The performance of angel-backed companies

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This draft: September 2017

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An earlier draft of the paper was presented at "2nd Entrepreneurial Finance Conference" - July 6-7, 2017, Ghent, Belgium.

Abstract

We provide first-time evidence of the post-investment performance and survivorship profile of angel-backed companies. Using a unique database of 111 angel-backed companies that received angel investments between 2008 and 2012 and at least 3 years of post investment financial data, we show that both the performance and the probability of survival of investee companies, are positively affected by the presence of: 1) angel syndicates and 2) by the hands-on involvement of business angels. Differently, the lack of angel experience and the structure of equity provision negatively affect the development of new ventures. Our results provide insights on the contribution of angel investors to the development of new ventures.

JEL Codes: G24, G32, M13

Keywords: business angels, start-ups; angel-backed companies; performance; survival; monitoring; active involvement; co-investments.

1. Introduction

Market data at both the US and European level (US ACA, 2016; EVCA, 2016; EBAN, 2016; Kraemer-Eis *et al.*, 2016; OECD, 2016) provide evidence of the growing and significant relevance of BAs as a main provider of capital to startup companies. BAs have filled the so-called "funding gap" existing between demand and supply of early stage equity capital thus promoting entrepreneurship and economic growth (Mason and Harrison, 2000; Sohl, 2012; Capizzi, 2015). Despite their economic impact, to date little is known on the performance of investments backed by business angels. This lack of knowledge is comparable to the status of Venture Capital research prior to the seminal Sahlman (1990) study.

One major factor affecting the quality of the research is the availability of data given the relatively high opaqueness of the market and the generally narrow representativeness of survey based samples (Harrison and Mason, 2008; Capizzi, 2015; Lerner *et al.*, 2016). Additionally, performance studies are further limited by the severe lack of data on private companies in most countries. As a result, contributions investigating the performance of angel-backed companies primarily rely on anecdotal or case-based evidence (Hellman, 2013; Kerr *et al.*, 2014; Mason *et al.* 2016).

In this paper we fill this gap by looking at a unique database containing qualitative and quantitative information on over 810 deals made by 330 unique business angels on 619 unique companies from 2008 to 2014 in Italy. Italian regulation requires mandatory disclosure of annual financial statements also for private companies. Building on this feature we extract a sample of 111 angel-backed companies invested between 2008 and 2012 for which we collect survivorship and financial performance information up to 3 years after the investment.

Our main unit of analysis is the relative impact of specific BAs' traits, investment style and background so to identify the "angel investment formula" that ultimately maximizes the value creation potential of the target venture. This allows us to focus on BA-backed companies only without requiring the identification of a matching sample of non-angel backed start-ups.

A critical methodological issue is the selection of an accurate set of metrics to measure performance. The extant literature looking at the impact of venture capitalists on the performance of portfolio companies generally adopts as measures of performance one or more of

the followings: turnover, employees, market share, capital assets (Brav and Gompers, 1997; Davila et al., 2003; Puri and Zarutsky, 2012). However, angel-backed companies are generally pre-revenue and their financial accounts are often limitedly informative, up to the point that companies can shut down without having generated any sale or having capitalized significant assets. In this respect the literature on angel-backed companies has tried to identify alternative metrics. Kerr et al. (2014) developed three different sets of measures: first, they build two binary indicators for survival and success (survival after 4 years from the funding event; successful exit through IPO or acquisition); second, they employ three outcome variables for growth (employment, patents, website traffic); finally, they treat as a performance measure the capability of an angel-backed company to raise subsequent venture financing. Levratto et al. (2017) analyze the impact of BAs on firm growth, as measured by the rate of growth in sales, employment and tangible capital assets.

In this paper, we first perform a benchmark analysis using traditional measures – namely firm size and turnover – then we contribute to the literature by developing an original proxy ("*PERFORMANCE-INDEX*") for the performance and the probability of subsequent survival of investee companies differentiating companies according to their generation pattern of both revenues and profits. The basic idea behind our measurement procedure is that it takes time for a startup receiving an equity injection that dramatically changes its pre-investment size to (i) deploy the operating investments outlined in the fundraising process, (ii) adjust the business model and company operations, (iii) start experiencing cash inflows, earnings and increase in the equity capital base. As a consequence a common growth path following an equity capital injection implies some years of zero or low revenues, negative profits and equity capital erosion, followed by an increase in turnover depending on the beginning of the operations, which could lead to an increase in earnings, cash flows and dividends. This pattern may also imply transitory periods of limited, null or negative net asset value before reverting positive growth and a sustainable business model.

Following this argument, our *PERFORMANCE-INDEX* is designed as an ordinal variable which can assume five different values associated with five different company outcomes, capturing differences across the sample on the quality of the funded ventures, based on different combinations of revenues, asset value and income.

Since we observe each venture in a time span from t=0, which is the year when the BA's investment occurred, to t=3, each firm can change its status one or more times during the observation period, the *PERFORMANCE-INDEX* is structured as a panel variable that allows to dynamically capture changes in the quality profile of angel-backed companies. Interestingly serves also as a proxy of their probability of survival, because it is reasonable to assume that successful ventures should experience a higher probability of survival over time than those obtaining lower scores. Conversely, we would expect those ventures showing negative scores to be future candidates to failure in the subsequent time period.

Our panel data analyses show that the performance and the probability of survivorship of investee companies are positively affected by the presence of angel syndicates and by the hands-on involvement of business angels, while they are negatively affected by the monitoring effort, especially for lower experienced angels. Furthermore, the angel-specific practice of fragmenting the provision of equity investment has a negative impact on the probability of default and the financial performance.

Given that the development of new ventures might be endogenously determined by some angel characteristics, we perform a set if instrumental variable regressions to control for this possible problem. Our results are unchanged and support our main conclusions.

The remainder of the paper is structured as follows: the second section will present the hypotheses development; the third paragraph we outline the empirical methodology and present the present the results of the econometric analysis; in the fourth section we present the conclusive remarks and suggestions for future research.

2. Hypotheses development

One major trend observed over time in the market for informal venture capital is the emergence of co-investments made by groups of angels, which have lead to a transformation of the investment practices formerly adopted by the "solo" angel investors (Paul and Whittam, 2010; Gregson *et al.*, 2013; Mason, Botelho and Harrison, 2016; Bonini *et al.*, 2016). Co-investments could be made through different degrees of angel syndicates, ranging from structured BANs to

semi-informal BAGs or to informal so-called "club deals" made up on a spot basis just to undertake a single investment opportunity (Lahti and Keinonen, 2016).

