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From the crowd to the market: The role of reward-based crowdfunding performance in attracting professional investors

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ABSTRACT

We focus on new technology-based entrepreneurial ventures engaging in reward-based crowdfunding and examine the effect of their performance in such funding channel on the likelihood of securing subsequent funding from professional investors. We also study how this effect is influenced by the presence of patents granted for the new product idea and the entrepreneur social capital. Results from a sample of technology projects launched on Kickstarter demonstrate that pledging a higher amount of money in crowdfunding can ignite professional investors' interest and thus help secure subsequent funding. However, this positive evidence is effective only when complemented by the presence of patents or a large network of social ties.

1. Introduction

Crowdfunding is a novel method for funding a variety of new projects, allowing founders of for-profit, cultural, or social projects to solicit funding from many individuals, i.e., the crowd, in return for future products/rewards or equity (Mollick, 2014). Interestingly, crowdfunding projects can vary substantially in both goal and magnitude, ranging from small artistic projects to new entrepreneurial initiatives seeking hundreds of thousands of dollars in seed capital (Schwienbacher and Larralde, 2012). The impressive impact of crowdfunding is quantified by some striking figures. Indeed, the amount of money raised in crowdfunding reached about $16 billions across the globe in 2014 and it is expected to grow dramatically in the next few years (Barnett, 2015). Two forms of crowdfunding currently dominate the scene: reward-based (or product-based) crowdfunding and equity-based crowdfunding (Belleflamme et al., 2014). In the first form, e.g., Kickstarter, entrepreneurs solicit individuals to fund their projects in exchange for rewards commensurate with the level of funding provided. Typical rewards comprise the product that will be commercialized by the entrepreneur if the project is successful. In the second form of crowdfunding, e.g., Crowdfunder, entrepreneurs ask individuals to finance the project in exchange for a share of equity securities.

Due to the extraordinary pace at which crowdfunding is growing and the consequent number of large-scale initiatives taken in several countries, e.g., the JOBS act in the US, academic research has recently commenced investigating the multi-faceted nature of this phenomenon. Particularly, a few empirical studies have examined the determinants of success of crowdfunding campaigns (Mollick, 2014; Ahlers et al., 2015; Colombo et al., 2015), whereas other works have explored the underlying dynamics behind the behavior of contributors of such campaigns, i.e., the backers, (Ordanini et al., 2011; Burtch et al., 2013; Agrawal et al., 2014b; Burtch et al., 2015; Cholakova and Clarysse, 2015; Kuppuswamy and Bayus, 2015). Furthermore, scholars have also investigated the differences in the way backers assess the quality of artistic projects as compared with art experts (Mollick and Nanda, 2016). Finally, a few theoretical studies have focused on the comparison of different forms of crowdfunding (Belleflamme et al., 2014).

While the extant literature has certainly enhanced our understanding of the internal dynamics of a crowdfunding campaign, scant attention has been devoted to the intriguing relationship between the crowdfunding phenomenon and traditional forms of new venture financing, such as angel and VC investments.[1] In particular, little is known on whether, for new technology-based entrepreneurial ventures utilizing reward-based crowdfunding, a better performance in such funding channel can increase the likelihood to secure subsequent (real) investments from professionally organized financial resource providers, such as angel and VC investors (hereafter referred to as professional investors in line with the prior literature, e.g., Nofsinger and Wang, 2011; Kotha and George, 2012). Indeed, many projects in reward-based crowdfunding platforms, e.g., Kickstarter, are launched by new entrepreneurial ventures that aim at marketing innovative technology-

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[1] A notable exception is Drover et al. (2017), who use experiments to understand whether various angel and crowdfunding attributes influence VCs' early-stage screening decisions.

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based products for the mass market. For these projects, crowdfunding can only broaden the "friends and family" slice of informal investing (Shane, 2013) as the amount raised by single projects in these platforms is usually below $1 million (Caldbeck, 2013). Thereby, tech entrepreneurs naturally need to rely on subsequent rounds of funding from professional investors to lead to growth and large-scale production (Segarra, 2013; Drover et al., 2017). Under the circumstances, reward-based crowdfunding can provide entrepreneurs and potential professional investors with information about the value placed by potential future customers on the new product idea, which helps dissipate the surrounding noise in terms of market potential (Agrawal et al., 2014a). In support of this view, Barry Schuler, managing director of DFJ Growth, a company investing in Formlabs, a low cost 3D-printing startup that raised $2.95 million on Kickstarter in 2012, referred to the crowdfunding campaign as "an ultimate test market" (Cao, 2014). Similar views have been expressed by other venture capitalists, such as Chris Arsenault from iNovia Capital and Alfred Lin from Sequoia Capital (Immen, 2012; Kolodny, 2013). In the same vein, serial tech entrepreneur Phil Windley echoed: "The primary reason I like the idea of Kickstarter is that it validates an idea. […] The money we'll make is likely small potatoes compared to what we'd raise in a typical funding scenario […]. But the big payoff is the information about the potential market we'll get" (Conner, 2013).

In this paper, we focus on new technology-based entrepreneurial ventures engaging in reward-based crowdfunding, and examine how their performance in such funding channel influences the access to subsequent funding from professional investors. We also study how the effect of the performance in the crowdfunding campaign is influenced by two crucial determinants of new venture financing that have been extensively underscored in the prior literature, namely the presence of patents granted for the given product idea (Lee et al., 2001; Baum and Silverman, 2004; Heeley et al., 2007; Graham and Sichelman, 2008; Helmers and Rogers, 2011; Conti et al., 2013a,b; Hsu and Ziedonis, 2013; Haeussler et al., 2014) and the entrepreneur social capital (Venkataraman, 1997; Stuart et al., 1999; Uzzi, 1999; Shane and Cable, 2002; Shane and Stuart, 2002; Batjargal and Liu, 2004).

Hence, our contribution is twofold. First, we add to the nascent literature on crowdfunding by shedding light on the informative role of the performance in reward-based crowdfunding for professional investors. In this respect, the present research also contributes to the extant literature on the determinants of new technology-based venture financing by introducing a new element at disposal of professional investors for their funding decisions, namely the performance in the crowdfunding campaign. We argue that, for new technology-based entrepreneurial ventures engaging in reward-based crowdfunding, a superior performance should be associated with a more probable access to funding from professional investors. This is because the crowdfunding performance can supplement the role of existing signals by informing about the quality aspect related to the market potential of the new venture's product idea, and thus alleviating this type of uncertainty suffering professional investors. Second, we offer unique contribution by proposing that, for new technology-based entrepreneurial ventures engaging in reward-based crowdfunding, the performance in the crowdfunding campaign and the two above mentioned determinants of new venture financing (i.e., patents and entrepreneur social capital) act as complements as the latter two inform about different quality aspects of the new venture and thus diminish different types of uncertainties. Specifically, patents unveil new venture's technological capabilities, and thus reduce the uncertainty about the technological viability of the new product idea and its value appropriability. The entrepreneur social capital alleviates the uncertainty about the new venture's capabilities to access the resources required to successfully implement the business initiative.

To test our arguments we considered all the entrepreneurial projects falling in the category Technology of the most important reward-based crowdfunding platform worldwide, i.e., Kickstarter, in a period ranging from its inception to the end of 2012. For each of the 105 technology-based entrepreneurial projects included in our final sample, we gathered data on funding (e.g., seed capital, Series A, B, …, mezzanine) received from professional investors after the crowdfunding campaign, the amount of money pledged (i.e., the amount reached at the end of the campaign), which is our main measure of performance reflecting the informative role of reward-based crowdfunding, the patents granted for the given new product idea, the entrepreneur social capital, and a number of additional controlling factors. In our setting potential endogeneity may arise as a consequence of omitted aspects of the new venture that are possibly correlated with both crowdfunding performance and ex-post financing from professional investors. To mitigate this risk, we carefully monitor each entrepreneurial project and its related events for sufficiently long periods before, during, and after the crowdfunding campaign. We also control for the quality aspects of the entrepreneurial project using the set of new venture's attributes suggested in the prior literature on new venture financing (Baum and Silverman, 2004) and on crowdfunding (Ahlers et al., 2015). In addition, we provide strong evidence that our results are robust and are unlikely to suffer from endogeneity bias with the support of carefully chosen Instrumental Variables (IVs) and the Heckman selection model.

Our results reveal that pledging a higher amount of money in the crowdfunding campaign can ignite professional investors' interest and thus help new technology-based entrepreneurial ventures secure subsequent funding. However, interestingly, this positive effect emerges (and becomes more intense) only when it is complemented by the presence of patents granted for the new product idea, which proves technological viability and exclusive protection, or when the entrepreneur has built a large network of social relationships and thus can benefit from a large pool of strategic resources. This suggests that, while professional investors interpret the relevant performance in crowdfunding as a positive signal from the market, they still need to be reassured about the real new ventures' capabilities to successfully implement the business initiative and profitably capture the relative value revealed by the crowd.

The remainder of the paper unfolds as follows. In § 2 we present our theoretical arguments and the relative hypotheses. In § 3, we describe the data, the variables and the methods adopted in this paper. In § 4, we present our empirical findings. In § 5, we resort to IVs and the Heckman selection model to further address endogeneity concerns, and perform a number of additional analyses for robustness checks. Finally, we provide implications for theory and practice and conclude in § 6.

2. Theory and hypotheses

2.1. The role of the performance in reward-based crowdfunding

A central tenet in the entrepreneurship literature is that because the quality of new ventures often cannot be observed directly, professional investors need to heavily rely on observable attributes to infer about the overall quality of a new entrepreneurial project and reduce the numerous sources of uncertainty (e.g., technology, market, competition, resource availability, entrepreneur capabilities) surrounding it (Stuart et al., 1999; Shane and Cable, 2002; Baum and Silverman, 2004; Hsu and Ziedonis, 2013; Ahlers et al., 2015). Several attributes have been found to positively influence new entrepreneurial venture attractiveness to potential professional investors, including entrepreneur human and social capital, the initial money raised from friends and family, as well as the presence of patents (Stuart et al., 1999; Shane and Venkataraman, 2000; Shane and Cable, 2002; Hsu, 2007; Conti et al., 2013a,b; Helmers and Rogers, 2011; Hsu and Ziedonis, 2013; Haeussler et al., 2014). These attributes help unveil relevant quality aspects of the new venture and thus are certainly important to alleviate professional investors' uncertainty and potential information asymmetries. However, they provide relatively scarce, or at least indirect, indications on the new venture's quality aspect that specifically pertains to the value

the market places on the output of the entrepreneurial project. Thus, they may be unable to effectively mitigate the portion of uncertainty related to the market potential of the new entrepreneurial project. Still, the knowledge of the market potential is of primary interest to professional investors. Indeed, there is considerable evidence that professional investors seek objectively verifiable information about new ventures' ability to meet a market need, such as whether ventures have established contacts with potential customers, or whether they have started their selling activities, thus demonstrating that customers are willing to pay for the given new product (Sahlman, 1990; Eckhardt et al., 2006). Particularly, VCs many times do not invest until a company has validated the market and gained traction (Lockett et al., 2002; Grant, 2013).

We argue that, at least for entrepreneurial projects aimed at marketing innovative technology-based products on a large scale, reward-based crowdfunding can supplement the role of existing signals by intervening specifically in the portion of uncertainty related to the market response. Indeed, these projects naturally require large capital to enable product development, large-scale production and commercialization. As tech entrepreneurs can only raise initial capital through crowdfunding (Caldbeck, 2013), they have to rely on subsequent rounds of funding from professional investors to scale up (Segarra, 2013; Drover et al., 2017). In this case, in addition to its money raising function, reward-based crowdfunding can provide professional investors with an effective way to gather direct information about the interest and valuation consumers place on the new product idea, thus serving to them as a vehicle to validate (or invalidate) the entrepreneurial project from a market perspective, before (possibly) providing supplemental capital.

