AN INTERDEPENDENCE THEORY OF ENTREPRENEURIAL OVEROPTIMISM:
EVIDENCE FROM VENTURE CAPITAL-BACKED FIRMS

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ABSTRACT

Drawing on interdependence theory, we explore the conditions under which entrepreneurs provide more overoptimistic forecasts to their investors. Using a proprietary longitudinal dataset of 321 forecasted and realized firm revenues as provided to a venture capitalist, our findings indicate that the longer the entrepreneur-investor relationship, the less overoptimistic the projections made. Further, entrepreneurs are more overoptimistic when there is a greater need to serve their own interests and there is more opportunity to do so, i.e. when they are about to raise a new round of financing and investor monitoring is low. We theoretically advance the literature by going beyond the simplified portrayal of entrepreneurs as naive optimists and identifying a time-varying and strategic component to the optimism conveyed to stakeholders.
INTRODUCTION

Forecasts are created and used for a wide variety of decisions, including those pertaining to investment, financing, logistics, marketing, and sales. By informing decision making and strategy formulation, forecasts substantially affect the future direction and success of entrepreneurial ventures (Durand, 2003). Despite the importance of accurate forecasts, research has shown that entrepreneurs tend to be overly optimistic in their projections of their ventures (e.g., Busenitz & Barney, 1997; Cassar, 2010; Cooper, Woo, & Dunkelberg, 1988; Hmieleski & Baron, 2009; Landier & Thesmar, 2009). Several alternative and complementary explanations have been put forward to explain why their predictions often exceed actual achievements, among them that entrepreneurs are high in dispositional optimism (e.g., Cooper et al., 1988; Hmieleski & Baron, 2009), that they are overconfident (e.g., Busenitz & Barney, 1997; Forbes, 2005; Koellinger, Minniti, & Schade, 2007), and that they act on positive but erroneous signals of venture success (e.g., Van den Steen, 2004).

Despite this progress, we believe the literature on entrepreneurial overoptimism can be advanced in multiple ways. First, since existing theoretical explanations conceptualize entrepreneurial overoptimism as a judgment bias, literature on forecasting in entrepreneurial ventures has failed to extend beyond the notion of entrepreneurs as naïve overoptimists who unwittingly overestimate their future venture’s performance. Yet, this overlooks the possibility of a more conscious form of entrepreneurial overoptimism — overoptimism as the result of a strategic reporting choice made by entrepreneurs.

Second, in line with the theoretical conceptualization of overoptimism as an individual judgment bias, research on the antecedents of entrepreneurial overoptimism has taken a person-centric perspective, focusing on individual characteristics such as entrepreneurs’ cognitive
abilities or planning activities (e.g., Cassar, 2010; 2013; Landier & Thesmar, 2009). In contrast, we apply interdependence theory to provide a multi-person perspective to explain entrepreneurial overoptimism. In accordance with the latter, human behavior, such as the choice between presenting information accurately or misrepresenting it, can only be understood by taking into account the interpersonal context individuals find themselves in, including the people to whom the information is targeted and the goals to be achieved with them (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959). Contextual factors such as the intended target of the forecast (e.g., for internal versus external consumption) and the incentive to deceive the target audience (e.g., investors) may therefore be major determinants of an entrepreneur’s overoptimism.

Finally, prior research has either assumed (e.g., Busenitz & Barney, 1997) or explicitly suggested (e.g., Landier & Thesmar, 2009) that entrepreneurial overoptimism persists over time. However, as interdependence theorists point out, interpersonal contexts are not static and individuals’ incentives to deceive others may change over time (Kelley et al., 2003). If the personal benefit to be derived from presenting a more optimistic forecast varies over time, then longitudinal research designs are needed to uncover new insights related to when entrepreneurs strategically inject more optimism into the projections provided to external stakeholders. Our study thus presents a longitudinal panel design to determine under what conditions entrepreneurs provide more optimistic forecasts to their venture capital (VC) investors.

We contribute to the literature on entrepreneurial overoptimism in a number of ways. First, we theoretically advance the literature beyond the notion of entrepreneurs as naïve optimists by establishing a strategic component to the optimism conveyed to stakeholders. Data constraints have prevented researchers from investigating how interactions with investors affect the forecasting behavior of entrepreneurs as this requires a comparison of the ex-ante forecasts
provided to investors with \textit{ex-post} outcomes over time from a sufficient sample of firms.\textsuperscript{1} Our unique proprietary data allows us to longitudinally observe the authentic yearly forecasted one-year-ahead revenues provided by entrepreneurs to their VC investor as well as the annually realized revenues.

Second, we provide a new theoretical perspective — interdependence theory — and empirical investigation to extend our knowledge of the strategic considerations that drive entrepreneurial overoptimism. Interdependence theory has been widely used in management and other fields to study a variety of phenomena including alliance formation (e.g., Gulati, 1995), conflict resolution (e.g., Beersma & De Dreu, 1999), consumer decision making (Simpson, Griskevicius, & Rothman, 2012), and the functioning of entrepreneurial teams (Blatt, 2009). Drawing on interdependence theory, we identify a time-varying component in entrepreneurial overoptimism by examining entrepreneurs’ incentives to deceive their investors over time. Specifically, we examine the evolution of entrepreneurial overoptimism over the course of the investor-entrepreneur relationship. Additionally, we examine the impact of two time-varying and situation-related antecedents of the motivation to deceive investors: whether entrepreneurs are approaching a new round of financing, and whether investor scrutiny is higher (versus lower).

Contrary to conventional wisdom, which regards overoptimism as a stable characteristic of entrepreneurs, we find that entrepreneurs’ projections are more realistic when they have a longstanding relationship with their investors, and when they are about to raise a new round of financing and investor monitoring is high.