By co-investing in a given deal, BAs can enjoy the opportunity to better diversify their investment portfolio as well as to share the information and know-how of other more experienced angels. While in a previous contribution Bonini et al. (2016) found evidence of a positive relationship between capital invested by BAs and co-investments, in this paper we focus on the effect co-investing generates on angel-backed companies. In fact, a company being funded by a syndicate of angels can leverage on a wider set of monetary and non monetary contributions than that potentially available from a solo angel, thus increasing its growth potential as well as it future probability of survival. Higher number of angels simultaneously investing means the possibility to immediately start the business with higher size scale, market potential and with an increased probability to get access to subsequent rounds of financing over time. A further monetary contribution for the angel-backed company comes considering that investors can share the burden of the normally high costs of due diligence, contracting and monitoring required to minimize the adverse selection and moral hazard issues as well as the high agency costs implicit in so informationally opaque an equity investment. Also the non monetary returns are higher, in that the funded venture can enjoy multiple sources of coaching and mentoring as well as benefit from each BA's industrial knowledge, previous entrepreneurial and management experience, relationship networks. It is to be highlighted that our arguments are consistent with a resource-based approach applied to entrepreneurial finance (Wright et al. 1998; Van Osnabrugge, 2000; Wiltbank, 2005; Bonnet and Wirtz, 2012), whose major implication is the relevant similarities of BAs' cognitive processes and entrepreneurs' ones. Furthermore, according to Penrose (1959) the kind of contribution and growth opportunity a firm can achieve by a given investor is also related to the specific personal experience and learning process of the latter, who is path dependent and, therefore different from investor to investor

This means the presence of co-investors implies an higher quality selection process and a more effective – also because of the possibility to leverage on wider experience and knowledge – post investment involvement, leading to our first research hypothesis

H1: *The performance of angel-backed companies is positively affected by the presence of co-investors.*

As highlighted by many authors, BAN membership offers a wide range of opportunities, first of all the possibility to benefit from higher quality deal flow. Other contributions come from the information and knowledge sharing effects taking place inside the community, thanks to the activity of the BAN managers (so-called "gatekeepers"), who also organize periodic training meetings as well as pitching events aimed at stimulating the interaction between angel investors an entrepreneurs looking for funding (Ibrahim, 2008; Paul and Whittam, 2010; Brush et al., 2012; Mason, Botelho and Harrison, 2016). In particular, the possibility for unexperienced angels to get access to the human capital (made up of experience, education, external standing) of experienced angels inside the BAN is a valuable opportunity that could subsequently increase their capability to contribute to the value creation process of the investee companies (Shane, 2000). Also the quality of the post involvement contribution given to the angel-backed venture is enhanced by BAN membership, which gives the possibility to fine tune and optimize BAS' decision making styles according to their specific investment behavior, ultimately increasing the probability of the company to raise additional growth capital (Wiltbank et al., 2009; Bonnet, Wirtz, Haon, 2013).

Thus, we think it's possible to apply to business angel networks, not only highlighting the contribution given by venture capitalists to startup firms (Lerner, 1994; De Clercq et al. 2006; Hsu, 1996) but most of all basing upon the evidence that a

As such, consistent with major findings coming from the extant literature dealing with social capital literature (Coleman, 1988; Granovetter, 1992), we argue that investors' strong social generate significant valuable investment opportunities by granting them access to superior information about startups and the environmental conditions they face (Burt, 2005; Alexy et al. 2012).

We accordingly formulate our second research hypothesis

H2: *The performance of angel-backed companies is positively affected by membership of BAs in a given BAN.*

One fundamental disciplining as well as monitoring mechanism in venture capital is "stage financing", an investment practice consisting in fractioning the capital infusion in multiple subsequent rounds of financing – also called follow-on investments. In this respect, venture capitalist exploit the option to differ over time their equity contributions, conditional on the venture reaching some target milestones, typically related to financial profitability (size or revenue goals) or technological or scientific achievements (Sahlman, 1990; Gompers, 1995; Bergemann and Hege, 1998; Gompers and Lerner, 2001; Tian, 2011). However, such mechanism generally implies relatively long time periods between two financing rounds and each round is typically provided to the investee as a single capital contribution.

Differentiating from the formal venture capital industry practices, the investment process of business angels is often not completed all at once in a single investment round, but is fractioned in two or more cash outs and deferred within a time period of up to 12 months. Such an investment practice depends on several possible explanations, one of them being a matter of liquidity of financial wealth: it could take some time for the BA to deploy the committed share of his personal wealth at the signing of the deal (t=0), thus financial constraining the operations and investments of the angel-backed companies. Second, it could be a soft and informal risk management mechanism undertaken by less experienced angels aimed at generating further information about the entrepreneur and the venture prior to increase their involvement in the firm. A third possible explanation could deal with the degree of involvement of the BA in the funded venture: BAs desiring to play an active role in the firm would develop a kind of empathy toward the entrepreneurial project, ultimately giving them the incentives to increase their investment in the company beyond what they could do had not the possibility implement a deferred equity infusion pattern.
This leads to the following research hypothesis

H3: *The performance of angel-backed companies is negatively affected by a temporally deferred equity infusion pattern: multiple follow-on investments decrease the performance of the investee companies.*

One major contribution of business angels lies in the non-monetary contribution provided to the funded venture through an active involvement in company operations (Harrison and Mason,

1992; Mason, 2006; Landstrom and Mason, 2016). BAs can add value through several different channels ranging from mentoring the entrepreneur and company manager, to providing networking in the financial and industrial community, to originating business opportunities, fine tuning the governance mechanisms or optimizing the accounting and control systems (Politis, 2008). If these contributions can meaningfully add valu, an opposite - hands-off - approach, typical of pure financial investors should be associated with lower performance especially for BAs that neither co-invest with other active BAs nor joining a BAN (Bonini et al. 2016).

We accordingly formulate our fourth research hypothesis:

H4: *The performance of angel-backed companies is positively affected by BAs' active involvement.*

One major issue dealing with an equity investment in small, risky, informationally opaque unlisted companies is the possibility to set up appropriate monitoring mechanisms in order to reduce the incentive to opportunistic behavior by the entrepreneur and/or the management team of the funded venture.

The finance literature extensively investigated the effectiveness of a wide number of contingent contracts and financing mechanisms implemented by venture capital organizations to decrease asymmetric information and moral hazard problems (Sahlman, 1990; Triantis, 2001; Kaplan and Stromberg, 2003; Gompers and Lerner, 2004; Chemmanur et al., 2008; Wong et al., 2009; Cumming and Johan, 2013).

In the case of angel investing, however, many contributions highlighted the low frequency of such "hard monitoring" based mostly on financial contracting, due to the negative impact on the relationship between the investee company and business angels, which has rather to be grounded on reciprocal trust. Therefore, the major substitutes for contractual monitoring are "soft" monitoring mechanisms like geographical proximity, BAs' knowledge of the industry and the business model, experience coming from previous investments and existing interactions with entrepreneurs (Van Osnabrugge, 2000; Wilbank and Boecker, 2007; Ibrahim, 2008; Wong et al., 2009; Goldfarb et al., 2012; Bonini and Capizzi, 2017). Such approach however may lead to

underestimating the development of the venture risk and a late intervention on a sidetracking business. We therefore hypothesize the following last research hypothesis:

H5: *The performance of angel-backed companies is negatively affected by BAs' soft monitoring.*

3. Sample data and variables

Our data are obtained from sequential surveys administered by the Italian Business Angels Network Association (IBAN) to its associates and other unaffiliated BAs. IBAN is the national trade association for angels and angel groups/networks. A full description of the survey procedure and of summary statistics is reported in the Appendix.

In order to investigate how the BA investment-decisions affects firm performance and survival, following prior contributions (Kerr *et al.*, 2014; Alemany and Villanueva, 2015), require available data for each firm for a at least four years. In particular we observe each venture in a time span from t=0, which is the year when the BA's investment occurred, to t=3 . We therefore select deals in the 2008-2012 surveys to ensure the availability of financial statements 3 years after the investment for all sample firms.

From a starting sample of 695 deals, we had to exclude a significant number of observations because the name of the target company was not or incorrectly specified preventing an unequivocal identification. This reduces the sample to 302 start-ups. We then performed a hand-made search on two external data sources, Orbis and Lexis/Nexis, in order to collect data from financial statements and any relevant information on acquisitions and initial public offerings involving the selected ventures. This procedure returns complete data for 111 firms. Table 1 reports details of the filtering process.

INSERT TABLE 1 HERE

The sample coverage is fairly uniform across years with the exception of 2008 that exhibits a significantly lower number of deals. This figure likely due to two different factors: first, 2008 is the inception year for IBAN surveys. Accordingly, it is not unlikely that the procedure had been refined in the following years. Second, because of the eruption of the financial crisis, the second half of 2008 has experienced a record low number of new firms creation. We address this possible concern by introducing year fixed-effects in all regressions that should absorb a

significant portion of such heterogeneity. Additionally, we also run a robustness check on three sub-samples obtained by restricting the year of the BA's investment. Results are qualitatively unchanged.