The informational value of reward-based crowdfunding is due to the nature of this type of funding channel. Indeed, given that the rewards in reward-based crowdfunding campaigns are often tied to the products that technology-based new ventures aim at commercializing, backers usually represent customers who show real interest in the new product idea by committing themselves to invest a considerable amount of money to "buy" the product early in advance at some risk. It is well known from economics and marketing literature that methods enabling economic commitment, i.e., methods inducing individuals to elicit their preferences via real purchases and payments, yield more reliable estimates about their real preferences and willingness to pay than methods unveiling hypothetical preferences (Neill et al., 1994; Wertenbroch and Skiera, 2002; Voelckner, 2006). This effect is magnified in a reward-based crowdfunding setting by the risk of losing the amount committed if the entrepreneurial project is not successful (or if a fraud occurs). By enabling risky economic commitment of backers, reward-based crowdfunding can provide a reliable indication about the value the market places on the proposed new product idea and thus help resolve the relative uncertainty, which usually tends to restrain professional investors (Sahlman, 1990; Gompers, 1995; Shane and Cable, 2002; Eckhardt et al., 2006; Hsu and Ziedonis, 2013). In addition, reward-based crowdfunding is useful to the purpose of obtaining reliable feedback from the market, even in the case backers provide little financial support (e.g., minimum thresholds such as $10), as they have even so demonstrated a certain interest and liking for the project. Finally, crowdfunding shares similarities with receiving money from family and friends, which has been shown to favor subsequent external financing for new entrepreneurial ventures (Conti et al., 2013a,b). However, in comparison, it provides a more powerful market signal. Indeed, without having close relationships with the entrepreneur, backers are less likely to be biased toward the entrepreneurial project than entrepreneur's family and friends, thus further increasing the reliability of the informative function of reward-based crowdfunding.

As our interest lies in reward-based crowdfunding as a market signal to professional investors, we argue that the total amount of backers' commitments, i.e., the amount of money pledged in the campaign, can provide a reliable indication about the market potential of new technology-based ventures engaging in this type of funding channels. By means of this information professional investors can reduce the relative uncertainty, and thus better separate new ventures with promising market potential from those with less rosy future (Bergh et al., 2014). *Ceteris paribus*, a large amount of money pledged in the campaign should inform that there are many consumers interested and willing to pay for the given new product idea. In contrast, a small amount of money pledged in the campaign should be a sort of warning that the project may face troubles succeeding in the market. In turn, this implies that new technology-based entrepreneurial ventures pledging larger amounts of money in the crowdfunding campaign should be more likely to attract subsequent funding from professional investors. Accordingly, we formulate the first hypothesis as follows:

H1. *The amount of money pledged to a new technology-based entrepreneurial venture in a reward-based crowdfunding campaign increases the likelihood of securing subsequent funding from professional investors.*

2.2. The complementary role of patenting

In this section, we extend the above argument by proposing that the positive effect exerted by market acceptance in a crowdfunding campaign is amplified by the technological capital of the new venture, as indicated by its patents granted for the new product idea. Prior research has underscored the role of patents in reducing uncertainty surrounding new technology-based entrepreneurial ventures, and thus favoring access to funding from professional investors (Baum and Silverman, 2004; Heeley et al., 2007; Graham and Sichelman, 2008; Conti et al., 2013a,b; Hsu and Ziedonis, 2013). By filing a patent application and succeeding in the examination process, the new venture informs potential investors about its capability to develop technological solutions that are novel, inventive, and capable of industrial application (Haeussler et al., 2014; Messeni Petruzzelli et al., 2015), as well as that may benefit from an exclusive protection over certain markets (Lee et al., 2001; Mann and Sager, 2007; Audretsch et al., 2012; Conti et al., 2013a,b; Haeussler et al., 2014). In fact, patents can confer to the new venture the ability to appropriate the value of the given innovative product, and hence secure profit advantages in the future market through distinctive product offerings and/or production processes relying upon proprietary technologies (Lee et al., 2001; Helmers and Rogers, 2011; Hsu and Ziedonis, 2013). In addition, turning knowledge into property rights via patenting can ensure the presence of a salvage value, and thus increase bargaining power of entrepreneurs and their investors when negotiating with third parties (Ziedonis, 2004; Graham and Sichelman, 2008; Hoenig and Henkel, 2015). Finally, even when patenting does not intrinsically guarantee a superior performance, it can still have a quality signaling function in the sense of Spence (1973). In fact, patenting can demonstrate that the new venture has invested a significant effort, in terms of both time and resources, to satisfy the patenting criteria, hence revealing its technological capabilities and certifying that the underlying technology is at an advanced development stage (Lemley, 2001; Long, 2002).

On the basis of the above considerations, it appears clear that the presence of patents exerts a positive influence on the likelihood of securing external financing. However, our main interest lies in understanding how the presence of patents interacts with the informative function of reward-based crowdfunding for new technology-based entrepreneurial ventures engaging in such type of funding channel, which has never been examined before.[2] We recognize that there may naturally exist some degree of substitutability between these two factors

[2] As the role of patents in favoring access to funding from professional investors has been widely examined by the cited literature, we do not formulate a specific hypothesis on the direct effect of patenting, but only on its interaction effect with the performance in the crowdfunding campaign. Nevertheless, we do control for the direct effect in our analysis.

with regard to their impact on the likelihood of receiving funding from professional investors, as they both concur to inform about the overall quality of the new entrepreneurial venture. Nevertheless, we argue they act chiefly as complements. More specifically, we maintain that the presence of patents granted for the given new product idea should trigger a boost on the hypothesized positive effect of the amount pledged in the reward-based crowdfunding campaign. The rationale is that these two factors mainly inform about different quality aspects of the new entrepreneurial project, and thus have impact on different types of uncertainty surrounding the new venture. Indeed, on the one hand, a positive performance in the crowdfunding campaign, as revealed by a large amount of money pledged, indicates the existence of good market prospects for the new technology-based entrepreneurial venture, and thus potential value to appropriate. However, it does not necessarily imply *per se* that the new venture will be able to capture this value. In fact, other firms (e.g., established firms) might be in a better position to appropriate this value if there are no mechanisms to preclude imitation (Kultti et al., 2007; Graham and Sichelman, 2008). Furthermore, the novel product idea may lack of the proof of technological viability required to turn it into an industrialized product, thus failing to dissipate the uncertainty about the actual profit that can be accrued from marketing the invention (Jaffe and Trajtenberg, 2002; Hall et al., 2005). On the other hand, patents can hardly provide information about the quality aspect of the new venture pertaining to the interest and valuation consumers place on the proposed product idea. In other words, the presence of patents alone is unlikely to resolve the uncertainty surrounding the entrepreneurial project from a market perspective (Nerkar and Shane, 2007). By contrast, patents certify that the new venture has been able to develop technologically sound solutions that are capable of industrial applications, hence dissolving the risks related to the uncertainty on the technological viability of the project and the possibility to take the prototypal invention to large-scale production (Jaffe and Trajtenberg, 2002; Long, 2002; Hall et al., 2005). In addition, the exclusive protection implied by the possession of patents granted for the given new product idea favors the relative value appropriation, thus certifying the technological leadership of the venture and diminishing the uncertainty related to competition issues (Lee et al., 2001; Helmers and Rogers, 2011; Hsu and Ziedonis, 2013). Because the two attributes act to mitigate different sources of uncertainty, we assert that the access to subsequent funding for new technology-based entrepreneurial ventures engaging in reward-based crowdfunding should be much more facilitated when the performance in this funding channel is largely positive and, concurrently, patents have been granted for the new product idea. Indeed, a new venture showing the existence of good market prospects (as indicated by the performance in the crowdfunding campaign) becomes more valuable in the eyes of professional investors when accompanied by evidence of technological viability and exclusive protection of the new product idea (as demonstrated by the presence of patents) as the latter enhances the new venture's ability to capture the high value signaled by the relevant performance in the campaign. Similarly, a technological sound product solution increases its value in the eyes of professional investors when the uncertainty about the market acceptance for the new product idea is reduced. These arguments lead to our second hypothesis, which contends in favor of complementarity of the amount pledged in the campaign and the presence of patents granted for the new product idea.[3] Specifically, the informational value of the reward-based crowdfunding campaign should be more influential in the presence of patented inventions, thus implying a strengthened effect of the amount pledged on the likelihood of receiving subsequent funding from professional investors. Accordingly, we hypothesize that:

H2. *The amount of money pledged to a new technology-based entrepreneurial venture in a reward-based crowdfunding campaign and its granted patents act as complements, so that the positive effect of the amount of money pledged on the likelihood of securing subsequent funding from professional investors is stronger when patents have been granted for the new product idea.*

2.3. The complementary role of social capital

In addition to the potentially reinforcing effect of patents, we argue that also the entrepreneur social capital is expected to magnify the benefits new technology-based ventures should gain from a positive performance in the reward-based crowdfunding campaign. The positive role of entrepreneur social capital in favoring access to funding from professional investors has been largely documented in the entrepreneurship and strategic management literature. In fact, organizational theorists have suggested that the establishment of social ties stimulates trust (Uzzi, 1996; Uzzi, 1999; Uzzi and Gillespie, 1999) and allows to overcome problems of information asymmetry and moral hazard in financing decision (Venkataraman, 1997; Ozmel et al., 2013), by virtue of "social obligations between connected parties and information transfer through social relationships" (Shane and Cable, 2002, p. 366). Thereby, the presence of a dense network of relationships can help soften new entrepreneurial ventures' disadvantage of having short performance track records and thus scarce observable histories, since social ties make available information about the quality and talent of the founders as well as their tendency to behave opportunistically (Uzzi, 1996; Gulati and Gargiulo, 1999; Shane and Stuart, 2002), which in turn may influence further investment decisions (Shane and Cable, 2002; Shane and Stuart, 2002). Indeed, a wide network of social relationships may offer endorsement opportunities (Stuart et al., 1999) and inform the investors' community about the actual reliability of the entrepreneur, as these ties may play the role of "intermediary in trust" (Coleman, 1990). Thus, a large network of social relationships may serve as the basis for quality and experience evaluation (Hsu, 2007) and, consequently, a device for social risk reduction (Batjargal and Liu, 2004).

Social ties also reflect the extent to which entrepreneurs are able to access a large pool of strategic resources (Tsai, 2001; Adler and Kwon, 2002; Koka and Prescott, 2002; Stuart and Sorenson, 2005; Stuart and Sorenson, 2007; Stam and Elfring, 2008; Laursen et al., 2012). Therefore, they also indicate the quality aspect of the new venture pertaining to the entrepreneur's capability to have relevant resources at disposal in order to proceed with the entrepreneurial project and bridge the gap between the business idea and its successful execution. Social capital can be indeed defined as the "the sum of the actual and potential resources embedded within, available through, and derived from the social contacts of an individual or an organization" (Nahapiet and Ghoshal, 1998, p. 243). Thereby, a large set of relationships facilitates the growth and development of the new venture, and expose entrepreneurs to more opportunities for new business creation, as compared with more isolated individuals (McFadyen and Cannella, 2004; Inkpen and Tsang, 2005; McEvily and Marcus, 2005). Also, social ties sustain entrepreneurs in diffusing entrepreneurial projects by operating as channels through which increasing their market impact more effectively (Reagans and McEvily, 2003). This in turn lowers investors' risks and enhances their guarantees with regard to the successful implementation of the business initiative.

Similarly to the case of patents, our main interest lies in understanding how the effect of the entrepreneur social capital interacts with the informative function of reward-based crowdfunding for new technology-based ventures utilizing this type of

[3] In light of the above explanations, there is no reason *a priori* to support substitutability between the amount pledged and the presence of patents granted for the new product idea. Indeed, substitutability could occur when considering factors that act to reduce the same type uncertainty suffering professional investors as the increase in one factor could compensate the reduction of the other. The same logic applies also to the interaction with the entrepreneur social capital, as discussed later.

funding channel.[4] Even in this case our main argument is that they act as complements. Specifically, we propose that an increase in the level of entrepreneur social capital tends to amplify the hypothesized positive effect of the amount pledged in the crowdfunding campaign. In fact, a large amount pledged in the crowdfunding campaign suggests the existence of a valuable market for the given new product idea, but it does not help reveal the specific quality aspect of the new venture that relates to the ability to successfully turn the ingenious and valuable new product idea into a well-functioning business. On the contrary, a high degree of entrepreneur social capital is unlikely to reflect market acceptance and willingness to pay for the given new product idea, but it can provide information on the new venture's capabilities to access strategic resources and capture business opportunities, required for the actual exploitation of the proposed novel product idea (Reagans and McEvily, 2003; Inkpen and Tsang, 2005; McEvily and Marcus, 2005; McFadyen and Cannella, 2004). In addition, a wide network of social relationships can reassure professional investors when scrutinizing entrepreneurs about their tendency to behave opportunistically (Uzzi, 1996; Gulati and Gargiulo, 1999; Shane and Stuart, 2002). Relying on these considerations, we believe that the access to funding for new technology-based entrepreneurial ventures engaging in reward-based crowdfunding is much more facilitated when the performance in this funding channel is largely positive and, concurrently, the entrepreneur can count on a wide network of social relationships. Specifically, the informational value of the performance in the reward-based crowdfunding campaign should be stronger as the entrepreneur social capital increases, thus implying a magnified effect of the amount pledged in the campaign on the likelihood of receiving subsequent funding from professional investors. Accordingly, we formulate our third hypothesis as follows:

H3. *The amount of money pledged to a new technology-based entrepreneurial venture in a reward-based crowdfunding campaign and the social capital of new venture's entrepreneur act as complements, so that the positive effect of the amount of money pledged in the campaign on the likelihood of receiving subsequent funding from professional investors is stronger as the entrepreneur social capital increases.*

3. Data

3.1. Data collection

To test the above hypotheses, we collected data of all the entrepreneurial projects available for funding on Kickstarter starting from its inception in 2009 to the end of 2012 and falling into the category Technology. Indeed, projects available on Kickstarter are greatly heterogeneous, ranging from arts (e.g., theater, music, etc…) to technology. As such, not all the various project categories are related to new entrepreneurial ventures engaged in a process of growth and development that may call for subsequent external funding from professional investors to lead to large-scale production and commercialization. Therefore, considering the category Technology was the first step to create a fairly homogenous sample to our scope. As a matter of fact, the category Technology encompasses new entrepreneurial projects where the technological and scientific component and the relative amount of money required to support growth are supposed to be relevant, hence representing potentially attractive investment opportunities for professional investors (PwC and National Venture Capital Association, 2014). To cite a few, applications in this category vary from 3D printing to software, from computer hardware to electronics and Internet-of-Things solutions.

