12 (8.54)	57.87 (8.52)	50.00 (0.00)	54.16 (7.53)^a	59.96 (8.35)
# Firms in Group	182	91	91	32	38	112

* a, b, and c denote significant differences in means at the 1%, 5%, and 10% levels, respectively. The footnotes depicted in columns 2 and 3 are based on tests of differences in means across small versus large firms (column 2 vs 3). The footnotes depicted in column 4 (angel-only) are based on tests of angel-only deals versus mixed deals (column 4 vs column 6). The footnotes depicted in column 5 (VC-only) are based on tests of VC-only deals versus mixed deals (column 5 vs column 6).

Table III: Cashflow Rights

The table displays Probit model marginal effects with robust t-statistics in parenthesis. We report results for the whole sample, as well as for small and large deal subsamples as noted in the table header (small and large deals have below and above median deal size, respectively). All independent variables (except dummy variables) are standardized to clarify exposition. The dependent variable in columns 1 and 5 is a dummy variable indicating whether the Series A stockholders have cumulative dividend rights (the cumulative dividend regression cannot be run for the small firm subsample because only 9 firms in this subsample had cumulative dividend rights). The dependent variable in columns 2, 4 and 6 is a dummy variable indicating whether preferred shareholders have liquidation rights exceeding the value of their initial investment. The independent variables include various investor and firm characteristics, as well as industry and time dummies, and are described in Tables I and II.

	All Deals		***Small Deals***		***Large Deals***	
Independent Variables	Probit Model Dep. Var.= Cumulative	Probit Model Dep. Var.= Liquidation	Probit Model Dep. Var.= Cumulative	Probit Model Dep. Var.= Liquidation	Probit Model Dep. Var.= Cumulative	Probit Model Dep. Var.= Liquidation
Angel-Only	–0.08 (–1.67)^c	–0.33 (–2.49)^b	N/A	–0.35 (–2.62)^a		
VC-Only	0.03 (0.53)	0.33 (2.59)^a		0.24 (1.25)	0.08 (0.87)	0.68 (4.23)^a
Pre Series A Angel Ownership	0.01 (0.37)	–0.11 (–2.16)^b		–0.03 (–0.58)	–0.04 (–0.83)	–0.34 (–3.22)^a
Fraction Sold	0.00 (–0.13)	0.01 (0.24)		0.13 (1.41)	–0.02 (–0.45)	–0.03 (–0.35)
Log Deal Size	0.03 (1.22)	–0.12 (–2.34)^b		–0.23 (–2.79)^a	0.02 (0.21)	–0.36 (–2.58)^a
Log # Investors	–0.02 (–0.83)	0.07 (1.15)		–0.05 (–0.61)	0.00 (–0.09)	0.33 (2.61)^a
Log One Plus Firm Age	0.07 (2.23)^b	0.06 (1.43)		0.07 (1.26)	0.13 (1.86)^c	0.23 (2.40)^b
Log Number of Founders	0.03 (1.17)	0.08 (1.70)^c		0.29 (4.00)^a	0.05 (1.03)	–0.03 (–0.44)
Pre Series A Common Round	0.04 (0.76)	0.10 (0.94)		0.00 (0.02)	0.02 (0.23)	0.21 (1.31)
Strategic Alliance	0.02 (0.23)	0.21 (1.44)		0.31 (1.38)	0.25 (1.59)	0.65 (3.15)^a
Product Release	0.16 (1.44)	0.24 (1.51)		0.50 (2.51)^b	–0.09 (–0.48)	–0.31 (–1.21)
IT Industry	–0.02 (–0.25)	–0.33 (–2.85)^a		–0.37 (–2.39)^b	0.01 (0.05)	–0.53 (–2.83)^a
Medical/Bio–Tech Industry	–0.06 (–0.81)	–0.08 (–0.53)		–0.21 (–1.37)	–0.04 (–0.22)	0.07 (0.24)
1998 to 3/2000 Dummy	0.08 (1.85)^c	0.25 (1.80)^c		0.28 (1.69)^c	0.10 (1.23)	0.58 (2.15)^b
Post 3/2000 Dummy	0.07 (1.56)	0.35 (2.63)^a		0.21 (1.12)	0.21 (2.31)^b	0.69 (3.06)^a
California Dummy	–0.02 (–0.37)	0.09 (0.97)		0.03 (0.21)	–0.01 (–0.15)	0.21 (1.31)
Brobeck Investor Dummy	–0.07 (–1.31)	0.25 (2.42)^b		0.37 (1.77)^c	–0.05 (–0.55)	0.29 (1.76)^c
Observations	182	182		91	91	91

* a, b, and c denote significant differences from zero at the 1%, 5%, and 10% levels, respectively.