In Table 2, Panel A, we show the industry distribution of the final sample data.

INSERT TABLE 2 HERE

Looking at the industry distribution of investments, deals are spread out across several industries, with a not surprising dominance of "traditional" sectors, such as ICT, electronics and biotech, which collectively attract approximately half of the aggregate investments. Interestingly, 13% of the amount invested is directed at cleantech-related ventures, consistent with a rising global trend of this activity taking place all over the world.

We report summary statistics on revenues, earnings and net asset value in Panel B and for the time span from t=0 to t=3 in Panel C. Considering the revenues, we can observe that many ventures have already started to sell their products or services at t=0, while 9 per cent of firms show zero revenues. It is interesting that 16 per cent of firms show zero revenues two years after the BA investment and 5 per cent of them are still inactive three years later, confirming that BAs are patient investors, available to wait for years before the business starts it operations and begins generating revenues as well as cash flows. Looking at the net asset value, we observe that the average assets of approximately 250,000 euro and maximum 1 m/euro fit in the profile of newly funded companies. However, it is worth noting that several firms show a negative net asset value already in the BA's investment year and that their incidence grows in the subsequent years, consistent with the peculiar revenues and cash flow generating patters of companies in the early stages of their life cycles which makes them the peculiar asset class for BAs and venture capitalists (Gompers, 1995; Gompers and Lerner, 2001; Harrison and Mason, 2002, Landstrom and Mason, 2016). Not surprisingly, more than half of the participated firms show negative net income in the year when the deal was made. Nevertheless, the incidence of ventures with negative earnings remains high also in the subsequent years, representing roughly half of the sample in t=3.

We measure the performance of angel-backed companies by deriving a synthetic index (*PERFORMANCE-INDEX*) which assumes five different ordinal scores:

- 2 when revenues, net asset value and net income are positive;
- 1 when revenues and net asset value are positive but net income is negative;
- 0 when revenues are positive but net asset value and net income are negative;
- -1 when revenues are zero and net income is negative but net asset value is positive;
- -2 when revenues are zero and net income and net asset value are negative.

Since the collection and analysis of firms' annual reports allows us to observe the changes in value of the accounting items over time, each firm can change its status one or more times during the observation period. Thus, our *PERFORMANCE-INDEX* is a panel variable.

Table 3 describes in detail the distribution of frequency of ordinal value in the observation period from t=0 to t=3.

INSERT TABLE 3 HERE

In table 4 we present descriptive statistics of the set of the explanatory and control variables.

INSERT TABLE 4 HERE

We test the first research hypothesis through the variable *Co-investors*, which should be positively related with our performance index. This variable assumes values from a minimum of zero to a maximum of 15 investors. Considering the median and the mean values, however, we observe that the majority of angel-backed companies have less than five associated investors.

In our second research hypothesis we test the impact of BAN affiliation on performance with the dummy *BAN-membership*. In presence of co-investors, the variable assumes the value one if at least one BA participating in the deal shows a BAN affiliation.

Our third research hypothesis deals with the kind of monetary injection chosen by BAs which could be realized either with a single investment round at t=0 or according to a deferred temporal pattern through follow-on investments, though in a short time frame (usually less than one year). In order to generate a measure of this anomalous and original investment practice, we build the dummy variable *Equity_infusion_pattern*, which assumes the value of one for those ventures that have received two separate capital injections by the same BA. Table 8 present descriptive statistics for the sample conditional on the value assumed by the *Equity_infusion_pattern* variable. The statistics do not support the possible argument related to

BAs wealth and experience, while the high share of BAs playing an active role in the business project could constitute first descriptive evidence supporting the BA's empathic behavior argument toward the entrepreneur. It is also interesting to observe that all the ventures receiving two separate capital injections already produce positive revenues at t=0 and have positive net asset value but negative net income.

INSERT TABLE 5 HERE

With the dummy *Active involvement*, we control for the presence of an active role of BAs in providing valuable non-monetary contributions (i.e. industrial, financial, strategic, relational competences) to the funded venture. Our fourth research hypothesis will be confirmed whether we find evidence that such an active role has a positive influence on firm performance and consequently on its probability of survival over time.

To test our final research hypothesis, we built an ordinal variable (*Soft-Monitoring*) assuming value from 1 to 5 depending on the frequency of the visits a BA makes to its portfolio companies (Bonini *et al.*, 2016), where 1 means very limited involvement (no or few company visits) and 5 means high involvement (a constant presence in the firm). We want to investigate whether an increase in the monitoring effort is a sufficient and effective value contributing tool available to BAs or, rather, a behavior negatively affecting the performance of the angel-backed company because of its impact on the trust and the quality of the relationship with the entrepreneurial team, especially in a context lacking of the more formal hard monitoring mechanism, contractual-based, typically implemented in venture capital deals.

Following the extant literature we add to our tests a vector of controls capturing BAs' characteristics. A first series of controls are angel-specifics and take into account age, experience – as measured by the number of past deals – and the share of the equity stake assumed by the BAs (Mason and Harrison, 2000; Van Osnabrugge, 2000; Shane, 2000; Paul *et al.* 2007; Sudek, 2008; Macht, 2011; Collewaert and Manigart, 2016). We expect more profitable ventures to be positively affected by older and more experienced BAs. Furthermore, the higher the control in the funded venture (either considering the share of the solo angel or considering the cumulative equity stake of the angel syndicate joining a given deal), the higher the commitment to make more and more effective the monetary and non-monetary contributions BAs give, thus increasing

both performance and probability of survival of the angel-backed company. A second series of control are firm-specifics and deal with the company size – as measured by its monetary equity base – its age and stage in the life cycle - measured by the positive value of revenues before the investment (t=0) – and its location (domestic or abroad based). Consistent with extant literature, we expect that the performance of angel backed companies is positively affected by their size, age and pre-investment revenue capacity (Wiltbank *et al.*, 2006; Alemany and Villanueva, 2015; Levratto, 2017) and negatively affected by their location (Sudek, 2008). Finally, we complete the model by considering time and industry fixed effects for their expected impact on angel-backed companies' performance (Harrison and Mason, 2002; Wiltbank and Boekor, 2007; Werth and Boeert, 2013; Kerr *et al.*, 2014; DeGennaro and Dwyer, 2014; Capizzi, 2015; Alemany and Villanueva, 2015; Levratto *et al.*, 2017).

4. Methodology and results

4.1. The determinants of the performance of angel-backed companies

We begin our econometric analysis by performing a set of ordinal logistics (Ologit) regressions analysis on 111 firms observed over four-year time period, where t=0 is the year of the BA's investment. The dependent variable is the five-stage ordinal variable *PERFORMANCE-INDEX*. We address potential heteroskedasticity concerns in two ways: firstly, we perform a logarithmic transformation of the explanatory angel-specific control variables *Share_BA* and *Equity* and of the square root of the explanatory Firm-specific control variable *Firm-Age;* second, we compute Huber-White heteroskedasticity-consistent standard errors.

The base model in Equation (1) tests the main research hypotheses related to the influence of co-investing (*Co-investors)*, of a BAN affiliation (*BAN_Membership*) and of a temporally deferred equity injection (*Equity_infusion_pattern)*. Since the probability of performing well is reasonably higher for those firms that are already active in t=0, and therefore not in the earliest stages of their life cycle, we also add a control for the presence of positive revenues in the year when the angel investment has been made (*Pre-Investment Revenues*). Finally, we add time and industry controls.