\textsuperscript{1} There is one important study that examines forecasts of entrepreneurs in venture capital-backed companies (Armstrong, Davila, Foster, & Hand, 2007). However, given data restrictions these authors do not compare forecasted to actual venture performance nor could they observe the extent that the forecasted numbers in their database are those that were specifically provided to actual and potential investors or if they were provided on a regular basis. As such, it provides limited insight into the question of under which conditions entrepreneurs strategically report more optimistic forecasts to their investors.
THEORY AND HYPOTHESES

Entrepreneurial Overoptimism in Investor-Entrepreneur Relations: An Interdependence Theory Perspective

A major premise of interdependence theory (Thibaut & Kelley, 1959; Kelley & Thibaut, 1978) is that the interpersonal context is essential to our understanding of human behavior. For example, the degree of interdependence (i.e. how people can influence each other’s outcomes through their actions), the information these individuals have about each other, and what they are trying to accomplish with each other are potent determinants of their individual behavior and social interaction (Kelley et al., 2003; Reis, Collins, & Berscheid, 2000). In situations where partners expect to work together over an extended period of time, yet have conflicting interests, interdependence theory postulates that partners’ joint gains will be maximized when they behave cooperatively, each foregoing their self-interest for the sake of the relationship (Kelley et al., 2003). This interpersonal perspective aligns with insights from VC scholars who emphasize the need to maintain a cooperative relationship between investors and entrepreneurs since it is difficult and expensive to replace either party given the reputation effects, knowledge specialization, and high search and negotiation costs (Cable & Shane, 1997; Sapienza, Manigart, & Vermeir, 1996). Lack of cooperation can undermine the investor-entrepreneur relationship and compromise the success of the venture. Busenitz, Fiet, and Moesel (2004), for instance, showed how truncating a reciprocal investor-entrepreneur relationship by dismissing a member of the new venture team decreases long-term new venture performance.

In such situations of conflicting interests, a dilemma arises as to whether or not to provide accurate information (Kelley & Thibaut, 1978). Whereas taking on a cooperative stance is conducive to the exchange of accurate information, taking on a competitive self-interested stance
is conducive to the misrepresentation of information. Despite cooperation being in the investor-entrepreneur partnership’s best interest, the entrepreneurship literature has similarly highlighted that entrepreneurs may have incentives to behave competitively by withholding information from or altering information provided to their investors (Cable & Shane, 1997). For example, entrepreneurs may want to protect themselves against an opportunistic investor by withholding sensitive information; they may overstate (future) venture performance to positively impress investors; or they may withhold negative information as to not to risk being replaced by the investor (Cable & Shane, 1997; Sapienza & Korsgaard, 1996). In all these instances there is an incentive to misrepresent information in pursuit of self-interest. Ultimately, though, such a strategy is likely to harm the investor-entrepreneur relationship (and the venture’s success) by leading to misguided decision-making and diminishing trust and mutual support (Cable & Shane, 1997; Sapienza & Korsgaard, 1996).

Applied to misrepresenting future venture performance through overoptimistic financial forecasts, forecasts are used as benchmarks to evaluate the venture and the entrepreneurial team. The importance of projections for post-investment monitoring purposes by VCs is widely acknowledged (e.g., Letts, Ryan, & Grossman, 1997). Therefore, when overoptimistic forecasts are used as input for strategic decision making in VC-backed companies, the resulting decisions will likely be misguided. Additionally, investors who infer that entrepreneurs are deliberately portraying future firm performance overoptimistically may question the accuracy and value of future projections (and other information) provided by entrepreneurs. Moreover, consistent errors in forecasting that result in actuals not meeting the forecasted targets may also prompt investors to question the entrepreneurs’ competence or ability, and, in so doing, undermine investor trust in the entrepreneur (Colquitt, Scott, & LePine, 2007), and ultimately harm the relationship by, for
instance, reducing the investor’s willingness to assist the entrepreneur (De Clercq & Sapienza, 2006; Sapienza & Korsgaard, 1996).

In sum, insights from interdependence theory and the VC literature suggest that while it may seem in the entrepreneur’s interest to misrepresent information to their investors, doing so may harm the investor-entrepreneur relationship. In the interest of maintaining a stable investment partnership, entrepreneurs should thus adopt a cooperative stance and provide what they consider to be accurate information to their investors.

Yet, notwithstanding the importance of cooperation, interdependence theorists equally insist on the dynamic nature of relationships and interactions (Kelley et al., 2003; Rusbult & Van Lange, 2003). In this sense they align with insights from the VC literature which underscore the dynamic nature of the entrepreneur-VC relationship (Sapienza, 1989). Frameworks that incorporate the dynamic process of the social relationships that develop between parties (such as interdependence theory) offer insight into where these relationships increase the probability of cooperation and mutual gain (Blatt, 2009; Cable & Shane, 1997), in a way that more static or contractual approaches such as agency theory cannot (Cable & Shane, 1997).

The dynamic nature of the entrepreneur-VC relationship has two important implications, which form the basis of our hypotheses: first, an entrepreneur’s incentive for cooperation will differ depending on the stage in the investment relationship; second, this incentive may also change depending on temptations that arise over time which may provide the entrepreneur with either a greater need or a greater opportunity to be overoptimistic, or both.

**Strategic Entrepreneurial Overoptimism and Time since Investment**

The first implication of relationship dynamism is that cooperation comes into being as partners learn to work together over time (Rapoport & Chammah, 1965). The length of any
relationship is important because it allows partners to assess each other’s past behaviors and to react contingently in the future. For example, anticipation of retaliation for noncooperative behavior may serve as an incentive to cooperate. In addition, the norm of reciprocity suggests that cooperative behavior will be matched by the other party. Based on the expected rewards associated with cooperative behavior, and the penalties associated with noncooperative behavior, research has established that the longer people interact, the more likely they are to cooperate (Axelrod, 2006; Van Lange, Klapwijk, & Van Munster, 2011).

Building on this line of reasoning we argue that a sense of partnership between entrepreneurs and investors will develop over time. This is consistent with entrepreneurs being less likely to behave opportunistically and investor-entrepreneur relationships being more likely to “move beyond just the formal financier-entrepreneur relationship” over time (Arthurs & Busenitz, 2003, p. 151). Consequently, the entrepreneur’s competitive behavior in the form of strategically conveying greater optimism to their investors should decline over time as they work together. We would further expect to see entrepreneurial overoptimism fall sharply in the first years of the investment relationship, and then level off.