However, even within the category Technology, there still exists strong heterogeneity among projects. For instance, there exist small recreational projects attracting a few hundred dollars, as well as large projects that collect amounts ranging from hundred thousand to a few million dollars. Small recreational projects should be disregarded, since they are not entrepreneurial projects but mostly simple ideas reflecting proponents' hobbies. As such, they will never be potential targets of professional investors because their non-entrepreneurial nature excludes any reciprocal interest from both parties (project proponents and professional investors). Therefore, to be consistent with our scope, we avoided including such projects in our sample. Specifically, we considered only projects able to pledge at least $50,000 (irrespective of whether they were really funded or not). This amount is quite reasonable given that the amount of seed capital for pre-product new technology-based ventures typically varies from a few hundred thousand dollars to one and half million dollars (Ernst and Young, 2014). At any rate in § 5.4 we perform robustness checks on the selection threshold showing robustness of our findings. Note that sampling based on an independent variable (the amount pledged, in this paper), does not generate, in general, serious bias concerns provided that there is sufficient variation in the independent variables (which is, indeed, the case in our sample, as shown later in the descriptive statistics) (Wooldridge, 2009, p. 323). More importantly, a threshold for inclusion in our sample is essential to avoid large heterogeneity. Including any type of technology projects would yield a sample potentially with a multitude of recreational or inconsistent projects, which will never be the target of professional investors simply because of their non-entrepreneurial or inconsistent nature. This may create much more dangerous bias in the results. Finally, note that we do not over claim that the posited relationships should be valid for all types of projects or ventures. Rather, we examine these relationships specifically for new technology-based entrepreneurial ventures that engage in reward-based crowdfunding to fund their product ideas. Therefore, setting the above threshold for inclusion appears as a sensible choice.

In particular, the choice of imposing a threshold for inclusion on the amount pledged, rather than the goal, depends on the fact that a threshold on the goal would have implied removing from the sample a considerable number of projects of potential interest for professional investors. In fact, note that, while the goal should intuitively reflect the amount of capital needed by the entrepreneur to support at least the very initial stages of the project, it also incorporates at least three other elements that distort this interpretation. First, the goal may depend on how many stages the entrepreneur intends to support with money obtained in crowdfunding. Second, even in case of similar number of stages, there may exist heterogeneity among entrepreneurs with regard to their ability to correctly estimate the amount actually needed. Third and most important, since Kickstarter utilizes an all-or-nothing mechanism and thus the money is actually transferred only if the goal is reached, entrepreneurs have incentive to lower the goal to increase the odds of receiving the money. Because of this, the goal may be strongly influenced by the heterogeneity of entrepreneurs in terms of risk aversion. That is, more risk-averse entrepreneurs tend to have a higher incentive to undercut the goal as compared with less risk-averse entrepreneurs since they perceive higher risk of failure in the campaign. As a result, the goal may be a spurious measure of the real "size" of the project. This helps explain why we observe low goals for many entrepreneurial projects, such as the exemplificative case of Nifty, which set a goal equal to only $11,000 and obtained almost $400,000 from the crowd for their Macbook memory-increasing device Nifty Minidrive, or the case of Keith McMillen Instruments, which set a goal equal to $15,000 and obtained more than $160,000 for their the 3D pad controller for electronic musicians QuNeo. Therefore, our choice of considering the amount pledged rather than the goal as a criterion to

[4] As the role of entrepreneur social capital in favoring access to funding from professional investors has been widely examined by the cited literature, we do not formulate a specific hypothesis on the direct effect of entrepreneur social capital, but only on its interaction effect with the performance in the crowdfunding campaign. Nevertheless, we do control for the direct effect in our analysis.

include projects in our sample is due to the considerable risk of missing entrepreneurial projects relevant to our purposes just because of the all-or-nothing mechanism utilized by Kickstarter.

In other words, our selection criterion implies that, among small-goal projects, only those displaying sufficiently high ratio amount pledged to goal are represented in our sample. This has beneficial implications for our analysis. First, as discussed above, low-goal projects attracting very small amounts do not display any entrepreneurial features, and thus they would never be of potential interest to professional investors. In this case, the exclusion from our sample avoids distorting upward the effect of the performance in crowdfunding on the access to subsequent professional funding. Second, as suggested by the examples above, the inclusion of low-goal projects attracting sufficiently high commitments from backers significantly reduces the risk of selection bias that would occur when eliminating *a priori* entrepreneurial projects potentially appealing to professional investors simply because the all-or-nothing mechanism adopted by Kickstarter perhaps provides them with higher incentive to set a low goal.

Also, it is important to highlight that our selection criterion on the amount pledged excludes projects displaying low ratio amount pledged to goal not only among the low-goal projects, but also among the high-goal projects. That is, projects for which the entrepreneurs set high goals but failed to meet enough favor from the crowd, as their amount pledged resulted below $50,000 (below $30,000 and $40,000 in the robustness checks in § 5.4), are also removed from the sample. In this sense, our selection does not create relevant differences between low- and high-goal projects in terms of representation in the sample as it operates in the same direction by eliminating those projects that do not reach at least $50,000, irrespective of the goal set by the entrepreneur. The rationale behind the exclusion of high-goal projects displaying low amount pledged is also due to the purpose of further reducing project heterogeneity in our sample by eliminating projects that do not possess the minimum characteristics to realistically have a chance to attract the interest of professional investors. Indeed, projects not even able to reach an acceptable level of commitments from the crowd, irrespective of the goal set by the entrepreneur, are very unlikely to even get the attention of professional investors simply because they are recreational projects or, at most, reflect largely undeveloped or inconsistent ideas. However, while we believe that our selection criterion is the most reasonable approach to reduce project heterogeneity in this setting and thus improve the reliability of our analysis, we recognize that, in contrast with low-goal low-amount projects, some high-goal low-amount projects could still have some chances to be potentially attractive to professional investors. This is because the high goal may still suggest that the entrepreneur is aiming “big” (rather than doing something recreational or too undeveloped), but perhaps made some mistakes in the communication with the crowd, thus resulting in very low amount pledged. In § 5.4 we address this issue by extending the sample to include also high-goal projects (i.e., goal above $50,000) reaching quite low amount pledged (below $30,000).

After applying the above restrictions, we were left with 131 technology-based entrepreneurial projects. However, we noted that a number of projects were proposed by long time established small businesses that utilize Kickstarter to fund their new projects, rather than by new ventures. As our focus is on new technology-based entrepreneurial ventures that can potentially attract professional investors in their initial stages, in line with evidence from industry and prior literature (Lee et al., 2001; Hsu, 2007; Hall and Woodward, 2010; Conti et al., 2013a,b; Hsu and Ziedonis, 2013; Forrest, 2014), we further restricted to projects related to ventures founded in between 2005 and 2012. For similar reasons, we also eliminated from the sample those projects related to non-profit organizations and those whose funding was cancelled by Kickstarter. We also removed from the sample the new entrepreneurial ventures that were no longer alive at the end of our period of observation (dated September 2014) to rule out the survival as a possible cause of subsequent financing from professional investors. More importantly, after contacting the remaining new entrepreneurial ventures via email, we excluded those not in need or in search of subsequent funding from professional investors. At the end of all these restrictions, we were left with 105 new technology-based entrepreneurial projects. The final sample consists of 83 projects whose campaign was launched in 2012, while 22 projects are related to campaigns launched in 2011. The size of our final sample is in line with previous studies on crowdfunding (e.g., Ahlers et al., 2015). Interestingly, with a selection criterion of amount pledged not inferior to $50,000, we found that only 6% of the projects were not successful in the campaign. All these precautions and criteria for inclusion significantly increase our confidence that the final sample consists of new technology-based entrepreneurial projects really needing and being interested in subsequent rounds of funding from professional investors because for these projects the money raised in the crowdfunding campaign could only provide the very initial capital. In § 5, we conduct IV regression analysis to cope with unobservables that may be related to the performance in crowdfunding and the likelihood of receiving subsequent funding, the Heckman selection model to cope with the fact that decision to go crowdfunding may be endogenous, as well as additional checks. All these analyses and the use of specific control variables further help reduce the risk of unobserved heterogeneity related to the need and interest for funding from professional investors.

Finally, as explained in more detail in § 3.2, to construct our dataset we collected, for each of the 105 projects, detailed information on the crowdfunding campaign from Kickstarter website. We gathered data on funding provided by professional investors by extensively consulting a number of venture capital databases, such as ThomsonOne-VentureXpert and Crunchbase. Patent information was retrieved from the United States Patent and Trademark Office (USPTO) and the European Patent Office (EPO), whereas information on entrepreneurs and other new venture characteristics was obtained by accessing LinkedIn, Facebook, and new venture websites. Note also that, for all projects in our final sample, the observation of data related to main independent variables and controls is strictly antecedent to any potential funding provided by professional investors after the crowdfunding campaign, so as to reduce endogeneity concerns due to reverse causality. Finally, we extensively monitored online news and announcements related to the projects included in the sample before, during, and after the crowdfunding campaign (until the end of our observation period) to rule out the possibility that other factors or events, in addition to the variables included in the analysis, may influence professional investors’ funding decisions.

3.2. Variables

3.2.1. Dependent variable

To test our hypotheses, we introduce a dummy variable (namely *Subsequent Professional Funding*) taking value one if the given new venture has received any type of funding from professional investors, ranging from seed stage to venture capital investments, zero otherwise. Notably, we observed whether a new venture had received funding from professional investors in a time span of approximately two-four years after the crowdfunding campaign (i.e., in a time span ranging from the end of the campaign to the end of our observation period dated September 2014), as professional investors tend to provide the first round of financing usually within the first two-three years of the venture’s life (Hall and Woodward, 2010; Forrest, 2014). We gathered data about traditional new venture funding rounds (e.g., seed, Series A, B, …, mezzanine) secured after the crowdfunding campaign by accessing different VC databases. Specifically, ThomsonOne-VentureXpert database was extensively consulted for all the new technology-based ventures included in the sample and integrated with information retrieved from free access AOL-owned Crunchbase database, which, similarly to ThomsonOne-VentureXpert, contains updated information about new ventures and relative funding stages. To ensure reliability

and consistency of our data, we also checked other databases providing information on new ventures and their funding rounds, such as Angel.co, Investing.Businessweek.com, CBInsights.com, and, when available, the press section on the website of each new venture. Interestingly, during the period of observation, 29% of the entrepreneurial projects in our sample received funding from professional investors after their crowdfunding campaign.

It is noteworthy that we consider the likelihood of receiving subsequent funding from professional investors as our dependent variable, rather than the number of investors or the cumulative amount of funding they provide, for two main reasons. First, our interest lies on understanding whether a relevant performance in reward-based crowdfunding can make professional investors more prone to finance new technology-based entrepreneurial ventures engaging in this type of campaigns, irrespective of the number of investors or the amount of money they invest in the new venture, which may be instead influenced by a number of factors such as the stage of maturity of the given new venture and/or syndication decisions. Second, approximately 70% of new ventures in our sample did not receive any funding from professional investors, which suggests that the primary question to ask is whether these entrepreneurial ventures are able to secure funding after the crowdfunding campaign or not. At any rate in § 5.4 we show robustness of our results by considering the amount of professional funding secured by new ventures as our dependent variable.