Performance-Index = f(Co-investors, BAN_Membership, Equity_infusion_pattern, Pre-Investment Revenues, Industry, Year) (1)

Equation (2) adds to the previous model the proxies *Active Involvement*, *Soft-Monitoring* and *Age-Firm*.

Performance-Index = f(Co-investors, BAN_Membership, Equity_infusion_pattern, Active Involvement, Soft-Monitoring, Age-Firm, Pre-Investment Revenues, Industry, Year) (2)

Equation (3) applies the full set of explanatory variables presented in Table 7.

Performance-Index = f(Co-investors, BAN_Membership, Equity_infusion_pattern, Active Involvement, Soft-Monitoring, Age-BA, Experience-BA, Share_BA, Age-Firm, Equity, Foreign, Pre-Investment Revenues, Industry, Year) (3)

Model results, presented in Table 6 (column (1)-(3)), show that a higher number of co-investors positively affects the performance of angel-backed companies, thus confirming our first research hypothesis. By getting access to equity capital raised by a syndicate of BAs, a company can also leverage on a wide set of non-monetary contributions, leading to an increase in its performance and probability of survival.

INSERT TABLE 6 HERE

The independent variable is statistically significant in each model specification. Differently from our expectation, the affiliation to a BAN does not seem to affect the probability of success of angel backed firms. However, this could be due to the intrinsic features of our survey-based dataset, which doesn't allow for the possibility to take into account the intrinsic qualitative differences in the many kind of BANs, BAGs and angel associations potentially existing.

One direction for future research, hence, could be the analysis of the differences in the quality of the services and contributions different kind of BANs offer to their members (Kerr et al., 2014; Landstrom and Mason, 2016).

The dummy *Equity_infusion_pattern* is significant in all model specifications and appears with a negative sign. Thus, in order to increase performance and to guarantee higher probability of survival over time to the angel-backed venture, equity capital should be injected in a single investment round, rather than through multiple follow-on investment in a short time period.

Investing in t=0 the 100% of the committed capital could be a proof of a high quality entrepreneur-investor relationship, where trust, information disclosure and mutual recognition of each other's contribution – monetary and non-monetary – play a major role, ultimately affecting firm's future performance.

This result might be affected by endogeneity in that investors may choose to provide capital in a fragmented fashion only to firms that have an inherently higher degree of risk. We tackle this issue Table A2 in Appendix, shows the results of an endogeneity control performed on the dummy *Equity_infusion_pattern*. The instrument is the dummy Low_Wealth, which assumes the value one if at least one of the BA participating to the deal has declared to belong to the lowest wealth bracket presented in the IBAN surveys. It is likely that "poorer" BAs could prefer to split their investment in two or more payments simply because they might face liquidity constraints at t=0. The dummy Low_Wealth is positively related with the supposedly endogenous variable. After the test we exclude the variable *Equity_infusion_pattern* to be affected by endogeneity.

Turning to hypotheses 4 and 5, we cannot find support for our conjectures as both BAs' active involvement and soft monitoring do not appear to be statistically correlated with the performance of angel-backed companies.

Looking at the impact of the control variables, model outcomes show that BAs' experience, in terms of number past deals, has a positive influence on future firm performance as well as BAs' age, confirming the results of other empirical analysis, previously cited, performed over different geographical samples. Similarly, achieving good performances in a four-year time period is easier for low capital intensity firms, than for business projects that require greater capital injections.

As expected, the positive sign of the variable *Pre-Investment Revenues,* confirms that those firms that at t=0 already sell their products or services are more like to perform well in a few years than those that still have to start their activity. Since the status of the *Pre-Investment Revenues* also contributes to the definition of the ranking of the *Performance-Index* in t=0, we run the three equations already presented by dropping this possible endogenous variable. As shown in Table 6 column (4)-(6) the results related to the main hypotheses remain stable.

These results suggest that the contribution to performance by BAs is more effective when it is made by teams of co-investors that include BAs with consolidated experience and capabilities to access better quality deal flow and selection processes.

4.2. Robustness checks

4.2.1. Sub-sampling by age, revenues, size of investment and monitoring.

We test the robustness of our main empirical findings by running the same regression on different sub-samples. In fact, we believe that BAs could more valuable in achieving profitability and survival over time in those ventures that are more opaque and potentially more innovative than those with an *ex-ante* higher observable quality. To this end, we run our analysis isolating homogeneous groups of firms in terms of age, ex-ante quality (as measured by their pre-investment revenue capacity) and capital intensity (as measured by their equity endowment).

First, we create two sub-samples on the basis of the firm-age: the first sub-sample that we call "start-up" includes firms with less than three years at t=0, while we call the second sub-sample "pre-existing" firms. Second, we split the sample in two groups of firms considering the presence of revenues in the investment year. Third, we consider the capital intensity of the business dividing the sample on the basis of the median value of the variable Equity. Finally, by assuming the variable *Soft-Monitoring* to be a proxy of the ex-ante degree of opacity of a business project, we create the following two sub-samples: firms characterized by a low or very low monitoring and firms object of frequent or continuous controls. Results of the analysis for sub-samples are presented in Table 7.

INSERT TABLE 7 HERE

Comparing outcomes of column (1) and (2) we observe some interesting phenomena further confirming some major outcomes of the base model. In fact, we find a positive role for co-investing when the investee companies do not generate revenues. In this segment of companies, both the BAs' active involvement and soft monitoring have an impact statistically significant and consistent with research hypotheses number 4 and 5. As in previous analyses, the variable *Equity_infusion_pattern* is significant and shows a negative sign for the firms with zero revenues and high capital intensity. The negative impact of a deferred equity injection is especially true for those companies where companies visits (soft monitoring) are most frequent, confirming the law

effectiveness of such a risk-reducing mechanism. If we focus on firms with no revenue capacity in t=0, we find a further evidence about the role of soft monitoring, in that is confirmed its negative impact on the performance of angel-backed ventures: for BAs it is much more effective, as a value creating contribution, to clearly and transparently commit themselves to active involvement behaviors, pre-agreed upon with the entrepreneurial team.

4.2.2.Sub-sampling by investment year.

As robustness checks, we perform a set of alternative regression analyses. First, we check for possible sample bias by running equation (3) on three sub-samples obtained by progressively dropping the deals related to the more distant survey years. The results reported in Table 11 confirm our main findings.

INSERT TABLE 8 HERE

4.3. The determinants of survival of angel-backed companies

As previously discussed, our three-year *Performance-Index* could be used as an effective proxy for estimating the probability of survival of angel-backed firms. To this end, we created a dummy variable, "*Dead-firms"*, assuming value one for those firms that have been closed down beyond our four-year observation period and zero if they are still alive. We obtained this information by checking through the external data base Orbis and Lexis/Nexis and performing a handmade search through Google and LinkedIn. With the above dummies as dependent variables, we run a set of logistic regression on the dependent variable *Dead-firms*, alternatively specifying the main explanatory variables as follows:

Performance Index: our main explanatory variable as introduced in section 3 and ranging from -2 to +2

Unsuccessful-firms is a dummy that assumes value 1 when in t=3 a firm shows zero revenues and negative net-income (status -1 and -2 of the *Performance-Index);*

Successful-firms is a dummy that assumes value 1 when in t=3 a firm shows positive revenues, net asset value and net income (status 2 of the *Performance-Index).*

Results in Table 9 confirm the effectiveness of the *Performance-Index* as predictive measure for the probability of future success/death of an angel backed firm, as the probability of being alive

(death) after our observation period is positively (negatively) related with our *Performance-Index.*

INSERT TABLE 9 HERE

Moreover, the dummy *Dead-firms* (*Surviving-firms*) is positively (negatively) related with the dummy *Unsuccessful-firms* and negatively (positively) related with the ordinal variable *Performance-Index* and with the dummy *Successful-firms*.