Table IV: Control Rights

The table displays Probit model marginal effects and OLS model coefficients with robust t-statistics in parenthesis. We report results for the whole sample, as well as for small and large deal subsamples as noted in the table header (small and large deals have below and above median deal size, respectively). All independent variables (except dummy variables) are standardized to clarify exposition. The dependent variable in columns 1, 3, and 5 is the fraction of board seats that are allocated to common shareholders (board of directors data is only available for 147 firms). The dependent variable in columns 2, 4, and 6 is a dummy variable identifying whether the Series A shares are redeemable (i.e., whether they can be returned to the firm in exchange for cash). The independent variables include various investor and firm characteristics, as well as industry and time dummies, and are described in Tables I and II.

	All Deals		***Small Deals***		***Large Deals***	
Independent Variables	OLS Model Dep. Var.= Common Seats	Probit Model Dep. Var.= Redeemable	OLS Model Dep. Var.= Common Seats	Probit Model Dep. Var.= Redeemable	OLS Model Dep. Var.= Common Seats	Probit Model Dep. Var.= Redeemable
Angel-Only	0.16 (1.70)^{c}	–0.22 (–3.25)^{a}	0.17 (1.42)	–0.04 (–3.26)^{a}		
VC-Only	0.04 (0.61)	0.15 (1.54)	0.15 (0.98)	0.00 (0.10)	–0.07 (–0.80)	0.38 (2.24)^{b}
Pre Series A Angel Ownership	0.04 (1.44)	–0.05 (–1.35)	0.01 (0.15)	0.00 (2.97)^{a}	0.09 (2.98)^{a}	–0.18 (–3.56)^{a}
Fraction Sold	–0.12 (–3.69)^{a}	0.01 (0.32)	–0.13 (–1.49)	0.00 (1.54)	–0.06 (–1.60)	0.01 (0.13)
Log Deal Size	–0.02 (–0.48)	0.00 (–0.09)	0.03 (0.31)	0.01 (2.65)^{a}	0.05 (0.80)	0.00 (0.04)
Log # Investors	0.00 (0.06)	0.01 (0.17)	0.05 (0.62)	–0.01 (–3.46)^{a}	–0.04 (–1.06)	0.14 (2.14)^{b}
Log One Plus Firm Age	–0.02 (–0.60)	0.08 (2.47)^{b}	–0.04 (–0.93)	0.00 (3.06)^{a}	0.04 (0.82)	0.12 (1.98)^{b}
Log Number of Founders	0.06 (2.58)^{a}	0.02 (0.64)	0.05 (1.13)	0.00 (–0.33)	0.09 (2.89)^{a}	0.03 (0.76)
Pre Series A Common Round	0.04 (0.88)	0.02 (0.27)	0.07 (0.85)	0.02 (2.24)^{b}	–0.01 (–0.21)	–0.04 (–0.37)
Strategic Alliance	–0.02 (–0.21)	0.19 (1.53)	–0.23 (–1.08)	0.00 (–0.63)	0.26 (2.45)^{b}	0.71 (3.45)^{a}
Product Release	0.15 (1.63)	0.07 (0.60)	0.11 (0.67)	0.03 (1.88)^{c}	–0.07 (–0.49)	–0.19 (–1.31)
IT Industry	0.04 (0.61)	–0.15 (–1.62)	0.14 (1.31)	–0.05 (–2.48)^{b}	–0.08 (–0.85)	–0.25 (–1.35)
Medical/Bio–Tech Industry	0.23 (2.37)^{b}	0.00 (0.01)	0.30 (1.85)^{c}	0.52 (2.67)^{a}	0.09 (0.66)	–0.19 (–1.31)
1998 to 3/2000 Dummy	0.06 (0.74)	0.23 (2.03)^{b}	0.07 (0.62)	0.00 (–0.23)	–0.03 (–0.22)	0.50 (2.00)^{b}
Post 3/2000 Dummy	–0.02 (–0.29)	0.12 (1.16)	0.06 (0.59)	0.00 (0.90)	–0.16 (–1.33)	0.26 (1.65)^{c}
California Dummy	–0.06 (–1.02)	–0.09 (–1.53)	–0.05 (–0.43)	0.00 (–1.07)	–0.03 (–0.46)	–0.05 (–0.54)
Brobeck Investor Dummy	–0.01 (–0.17)	0.11 (1.38)	–0.11 (–0.93)	0.59 (3.75)^{a}	0.04 (0.55)	–0.03 (–0.27)
Observations	147	182	70	91	77	91