3.2.2. Main independent variables

As our interest lies in reward-based crowdfunding as a mechanism to gather information about the market potential of a new technology-based entrepreneurial project, our measure of performance in this funding channel is the amount of money pledged (in dollars) in the campaign for each project. Indeed, even in the case of unmet goal, professional investors may still see high value in a project not funded, but able to attract valuable interest and commitment from the crowd. In support of this view, there is considerable evidence of entrepreneurial projects in Kickstarter that received funding from professional investors after gaining large interest from the crowd, even though they failed to meet the goal. Examples include the smart illumination system from the startup Moore's Cloud, which failed in the crowdfunding campaign despite pledging 275,000 (out of a goal set equal to 700,000) and later received funding from professional investors (Pollenizer, 2014). To our purpose, we prefer using the amount of money pledged in the campaign, rather than the ratio between the amount pledged and the goal, as our main independent variable because the former better conveys the preferences and the willingness to pay of consumers accessing Kickstarter. Indeed, the amount pledged is an exogenous indication of the market prospects of the project. In contrast, by construction, the ratio is certainly not exogenous to entrepreneur's decisions as it is strongly affected by the goal they set. Recall indeed that the all-or-nothing mechanism adopted by Kickstarter gives entrepreneurs the incentive to lower the goal in order to increase the odds of receiving the money. In addition, entrepreneurs may be characterized by different risk aversion so that some of them may even have higher incentive to undercut the goal. As a result, the ratio of the amount pledged over the goal might not be a good performance measure to inform about the market potential of the entrepreneurial project. Hence, in our main model we consider the amount of money pledged as our independent variable and, for each entrepreneurial project in our sample, introduce the natural logarithm of this variable (namely *Pledged Amount*). At any rate, in § 5.3, we show robustness of our results also when the ratio of the amount pledged over goal is used as independent variable by appropriately controlling for the goal to mitigate the disadvantages associated with this variable.

To test our hypothesis *H2*, we introduce the interaction term between the variable *Pledged Amount* and a dummy variable (namely *Patents*), equal to one if the new venture had been already granted at least one patent related to the "kickstarted" new product idea before (possibly) receiving the funding from professional investors, and zero otherwise.[5] In particular, for the new ventures that at the end of our observation period had received subsequent funding from professional investors we retrieved information about the presence of patents granted for the new product idea before the professional funding was actually received. This implies that we consider the presence of patents both before and after the crowdfunding campaign as long as they were granted before the funding from professional investors was actually received. For the new venture that at the end of our observation period did not receive subsequent professional funding, we retrieved information about the presence of patents granted for the new product idea at the end of our observation period. By considering patents granted after the crowdfunding campaign but before the professional funding is received, we avoid problems of reverse causality as well as the risk of missing relevant events after the crowdfunding campaign. To retrieve the information about the presence of granted patents related to the new product idea for each new venture in our sample, we utilized USPTO database as our primary source, since the great majority of entrepreneurial projects were geographically located in the United States. However, when necessary, we also consulted EPO database. Finally, it is important to highlight that, in line with recent crowdfunding studies (Ahlers et al., 2015), we used a dummy variable instead of a count one because only a few new ventures naturally hold a patent for their invention, and even fewer hold more than one patent. In fact, consistent with previous studies on the beneficial role of patents in stimulating funding from professional investors (Lee et al., 2001; Helmers and Rogers, 2011; Conti et al., 2013a,b; Haeussler et al., 2014; Ahlers et al., 2015), evidence from our sample suggests that 9% of new ventures were granted a patent for their new product idea.

To test our hypothesis *H3*, we introduce the interaction term between the variable *Pledged Amount* and a measure of the entrepreneur social capital. Before explaining how we operationalized the entrepreneur social capital, it is important to note that numerous new ventures are founded and managed by a team of key people, rather than a single entrepreneur. We use the term key people to indicate the founder(s), the CEO and the President.[6] For instance, in our sample the number of key people varies from one to six. Therefore, in presence of more than one leading person we gathered data about each key person's profile. Considering the objective difficulties in retrieving data for the entrepreneurs behind "kickstarted" new ventures, we resorted to the number of LinkedIn connections of each key person to assess the entrepreneur social capital for each new venture. The number of LinkedIn contacts has been recently used as a measure of entrepreneur social capital in crowdfunding studies (Colombo et al., 2015). Following the same approach utilized in the case of patents, for the new ventures that had received subsequent funding from professional investors during our observation period we retrieved information about the LinkedIn connections of the key people of the given new venture before the professional funding was actually received. For the new venture that never received professional funding subsequent to the crowdfunding campaign during our observation period, we retrieved information about the LinkedIn connections of the key people of the given new venture at the end of our observation period. By doing so, we avoid problems of reverse causality as well as the risk of missing relevant events after the crowdfunding campaign. Afterwards, as our interest lies in a measure of entrepreneur social capital at the new venture level, we simply summed

[5] Note that we consider patents granted for the new product idea irrespective of whether the assignee of the patent is the new venture or one of the key people of the new venture. The only conditions we impose are that the patents must be granted and related to the proposed new product idea.

[6] Note that, in most of the cases, given the young age of the considered ventures, the founder(s) assume the roles of CEO and/or President. Hence, these figures mostly coincide in our sample.

the LinkedIn connections across all key people related to the given new venture (referred to as *Total LinkedIn Connections*).[7]

3.2.3. Control variables

In addition to the variables of interest, it is crucial to control for the relevant quality aspects of the new entrepreneurial project as well as for other factors that may impact on the likelihood of securing subsequent funding from professional investors. In particular, controlling for relevant quality aspects is pivotal in our setting as we need to be sufficiently confident that the relationship between the performance in the crowdfunding campaign and the likelihood of receiving subsequent funding from professional investors is not spurious, as a result of omitted project quality aspects. Indeed, these quality aspects may be correlated with both the amount pledged in crowdfunding and the subsequent funding from professional investors. Hence, if they are not controlled for, endogeneity concerns may arise. In line with the prior literature, we control for relevant quality aspects of the new technology-based entrepreneurial project by including the set of characteristics utilized by venture capitalists to assess technology startup quality, namely intellectual, social, and human capital, as each of these characteristics helps capture a specific aspect of the entrepreneurial project quality and thus mitigate the relative source of uncertainty suffering professional investors (Baum and Silverman, 2004; Hsu, 2007; Conti et al., 2013a,b; Hsu and Ziedonis, 2013; Ahlers et al., 2015). Specifically, in addition to introducing its interaction with the variable *Pledged Amount*, we control for the consolidated direct effect of the presence of patents granted for the given product idea (*Patents*), which represents the intellectual capital of the new venture, and thus helps capture the quality aspect pertaining to the ability to develop technologically viable solutions and appropriate the relative value (Ahlers et al., 2015). Similarly, in addition to introducing its interaction with the variable *Pledged Amount*, we introduce the variable *Total LinkedIn Connections*. Consistent with recent works on crowdfunding (Colombo et al., 2015), this variable measures the entrepreneur social capital, and thus provides indications on the quality aspect of the new venture related to the ability to access strategic resources that will favor the successful implementation of the business initiative (Reagans and McEvily, 2003; Inkpen and Tsang, 2005; McEvily and Marcus, 2005; McFadyen and Cannella, 2004). Finally, we control for the entrepreneur human capital built before the funding from professional investors was (possibly) received through a set of variables. Specifically, in accordance with most of the previous studies on new venture financing (e.g., Hsu, 2007; Conti et al., 2013a,b; Hsu and Ziedonis, 2013; Ahlers et al., 2015), we control for the average industry experience of the key people involved in the given new venture (*Average Industry Experience*), whether at least one of the key people has received an MBA (*MBA*), whether at least one of the key people has received a Ph.D. (*PhD*), and whether at least one of the key people has founded previous new ventures in the past (*Previous New Ventures*). Similarly to most of the studies above, we also control for whether at least one of the key people has received funding from professional investors for previously founded new ventures and/or whether such previous new ventures have been successfully sold to established firms (*Previous Funded or Sold New Ventures*). This variable informs professional investors on whether the entrepreneurial story of the team has been successful in the past, thus providing a valuable quality indication on the entrepreneurial ability and experience also with regard to the current project (Hsu, 2007; Hsu and Ziedonis, 2013). All these variables were obtained by combining information available on LinkedIn and Facebook webpages of each key person, and the startup website with information provided by the venture capital databases at our disposal.[8] We also introduce another variable that may help capture quality aspects of the new entrepreneurial project, namely *Kickstarter Picks*, indicating whether the given project has been featured by Kickstarter staff in the special selection of projects named Staff Picks. According to Kickstarter, the inclusion in this special selection is based on a quality judgment, and not driven by some sort of financial remuneration (Mollick, 2014). Overall, by controlling for the set of observable attributes suggested in the prior literature, we are able to mitigate the endogeneity concerns due to unobserved quality aspects as well as sample selection. At any rate, in § 5, with the help of carefully chosen instrumental variables as well as the Heckman selection model, we provide evidence that our analysis is unlikely to suffer from endogeneity bias and yields robust results irrespective of the regression model utilized.

In addition to the control variables introduced above, we also include a number of other controls that may affect the likelihood of securing funding from professional investors, without being necessarily related to the quality of the new technology-based entrepreneurial project. First, similarly to Conti et al. (2013a,b) and Mollick (2014), we consider that new ventures are located in different entrepreneurial ecosystems, which can, in turn, influence the likelihood of receiving subsequent funding from professional investors. In this respect, we introduce a dummy variable (*Top Startup Ecosystems*) indicating whether the new entrepreneurial venture is located in the metropolitan area of one of the top 20 ecosystems worldwide for establishing and nurturing a startup, according to the Startup Genome Report (Marmer et al., 2012).[9] Second, in spite of the fact we have already restricted to the Technology category, we further take into account the heterogeneity related to the project nature. Specifically, with the help of the sub-categorization provided by Kickstarter and a careful analysis of the descriptions of each project in our sample, we are able to introduce a set of 4 dummies better indicating the type of product/applications related to each project, namely *Electronics & Hardware*, *Software & Internet*, *3D Printing & Robotics,* and *Aerospace*. Third, we also control for project heterogeneity in terms of investment required at least in the initial stages, by explicitly controlling for the amount requested by the entrepreneur, namely the variable *Goal*.[10] Fourth, as we study the effect of the amount of money pledged in reward-based crowdfunding on the likelihood of attracting further funding from professional investors, we also control for whether the given entrepreneurial project has received funding from this or other types of investors even before the launch of

[7] Note that since LinkedIn does not display the exact number of connections for people having more than 500 connections, in the main analysis to construct our measure of entrepreneur social capital these people were assigned a number of connections equal to 500. However, for the sake of robustness, we also performed our econometric analyses by using an alternative measure of entrepreneur social capital still based on LinkedIn connections. Specifically, we built an ordinal variable equal to 0 if the given key person did not have any LinkedIn connections (note that, in our sample, all key people registered to LinkedIn had at least one connection), 1 if the key person had less than 100 (but greater than zero) LinkedIn connections, 2 if the key person had less than 200 (but greater or equal to 100), and so forth until the value of 6 for a key person with more or equal to 500 connections. Afterwards, we computed the average value of such ordinal variable across all key people related to the given new venture. Our results are strongly confirmed also under this alternative specification (and can be made available from the authors).

[8] We do not introduce the number of key people as a control variable in the main analysis because this variable is highly correlated with our variable *Total LinkedIn Connections* (Pearson correlation coefficient equal to 0.783). At any rate, our results are robust to the inclusion of the number of key people, even though the level of significance naturally decreases in some occurrences.

[9] According to the Startup Genome Report (Marmer et al., 2012), the top 20 startup ecosystems worldwide are (in order): Silicon Valley, Tel Aviv, Los Angeles, Seattle, New York city, Boston, London, Toronto, Vancouver, Chicago, Paris, Sydney, Sao Paulo, Moscow, Berlin, Waterloo (Canada), Singapore, Melbourne, Bangalore, Santiago. The criteria utilized for inclusion in the ranking consider indexes on startup output, startup funding, company performance, talent, support infrastructure, entrepreneurial mindset, trendsetting tendencies, and ecosystem differentiation.