Taking on a VC is a dramatic event in an entrepreneur’s life – they have to relinquish part of the control over their venture or “baby” (Arthurs & Busenitz, 2003). Additionally, negotiations with VCs tend to be tough; most investors impose harsh restrictions (De Clercq, Fried, Lehtonen, & Sapienza, 2006). Hence entrepreneurs may feel resentment towards their investors after the initial negotiation, and thus adopt a more competitive stance towards their investors. Conversely, as the relationship develops, they realize that they are in the same boat with their investors (e.g., Sapienza, 1989) and that their initial stance can only harm the relationship. Therefore, we posit that entrepreneurs’ tendency to intentionally misinform investors by providing overoptimistic
forecasts will decrease drastically, especially in the earlier stages of their investment relationship, and eventually stabilize at a much lower level. Thus:

*Hypothesis 1. Entrepreneurial overoptimism in forecasts provided to investors decreases over time and in a nonlinear fashion.*

**Strategic Entrepreneurial Overoptimism: Need and Opportunity**

Looking through the ‘dynamic’ lens at investor-entrepreneur relationships and interactions equally implies that over time temptations arise that change the partners’ incentives and provide an impetus to forego their mutual interests for the sake of self-interest, ultimately impeding cooperation (Kelley et al., 2003; Rusbult & Van Lange, 2003). Over time such temptations may prompt the entrepreneur to misrepresent information to their investors in the form of overoptimistic forecasts. Prior research on misrepresentation of information – outside the context of forecasting – suggests that individuals have an especially strong incentive to deceive others by providing inaccurate and dishonest information “when there is a greater need to serve one’s own interests or more opportunity to do so, or both” (Steinel & De Dreu, 2004, p. 420). We argue that in the context of the investor-entrepreneur relationship, a greater *need* arises when entrepreneurs are about to raise a new round of financing, and greater *opportunity* when there is less monitoring by investors.

*Strategic entrepreneurial overoptimism and new rounds of financing.* Complementary to the general incentive of entrepreneurs to work cooperatively with investors to maximize their mutual benefit and maintain a stable relationship, the benefit from taking a more competitive stance by providing overly-optimistic forecasts to investors likely varies over time. If there is variation in the personal benefit to present more optimistic forecasts, entrepreneurs will deviate
from the cooperative norm and selectively include strategic optimism in their projections. We posit that the incentive to take a more competitive stance towards investors and portray entrepreneurial firms’ prospects in a more favorable light is greater when firms approach a new round of financing.

While relatively little research has focused on financing rounds as a substantive variable, they are traditionally considered critical events for entrepreneurial firms (Forbes, Korsgaard, & Sapienza, 2010; Wasserman, 2003; 2006). Indeed the ability to raise financing is essential to the founding and survival of firms (Cassar, 2004). When entrepreneurs face financing constraints they may be unable to realize their ambitions or exploit the opportunities ahead (Carpenter & Petersen, 2002). Capital needs for building the business and fuelling growth include hiring employees, investing in research and development, bringing new technologies and products to the market, and building larger-scale production systems. Without capital, entrepreneurs are not only hindered in achieving these goals, but may also face a higher chance of failure. This significantly affects entrepreneurs since they have often invested substantial human and financial capital in a venture from its inception (Forbes et al., 2010). Their personal investment together with their intimate knowledge and control of the venture creates a strong psychological and emotional attachment to their ventures (Pierce, Kostova, & Dirks, 2001). Hence, given their high personal stakes when new financing is required, entrepreneurs have a particularly keen sense of protecting their self-interest. We posit that one way entrepreneurs do so is by providing more optimistic financial forecasts to the investor when approaching new rounds.

While generally entrepreneurs have incentives to secure the financing needed for starting and/or continuing their projects, investors only invest when the perceived returns are sufficient. Therefore entrepreneurs have an incentive to overstate their prospects, knowing that VCs will use such forecasts to inform their judgment, particularly given the uncertainty and lack of track
record commonly associated with entrepreneurial ventures (Rutherford, Buller, & Stebbins, 2009). Key investment criteria such as the market and return potential, which are supported by financial projections, underscore the importance of these forecasts and the overall positive portrayal of the venture’s prospects (e.g., Hall & Hofer, 1993; Tyebjee & Bruno, 1984). Projections of the financial performance of the venture are also used as a basis for deal negotiation and as such impact venture valuation and other deal terms (Fried & Hisrich, 1994; Sahlman, 1990). During the deal negotiation, it is in the interest of the entrepreneur to negotiate a high valuation in order to curb the VC’s share for a new investment. This again provides an incentive to provide an overoptimistic forecast. Indeed VCs typically discount the projections of entrepreneurs to offset their overoptimism (Smith, Smith, & Bliss, 2011). According to the renowned investor Guy Kawasaki, “An entrepreneur's projections are never conservative. If they were, they would be $0… As a rule of thumb, when I see a projection, I…multiply by .1” (Kawasaki, 2006).

In sum, the ability to raise new rounds of financing is critical for entrepreneurs. Their assumption that their financial projections will be used in the investment decision-making process of VCs provides an incentive to overstate future revenues in an effort to secure financing under the most favorable terms possible. Given that incentive, we posit that forecasts provided by entrepreneurs to investors before financing will be more optimistic.

Hypothesis 2. Entrepreneurial overoptimism in forecasts provided to investors increases when preceding new rounds of financing.

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2 Note that our argument does not require that these projections actually assist in securing funding, which research suggests it may not do (e.g., Kirsch, Goldfarb, & Kera, 2009; Shane & Cable, 2002), but rather that entrepreneurs believe that they may help.
**Strategic entrepreneurial overoptimism and investor monitoring.** VCs are important monitors of management in new and developing firms (Lerner, 1995). As large blockholders, they have a greater incentive to monitor entrepreneurs than dispersed owners (Zahra, 1996). VC monitoring often takes place through their representatives on the board of directors (Kaplan & Stromberg, 2003). But there is substantial variation in the degree of monitoring within the VC firm’s portfolio due to the fact that monitoring entrepreneurial behavior and actions is costly for investors (Sapienza et al., 1996). We argue that more active monitoring by investors – via their board membership – can prevent entrepreneurs from opportunistically biasing their forecasts. This reduces strategic entrepreneurial overoptimism for two reasons.