* a, b, and c denote significant differences from zero at the 1%, 5%, and 10% levels, respectively.

Table V: Summary Statistics of Outcomes for Firms in Sample

The table displays mean characteristics for various dummy variables associated with firm outcomes. *IPO* and *Acquisition* are one if a liquidity event occurred either as an IPO or as an acquisition, respectively (from archival sources, primarily press releases). *Non-exited survival* is one if the firm was still in business as an independent private entity in March 2008 (from World Wide Web presence and archival sources). *Active non-exited survival* is one if the firm additionally issued at least one press release or updated its website between January 2005 and March 2008. *Inactive non-exited survival* is one if there was neither a press release nor an update to the website during this period. Firms are tagged as *Failure* if they did not experience a liquidity event and they are not still an ongoing private independent firm. *Ex post VC Financing* is one if the firm secures later financing (after Series A) from venture capital firms as reported by Venture Economics. The Venture Economics sample includes US-based venture capital investment targets founded after 1967 with the first investment between 1993 and 2002. Private Equity disbursements labeled as buyout, acquisition, other or unknown were eliminated. Outcome variables of the Venture Economics sample are as reported in that database, but weighted to reflect the distribution of deal origination dates in the Brobeck sample.

Variable	All Deals	Small Deals	Large Deals	Angel-Only Deals	VC-Only Deals	Mixed Deals	Venture Economics Deals
IPO	0.044	0.022	0.066	0.031	0.105	0.027	0.057
Acquisition	0.264	0.231	0.297	0.188	0.316	0.268	0.171^{a}
Non-exited survival	0.280	0.264	0.297	0.500^{a}	0.211	0.241	
Active non-exited survival	0.187	0.154	0.220	0.250	0.184	0.170	
Inactive non-exited survival	0.093	0.110	0.077	0.250^{a}	0.026	0.071	
Failure	0.412	0.484^{a}	0.341^{a}	0.281^{b}	0.368	0.464	
Ex post VC financing	0.489	0.429	0.549	0.281^{a}	0.474	0.554	0.726^{a}
# Firms in Group	182	91	91	32	38	112	9,902

* a, b, and c denote significant differences in means at the 1%, 5%, and 10% levels, respectively. The footnotes depicted in columns 2 and 3 are based on tests of differences in means across small versus large firms (column 2 vs 3). The footnotes depicted in column 4 (angel-only) are based on tests of angel-only deals versus mixed deals (column 4 vs column 6). The footnotes depicted in column 5 (VC-only) are based on tests of VC-only deals versus mixed deals (column 5 vs column 6). The footnotes in column 7 (Venture Economics Deals) are based on tests of All Deals (from Brobeck) versus the Venture Economics Deals (column 1 vs column 7).

Table VI: Outcomes versus Deal Characteristics

The table displays Probit model marginal effects, with robust t-statistics in parenthesis. All independent variables (except dummy variables) are standardized to clarify exposition. The dependent variable in the first probit model (columns 1, 3, 6) is a dummy variable indicating whether the firm experienced an Acquisition or IPO by March 2008. The second model's (columns 2, 4, 7) dependent variable is a survival dummy variable which equals one if the firm went public, was acquired, or is still an ongoing independent private firm as of March 2008. The activity adjusted model in column 5 is similar to the survival model in column 4, except that surviving firms that have neither made any press releases nor updated their website between January 2005 and March 2008 have been re-categorized as failures. The independent variables include various investor and firm characteristics, as well as industry and time dummies, and are described in Tables I and II.