[10] We have recognized that the goal set by the entrepreneur may not only reflect the money necessary to the new venture (at least in its very initial stages), but also factors such as risk aversion or ability to provide correct investment estimation. In spite of these aspects, we believe that controlling for the goal is still one of the two reasonable ways at our disposal (the other being the inclusion of product subcategories, as we have done), even though rough, to further take into account the heterogeneity in our sample in terms of required project investment.

Table 1
Descriptive Statistics.

Variables	Panel A New ventures engaging in crowdfunding				Panel B New ventures not engaging in crowdfunding (used for Heckman selection model)			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Subsequent Professional Funding (Dep. variable)	0.29	0.45	0	1	–	–	–	–
Top Startup Ecosystems	0.51	0.50	0	1	0.61	0.49	0	1
Average Industry Experience	9.89	6.87	0	33	14.40	7.91	1	46
MBA	0.05	0.21	0	1	0.27	0.44	0	1
PhD	0.10	0.31	0	1	0.14	0.34	0	1
Previous New Ventures	0.43	0.50	0	1	0.51	0.50	0	1
Previous Funded or Sold New Ventures	0.17	0.38	0	1	0.24	0.43	0	1
Previous Professional Funding	0.10	0.29	0	1	–	–	–	–
Patents	0.09	0.28	0	1	0.25	0.43	0	1
Total LinkedIn Connections	580.78	499.95	0	2000	937.62	484.13	0	3000
Goal (Thousands $)	74.32	120.62	4	750	–	–	–	–
Kickstarter Pick	0.43	0.50	0	1	–	–	–	–
Pledged Amount (Thousands $)	234.66	408.44	50.25	2946	–	–	–	–
Electronics & Hardware	0.61	0.49	0	1	0.34	0.47	0	1
Software & Internet	0.13	0.34	0	1	0.63	0.48	0	1
3D Printing & Robotics	0.22	0.42	0	1	0.02	0.15	0	1
Aerospace	0.04	0.19	0	1	0.01	0.09	0	1
Year of Est. 2005	0.04	0.19	0	1	0.14	0.35	0	1
Year of Est. 2006	0.04	0.19	0	1	0.20	0.40	0	1
Year of Est. 2007	0.02	0.14	0	1	0.20	0.40	0	1
Year of Est. 2008	0.04	0.19	0	1	0.16	0.37	0	1
Year of Est. 2009	0.08	0.27	0	1	0.11	0.31	0	1
Year of Est. 2010	0.14	0.35	0	1	0.08	0.27	0	1
Year of Est. 2011	0.32	0.47	0	1	0.06	0.24	0	1
Year of Est. 2012	0.32	0.47	0	1	0.05	0.21	0	1
B2B (used for Heckman selection model)	0.057	0.233	0	1	0.33	0.47	0	1

Note: obviously, in the sample of new ventures not engaging in crowdfunding we cannot distinguish between funding received from professional investors before and after the campaign. At any rate, the information on the funding from professional investors for this sample is not necessary as this sample is only used in the first stage regression of the Heckman selection model where the decision to use crowdfunding is studied.

the crowdfunding campaign. By doing so, we take into account the heterogeneity in terms of need/interest for funding across new ventures that may occur due to the fact that some new ventures may have received funding before the campaign, while other may have not. Hence, in line with prior studies (e.g., Hsu, 2007), we introduce the dummy *Previous Professional Funding*, using the same sources of information as those used for our dependent variable. Fifth, we control for the year of new venture establishment by introducing eight dummies (*Year of Establishment 200x*), which help control for the different stages of new ventures' lifecycle.[11]

Table 1–Panel A summarizes the main descriptive statistics for our variables, whereas Table 2 reports further descriptive statistics distinguishing the characteristics of new ventures that received subsequent funding from professional investors from the characteristics of those that did not. Particularly, from Table 2 it can be noted that the new ventures receiving professional funding after the crowdfunding campaign have pledged approximately three times the amount pledged to those new ventures that did not receive professional funding after the campaign ($447,000 vs. $149,000). A preliminary T-test shows that this difference is statistically significant. The same test suggests that there are also significant differences with regard to the presence of patents and the entrepreneur social capital. As a matter of fact, 23% of the new ventures receiving professional funding subsequently to the crowdfunding campaign have been granted a patent for their new product idea, while this percentage is only 3% for those ventures that did not receive subsequent funding from professional investors. Similarly, key people of new ventures receiving funding after the crowdfunding

Table 2
Descriptive statistics for new ventures engaging in crowdfunding: new ventures subsequently funded vs. not subsequently funded by professional investors.

Variables	Subsequent Professional Funding = 1		Subsequent Professional Funding = 0		*T*-test
	Mean	Std. Dev.	Mean	Std. Dev.	Mean difference
Top Startup Ecosystems	0.60	0.50	0.48	0.50	0.12
Average Industry Experience	10.44	7.96	9.79	6.45	0.35
MBA	0.07	0.25	0.04	0.20	0.03
PhD	0.13	0.35	0.09	0.29	0.04
Previous New Ventures	0.57	0.50	0.37	0.49	0.20*
Previous Funded or Sold New Ventures	0.37	0.49	0.09	0.29	0.28***
Patents	0.23	0.43	0.03	0.16	0.20**
Total LinkedIn Connections	843.37	514.13	475.75	456.68	367.62***
Goal (Thousands $)	117.80	180.04	56.93	81.69	60.87*
Kickstarter Pick	0.43	0.50	0.43	0.50	0.00
Amount Pledged (Thousands $)	447.28	692.94	149.61	143.60	297.67**
Electronics & Hardware	0.60	0.49	0.61	0.50	−0.01
Software & Internet	0.17	0.38	0.12	0.33	0.05
3D Printing & Robotics	0.20	0.41	0.23	0.42	−0.03
Aerospace	0.03	0.18	0.04	0.20	−0.01
Year of Est. 2005	0.03	0.18	0.04	0.20	−0.01
Year of Est. 2006	0.03	0.18	0.04	0.20	−0.01
Year of Est. 2007	0.03	0.18	0.01	0.11	0.02
Year of Est. 2008	0.07	0.25	0.03	0.16	0.04
Year of Est. 2009	0.07	0.25	0.08	0.27	−0.01
Year of Est. 2010	0.13	0.35	0.15	0.36	−0.02
Year of Est. 2011	0.27	0.45	0.34	0.48	−0.07
Year of Est. 2012	0.37	0.49	0.31	0.46	0.06

* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

[11] As we already take into account a possible time effect by controlling for the year of new venture establishment, we do not include the time elapsed between the end of the crowdfunding campaign and the end of our period of observation (i.e., September 2014). At any rate, we verified that the inclusion of this additional variable does not affect our findings (the analysis can be made available from the authors).

campaign had on average a number of total connections on LinkedIn equal to 843, whereas those that did not receive funding displayed around 476 connections. This descriptive analysis provides some initial insights about the relationship between the dependent variable and the independent variables of our interest before running the formal regression models.

Unreported correlation matrix does not seem to suggest a considerable degree of correlation between *Pledged Amount* and *Goal*. Yet, the (uncentered) Variance Inflation Factor (VIF) computed after performing our regression models exceeds the rule-of-thumb value of 10 only for these two variables when they are concurrently introduced in the models. Nevertheless, we can safely include the control variable *Goal* in our models because, as shown later, the statistical significance of our variables of interest is not influenced by the presence of this control variable. As a matter of fact, the standard error regarding our variable *Pledged Amount* is sufficiently small to ensure a statistically significant result (at the same level of significance) irrespective of the inclusion of the variable *Goal*. In addition, results reveal that this control variable is never significant (not even when the variable *Pledged Amount* is excluded). As the effect of collinearity is to inflate standard errors leading to insignificance of collinear variables, the fact that our variable of interest *Pledged Amount* remains significant irrespective of the variable *Goal*, while the latter is never significant, safely indicates that collinearity is not an issue in our case (Baum, 2006).

4. Empirical results

Given the cross-sectional nature of our dataset and the binary nature of our dependent variable we used different specifications of the following robust probit model to test our hypotheses (for the sake of completeness presented here in the case where all the interactions are introduced):

$$\Pr(Subs.Prof.Funding = 1|X) = \Phi(\beta_0+\beta_1 \cdot LnAmountPledged + \beta_2 \cdot LnAmountPledged \cdot Patents + \beta_3 \cdot LnAmountPledged \cdot Total\ \ Linked\ \ In\ \ Connections + B \cdot Controls) \quad (1)$$

where X is the set of regressors specified in the right hand side of (1), *Controls* stands for the set of controls identified in § 3.2.3, and Φ is the standard normal cumulative distribution function.

Table 3 reports the major findings of our empirical analysis based on the robust probit model presented in (1). In particular, in Table 3 for each variable the first line reports the coefficient and the relative standard error, whereas the second line reports the average marginal effect and the relative standard error. We first checked whether the results from our sample corroborate those documented in the prior literature by including the variables *Patents* and *Total LinkedIn Connections* and all the control variables. The first column in Table 3 provides a picture consistent with previous studies. Specifically, the presence of patents granted for inventions related to the "kickstarted" new product idea positively affects the likelihood of securing subsequent funding from professional investors. Moreover, our measure of entrepreneur social capital exerts a significant and positive impact, thus suggesting that entrepreneurs with a larger network of social relationships are more likely to receive subsequent funding from professional investors. With regard to the human capital of the entrepreneurial team, the dummy *Previous Funded or Sold New Ventures* also reveals a significant positive effect, hence confirming that new ventures led by a team with a successful entrepreneurial story have a higher probability of being financed by professional investors. Other related control variables, such as the average industry experience of the key people, the presence of key people with MBA and/or PhD education levels, and the presence of key people who have founded previous new ventures, are shown to be not significant. This is possibly because the positive effect of the human capital is already captured to a considerable extent by the dummy *Previous Funded or Sold New Ventures*. Similarly, the variables *Goal* and *Kickstarter Picks* are not significant either. With regard to the variable *Kickstarter Picks*, we verified that it is never significant, not even when the major variables of interest in our model (*Pledged Amount*, *Patents*, *Total LinkedIn Connections*) are removed. Therefore, the irrelevance of this variable seems to suggest the quality aspects assessed by Kickstarter experts may not be along the lines of those professional investors consider when making funding decisions. Finally, while for the sake of parsimony we do not report the related coefficients, marginal effects and significance, it is worthwhile to highlight that there is no strongly significant effect of the year of new venture establishment on the likelihood of receiving funding from professional investors. Indeed, all dummies (2007, 2008, 2009, 2010, 2011, and 2012) except the year 2006 are significant and positive as compared to the year 2005, which is chosen as baseline. In addition, the coefficients of the significant years are quite similar among each other (with 2007 showing the highest coefficient and 2009 the lowest one).

Columns 2–5 in Table 3 report our main results. Specifically, we present the results of the different models performed by gradually adding our variable *Pledged Amount* and the interaction terms with the dummy *Patents* and the variable *Total LinkedIn Connections*. The positive (and significant) coefficients of the interaction terms across the different models (see the first line for each variable in Table 3) seem to consistently confirm our hypotheses *H2* and *H3*, thus hinting at the existence of complementarity between the amount pledged in the reward-based crowdfunding campaign and two important determinants of subsequent funding from professional investors, namely the presence of patents for the new product idea and the entrepreneur social capital. However, we also find that the coefficient of the variable *Pledged Amount* is not significant when including both interaction terms (column5), while being significant (at 2.6% level of confidence) in the absence of interaction terms (column 2.) Hence our hypothesis *H1* is only partially supported. Taken together, these results would suggest that the positive effect of the amount of money pledged in the campaign on the likelihood of securing subsequent funding from professional investors is contingent upon the presence of patents and/or a sufficiently large value of entrepreneur social capital (note that we standardize our variables involved in the interaction terms to reduce collinearity).

However, in a probit model coefficients do not provide a sufficient basis to draw reliable statistical conclusions on the interaction effects (Hoetker, 2007; Zelner, 2009). Moreover, by looking at the average marginal effects of the variables *Pledged Amount*, *Patents*, and *Total LinkedIn Connections* reported in Table 2 (second line for each variable), we observe that they are all significant and positive, though being unable to discern the direct effect of the variable *Pledged Amount* from the effect of its interaction with the other two variables. Therefore, given the continuous nature of the amount pledged, we followed the approach suggested in the literature (e.g., Zelner, 2009) and verified the statistical significance of the marginal change in the likelihood of receiving financing from professional investors due to an increase in the amount pledged at different values of the variables *Patents* and *Total LinkedIn Connections*, respectively, while setting, without loss of generality, the remaining variables equal to zero if binary (except the baseline dummies *Electronics & Hardware* and year of establishment 2012), or to their sample mean if continuous or integer. For the sake of convenience, we refer to the new ventures, for which the remaining variables were set at these meaningful values, as the "baseline" new ventures. We first examined the effect of the interaction between the variable *Pledged Amount* and the dummy *Patents*. Specifically, based on the estimates obtained under the full model (see column 5 in Table 3), we computed the marginal change in the likelihood of securing funding

Table 3
Probit regression models reporting coefficients (in the first line for each variable) and average marginal effects (in the second line for each variable).