First, research in the social psychology realm (Steinel & De Dreu, 2004) suggests that individuals’ incentives to deceive others is not only influenced by the need, but also by the opportunity to do so. Applied to entrepreneurs strategically biasing forecasts provided to investors, this opportunity will be substantially reduced when investors have a seat on the board, whose key tasks include reviewing and assessing the accuracy of the information provided. As such, they protect the investors’ interests against the misrepresentation or masking of information on the part of the entrepreneur (Sapienza, Korsgaard, Goulet, & Hoogendam, 2000). This implies that VCs with a seat on the board will more closely scrutinize any information provided. Additionally, they will grow increasingly accurate in assessing information given their more intimate knowledge of the firm. Combining these increased capabilities to assess forecasts with the increased scrutiny of information related to their board presence, the likelihood of strategically biased financial forecasts going undetected should decrease. This would be consistent with findings on public firms indicating that managers’ public forecasts are more accurate when issued in a venue where they anticipate immediate scrutiny, such as a meeting
with analysts (Bamber & Cheon, 1998). Accordingly, we argue that a VC presence on the board is an important deterrent to overoptimistic forecasting by entrepreneurs.

Second, as VC investors become more actively involved, they are more likely to be seen by entrepreneurs as partners rather than as mere providers of financial resources. With more passive investors, entrepreneurs may be less likely to internalize the concerns of their investors (e.g., Forbes, 2005), prioritizing self-interest above that of the relationship. As a key interface through which entrepreneurs and investors interact (Rosenstein, 1988), board membership allows VCs to act as a sounding board and mentor for entrepreneurs (Sapienza et al., 1996), thereby fostering a deeper relationship, and making it less likely that entrepreneurs will intentionally want to mislead investors. Taken together, we posit:

_Hypothesis 3. Entrepreneurial overoptimism in forecasts provided to investors decreases when the investor has a seat on the board of directors._

**Strategic entrepreneurial overoptimism, new rounds and investor monitoring.** In addition to the separate roles of need and opportunity to deceive investors by providing a strategically overoptimistic forecast, these two factors may play a combined role. Specifically, whereas entrepreneurs may have an incentive to strategically bias their forecasts to investors when raising new financing, they do so at the risk of damaging the relationship. Consequently, entrepreneurs may not be willing to take this risk because of need alone; whether or not they have the opportunity to do so undetected may be an equally important factor. The risk of strategic entrepreneurial overoptimism being detected and its harmful consequences for the investor-entrepreneur relationship should weaken entrepreneurs’ incentives to pursue their self-interest when raising new funding, thereby reducing the expected surge in entrepreneurial overoptimism
at such moments. Conversely, prior to a new round of financing, entrepreneurs will be significantly more overoptimistic when investor monitoring is low since this offers them an opportunity to deceive their investors. We thus argue that entrepreneurs’ strategic overoptimism will generally be highest when they have both the need and opportunity to deceive their investors. Thus:

*Hypothesis 4. Forecasts provided to investors when preceding new rounds of financing will be less overoptimistic when the investor has a seat on the board of directors.*

**METHOD**

**Sample**

For the purpose of this study we obtained the cooperation of a large European VC firm. As of 1999, this VC firm started consistently recording annual financial accounting information on all its portfolio companies into an internal database. Through access to this database we compiled a sampling frame of 179 participations in private ventures held by the VC firm between 1999 and 2010. For each of these portfolio companies we use the VC’s internal database to retrieve all available yearly forecasted and realized financial account data starting from the year of VC investment up to a maximum of seven years thereafter (data was available up to 2010) or the time of exit. Given our interest in the evolution of entrepreneurial overoptimism over time, we excluded those firms for which we only had one observation (29 firms). After also excluding ventures missing data for the variables of interest (see below), we had a final sample of 82

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3 We excluded investments in real estate, other investment funds and non-profit ventures. We also excluded new investments made in 2010 in order to be able to gather ex post-realization data.

4 Note that out of the 179 participations held between 1999 and 2010, 46 were made prior to 1999 (in terms of initial investment). For these companies, data was thus collected from 1999 up to maximum six years after investment or exit if earlier than year six.
portfolio companies, representing 321 firm-year observations (ranging from two to eight forecasts per firm). Of these 82, 38 companies had been exited by January 2011.5

By focusing on one specific VC (for a similar approach, see, for example, Petty and Gruber, 2011), we improve the internal validity of our findings by excluding any effects from venture capitalist heterogeneity. However, it is informative to briefly discuss the representativeness and generalizability of our thesis and findings, noting that our unit of analysis is forecasts provided by entrepreneurs to venture capitalists. First, our data originates from a large VC firm that invests across a typical range of industries and in both new and established ventures. Specifically, most of its investments were in high-tech manufacturing (11.5%), other manufacturing (24.7%), wholesale (14.9%), computer (12.6%) and other services (26.4%). 36.4% of the VC’s initial investments were made at start-up, 33.4% at one to five years of age, 13.6% at six to ten years of age and 16.6% at an age of more than ten years. In 2011, the total amount invested (including follow-on rounds) in that year was €14.8 million and the total amount invested over the VC firm’s lifetime was over €100 million. For our sample firms the average initial amount invested was €523,853. While this VC’s investment scope is broad, we note that even if the types of ventures invested in were significantly constrained this would be of limited concern for our thesis for two reasons. First, entrepreneurs should have the same forecast incentives regardless of the specific VC firm. Second, while our ventures are concentrated in Western Europe, given a similar absence of differences in regulatory and business practices in other settings, there is no obvious reason why our theoretical arguments and findings would not

5 The final sample of 82 companies is representative for our sampling frame with no statistically significant differences in firm age at time of investment (t = .07, n.s.) and development stage (90% versus 93% had developed a prototype prior to funding, t = -.74, n.s.). Both groups of companies were also similar with regard to industry distribution; other services and other manufacturing are the two most represented industries, whereas agriculture, construction, retail and financial services are the least represented (each containing less than 5% of the subsamples).
apply to other geographic settings. However, given the geographic concentration of the data, the usual caveats apply.

**Dependent Variable**

*Overoptimism – forecast error.* We measure forecast error as the difference between yearly forecasted and realized revenues, divided by the sum of these two (as in Cassar, 2010). Entrepreneurial overoptimism or the forecasting error observation for year 2005 would thus be calculated based on the revenues forecasted for 2005 and the revenues realized by the end of 2005. The primary advantage of using the symmetric mean absolute percentage error for deflation rather than using only forecasted or realized revenues is the reduced susceptibility to extreme values that can occur when forecasting revenues of VC-backed firms. The forecasted revenues are obtained from the VC’s internal database and are provided by the entrepreneur to the VC at the start of every year. Realized or actual revenues are based on the companies’ financial accounts and were also obtained from the VC’s internal database.