	All Deals		***Small Deals***			***Large Deals***	
Independent Variables	Probit Model Dep. Var.= Merger/IPO	Probit Model Dep. Var.= Survival	Probit Model Dep. Var.= Merger/IPO	Probit Model Dep. Var.= Survival	Probit Model Dep. Var.= Survival (Activ. Adj.)	Probit Model Dep. Var.= Merger/IPO	Probit Model Dep. Var.= Survival
Angel-Only	–0.04 (–0.37)	0.33 (3.11)^a	–0.04 (–0.37)	0.43 (2.81)^a	0.17 (1.22)		
VC-Only	0.15 (1.39)	0.18 (1.63)	–0.04 (–0.32)	0.22 (1.12)	0.09 (0.47)	0.46 (2.64)^a	0.18 (1.33)
Log Deal Size	0.12 (2.59)^a	0.18 (3.44)^a	0.01 (0.18)	0.24 (2.24)^b	0.20 (2.17)^b	0.18 (1.59)	0.18 (1.61)
Fraction Sold	–0.09 (–1.97)^b	–0.04 (–0.82)	–0.15 (–2.04)^b	–0.02 (–0.23)	–0.11 (–1.23)	–0.04 (–0.66)	–0.05 (–0.85)
Log # Investors	0.00 (0.00)	0.08 (1.40)	0.00 (0.09)	0.15 (1.71)^c	0.12 (1.65)^c	–0.02 (–0.17)	–0.04 (–0.52)
Strategic Alliance	–0.11 (–1.01)	–0.42 (–2.78)^a	–0.03 (–0.17)	–0.53 (–2.23)^b	–0.25 (–1.32)	–0.30 (–1.95)^c	–0.48 (–2.01)^b
Product Release	0.18 (1.33)	0.30 (2.27)^b	0.04 (0.22)	0.31 (1.53)	0.09 (0.43)	0.56 (2.48)^b	0.35 (1.88)^c
Log One Plus Firm Age	0.01 (0.35)	0.05 (1.02)	–0.02 (–0.49)	0.05 (0.78)	–0.02 (–0.28)	0.04 (0.57)	0.03 (0.37)
Log Number of Founders	0.01 (0.14)	0.01 (0.13)	0.03 (0.62)	0.01 (0.12)	0.02 (0.28)	–0.05 (–0.94)	0.00 (–0.03)
Pre Series A Common Round	0.02 (0.25)	0.00 (–0.03)	0.02 (0.11)	–0.11 (–0.67)	–0.02 (–0.13)	0.22 (1.51)	0.03 (0.23)
Brobeck Investor Dummy	–0.08 (–0.93)	–0.23 (–2.07)^b	–0.13 (–1.15)	–0.37 (–2.18)^b	–0.38 (–2.84)^a	0.00 (0.01)	0.02 (0.13)
IT Industry	–0.08 (–0.79)	–0.14 (–1.27)	–0.18 (–1.52)	–0.28 (–1.79)^c	–0.19 (–1.22)	–0.13 (–0.54)	0.17 (0.83)
Medical/Bio–Tech Industry	–0.23 (–2.02)^b	–0.10 (–0.57)	–0.14 (–1.11)	–0.29 (–1.32)	–0.19 (–1.03)	–0.40 (–2.04)^b	0.22 (1.04)
1998 to 3/2000 Dummy	–0.13 (–1.24)	–0.13 (–0.98)	–0.15 (–1.41)	–0.25 (–1.49)	–0.35 (–2.47)^b	0.21 (0.85)	0.02 (0.10)
Post 3/2000 Dummy	–0.25 (–2.38)^b	0.01 (0.06)	–0.28 (–2.49)^b	–0.09 (–0.44)	–0.26 (–1.67)^c	–0.04 (–0.20)	0.12 (0.67)
California Dummy	0.26 (3.36)^a	0.25 (2.87)^a	0.10 (0.83)	0.32 (2.18)^b	0.05 (0.36)	0.45 (3.41)^a	0.13 (1.22)
Observations	182	182	91	91	91	91	91

* a, b, and c denote significant differences from zero at the 1%, 5%, and 10% levels, respectively.