	Probit (1)	Probit (2)	Probit (3)	Probit (4)	Probit (5)
Top Startup Ecosystems	−0.284 (0.302)	−0.255 (0.310)	−0.431 (0.362)	−0.220 (0.329)	−0.413 (0.384)
	−0.068 (0.073)	−0.059 (0.071)	−0.089 (0.073)	−0.049 (0.073)	−0.082 (0.074)
Average Industry Experience	−0.015 (0.023)	−0.019 (0.023)	−0.025 (0.025)	−0.023 (0.023)	−0.030 (0.026)
	−0.004 (0.006)	−0.004 (0.005)	−0.005 (0.005)	−0.005 (0.005)	−0.006 (0.005)
MBA	0.108 (0.616)	0.291 (0.651)	−0.059 (0.816)	0.077 (0.716)	−0.311 (0.924)
	0.026 (0.148)	0.068 (0.151)	−0.012 (0.168)	0.017 (0.160)	−0.062 (0.183)
PhD	0.281 (0.425)	0.097 (0.456)	0.085 (0.486)	−0.091 (0.504)	−0.102 (0.510)
	0.068 (0.102)	0.023 (0.106)	0.017 (0.100)	−0.020 (0.113)	−0.020 (0.101)
Previous New Ventures	−0.122 (0.388)	−0.061 (0.397)	0.020 (0.430)	0.006 (0.406)	0.081 (0.437)
	−0.029 (0.093)	−0.014 (0.092)	0.004 (0.089)	0.001 (0.090)	0.016 (0.087)
Previous Funded or Sold New Ventures	1.057** (0.511)	1.189** (0.534)	1.412** (0.596)	1.115** (0.564)	1.352** (0.617)
	0.255** (0.114)	0.276** (0.113)	0.291*** (0.112)	0.250** (0.116)	0.269** (0.113)
Previous Professional Funding	0.237 (0.527)	−0.036 (0.505)	−0.420 (0.583)	−0.212 (0.507)	−0.713 (0.600)
	0.057 (0.127)	−0.008 (0.117)	−0.087 (0.120)	−0.047 (0.113)	−0.118 (0.043)
Patents	1.588*** (0.610)	1.443** (0.629)	2.813*** (0.955)	1.493** (0.627)	2.811*** (0.978)
	0.383*** (0.129)	0.335** (0.131)	0.267*** (0.060)	0.334*** (0.126)	0.268*** (0.061)
Total Linkedin Connections	0.0009** (0.0004)	0.0008** (0.0004)	0.001***(0.0004)	0.452** (0.211)	0.640** (0.251)
	0.0002** (0.0001)	0.0002** (0.0001)	0.0002*** (0.0000)	0.096** (0.043)	0.118*** (0.043)
Goal (Ln)	0.208 (0.155)	0.124 (0.157)	0.255 (0.185)	0.135 (0.157)	0.273 (0.190)
	0.050 (0.037)	0.029 (0.036)	0.053 (0.037)	0.030 (0.035)	0.054 (0.037)
Kickstarter Pick	0.376 (0.310)	0.296 (0.306)	0.417 (0.362)	0.215 (0.313)	0.310 (0.378)
	0.090 (0.075)	0.069 (0.071)	0.086 (0.074)	0.048 (0.071)	0.062 (0.076)
Pledged Amount (Ln)		0.432** (0.195)	0.331* (0.197)	0.313* (0.187)	0.221 (0.211)
		0.100** (0.044)	0.170*** (0.045)	0.077* (0.040)	0.154*** (0.046)
Pledged Amount (Ln) X Patents			6.598*** (2.088)		6.507*** (2.146)
			–		–
Pledged Amount (Ln) X Total LinkedIn Connections				0.360** (0.172)	0.364** (0.184)
				–	–
Year of Establishment (dummies)	Included	Included	Included	Included	Included
Subcategories (dummies)	Included	Included	Included	Included	Included
Constant	−4.056** (1.855)	−8.486*** (2.738)	−6.275*** (2.249)	−2.763 (1.856)	−5.366** (2.239)
N	105	105	105	105	105
Pseudo R^2	0.277	0.303	0.378	0.324	0.397

Standard errors in parentheses − * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

from professional investors due to an increase in the amount pledged at the two values of the dummy *Patents* (zero and one, respectively) for the "baseline" new venture. Fig. 1a shows that the marginal effect of the amount pledged in the reward-based crowdfunding campaign is positive and significant only when the new venture has been granted at least one patent for the new product idea. In fact, in absence of patents, the vertical segment in Fig. 1a, indicating the confidence interval, includes zero, whereas it is largely above zero (p-value < 0.001) when the dummy *Patents* is equal to one. This suggests that "baseline" new technology-based ventures pledging larger amount of money in the crowdfunding campaign are more likely to attract funding from professional investors only if they have been granted a patent for their new product idea. We repeated the above computation setting the value of the variable *Total LinkedIn Connections* at the sample maximum, rather than at the sample mean as done before. In this case, Fig. 1b shows that the marginal effect of the amount pledged in the reward-based crowdfunding campaign is always positive and significant (with p-value ranging from less than 0.05 to less than 0.001), irrespective of the presence of patents granted for the new product idea. This reveals that new technology-based ventures, displaying "baseline" characteristics except for the entrepreneur social capital (which is maximum or large enough) and able to pledge larger amount of money in the reward-based crowdfunding campaign are *always* more likely to attract funding from professional investors.

We replicated the above analysis for the effect of the interaction between the variables *Pledged Amount* and *Total LinkedIn Connections* and obtained qualitatively the same results. Specifically, Fig. 1c shows that, in absence of patents, the marginal effect of the amount pledged in the reward-based crowdfunding campaign is positive and significant (with p-value ranging from less than 0.05 to less than 0.001) only when the value of the entrepreneur social capital is quite large. On the other hand, Fig. 1d shows that the marginal effect of the amount pledged in the reward-based crowdfunding campaign is always positive and significant (p-value always less than 0.001) irrespective of the level of the entrepreneur social capital, when the dummy *Patents* is set equal to one rather than zero. Similarly to the previous interaction effect, these two figures suggest that, in absence of patents, "baseline" new technology-based ventures pledging larger amount of money in the reward-based crowdfunding campaign are more likely to attract funding from professional investors only when the entrepreneur has built a large network of social relationships. However, in the presence of patents, the positive informative function of the amount pledged is effective irrespective of the level of the entrepreneur social capital.

Overall, the analysis on marginal effects corroborates the results shown in Table 3 and clarifies that, for new technology-based ventures engaging in reward-based crowdfunding, the positive effect of the performance in such funding channel, as measured by the amount of money pledged, is significant only when coupled with the presence of patents and/or a large set of social ties. Interestingly, it also reveals that either of these two factors is sufficient to the emergence of this positive effect.

5. Robustness checks

5.1. Endogeneity check using IVs

In this section, we provide additional evidence to increase our confidence that the results obtained under the model presented in (1) are largely robust and do not suffer from potential endogeneity concerns due to unobservables. Specifically, we resort to the Instrumental Variables (IVs) approach to show the robustness of our major findings as well as the exogeneity of our main independent variable, i.e., *Pledged Amount*, and the relative interactions. In the first stage, we regress the amount pledged (and the relative interactions) against our set of control variables in model (1), including the variables *Patents* and *Total LinkedIn Connections*, plus two

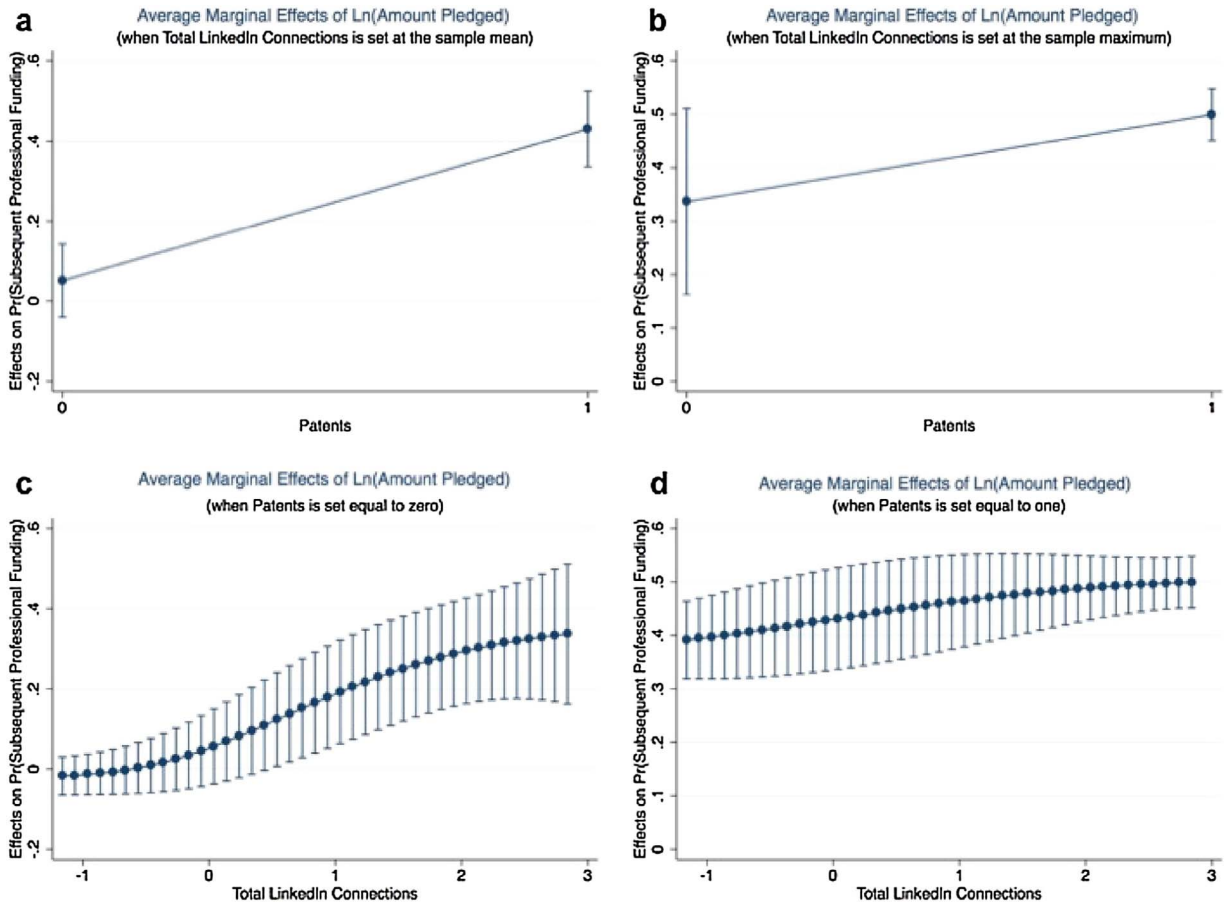

Fig. 1. The effect of a marginal change in the amount pledged computed at different values of the variables *Patents* (*a* and *b*) and (standardized) *Total LinkedIn Connections* (*c* and *d*), respectively. The variable is *Total LinkedIn Connections* is set equal to the sample mean in figure a, whereas to the maximum in figure b. The variable *Patents* is set equal to 0 in figure *c*, whereas to 1 in figure *d*. In all figures, the remaining variables are set equal to zero if binary (except for the dummies *Electronics & Hardware* and *Year of Establishment 2012*, which are set equal to one) or to their sample mean if continuous or integer.

instruments. When the interactions of our interest are considered, our first stage regressors include the interactions of each instrument with the variables *Patents* and *Total LinkedIn Connections* (i.e., the variables interacted in the second stage with the supposedly endogenous regressor *Pledged Amount*), as usually done when potentially endogenous regressors are interacted with other variables. In the second stage, we regress our dependent variable, i.e., the dummy *Subsequent Professional Funding*, against the set of controls in model (1), including the variables *Patents* and *Total LinkedIn Connections*, and the "adjusted" amount of money pledged variable (and its interaction terms with the variables *Patents* and *Total LinkedIn Connections*, when they are introduced).