Our decision to focus on (forecast errors in) revenues to investigate the favorable representation of forecasted information to investors is motivated by the fact that greater revenues is an unambiguously positive outcome that is critical to the eventual success of all growing VC-backed companies. Further, as opposed to profit, revenues are not influenced by accounting treatments of particular firm investments, such as R&D and capital expenditures. By having a constant forecast horizon of one year we also eliminate any potential influence of the length of forecast horizon on reported overoptimism (see, for example, Armstrong et al., 2007).
Independent Variables

*Time since investment.* We measure time on the basis of the year in which the VC firm made its first investment. Given our sample restrictions, this variable ranges between zero and seven years. To capture the expected non-linear effect of time, we use the natural logarithm of time since investment plus one.

*New round.* The incentive for entrepreneurs to strategically increase the optimism reported to financers is captured by the variable *New Round* coded one if the firm raises financing in the year under consideration, and zero otherwise. Thus, if a new round occurs in 2005, then forecasts made at the end of 2004 (for 2005) are likely biased in the case of a strategic incentive on the entrepreneur’s part.

*Monitoring.* The degree of monitoring is captured by the presence of a venture capitalist on the board of directors. This variable is dynamic in that we noted the presence or absence of a VC on the board for every one of the relevant forecast years. A VC is on the board of directors in 37 percent of our forecast years.

Control Variables

We control for several factors that may influence the optimism of an entrepreneur’s forecast. Research suggests that as the forecasting task becomes more uncertain, accuracy

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6 One concern may be that forecast optimism affects the likelihood of obtaining financing. While entrepreneurs may believe this to be true, anecdotal evidence suggests that VCs are not fooled by entrepreneurs’ overoptimistic forecasts in that they traditionally discount these projections by a standard percentage (Kawasaki, 2006; Smith et al., 2011). Consistent with this, prior research found that entrepreneurs’ claims about their opportunities’ value nor their business planning documents affect investors’ funding decisions (Kirsch et al., 2009; Shane & Cable, 2002). If VCs are indeed not fooled by entrepreneurial overoptimism, then the latter should have no effect on the probability of raising a new round of financing and reverse causality should not affect our results. To rule out this alternative causality, we ran a probit regression (with clustered standard errors) predicting the likelihood of obtaining a new round controlling for year and industry effects as well as the firm and entrepreneurial controls from the main models. Consistent with prior research, we find that entrepreneurial overoptimism does not significantly affect the probability of raising a new round of VC financing ($\chi^2 = 89.30, p < .001$; entrepreneurial overoptimism $\beta = .40, \text{n.s.}$).
declines and optimism increases (Kahneman, Slovic & Tversky, 1982). We therefore include firm age (plus 1) and total assets to capture forecast uncertainty (both ln). The characteristics of the entrepreneurs concerned may also affect forecast optimism (e.g., Cassar, 2010). To take this into account, we include controls for the number of entrepreneurs and their average age. We obtained entrepreneurial characteristics from files the VC firm holds on all its prior and current portfolio companies, including information related to initial business plans submitted to the VC and investment proposals brought to the investment committee.

Forecast errors may also vary systematically if some of our sample firms are exposed to similar idiosyncratic stocks in the economic, environmental or technological conditions (Cassar, 2013). Therefore we include industry fixed effects (high-tech manufacturing; other manufacturing (reference category); transportation, communication, electric, gas and sanitary services; wholesale trade; retail trade; computer services; other services) to control for industry heterogeneity.7 We also include calendar year fixed effects to control for time-varying optimism as VC investment, economic conditions and sentiment are generally positively associated over time (Gompers, Kovner, Lerner, & Scharfstein, 2008). Hence any observed association between new financing and optimism may be driven by the clustering of new round financing during periods of strong economic sentiment. The inclusion of time-varying controls allows the research design to decouple the extent to which reported optimism is driven by our hypothesized effects versus time-varying optimism and potential clustering of new rounds during periods of strong economic sentiment. Table 1 provides the distribution of revenue forecast errors and number of new financing rounds for our sample by calendar year. As shown, there is no obvious clustering

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7 Industries were coded based on the portfolio companies’ primary two-digit SIC codes. Based on Carpenter and Petersen (2002), we define high-tech manufacturing as corresponding with SIC 28, 35, 36 and 38.
of forecast errors or of new round financing over time during our sample period. Regardless of this we include year fixed effects in our analyses.

Finally, panel datasets often suffer from sample attrition, and this is no different for our study – companies could drop out of the panel due to, for instance, the firm failing or the VC exiting the portfolio company during our observation period. To correct for this we used a Heckman selection model to predict the probability of the firm still being present in the next wave and included the generated correction variable, the inverse Mills ratio, in our regression models. We modeled the probability of being present in the next wave as a function of firm age (ln), firm size (ln) and a bankruptcy probability score as assessed annually by the responsible investment manager (the latter was also retrieved from the VC’s internal database, scored from 1 to 5, with a higher score indicating a higher estimated probability of bankruptcy).

**Estimation Method**

Consistent with prior research using unbalanced panel data (e.g., Philippe & Durand, 2011; Vergne, 2012; Yang, Zheng, & Zhao, 2013), we use feasible generalized least squared (FGLS) regression models. While panel data have many advantages such as capturing dynamic effects, they also tend to suffer from problems such as heteroskedasticity and serial correlation. A Wooldridge test and a likelihood ratio test indicate the presence of autocorrelation and heteroskedasticity. We also computed the Sargan-Hansen (SH) statistic as an alternative to the traditionally used Hausman test as the latter is not robust to heteroskedasticity. A random effects estimator was preferred to a fixed effects one as the SH test yielded a statistically non-significant result (SH = 12.11, n.s.), supporting the use of random effects. Combined with the issues of
autocorrelation and heteroskedasticity, we therefore relied on FGLS (Wooldridge, 2002). To verify the robustness of our results we also estimated the models using a generalized least squares model with random effects with robust standard errors that account for within-panel serial correlation. Additionally, we used a generalized estimation equation (GEE) approach. To implement this approach we specified an identity link function and used the exchangeable correlation as the working correlation matrix with robust standard errors. Results using these alternative estimation methods are statistically similar to the FGLS ones reported below.