We also test whether using as dependent variable the dummy *Dead-firms* we obtain results consistent with the base model proposed in Table 9. We then run a set of logistic regressions using the same explanatory variables of equation (3). In order to check for the stability of our results, we run again the above model but dropping the *Dummy_revenues_t0*.

The results presented in Table 14 confirm the outcome of our base model: Co-investing actually reduces the probability of being an unsuccessful firm, while deferring in subsequent time periods the equity injection by the BA increases the probability of future company close down. Additionally, we observe that the probability of close down increases with the firm-age. Interesting to highlight, BAN affiliation shows a negative relationship with company failure, suggesting that, at least for the worst performing companies, the membership to a given BAN is positively correlated to the survival of angel backed companies, consistent with research hypothesis 2.

INSERT TABLE 10 HERE

We finally check whether traditional accounting measures for startups' size and performance show an effective power in predicting the success/failure of a venture. We consider firms' *Total Asset* and *Revenues*. Firstly, we test the relationship with the *Performance-Index* and with the dummies *Unsuccessful-firms* and *Successful-firms.* As presented in Tables 11, both accounting variables are positively related with the *Performance-Index* , but do not show any significant relationship with the two dummies which discriminate our sample firms according to their censored survivorship in t=3.

INSERT TABLE 11 HERE

We finally test whether the probability of survival in t>3 is affected by the above mentioned accounting measures for size and performance. Results in Table 12 (Y=*Dead_Firms*) show that the probability of being alive is not related to firms' total asset, while only in the univariate equation (in column (3)) is affected by firms' revenues.

INSERT TABLE 12 HERE

5. Conclusions and interpretations

In this paper, we shed light on one major issue in the entrepreneurial finance literature, that is the impact of early-stage investors on performance on funded ventures. In particular, we focus on the informal venture capital segment of the equity financing industry, which didn't receive a great deal of attention by scholars mostly because of the intrinsic sample bias limitations affecting angels data and of limited availability of financial information of n=investee companies. Usually these companies are very small, informationally opaque, sometimes inactive for many years and, in many cases, not tracked by structured databases.

In this study we provide previously unavailable evidence on the post-investment performance and probability of survival of angel-backed companies conditional on an original set of independent variables related to business angels' investment practices (*Co-investors*, *BAN_Membership*, *Equity_infusion pattern*, *Active Involvement*, *Soft-Monitoring*). Contributing to the literature we introduce an innovative ordinal metric ("PERFORMANCE-INDEX") that we use as dependent variable differentiating companies according to their revenues and profits generation pattern.

We empirically test empirically test our research hypotheses on a sample of 111 angel-backed companies extracted from a unique database containing qualitative and quantitative information on over 1,570 deals made by about 1,420 business angels from 2008 to 2015. Our main results show that the performance and the probability of survivorship of investee companies are positively affected by the presence of angel syndicates of co-investors, suggesting the capability of angel syndicates to give rise to higher quality deal flow and selection processes and, furthermore, to offer to funded ventures a wider set of non-monetary contributions.

Looking at the survivorship of companies, we show that our innovative metric -*PERFORMANCE-INDEX* – offers a substantial predictive power, being able to differentiate companies surviving over time from companies closing down. We also provide evidence that the membership to a given BAN is positively correlated with the survival of angel backed companies, in particular for the weakest companies of the sample and that equity capital should be injected in a single investment round, rather than fragmented in multiple disbursements. We interpret this result as follows: the immediate investment of the total committed capital is a signal of an high quality relationship between the investee company and the angel investors, where the former has been able to fully disclose information about the company and the projected investments and the BA, thanks to its experience, has been able to provide the required capital together with the right incentives. Finally, BAs' active involvement seems to constitute a value creating mechanism more effective than soft monitoring (based on company visits rather than on the formal contractual provisions set up by venture capitalists) in driving the angel-backed companies to profitability and survival; this is especially true for funded ventures with yet limited revenue capacity at the investment period.

Future research will have to further investigate the contribution of BA and BANs to the profitability of funded ventures, by trying to better fine tune the investment process of business angel networks, also considering the many possible differences in the kind of activity performed by associations with various degrees of internal formal rules, ranging from membership mechanisms, to BAN management practices, to the set of services offered to their members.

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Table 1

Sampling procedure

This table presents details on the filtering process leading to the final sample. From a starting sample of 695 deals, we exclude observations where name of the target company was not specified or incorrectly specified preventing an unequivocal identification. We then keep companies for which financial statements and any relevant information on acquisitions and initial public offerings is available on Orbis and Lexis/Nexis.

Year of the BA investment		Number of fully identified deals	Panel firms	(2)/(1)	(3)/(2)
	(1)	(2)	(3)	(4)	(5)
2008	92	10	2	11%	20%
2009	145	59	12	41%	20%
2010	137	86	27	63%	31%
2011	159	74	23	47%	31%
2012	162	73	47	45%	64%
Total	695	302	111	43%	37%

Table 2

Sample descriptive statistics

This table presents details on sample firms characteristics. Panel A presents industry distribution data; Panel B presents summary statistics for the 3 main financial indicators: revenues, Net Income and Net Assets; Panel C presents cluster frequencies of firms in different reveues, assets and income cluster by post-investment year.

PANEL A- Industry distribution

	Number of firms	%
Biotech	18	16.22
Cleantech	14	12.61
Commerce and distribution	10	9.01
Electronics	17	15.32
Information and Communications Technology (ICT)	20	18.02
Media & Entertainment	10	9.01
Other sectors	21	18.92
Total	111	100.00

PANEL B - Firms financials

	Median	Mean	Min	Max
Revenues	95,370	395,454	0	2,590,289
Net Income	-30,643	-165,292	-1,629,856	486,276
Net Assets	64,648	240,850	-370,438	1,243,246

PANEL C - Distribution by revenues, assets and income cluster

	Frequencies			
	t=0	t=1	t=2	t=3
Revenues =0	9.01	18.02	16.22	5.41
Revenues> 0	63.06	72.97	83.78	64.86
Net income <= 0	53.15	72.07	72.07	49.55
Net Income > 0	18.9	18.9	27.9	20.7
Net assets < = 0	4.5	8.1	17.1	11.7
Net assets > 0	67.6	82.9	82.9	58.6

Table 3

Performance-Index Variable : codification and distribution through time

This table reports summary statistics for the variable PERFORMANCE-INDEX. The variable is designed as an ordinal variable which can assume five different values based on different combinations of revenues, asset value and income. We compute the variableon annual basis over a time span from t=0, which is the year when the BA's investment occurred, to t=3.

		Distribution of ordinal value in T0 to T3				
Description	Value	T0	T1	T2	T3	Total by value
Net asset value, Net income and Revenues are positive	2	20	20	30	21	91
Net asset value and revenues are positive but net income is negative	1	47	41	50	41	179
Both net asset value and net income are negative but revenues are positive	0	3	8	9	20	40
Net asset value is positive revenues are equal to zero and net income is negative	-1	8	31	12	3	54
are negative and revenues are equal to zero	-2	2	1	10	3	16
Number Firms with no info		31	10	0	23	64
Observation by year		111	111	111	111	444

Table 4

Independent variables: descriptive statistics

This table reports descriptive statistics for the main independent variables, a set of angel-specific and firm-specific controls derived from the extant literature.