The instruments utilized in this analysis are the number of times backers and the entrepreneur of each project have interacted within the Kickstarter platform with regard to the project during the campaign (*Number of Interactions*) and a measure of the propensity of backers to be active in the category Technology and thus fund this type of projects during a given project campaign (*Periodic Backer Propensity to Fund*). To obtain the first measure we have simply summed for each project the number of updates provided by the entrepreneur and the number of backers' comments to which the entrepreneur has replied before the campaign ended. Indeed, prior research has suggested that interacting frequently with the community and providing updates about the project are crucial to ultimately stimulate funding in reward-based crowdfunding platforms (Dushnitsky and Marom, 2013; Hui et al., 2014; Mollick, 2014; Colombo et al., 2015). To obtain the second measure, we have first computed for each project the total amount of money pledged by the backers of all Technology projects launched in the same period and showing at least 15 days of campaign overlap with it.[12] This indicates how much money backers have committed to technology projects in the platform in the same period the campaign of the given project has been launched. However, this amount naturally tends to increase with the number of projects launched during the period of the given project campaign because a higher number of projects in a given period tends to attract a higher number of backers. Therefore, to rule out any possible effect due to the growth of the phenomenon over time and more accurately capture the propensity of backers to fund in different periods, our final instrument is computed for each project by dividing the total amount pledged by the backers of all the projects in the category Technology during the crowdfunding campaign of the given project (with at least 15 days of campaign overlap) by the total number of technology projects available for funding in the same period. The intuitive argument behind the choice of this instrument is that a project launched in a period where backers are more active in their funding activities is more likely to result in a large amount of money pledged, i.e., large value of our main independent variable *Pledged Amount*.

To properly utilize the IVs approach and test for the exogeneity of our main independent variable, we first provide compelling arguments in support of the exogeneity of at least one instrument (and the relative interactions) and report the tests for exclusion restriction in order to

[12] Our results are robust also considering seven or one day of campaign overlap. We do not consider full overlap (e.g., 30 days) because projects tend to be launched on different dates and thus only a few of them displayed full overlap.

extend the validity to all the utilized instruments (Murray, 2006; Larcker and Rusticus, 2010). Afterwards, we check the strength of our instruments and resort to inference robust to weak instruments for the cases where the strength of our instruments cannot be supported (Andrews and Stock, 2002; Stock et al., 2002; Mikusheva, 2010). Finally, we show that the results obtained using the IVs approach are consistent with those presented in Table 3 (i.e., simple probit models) and also present the results of the exogeneity test for the main independent variable.

We argue that especially the instrument *Periodic Backer Propensity to Fund* is exogenous. First, this variable captures a characteristic of backers of projects falling in the category Technology in a given period (i.e., their propensity to be active in the platform and thus financially contribute to this type of projects over time). As such, it is predetermined in the sense that it cannot be determined or manipulated by the entrepreneur. The fact that the instrument *Periodic Backer Propensity to Fund* is not an entrepreneur's decision is a first important point to sustain our argument of exogeneity. Second, rather than being related to the quality of each specific project and in turn directly to the likelihood of receiving funding from professional investors, this instrument captures dynamics and behaviors that are typical of online communities (Weng and Fesenmaier, 2003; Wierz and de Ruyter, 2007; Liu and Aaker, 2008; Kraut and Resnick, 2011; Colombo et al., 2015), such as users' tendency to be more active and fund in certain periods of the year or in certain days of the week (Kuppuswamy and Bayus, 2015; Lile, 2015; Stegmaier, 2015). As a matter of fact, in line with these sources, we observed that our measure had negative peaks in the middle of holidays (e.g., Christmas) or when the campaign time span included a high number of weekends. In this respect, it is also crucial to underscore that the total absence of any monotonic behavior over time in our measure considerably reduces the chances that this instrument is directly correlated with the likelihood of receiving funding from professional investors for each specific project. It is indeed extremely unreasonable to hypothesize that professional investors modify their interest or their platform monitoring intensity to discover "investable" projects in a short period, such as from a month to the subsequent one. In addition, at least for projects in our sample, professional investors may not have even been informed about the greater propensity of backers to fund in certain periods of the year as our data relates to the initial stages of the reward-based crowdfunding phenomenon (at least for the category Technology), i.e., years 2011–2012, where not sufficient statistics about backers' behavior were available.[13] This further reduces the chances that the instrument *Periodic Backer Propensity to Fund* is directly correlated with the main dependent variable.

The above arguments make us confident that at least the instrument *Periodic Backer Propensity to Fund* (and consequently the relative interactions) can be treated as exogenous. Therefore, we rely on the exogeneity of this instrument (and the relative interactions) to show that, at least in our sample, all the utilized instruments, and thus also the *Number of Interactions* and the relative interactions, are valid (Murray, 2006; Larcker and Rusticus, 2010). Specifically, we perform both the Amemiya-Lee-Newey statistic and the J statistic for overidentifying restrictions for the IV probit regression models presented in Table 4. In this table the last two columns report the results of the second stage IV probit regression models corresponding to the simple probit models presented in columns 2 and 5 of Table 3 (i.e., without and with all interactions), respectively. As shown at the bottom of Table 4, the large insignificance of these two tests suggests that we cannot reject the hypothesis that our first stage instruments are exogenous.

We next check the strength of our instruments. As it can be seen at the bottom of Table 4 (last two columns), in most of the cases the F statistics related to the excluded instruments in each IV probit model are largely higher than the respective thresholds reported in the tables provided by Stock and Yogo (2005), thus implying that in such occurrences the instruments are sufficiently strong, so that the bias introduced by using the IVs approach is certainly not large. However, there is one case where the F statistics is below the respective threshold. To cope with it we resort to small sample adjusted tests that are robust to weak instruments to demonstrate that, even in presence of weak instruments, the bias introduced by the use of IVs is definitely not dangerous (Andrews and Stock, 2002; Stock et al., 2002; Mikusheva, 2010; Finlay et al., 2014). Specifically, at the bottom of Table 4, we report the Anderson-Rubin test, the Conditional Likelihood Ratio (CLR) test, the combined K-J test, and the Lagrange Multiplier K test. These tests, which are robust to the presence of weak instruments, are utilized to make inference on whether the values of the coefficients estimated for the supposedly endogenous variables (i.e., the variable *Pledged Amount* and the relative interactions with *Patents* and *Total LinkedIn Connections*, in our case) using the IV probit regression models cannot be rejected (Andrews and Stock, 2002; Stock et al., 2002; Mikusheva, 2010; Finlay et al., 2014). As shown at the bottom of Table 4 (last two columns), these tests are consistently insignificant, thus implying that the estimates obtained by using the IVs approach are not dangerously biased. In Table 4, we also report the first stage regressions for the model without interactions (column 1) and the three first stage regressions (one for each supposedly endogenous variable) for the model with all interactions (columns 2-3-4).

We can now test for exogeneity of our main independent variable, namely *Pledged Amount* (and the relative interactions when they are introduced) by means of the Wald test of exogeneity for probit models. Before doing that, we highlight that the results obtained by using the IVs approach are consistent with those obtained under the simple probit regression models presented in Table 3. Indeed, by looking at the complete model in last of column of Table 4, we observe, consistently with the results in Table 3, that the interaction terms are positive and significant, whereas the direct effect of the variable *Pledged Amount* is not significant. Marginal effects analysis yields the same results and can be made available from the authors. Hence, our findings are valid irrespective of the regression model (simple probit or IV probit regression model.) We presented the simple probit model in (1) as our main model because the Wald test of exogeneity reported at the bottom of Table 4 (last two columns) for each model is largely insignificant, implying that the exogeneity assumption cannot be rejected. In this case, the use of the IV regression approach should not be preferred due to the fact that IV methods are never unbiased (though not dangerously, in our case) and the standard errors have the tendency to be large (Wooldridge, 2002, pp. 101–105).

5.2. Addressing sample selection: Heckman selection model

In this section we check robustness of our findings to any bias potentially arising from sample selection. Indeed, since we observe only new ventures engaging in reward-based crowdfunding, our findings may be affected by unobservables correlated to both the decision to launch a reward-based crowdfunding campaign and the likelihood to receive funding from professional investors. We argue that this should not be the case in our setting because the scope of the paper is to generate insights only on the relationship between the crowdfunding performance and the probability of receiving subsequent professional funding for new ventures engaging in reward-based crowdfunding. We do not study the effects of engaging versus not engaging in crowdfunding on the same probability. Hence, the relevant unobservables should be only those related to both the crowdfunding performance measure and the likelihood of receiving professional funding, which have been already addressed by means of the IVs approach. Nevertheless, we perform the Heckman selection model for probit regression, which introduces a two-stage process to correct sample-

[13] For the same reason, it is also hard to believe that entrepreneurs' decision to launch their crowdfunding campaigns in certain periods depends on the quality of their projects as sufficient statistics about backers' behavior were not accessible to entrepreneurs to influence their decisions.

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Table 4
Instrumental Variables (IVs) probit regression models.

	First stage IVs probit regression models				Second stage IVs probit regression models	
	First stage IVs regression on Pledged Amount (no interactions) − corresponding to IV Probit (2)	First stage IVs regression on Pledged Amount (all interactions) − corresponding to IV Probit (5)	First stage IVs regression on Pledged Amount X Patents (all interactions) − corresponding to IV Probit (5)	First stage IVs regression on Pledged Amount X Total LinkedIn Connections (all interactions) − corresponding to IV Probit (5)	IV Probit (2) − no interactions	IV Probit (5) − all interactions
Top Startup Ecosystems	0.130	0.217	0.032	−0.183	−0.290	−0.226
	(0.131)	(0.154)	(0.079)	(0.159)	(0.388)	(0.545)
Average Industry Experience	−0.009	−0.008	−0.009	0.018	−0.019	−0.038
	0.010	(0.011)	(0.006)	(0.012)	(0.029)	(0.042)
MBA	−0.268	−0.303	0.164	0.127	0.217	−1.520
	(0.303)	(0.359)	(0.185)	(0.370)	(0.910)	(1.526)
PhD	0.371*	0.259	0.016	0.110	0.168	−0.065
	(0.194)	(0.234)	(0.120)	(0.240)	(0.571)	(0.843)
Previous New Ventures	−0.178	−0.107	−0.115	−0.061	−0.112	0.157
	(0.145)	(0.171)	(0.088)	(0.176)	(0.425)	(0.584)
Previous Funded or Sold New Ventures	0.144	−0.053	0.267**	−0.088	1.207**	1.063
	(0.200)	(0.246)	(0.126)	(0.253)	(0.593)	(0.877)
Previous Professional Funding	0.277	0.347	0.107	0.637**	0.146	−1.352
	(0.241)	(0.279)	(0.143)	(0.287)	(0.738)	(1.277)
Patents	0.561**	0.698***	0.591***	0.009	1.585**	2.556
	(0.226)	(0.259)	(0.133)	(0.266)	(0.683)	(1.737)
Total LinkedIn Connections	0.0003*	0.111	−0.013	0.062	0.0009**	0.985**
	(0.0002)	(0.088)	(0.045)	(0.090)	(0.0004)	(0.407)
Goal (Ln)	0.153**	0.139*	0.046	−0.034	0.162	0.385
	(0.065)	(0.077)	(0.040)	(0.080)	(0.205)	(0.308)
Kickstarter Pick	0.176	0.226	0.063	0.328**	0.333	0.067
	(0.123)	(0.145)	(0.075)	(0.149)	(0.383)	(0.592)
Periodic Backer Propensity to Fund (Ln)	0.376**	0.202**	−0.042	−0.004		
	(0.169)	(0.088)	(0.045)	(0.091)		
Number of Interactions	0.0006***	0.557***	0.083**	0.264***		
	(0.0001)	(0.069)	(0.035)	(0.071)		
Periodic Backer Propensity to Fund (Ln) X Patents		−0.115	0.523***	−0.422		
		(0.257)	(0.132)	(0.265)		
Periodic Backer Propensity to Fund (Ln) X Total LinkedIn Connections		0.075	−0.062	0.258***		
		(0.093)	(0.048)	(0.095)		
Number of Interactions X Total LinkedIn Connections		0.111*	−0.001	0.674***		
		(0.062)	(0.032)	(0.064)		
Pledged Amount (Ln)					0.156	−0.704
					(0.418)	(0.885)
Pledged Amount (Ln) X Patents						8.491**
						(3.475)
Pledged Amount (Ln) X Total LinkedIn Connections						1.258**
						(0.641)
Year of Establishment (dummies)	Included	Included	Included	Included	Included	Included
Subcategories (dummies)	Included	Included	Included	Included	Included	Included
Constant	6.237***	−1.007	−0.506	−0.180	−5.556	−5.702
	(1.999)	(0.905)	(0.465)	(0.931)	(4.940)	(3.618)
N	105	105	105	105	105	105
R^2	0.675	0.698	0.535	0.652	–	–
Statistics						
Amemiya-Lee-Newey statistic (Overidentification test) − pvalue					0.335	0.590