**RESULTS**

Table 2 reports the means, standard deviations and correlations of all relevant variables, except for calendar year and industry dummies. We also include absolute revenue forecast error (AFE) as a further validity check of our data. Specifically, consistent with existing evidence we observe that older and larger ventures have (significantly) better forecast accuracy. Variance inflation factor (VIF) scores (all below 5) suggested that multicollinearity was not a cause for concern.

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<th>Insert Table 2 about here</th>
</tr>
</thead>
</table>

Consistent with entrepreneurs generally providing overoptimistic revenue forecasts to investors, the overall unconditional mean revenue forecast error is 0.10 (s.d. 0.23, p < .001), with 68.54% (31.46%) over(under) estimating one-year-ahead revenues. The unconditional mean revenue forecast error in year 0 is 0.16 (s.d. 0.30, p <.001). Consistent with our ex-ante concerns of deflator-induced skewness, if we deflate the forecast error by realized revenues, instead of symmetric deflation, the resultant forecast error is highly positively skewed with a mean of 6.03 (s.d. 81.83, max 1436.13).
Table 3 provides the mean revenue forecast error conditional on the ventures receiving a new round of financing and the presence of a VC on the board of directors. We provide these conditional means to highlight the significant variation in mean forecast errors across these classifications, which is consistent with entrepreneurs providing more optimistic forecasts when their incentives to do so are greater, i.e. when preceding new rounds and when VC monitoring is weaker (mean revenue forecast error is 0.19, p <.001). These relations are formally examined below.

Table 4 presents the results of our FGLS analyses. Model 1 includes control variables only. In Model 2 we add in the main effects and in Model 3 we add the interaction effect to capture the combined effect of need and opportunity on reported optimism.

Hypothesis 1 predicts that entrepreneurial overoptimism will decrease over time in a nonlinear fashion. Model 2 shows that there is indeed a significant nonlinear and negative relationship between time since investment and entrepreneurial overoptimism, supporting Hypothesis 1. Hypothesis 2 predicts a positive effect of new round financing on entrepreneurial overoptimism. The non-significant result in Model 2 is inconsistent with this hypothesis and suggests that a greater need to provide optimistic forecasts to investors does not influence actual reported optimism by entrepreneurs. We do, however, find support for Hypothesis 3 which predicts that entrepreneurial overoptimism decreases when a VC has a seat on the board of directors; in Model 2 we find a statistically significant negative effect of board presence on
entrepreneurial overoptimism. However, as shown below, Model 2 alone provides an incomplete description of the role of need and opportunity on reported optimism.

Model 3 allows entrepreneurial overoptimism to vary by need (new rounds of financing), opportunity (monitoring) and the interaction between the two. In contrast to Model 2, this shows a significant positive association between new round financing and entrepreneurial overoptimism ($\beta = .04$, $p = .06$) for firms without a VC presence on the board of directors. Further, it shows that the presence of a VC on the board significantly reduces entrepreneurial overoptimism in VC-backed firms when preceding times of financing ($\beta = -.10$, $p < .001$). These results support Hypothesis 4.

Taken together, the results in Table 4 yield the important insight that the lack of support for Hypothesis 2 in Model 2 is partly driven by firms that have a VC presence on the board of directors. As shown in Model 2, new round financing has a limited influence on overoptimism when constraining the effect to be equal across all firms. However, when we separate the role of new rounds on forecasts for firms that are and are not monitored by VCs on the board of directors, as we do in Model 3, the influence of new rounds becomes clearer. Specifically, the results show that the incentive for entrepreneurs to forecast more optimistically when approaching new rounds of financing results in greater optimism only when they are not monitored by their VC. Figure 1 provides a graphic summary of the empirical relation between entrepreneurial overoptimism, new rounds and monitoring.
DISCUSSION

In this study we set out to investigate under which conditions entrepreneurs provide more optimistic forecasts to their venture capital investors. We posited that entrepreneurs behave less strategically in providing overoptimistic forecasts to their investors when they work together over a longer period of time; and more strategically when there is a greater need to do so based on serving their self-interest as well as a greater opportunity to do so. For this purpose we used a unique database comprising longitudinal data on the forecasted and realized revenues in the portfolio companies of a large European venture capital firm. We found that entrepreneurial overoptimism decreased over time non-linearly, and that when entrepreneurs were about to raise a new round of financing (i.e. greater need) they were significantly more optimistic, but only when they are not monitored by a VC on the board of directors. Investor monitoring helped somewhat in reducing entrepreneurial overoptimism overall, but especially so when approaching a new round of funding. In short, both need and opportunity influenced the forecasting behavior of entrepreneurs.

We consider these findings to be of interest for several reasons. First, prior research has suggested that entrepreneurs are naively overoptimistic when evaluating their ventures’ prospects, whether due to being generally optimistic in nature (e.g., Cooper et al., 1988; Hmieleski & Baron, 2009), being overconfident when starting and running a business (e.g., Busenitz & Barney, 1997; Forbes, 2005), or self-selecting into entrepreneurship (e.g., Van den Steen, 2004). None of these explanations account for more strategic considerations of entrepreneurs when they are preparing forecasts and deciding on the level of optimism conveyed therein to investors. Person-centric theories of entrepreneurial overoptimism ignore the strategic forces at play when entrepreneurs communicate with their investors. The substantial variations identified in this study, depending on whether entrepreneurs are about to raise new funding and
whether the investor has a seat on the board (ranging from -0.00 to 0.19 as shown in Table 3), add nuance to the overoptimism story. By investigating these issues we progress the literature on entrepreneurial overoptimism; we advance theory beyond the portrayal of entrepreneurs as naïve optimists and show that need and opportunity play a key role in the optimism of entrepreneurial projections conveyed to stakeholders.