Variables	Description	Obs.	Median	Mean	St.Dev.	Min	Max	Dummy=1 percentage
Co-investors	Numbero of co-investors	444	1	3.766	5.1	0	15	
BAN_Membership	Dummy=1 if at least one BA owns to the Italian BA Network (IBAN)	440						0.53
Equity_infusion_pattern	Dummy = 1 in presence of different investment rounds	444						0.05
Active Involvement	Dummy =1 if the BA has made managerial contributions to the invested firm	444						0.68
Soft-Monitoring	Ordinal variable ranging from 1 to 5	392	3	2.95	1.17	1	5	
Angel-specific controls								
Age-BA	Average age of the BA/BAs participating to each investment	396	49	48.17	9.52	30	70	
Experience-BA	Number of past deals of angel financing. In presence of co-investing, it is the number of deals of the most expert BA.	396	7	6.69	3.95	0	12	
Share-BA	Share of BAs' participation in the firm	444	0.08	0.16	0.20	0.01	1	
Firm-specific controls								
Age-Firm	Number of years since the BA investment	428	1	2.96	4.22	0	16	
Equity	Firm's equityin euro	361	240,909	440,707	496,234	1724	1,463,569	
Foreign	Dummy =1 for foreign firms	428						0.07
Pre-Investment Revenues	Dummy = 1 if revenue was greater than zero when the BAs' investment occurred	420						0.66

Table 5

Descriptive statistics by type of equity infusion pattern

In this table we present summary statistics of firms charcateristics conditional on the pattern of equity provision modeled as the dummy variable Equity_infusion_pattern, which assumes the value of one for those ventures that have received two separate capital injections by the same BA

	One Capital injection	Multiple capital injections
Experience		
Median	7	9.5
Mean	6.54	8.833
Min	0	3
Max	12	12
Wealth (th euro)		
Median	1250	1700
Mean	1270	2030
Min	250	850
Max	7500	3500
Managerial contribution	0.67	0.83
	Frequencies at t=0	
Revenues > 0	0.64	1
Revenues $= 0$	0.36	0
Earnings $< = 0$	0.8	1
Earnings > 0	0.2	0
Net asset value $< = 0$	0.05	0
Net asset value > 0	0.95	1

Table 6

Base model Results

The table reports odds ratios for ordinal logit models with White heteroskedasticity-consistent standard errors. The dependent variable, PERFORMANCE-INDEX, is a five stages ordinal variable. Column (1) comprises a fully balanced model with fixed-effect. Column (2) adds to the previous model other explanatory variables. Column (3) comprises all the explanatory variables. In columns (4),(5) and (6) we replicate estimations dropping the variable Dummy_Revenues_t0. Significance at *** 1%, ** 5%, * 10% level.

	(1)	(2)	(3)	(4)	(5)	(6)
Co-investors	1.056	1.054	1.078	1.071	1.062	1.071
	(2.30)**	(2.07)**	(2.43)**	(2.81)***	(2.33)**	(2.15)**
BAN_Membership	1.452	-0.929	-0.959	1.448	1.047	1.187
	(1.44)	(0.21)	(0.09)	(1.47)	(0.13)	(0.39)
Equity_infusion_pattern	-0.138	-0.223	-0.151	-0.164	-0.23	-0.137
	(4.83)***	(3.53)***	(3.91)***	(4.49)***	(3.49)***	(3.95)***
Active Involvement		1.413	1.996		1.291	1.594
		(1.22)	(1.95)*		(0.91)	(1.4)
Soft-Monitoring		-0.942	-0.763		-0.981	-0.847
		(0.46)	(1.82)*		(0.15)	(1.1)
Angel-specific controls						
Age-BA			1.01			1.023
			(0.68)			(1.68)*
Experience-BA			1.092			1.1
			(2.37)**			(2.53)**
Share-BA			1.465			1.236
			(2.57)**			(1.58)
Firm-specific controls						
Age-Firm		-0.718	-0.654		-0.878	-0.889
		(2.28)**	(2.39)**		(1.05)	(0.78)
Equity			-0.678			-0.746
			(3.80)***			(3.05)***
Foreign			2.019			3.311
			(1.21)			(2.01)**
Pre-Investment Revenues	2.112	2.604	4.371			
	(2.65)***	(2.72)***	(3.34)***			
Time-effect	YES	YES	YES	YES	YES	YES
Industry-FE	YES	YES	YES	YES	YES	YES
Prob>Chi^2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.09	0.09	0.132	0.08	0.08	0.11
N	363	332	303	372	335	306

Table 7
Results in different Sub-samples

The table reports odds ratios for ordinal logit models on different sub-samples In parenthesis White heteroskedasticity-consistent standard errors. The dependent variable is the five stage PERFORMANCE-INDEX. We consider as start-up those firms with age minor than three years. The variable soft-monitoring varies from 1 to 5. In Column (7) and (8) the variable Soft-Monitoring assumes the value 1 and 2. Due to a multicollinearity problem related to the variables Co-investors and Equity Infusion Pattern we run two separate equation by alternatively dropping the two variables. Significance at *** 1%, ** 5%, * 10% level.

	Firm-age		Firm-Revenues at t=0		Firm Equity		Soft-Monitoring		
	Start-up	Preexisting	No Revenues	Revenues	=< Median value	> Median value	Very low or Low		Medium, High, Very High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)
Co-investors	-0.966	1.126	1.119	-0.92	-1.01	1.104	1.189		0.787
	(0.89)	(1.82)*	(3.73)***	(1.42)	(0.11)	(2.80)***	(3.55)***		(0.89)
BAN_Membership	-0.785	4.00	1.56	-0.247	-0.952	2.38	-0.296	-0.9	-0.502
	(0.67)	(1.63)	(0.89)	(2.32)**	(0.09)	(1.43)	(1.58)	(0.17)	(0.67)
Equity_infusion_pattern	-0.591	-0.05	-0.076		-0.139	-0.035		-0.261	-0.084
	(0.5)	(3.31)***	(4.55)***		(1.57)	(4.59)***		(1.35)	(0.5)
Active Involvement	-0.94	2.518	2.246	-0.804	1.398	2.839	4.531	2.226	3.530
	(0.15)	(1.49)	(1.89)*	(0.38)	(0.70)	(2.05)**	(1.57)	(0.93)	(0.15)
Soft-Monitoring	-0.73	-0.322	-0.565	-0.923	-0.511	-0.621			-0.6444
	(2.17)**	(3.03)***	(3.44)***	(0.33)	(2.35)**	(2.38)**			(2.17)**
Angel-specific controls									
Age-BA	-0.998	-0.994	1.017	-0.948	-0.994	1.002	-0.99	1.012	0.415
	(0.14)	(0.19)	(0.95)	(1.80)*	(0.27)	(0.09)	(0.37)	(0.48)	(0.14)
Experience-BA	1.044	1.15	1.081	1.11	1.127	1.034	1.043	1.149	1.094
	(1.07)	(1.48)	(1.62)	(1.84)*	(1.34)	(0.68)	(0.71)	(1.99)**	(1.07)
Share-BA	1.122	1.252	1.664	1.249	1.479	1.66	-1	-0.795	-0.369
	(0.62)	(0.49)	(2.51)**	(1.04)	-1.29	(2.85)***	(0.00)	(0.91)	(0.62)
Firm-specific controls									
Age-Firm			-0.62	-0.993	-0.597	1.123			
			(2.43)**	(0.03)	(2.80)***	(0.38)			
Equity	-0.736	-0.844	-0.709	-0.665			-0.415	-0.545	-0.440
	(3.12)***	(0.88)	(3.19)***	(2.11)**			(4.24)***	(3.64)***	(3.12)***
Foreign	1.075	-0.688	1.057		1.59	1.361	-0.72	4.84	2.485
	(0.1)	(0.26)	(0.08)		(0.42)	(0.49)	(0.4)	(1.74)*	(0.1)
Pre-Investment Revenues	3.4	3.685			3.237	2.672	2.938	1.676	2.174
	(3.05)***	(1.2)			(2.16)**	(1.58)	(0.93)	(0.51)	(3.05)***
Time-effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry-FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Prob>Chi^2	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.079	0.235	0.1718	0.1657	0.1053	0.1884	0.207	0.183	0.133
N	204	99	90	216	136	181	132	132	175

Table 8

Subsampling by investment year

The table reports odds ratios for ordinal logit models on different sub-samples In parentheses White heteroskedasticity-consistent standard errors. The dependent variable is the five stage PERFORMANCE-INDEX. Model 1 and 2 drop investments done in year 2008; Model 3 and 4 drop investments done in years 2008 and 2009; Model 5 and 6 drop investments done in years 2008,-2010. Significance at *** 1%, ** 5%, * 10% level.