Table VII: Propensity to be Angel-Only Financed and Large Deal Outcomes

The table displays the results of two stage probit models examining the relationship between expected angel-only incidence and outcomes. The first stage model (first column) is a probit model fitting the likelihood that deals are financed exclusively by angels. This model is based on the sample of small firms only (where investor and firm matching is presumed to be unconstrained). The second column is a check as to whether the variables in the first stage model also predict outcomes. The remaining four columns are second stage probit models in which the dependent variable is the IPO/Acquisition dummy. In all four columns, the sample includes only large deals. To construct the propensity variable *Angel-Only Propensity* for the sample of large deals in the last four columns (stage 2), we use the fitted stage 1 model in column 1. This is the propensity that the given firm would have chosen angel-only financing if sufficient funding capacity existed. All independent variables (except dummy variables) are standardized to clarify exposition. The independent variables include various investor, firm and deal characteristics, as well as industry and time dummies, and are described in Tables I and II.

	Stage 1 – Small Deals		***Stage 2 – Large Deals***			
Independent Variables	Probit Model Dep. Var.= Angel-Only (Stage 1)	Probit Model Dep. Var.= IPO/Acquisition (Check)	Probit Model Dep. Var.= IPO/Acquisition (Stage 2)	Probit Model Dep. Var.= IPO/Acquisition (Stage 2)	Probit Model Dep. Var.= IPO/Acquisition (Stage 2)	Probit Model Dep. Var.= IPO/Acquisition (Stage 2)
VC-Only				0.22 (1.08)	0.42 (2.41)^{b}	0.21 (0.94)
Angel-Only Propensity x Mixed Dummy			–1.75 (–3.03)^{a}	–1.46 (–2.33)^{b}		–1.62 (–1.66)^{c}
Angel-Only Propensity					–0.80 (–1.97)^{b}	0.16 (0.20)
Log Deal Size			0.24 (1.88)^{c}	0.22 (1.68)^{c}	0.23 (2.06)^{b}	0.22 (1.60)
Log # Investors			–0.09 (–0.87)	–0.04 (–0.32)	–0.05 (–0.51)	–0.03 (–0.27)
1998 to 3/2000 Dummy			0.07 (0.30)	0.18 (0.67)	0.11 (0.43)	0.19 (0.69)
Post 3/2000 Dummy			–0.15 (–0.67)	–0.08 (–0.34)	–0.16 (–0.74)	–0.06 (–0.24)
Brobeck Investor Dummy			–0.03 (–0.18)	–0.01 (–0.08)	0.00 (–0.02)	–0.01 (–0.08)
Log Number of Founders			0.02 (0.30)	–0.01 (–0.10)	–0.03 (–0.54)	–0.01 (–0.10)
Pre Series A Common Round			0.14 (0.88)	0.17 (1.03)	0.24 (1.67)^{c}	0.16 (0.97)
Strategic Alliance			–0.33 (–1.37)	–0.32 (–1.21)	–0.35 (–2.64)^{a}	–0.31 (–1.16)
Product Release			0.62 (1.55)	0.60 (1.43)	0.63 (3.03)^{a}	0.59 (1.41)
Log One Plus Firm Age			0.00 (0.03)	0.03 (0.27)	0.01 (0.19)	0.03 (0.30)
IT Industry			0.02 (0.10)	–0.03 (–0.15)	–0.05 (–0.20)	–0.03 (–0.17)
Medical/Bio–Tech Industry			–0.33 (–1.70)^{c}	–0.35 (–1.83)^{c}	–0.37 (–2.01)^{b}	–0.35 (–1.82)^{c}
California Dummy			0.47 (3.18)^{a}	0.48 (3.18)^{a}	0.45 (3.43)^{a}	0.48 (3.18)^{a}
Fraction Sold	–0.54 (–1.98)^{b}	–0.09 (–1.42)	–0.17 (–2.34)^{b}	–0.14 (–1.74)^{c}	–0.12 (–1.55)	–0.13 (–1.60)
Liquidation Flag	–1.11 (–2.88)^{a}	0.12 (1.11)				
Redeemable Flag	–1.06 (–1.94)^{c}	–0.13 (–1.06)				
% Common BOD Seats	0.55 (0.96)	–0.09 (–0.59)				
Observations	91	91	91	91	91	91

* a, b, and c denote significant differences from zero at the 1%, 5%, and 10% levels, respectively.