Second, we underscore the importance of the quest for (new) funding in explaining entrepreneurs’ behavior towards their investors. When investor monitoring is high, the risk of strategic biasing being detected outweighs the desire to impress investors (so as to secure new financing at favorable terms) so entrepreneurial overoptimism is curbed. Indeed, not only is it curbed in these circumstances, but entrepreneurs become even more conservative than in a non-financing period. A possible explanation for this effect could be that when there is less of an opportunity to deceive investors, entrepreneurs may prefer another route to impress investors (when seeking a new round of financing) by providing realistic forecasts, thereby signaling trustworthiness and credibility. In so doing, we respond to the call for more fundamental research on financing rounds in entrepreneurial ventures as a key event in the venture cycle, and in the investor-entrepreneur relationship (Forbes et al., 2010; Wasserman, 2003). Thus far, research related to financing rounds has mainly focused on their role as a monitoring device (i.e. staged financing) (e.g., Tian, 2011). Recent exceptions include Forbes et al. (2010), who showed that new rounds could trigger conflict within the board, and Wasserman (2003) who showed that new rounds could trigger founder replacement. Our study extends this research stream, notably the work of Forbes et al. (2010), to show the substantial impact that the prospect of a new round of funding can exert on entrepreneurs’ behavior towards and interaction with investors.

Third, our findings support the basic predictions of interdependence theory that interpersonal properties of a situation, including what one is trying to achieve with the other
party, will have an important impact on the interaction between, and behavior of, the parties involved (Kelley & Thibaut, 1978; Thibaut & Kelley, 1959). Hence, whether or not entrepreneurs behave overoptimistically should not just be approached from a person-centric perspective by looking at their individual characteristics, but should also take into account their specific situation, such as the investors they have on board and what they are trying to accomplish with those investors. Not only does this advance the literature on entrepreneurial overoptimism, it also informs the broader investigation of how entrepreneurs portray their ventures’ prospects to potential and actual stakeholders. Specifically, our evidence suggests that strategic representation choices trade-off incentives (self-interest) and costs (harm to the relationship) that vary over time and therefore lead to different choices depending on the current and expected circumstances of the venture.

Finally, our findings have major implications for the literature on deception in general, and, in particular, on situations where partners have an incentive to deceive each other, notably by misrepresenting financial information. We demonstrate that both need and opportunity influence intentional deception. Our findings translate especially well to bargaining situations, such as those between acquirers and targets, manufacturers and distributors, suppliers and buyers, where the exchange of accurate financial information is key to sound decision making. Specifically, as the need for financial resources increases and the scrutiny of the information-receiver diminishes, the likelihood of deception/misrepresentation of financial information will rise. Future research could also explore to what extent these findings can be extended to the acquisition of other resources such as human resources and to specific forms of monitoring.
Limitations, Future Research and Implications

This study is not without limitations, which in turn offer opportunities for future research. First, although we establish how raising new financing connects with investor monitoring to predict entrepreneurial overoptimism, we do not examine the underlying mechanisms through which we expect this to occur. Future research could explore these mediating mechanisms by measuring factors such as entrepreneurs’ perceptions of how more optimistic forecasts may influence the investor decision-making process, as well as their perceptions of their ability to fool investors.

Additionally, reverse causality and endogeneity may be a potential concern. As an example, if entrepreneurs who are seeking to raise new financing fail to do so, this might influence firm performance (e.g., realized revenue). Given that entrepreneurs’ forecasts are based on the amount of financing they expected to raise, they may turn out to be more optimistic. Such alternative explanations are unlikely, however, for at least two reasons. First, we have focused on forecast errors in revenues (as opposed to total assets or profit) precisely to reduce these concerns. Over a short horizon, realized revenue is unlikely to be affected by the receipt of new funding. Rather, ventures invest new money in advancing existing projects or initiating new projects, hence it will take time for new financing to translate into increased revenue. Second, our study confirms that, when seeking new financing, only entrepreneurs who are not closely monitored by VC investors are more optimistic in their projections; those who are under close scrutiny are actually more realistic. This contingency serves to strengthen the explanations we advance relative to alternative, endogenous explanations.

Finally, one may argue that our measure of monitoring, while consistent with Lerner (1995), is rather crude because it only captures whether a VC investor is on the board or not. We recognize there is a vast amount of research that highlights the importance of board composition
for ventures’ critical decisions (Deutsch, 2005). Future studies could, for instance, examine whether the proportion of outside directors plays a role, or whether who else (e.g., types of investors) is on the board has an impact. Despite this additional heterogeneity of the board, whether a VC is on the board or not is probably of first order importance for VC-backed companies. Indeed, the board is often considered as the interface through which entrepreneurs and VC investors interact (e.g., Rosenstein, 1988).

In addition to addressing these shortcomings, future research may also want to extend some of this study’s implications to other situations where entrepreneurs may want to favorably portray themselves to investors. For instance, there is some debate on the role of passion in entrepreneurial pitches and whether or not it helps to secure funding (e.g., Chen, Yao, & Kotha, 2009; Mitteness, Cardon, & Sudek, 2012). A fruitful avenue for future research may be to explore whether entrepreneurs may strategically choose to display more passion, along the lines of ‘emotional labor’, rather than authentically feeling it. Moreover, drawing on the insights here, one could explore when such behavior is more likely (e.g., when would entrepreneurs perceive a need to display more passion to investors). Researchers could thus theorize and exploit temporal variations in entrepreneurs’ incentives and monitoring to predict how they should portray their firm’s prospects to stakeholders.

Our paper has a number of practical implications. For venture capital investors, it confirms the oft-repeated view that entrepreneurs tend to be overoptimistic when presenting their financial forecasts. Two somewhat less obvious findings are, firstly, that our insight into the mean forecasting error across the four conditions of interest (i.e. no new round-no board; no new round-board; new round-no board; new round-board, see Table 3) reveals that when entrepreneurs are about to raise new financing, active monitoring by the VC firm pays off since it prompts the entrepreneurs to provide accurate forecasts. In this way we inform the debate on
whether reputational concerns and monitoring efforts can limit strategic forecasting where there is an incentive to maintain a strong entrepreneur-financier relationship. Our evidence suggests that the existence of such a relationship does not in and of itself eliminate strategic optimism, but that tighter monitoring by investors reduces overoptimism when the incentive to report optimistically is higher.

Second, the significant variation in entrepreneurial overoptimism (according to these conditions and over time) suggests that the tendency of investors to apply a fixed discount to forecasts is inappropriate. Such a one-size-fits-all approach may in some cases result in substantially overestimating overoptimism (underestimating the true potential of the venture), while in others underestimating overoptimism (and the venture’s potential overestimated). The findings of our study should allow for more accurate decision-making (e.g., funding decisions) on the part of investors. As for entrepreneurs, many negotiations with venture capitalists fail because entrepreneurs believe investors are too pessimistic and undervalue their venture given the expectations envisaged in their business plans. Our findings, however, demonstrate that entrepreneurs should not be surprised when venture capitalists employ significant discounts on the figures in their business plan, given that these figures are, on average, indeed very optimistic.