	Investment year > 2009		Investment year > 2010		Investment year > 2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Co-investors	1.074	1.076	1.071	1.077	1.124	1.164
	(2.16)**	(2.36)**	(2.15)**	(2.58)***	(3.12)***	(3.62)***
BAN_Membership	1.072	1.036	1.452	1.627	1.497	7.893
	(0.19)	(0.08)	(0.89)	(0.9)	(0.85)	(2.99)***
Equity_infusion_pattern	-0.139	-0.143	-0.073	-0.079	-0.059	-0.031
	(4.09)***	(4.01)***	(4.52)***	(4.18)***	(4.14)***	(4.74)***
Active Involvement	1.666	2.037	-0.983	-1.281	-0.62	-0.435
	(1.54)	(2.00)**	(0.04)	(0.51)	(0.83)	(1.28)
Soft-monitoring		-0.75		-0.702		-0.409
		(1.93)*		(1.62)		(2.30)**
Angel-specific controls						
Age-BA	1.027	1.013	1.012	0.987	1.001	0.987
	(1.94)*	(0.92)	(0.75)	(0.69)	(0.06)	(0.34)
Experience-BA	1.088	1.089	1.183	1.172	1.122	1.159
	(2.25)**	(2.28)**	(3.68)***	(3.33)***	(1.91)*	(2.20)**
Share-BA	1.228	1.485	1.432	1.559	1.305	1.03
	(1.58)	(2.66)***	(1.74)*	(2.07)**	(0.96)	(0.07)
Firm-specific controls						
Age-Firm	-0.924	-0.65	-1.186	-0.821	-0.815	-0.441
	(0.52)	(2.40)**	(0.87)	(0.8)	(0.68)	(1.52)
Equity	-0.736	-0.675	0.859	-0.8	1.205	1.336
	(3.07)***	(3.82)***	(1.34)	(1.85)*	(1.14)	(1.59)
Foreign	3.56	2.129	1.474	0.881	14.36	24.324
	(2.11)**	(1.32)	(0.47)	(0.15)	(1.65)*	(1.94)*
Pre-Investment Revenues		4.183		3.272		0.747
		(3.20)***		(2.04)**		(0.34)
Time-effect	YES	YES	YES	YES	YES	YES
Industry-FE	YES	YES	YES	YES	YES	YES
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.12	0.13	0.14	0.15	0.208	0.25
N	308	301	227	220	147	140

Table 9

Angel-backed companies survival

In this table we present results for a set of logistic regression on the dependent variable Dead-firms, a dummy assuming value one for those firms that have been closed down beyond our four-year observation period and zero if they are still alive. We alternatively specify the main explanatory variables as follows: Performance Index, our main explanatory variable as introduced in section 3, Unsuccessful-firms a dummy that assumes value 1 when in t=3 a firm shows zero revenues and negative net-income (status -1 and -2 of the Performance-Index); Successful-firms is a dummy that assumes value 1 when in t=3 a firm shows positive revenues, net asset value and net income (status 2 of the Performance-Index). Significance at *** 1%, ** 5%, * 10% level.

	Y= dead firms					
	(1)	(2)	(3)	(4)	(5)	(6)
Performance-Index	-0.55	-0.54				
	(2.27)**	(2.11)**				
Unsuccesful-firms			7.43	9.14		
			(2.97)***	(3.10)***		
Successful-firms					-0.13	-0.13
					(3.08)***	(2.94)***
Industry-FE	NO	YES	NO	YES	NO	YES
Prob>Chi^2	0.016	0.006	0.000	0.002	0.000	0.000
Pseudo R^2	0.054	0.154	0.075	0.124	0.087	0.118
N	80	79	111	109	111	109

Table 10

Firm survival determinants

In Columns (1)-(2) odds ratio of the Logit model with Dead-firms as dependent variables (dummy = 1 for dead firms in t>3). In Column (2) base model with all explanatory variables. In Columns (1) the variables Soft-Monitoring and Pre-Investment Revenues are omitted. Significance at *** 1%, ** 5%, * 10% level.

	Y= dead firms	
Independent variables	(1)	(2)
Co-investors	-0.832	-0.793
	(1.79)*	(1.89)*
BAN_Membership	-0.157	-0.124
	(1.52)	(1.66)*
Equity_infusion_pattern	22.613	62.975
	(1.70)*	(1.87)*
Active Involvement	2.552	1.789
	(0.80)	(0.46)
Soft-Monitoring		-0.802
		(0.37)
Angel-specific controls		
Age-BA	-0.978	-0.948
	(0.41)	(0.87)
Experience-BA	-0.818	-0.839
	(1.82)*	(1.41)
Share-BA	-0.591	-0.417
	(1.02)	(1.34)
Firm-specific controls		
Age-Firm	2.444	3.58
	(2.35)**	(2.32)**
Equity	-0.672	-0.618
	(1.39)	(1.43)
Foreign	2.661	3.228
	(0.70)	(0.72)
Pre-Investment Revenues		-0.467
		(0.47)
Industry-FE	YES	YES
Successful-firms	1.58	1.10
	(1.30)	(0.87)
Prob>Chi2	0.034	0.000
Intercept	9.457	10.51
	(17.41)***	(12.44)***
Psedo R2	0.4632	0.489
N	68	66

Table 11

Relationship between firms' asset and different performance measures

In columns (1) and (2) results for panel equation with Total Asset as dependent variable. In columns from (3) to (6) results for OLS regression with Total Asset as dependent variable. In columns (3) and (4) univariate models. In columns (2), (4) and (6) we add Industry-FE). White heteroskedasticity-consistent standard errors in columns (1) and (2). Significance at *** 1%, ** 5%, * 10% level.

PANEL A

	Y= Total Assets					
	(1)	(2)	(3)	(4)	(5)	(6)
Performance-Index	0.093	0.094				
	(2.12)**	(2.14)**				
Unsuccesful-firms			0.315	0.270		
			(0.73)	(0.63)		
Successful-firms					-0.518	-0.358
					(-1.41)	(-0.92)
Intercept	12.647	12.961	12.66	13.01	12.80	13.108
	(92.45)***	(69.46)***	(79.31)***	(51.18)***	(77.98)***	(50.68)***
Time effect	YES	YES	n.a.	n.a.	n.a.	n.a.
Industry FE	NO	YES	NO	YES	NO	YES
Prob>Chi2	0.0337	0.0375	0.4660	0.4169	0.1619	0.3629
Adjusted R2	0.0004	0.0315	0.0016	0.008	0.0124	0.007
N	370	365	80	79	80	79

PANEL B

	Y= Revenues					
	(1)	(2)	(3)	(4)	(5)	(6)
Performance-Index	3.159	3.092				
	(23.17)***	(20.74)***				
Unsuccesful-firms			-0.5	-0.531		
			(-0.97)	(-1.02)		
Successful-firms					1.58	1.10
					(1.30)	(0.87)
Intercept	6.882	7.483	9.524	10.612	9.457	10.51
	(23.79)***	(18.29)***	(23.42)***	(16.79)***	(17.41)***	(12.44)***
Time effect	YES	YES	n.a.	n.a.	n.a.	n.a.
Industry FE	NO	YES	NO	YES	NO	YES
Prob>Chi2	0.000	0.000	0.3298	0.0003	0.1958	0.1899
Adjusted R2	0.6223	0.6312	0.0015	0.3	0.009	0.0331
N	347	343	80	79	80	79

Table 12

Results of the logistic models with Dead-Firms as dependent variable

The table reports odds ratios of the Logistic model with Dead-firms as dependent variable. In columns (1) and (3) we run univariate equations. In columns (2) and (4) we add Industry-FE. Significance at *** 1%, ** 5%, * 10% level.

	Dead-Firms			
	(1)	(2)	(3)	(4)
Total Asset	1.161	1.225		
	(0.84)	(1.02)		
Revenues			-0.895	-0.925
			(-2.04)**	(-1.33)
Time effect	n.a.	n.a.	n.a.	n.a.
Industry FE	NO	YES	NO	YES
Prob>Chi2	0.3951	0.0276	0.036	0.021
Psedo R2	0.0067	0.118	0.041	0.1248
N	80	79	80	79

Appendix

IBAN Survey methodology

Our data are obtained from sequential surveys administered by the Italian Business Angels Network Association (IBAN) to its associates and other unaffiliated BAs. IBAN is the national trade association for angels and angel groups/networks.

A known problem in business angel research is estimating the "true" population. Some investors in fact, strive for anonymity creating an "invisible market" that is difficult to detect using simple survey techniques (Mason and Harrison, 2008; Landström and Mason, 2016). To circumvent this issue, IBAN adopted a strategy of integrating the "visible market" – represented by BAs and networks/groups affiliated to IBAN – with an estimation of the "invisible" component. The estimation is done by supplementing a traditional "snowball sampling" (Schuessler, 1979) – based upon the identification on people believed to be business angels through their connections with the surveyed BAN-members – with an inferential approach based on the results of a domestic research program (Private Equity Monitor PEM) aimed at identifying and analyzing private equity and venture capital investors activity. PEM collects information on PE and VC-backed companies. Focusing on the segment of venture capital-backed companies investments, IBAN researchers collected complete ownership data[2] from Bureau Van Dijk-AIDA and identified individual shareholders whose investment pattern was consistent with that of a business angel (Mason 2006). In particular, researchers classified as business angels shareholders that exhibited the following characteristics: repeated investor in new companies; non-executive role; non-majority ownership.

While acknowledging possible sample biases in the survey data, the rigorous sampling method and the repeated nature of the survey over a 7 years period appear to be strong mitigating factors that justify confidence in the sample representativeness.

The survey structure is designed to collect information on the previous year's operations and is conducted through a four-steps process: at the beginning of January, IBAN forwards the survey's website link to its associates and other known or estimated BAs.[3] Responses are

[2] Italy as numerous European countries, require a relatively high level of disclosure of financial and ownership information that is publicly available through government and third-parties sources such as BVD-Aida.
[3] See the IBAN website (www.iban.it) for the survey questionnaire.

collected by the first week of March (step 1). Non-responding BAs are contacted by email and phone to solicit survey completion (step 2) while an IBAN team reviews the data to identify incomplete, wrong or unverifiable answers (step 3), which are further checked through direct follow-up calls (step 4). This process is a common survey technique called sequential mixed mode (Snjikers et al., 2013). Evidence shows that a mixed mode survey approach significantly improves the response rate (De Leeuw, 2005 and Dillman et al., 2009).

Survey statistics are reported in Table A1.

Table A1

IBAN Survey - Sample coverage and response rates

This table report sample coverage and repsonse rates for our survey data. The first column reports the number of surveys administered over the period 2008-2014. The second column reports the number of surveys received after the follow-up rounds described in section 3; the third column reports the number of surveys that have been kept after discarding: a) surveys with material inconsistencies and b) surveys reporting zero investments; the fourth column indicates the number of deals reported by the survey respondents; given that the same investor can be surveyd multiple times and the same companies cna be invested by more than one angel in the fifth and sixth column we finally report the number of unique investors and unique companies.

	Surveys sent	**Surveys received**	**Final surveys sample**	**# of deals reported**	**Unique investors**	**Unique companies**
Overall sample	3,000	1,250 (41.7%)	439 (14.6%)	810	330	619
BAN Members	929	438 (47.2%)	246 (26.5%)	438	150	334
Non-BAN members	2,071	812 (39.2%)	209 (10.1%)	372	180	285

IBAN administered 3,000 questionnaires to 929 affiliates and 2,071 non-affiliates from 2009 (2008 investment data) through 2015 (2014 investment data).

The overall response rate over the full sample period is 41.7%. The response rate is higher (about 47.2%) for the sub-sample of BAN members than for non-BAN members (39.2%) who are less likely to respond because of anonymity concerns or possible erroneous estimated identification.

Out of the 1,250 responses the researchers discarded: a) surveys with material inconsistencies and b) surveys reporting zero investments. This leads to a final sample of 439 responses reporting an aggregate of 810 deals, on 619 unique companies by 330 unique investors during the 2008 – 2014 time period.

Table A2

Instrumental variable regression

Results of the endogeneity test conducted on the dummy Equity_Infusion_Pattern with the Stata function ivreg2. The instrument is the dummy Low_Wealth which assumes value 1 if at least one of the angels participating to the deal belong to the lowest wealth bracket of the IBAN survey and zero otherwise. Significance at *** 1%, ** 5%, * 10% level.

	Instrument = Low_Wealth	
	Step 1 Y=Equity Infusion Pattern	Step 2 Y=Performance Index
Low_Wealth	0.103***	
	(3.27)	
BAN_Membership	0.090***	-0.206
	(2.76)	(-0.81)
Co-investors	0.011***	0.012
	(4.29)	(0.58)
Equity_infusion_pattern		0.973
		(0.63)
Active Involvement	0.001	0.206
	(0.01)	(1.31)
Soft-Monitoring	-0.014	-0.138**
	(-1.12)	(-1.97)
Age-BA	0.004**	-0.004
	(2.52)	(-0.47)
Experience-BA	0.009**	0.022
	(2.52)	(1.04)
Share-BA	0.018	0.180**
	(1.2)	(2.29)
Age-Firm	0.034**	-0.318***
	(2.15)	(-3.21)
Equity	0.007	-0.095**
	(0.91)	(-2.14)
Foreign	0.121**	-0.062
	(2.09)	(-0.17)
Pre-Investment Revenues	-0.005	0.762***
	(-0.15)	(3.92)
Intercept	-0.382***	2.80***
	(-3.00)	(3.29)
Time-effect	YES	YES
Industry-FE	YES	YES
Prob > F	0.000	0.000
Centered R2	0.38	0.53
Observations	293	293
Underidentification test (Anderson canon. corr. LM statistic):	11.03	
Chi-sq(1) P-value	0.001	
Weak identification test (Cragg-Donald Wald F statistic):	10.679	
Stock-Yogo weak ID test critical values		
10% maximal IV size	16.38	
15% maximal IV size	8.96	
20% maximal IV size	6.66	
25% maximal IV size	5.53	
Sargan statistic (equation exactly identified)	0.000	
Tests of endogeneity of: atleast1ibanmembership H0: Regressor is exogenous		
P-value Wu-Hausman F test	0.182	
P-value Durbin-Wu-Hausman chi-sq test	0.167	