REFERENCES


### TABLE 1
Number of New Round Observations by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of New Rounds in this Year</th>
<th>Number of Forecast Error Observations in this Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>2000</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>2001</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>2002</td>
<td>12</td>
<td>36</td>
</tr>
<tr>
<td>2003</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>2004</td>
<td>7</td>
<td>34</td>
</tr>
<tr>
<td>2005</td>
<td>6</td>
<td>34</td>
</tr>
<tr>
<td>2006</td>
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<td>27</td>
</tr>
<tr>
<td>2007</td>
<td>9</td>
<td>31</td>
</tr>
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<td>2008</td>
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<td>2009</td>
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<td>23</td>
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<tr>
<td>2010</td>
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<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>21</td>
</tr>
</tbody>
</table>

### TABLE 2
Descriptive Statistics and Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>s.d.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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</thead>
<tbody>
<tr>
<td>1. Firm Age&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.06</td>
<td>0.96</td>
<td>-</td>
<td>7</td>
<td>3.5</td>
<td>3.5</td>
<td>5.3</td>
<td>5.3</td>
<td>6.0</td>
<td>6.0</td>
<td>7.0</td>
</tr>
<tr>
<td>2. Total Assets&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.24</td>
<td>1.73</td>
<td>.44</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Number of Entrepreneurs</td>
<td>1.56</td>
<td>0.73</td>
<td>-.29</td>
<td>-.18</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. Average Entrepreneur Age</td>
<td>43.87</td>
<td>7.76</td>
<td>.20</td>
<td>.34</td>
<td>.06</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Time since Investment&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.09</td>
<td>0.65</td>
<td>.45</td>
<td>.20</td>
<td>-.21</td>
<td>.22</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6. Inverse Mills</td>
<td>0.35</td>
<td>0.12</td>
<td>-.22</td>
<td>-.43</td>
<td>.17</td>
<td>-.01</td>
<td>.00</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. New Round&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.30</td>
<td>0.46</td>
<td>-.28</td>
<td>-.08</td>
<td>.21</td>
<td>-.07</td>
<td>-.60</td>
<td>.04</td>
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<td></td>
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<tr>
<td>8. Board of Directors&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.37</td>
<td>0.48</td>
<td>.40</td>
<td>.64</td>
<td>-.26</td>
<td>.25</td>
<td>.15</td>
<td>-.22</td>
<td>-.11</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9. Absolute Revenue Forecast Error</td>
<td>0.15</td>
<td>0.20</td>
<td>-.34</td>
<td>-.35</td>
<td>.17</td>
<td>-.10</td>
<td>-.21</td>
<td>.35</td>
<td>.20</td>
<td>-.27</td>
<td>-</td>
</tr>
<tr>
<td>10. Entrepreneurial Overoptimism (Revenue Forecast Error)</td>
<td>0.10</td>
<td>0.23</td>
<td>-.25</td>
<td>-.25</td>
<td>.14</td>
<td>-.01</td>
<td>-.16</td>
<td>.36</td>
<td>.11</td>
<td>-.24</td>
<td>.71</td>
</tr>
</tbody>
</table>

<sup>a</sup> Number of observations = 321. Correlations above 0.14 are significant at p < .05. Year and industry dummies are not reported.
<sup>b</sup> Logarithm.
<sup>c</sup> Dummy variable.
**TABLE 3**  
Mean Entrepreneurial Overoptimism by New Round and Board of Directors

<table>
<thead>
<tr>
<th>VC Member of Board of Directors</th>
<th>New Round of Financing</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>0.11***</td>
<td>0.19***</td>
</tr>
<tr>
<td>Yes</td>
<td>0.03**</td>
<td>-0.00</td>
</tr>
</tbody>
</table>

*** p <.001  
** p <.01

**TABLE 4**  
Results of FGLS Analyses Predicting Entrepreneurial Overoptimism$^a$

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-.14 (.10)</td>
<td>.01 (.11)</td>
<td>-.04 (.11)</td>
</tr>
<tr>
<td>Firm Age$^b$</td>
<td>-.02** (.01)</td>
<td>-.02† (.01)</td>
<td>-.01 (.01)</td>
</tr>
<tr>
<td>Total Assets$^b$</td>
<td>-.02** (.01)</td>
<td>-.01 (.01)</td>
<td>-.01 (.01)</td>
</tr>
<tr>
<td>Number of Entrepreneurs</td>
<td>.01 (.01)</td>
<td>.01 (.01)</td>
<td>.00 (.01)</td>
</tr>
<tr>
<td>Average Entrepreneur Age</td>
<td>.00† (.00)</td>
<td>.00* (.00)</td>
<td>.00* (.00)</td>
</tr>
<tr>
<td>Inverse Mills</td>
<td>.36*** (.07)</td>
<td>.42*** (.07)</td>
<td>.44*** (.07)</td>
</tr>
<tr>
<td>Time since Investment$^b$</td>
<td>-.03** (.01)</td>
<td>-.03** (.01)</td>
<td>-.03** (.01)</td>
</tr>
<tr>
<td>New Round</td>
<td>-.01 (.1)</td>
<td>.04† (.02)</td>
<td></td>
</tr>
<tr>
<td>Board of Directors</td>
<td>-.03† (.02)</td>
<td>-.02 (.02)</td>
<td></td>
</tr>
<tr>
<td>New Round x Board of Directors</td>
<td></td>
<td>-.10*** (.03)</td>
<td></td>
</tr>
<tr>
<td>Industry dummies included</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year dummies included</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Wald $\chi^2$</td>
<td>100.91***</td>
<td>115.74***</td>
<td>141.98***</td>
</tr>
</tbody>
</table>

$^a$ Number of observations = 321; number of firms = 82. Two-tailed tests.  
$^b$ Logarithm.  
† p <.10  
* p <.05  
** p <.01  
*** p <.001
FIGURE 1
Entrepreneurial Overoptimism as a Function of New Round Financing and VC on the Board of Directors