(continued on next page)

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Table 4 *(continued)*

	First stage IVs probit regression models				Second stage IVs probit regression models	
	First stage IVs regression on Pledged Amount (no interactions) − corresponding to IV Probit (2)	First stage IVs regression on Pledged Amount (all interactions) − corresponding to IV Probit (5)	First stage IVs regression on Pledged Amount X Patents (all interactions) − corresponding to IV Probit (5)	First stage IVs regression on Pledged Amount X Total LinkedIn Connections (all interactions) − corresponding to IV Probit (5)	IV Probit (2) − no interactions	IV Probit (5) − all interactions
J overidentification test − pvalue					0.331	0.566
F-statistic for instruments included in the first stage regression on Pledged Amount					38.56	17.17
F-statistic for instruments included in the first stage regression on Pledged Amount X Patents					–	4.54
F-statistic for instruments included in the first stage regression on Pledged Amount X Total LinkedIn Connections					–	37.29
Anderson-Rubin test – pvalue					0.586	0.784
Conditional Likelihood Ratio test (CLR) – pvalue					0.725	0.778
K-J combined test − pvalue					0.774	0.784
Lagrange multiplier K test – pvalue					0.724	0.726
Wald test of exogeneity – pvalue					0.420	0.355

Standard errors in parentheses − $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Note: in the first stage regressions the interaction variable *Number of Interactions X Patents* has not been included because of the strong collinearity with the variable *Periodic Backer Propensity to Fund (Ln) X Patents*, which is naturally due to the low number of new ventures being granted a patent for their product idea. Still, our model is over-identified as there are more instruments than variables treated as endogenous.

induced endogeneity (Heckman, 1979; Certo et al., 2016). The Heckman selection model helps correct for the potential bias created by unobservables that drive the decision to use crowdfunding. For instance, one of these unobservables could be the fact that some new ventures in our sample may choose to use crowdfunding because they are less interested in seeking funding from professional investors.

To apply the Heckman selection model, we take advantage from the availability of a large sample of new technology-based entrepreneurial ventures (in the same product categories) that did not engage in any crowdfunding campaign during our period of observation. This sample encompasses 834 technology-based new ventures in the same product categories (i.e., Electronics & Hardware, Software & Internet, 3D Printing & Robotics, Aerospace), established in the same range of years (i.e., 2005–2012) and in the same geographic areas (i.e., the great majority in US, the rest in Canada and UK) as the “kickstarted” ventures, still being alive at the end of our observation period, and for which we were able to retrieve all necessary information through the same sources, i.e., new ventures’ websites, LinkedIn, USPTO, ThomsonOne-VentureXpert and Crunchbase, and at the same time of data collection as that of our sample of “kickstarted” new ventures. In Table 1–Panel B, we summarize the descriptive statistics for this sample.

To apply the Heckman selection model, the set of first-stage regressors must include at least one variable that is not utilized in the second stage regression. In this respect, we use a dummy variable, namely *B2B* (business-to-business), which is likely to explain the decision to use reward-based crowdfunding. This dummy is equal to one if the type of market the new venture intends to serve is business-to-business (B2B), zero if it is business-to-consumers (B2C). Because of the reward mechanism, reward-based crowdfunding is mostly suitable for consumer products. Therefore, it is expected that most of the technology-based new ventures in Kickstarter would focus on the B2C market. In fact, from Table 1, we observe that approximately 94% of the “kickstarted” new ventures in our sample focus on the B2C market. In contrast, for the sample of 834 entrepreneurial ventures (in the same product categories) not engaging in crowdfunding, the percentage of those operating in the B2C market is about 67%, which suggests a considerable difference between the two samples of entrepreneurial ventures. While the type of market strongly affects the choice of using reward-based crowdfunding (as shown later in Table 5), there is no strong argument to claim that it should directly influence the likelihood of receiving funding from professional investors. This makes the dummy *B2B* suitable for the Heckman model. Indeed, there is large evidence that both B2C and B2B new ventures are funded by professional investors (Lee, 2016; Reuters News, 2016).

In addition to the dummy *B2B*, the first stage regression includes almost all the variables also utilized in the second stage regression. In Table 5 the first two columns report the results of the first stage regressions, whereas the second two columns report the corresponding second stage regressions without and with all interactions, respectively.[14] First stage regression results suggest entrepreneurial ventures engaging in reward-based crowdfunding have significantly smaller network of social ties, display a significantly lower percentage of occurrences of granted patents, and are less frequently founded and/or managed by people with large industry experience and holding an MBA. In addition, new ventures that intend to commercialize software or run Internet-centered business tend not to use reward-based crowdfunding. Finally, as anticipated, reward-based crowdfunding is much more likely to be utilized by B2C new entrepreneurial ventures ($p < 0.001$). According to Certo et al. (2016), the fact that the first

[14] The results are fully robust also when considering only new ventures not engaging in crowdfunding established in years 2009–2012 (the analysis can be made available from the authors). This case is useful to take into account the fact that less recent new ventures did not use crowdfunding simply because Kickstarter did not exist before 2009.

stage pseudo R^2 is quite high (it is indeed equal 0.47, much higher than in their study) is also an indication of the strength of the dummy *B2B*, which reassures us on the reliability of the Heckman model.

The second stage regression results are qualitatively the same as those obtained in our basic model in Table 3 (columns 2 and 5), thus implying that even running the Heckman model yields the same robust message (in the interest of length, the marginal effects analysis can be made available from the authors). Actually, the use of a sample of entrepreneurial ventures not engaging in crowdfunding enhances the understanding of our findings. Indeed, given that on average technology-based entrepreneurial ventures engaging in reward-based crowdfunding have smaller network of social ties and have been granted patents less frequently than their counterparts not using such funding channel, professional investors really need to observe a good signal from the crowdfunding campaign coupled with a good evidence of patents and/or entrepreneur social capital before committing to any funding. At the bottom of Table 5 we report the Wald test for the significance of rho (i.e., the correlation between the errors of first and second stage regressions). The large insignificance of this test coupled with the strong significance of our dummy *B2 B* increases our confidence that there is no relevant selection bias in our standard probit regression models reported in Table 3, thus further supporting our choice of proposing that model as the main one.

5.3. Alternative characterizations of the performance in reward-based crowdfunding

In this section, to verify the robustness of our findings, we analyze the effect of alternative characterizations of the performance in reward-based crowdfunding campaigns on the likelihood of receiving subsequent funding from professional investors.

First, we check robustness by explicitly controlling for whether the new venture was successfully funded (i.e., was at least able to equalize the goal). In Table 6, columns 3–4, we add the dummy *Successful Crowdfunding* to the main models presented in Table 3 without and with all interactions. This dummy is shown to be largely insignificant and its inclusion does not change our findings on *Pledged Amount* and the relative interactions.[15] In addition, we have verified that this dummy is not significant even when it is used as an alternative to the variable *Pledged Amount*, which is then removed from the analysis (the results of this analysis are available from the authors). This insignificance holds also when enlarging the sample by reducing the threshold for inclusion to an amount pledged equal at least equal to $30,000 (which increases the number of unsuccessful campaigns). These results suggest that professional investors are not much interested in whether the campaign is successful or not (i.e., whether the project is at least able to reach the goal or not). Professional investors, indeed, seek information about the market prospects of the new product idea and thus are receptive of signals from the crowdfunding campaign able to reflect this type of information. Hence, the intuition we derive from connecting these results with the main ones is that, in the eyes of professional investors, simply exceeding the goal is not a sufficient indication of the future market response. In contrast, the magnitude of backers' commitments to the project is a much better indication of the market prospects of the entrepreneurial project and as such it is the measure of crowdfunding performance that professional investors tend to consider in their funding decisions, as demonstrated by the results obtained when using the *Pledged Amount*.

Second, we discuss the implications of using another possible measure of performance in the crowdfunding campaign, namely the ratio of the amount pledged over the goal (our variable *Ratio Pledged Amount over Goal*) and connect them with those obtained under the main model. In our main model, we examine the effect (without and with the interactions with patents and entrepreneur social capital) of the variable *Pledged Amount*, i.e., the contributions pledged by backers for the new product idea. This is because we are interested in capturing an indication of the market potential of new technology-based projects launched on Kickstarter. We believe that this variable is the most suitable to this scope as it clearly reflects consumers' interest and willingness to pay for the new product idea. In a model where the variable *Ratio Pledged Amount over Goal* is used as a measure of crowdfunding performance, the interpretation should be different. Indeed, this ratio measures how much the new venture is able (or not able) to exceed the goal. Therefore, interpreting the ratio as a "pure" indication of the market prospects of the project may be problematic for projects launched on Kickstarter. As already discussed, this is because the all-or-nothing mechanism used by the platform naturally provides entrepreneurs with the incentive to undercut the goal to mitigate the risk of failing in the campaign, thus possibly revealing differences in terms risk aversion among entrepreneurs. This argument is supported by the fact that on average the new ventures in our sample exceeds the goal they set by six times, with no difference between new ventures that received funding after the campaign and those that did not (the averages are 6.23 and 5.87, respectively). Also, more than 70% of new ventures display an amount pledged at least twice the corresponding goal. Therefore, the simple ratio may not be that meaningful per sé. For instance, a high ratio could be achieved even in the presence of a relatively limited amount of backers' commitments by simply setting a very low goal, and as such may not generate any interest from professional investors, who seek instead information about the market prospects of the new product idea. It is not a case that in our sample the highest ratio is related to a project displaying the second lowest goal in the sample, i.e., $5000. Vice versa, for the same reason, a not so high ratio could still attract professional investors if it is obtained by exceeding a very challenging goal. Therefore, in comparison with the main model, the role of the variable *Goal* becomes much more important to better interpret the results when the ratio is used as a measure of crowdfunding performance. Especially in a model where the ratio is considered, the variable *Goal* helps control not only for the fact that projects may be heterogeneous in terms of investment required at least in the initial stages, but also for the fact that certain entrepreneurs may set the goal at very low levels and it is easier for them to reach high ratios, whereas other may set quite challenging goals and thus it is harder for them to display high ratios. In the first column of Table 6 we present the results of the model where the variable *Ratio Pledged Amount over Goal* substitutes the variable *Pledged Amount* (the case without interactions). In this model both *Ratio Pledged Amount over Goal* and *Goal* variables are largely significant and positive. This may appear as a different result from that obtained under the main model, where the *Pledged Amount* is positive and significant but the *Goal* is not significant (Table 3, column 2). Note, however, that the *Goal* is *per se* not significant. Indeed, the first column of Table 3, where only control variables are included (i.e. neither *Pledge Amount* nor *Ratio Pledged Amount over Goal* are included), shows that the *Goal* is not significant. Essentially, the variable *Goal* becomes relevant only when the variable *Ratio Pledged Amount over Goal* is included. This is because in this model both variables are useful to capture the role of crowdfunding as a mechanism to provide an indication of the market potential of a new product idea and thus ignite the interest of professional investors. The variable *Goal* tends to capture the positive benefits (in terms of subsequent funding from professional investors) of setting a challenging goal without necessarily showing a great magnitude in the ratio. That is, it helps capture the fact that professional investors can still be interested in projects setting very challenging goals but displaying not particularly relevant ratios, e.g., ratio not much higher than 1, because the campaign can still show large amount of backers' commitments and thus the market potential can still be high in this case. The variable

[15] Our findings are confirmed even when restricting our sample only to those new ventures that were successfully funded on Kickstarter.

Table 5
Heckman selection model: first and second stage regressions.

	First stage selecting for crowdfunding (no interactions)	First stage selecting for crowdfunding (all interactions)	Second stage (no interactions)	Second stage (all interactions)
Top Startup Ecosystems	−0.081	−0.064	−0.256	−0.433
	(0.159)	(0.165)	(0.312)	(0.366)
Average Industry Experience	−0.026**	−0.025***	−0.019	−0.040
	(0.009)	(0.009)	(0.027)	(0.028)
MBA	−1.005***	−1.014***	0.283	−0.510
	(0.256)	(0.257)	(0.698)	(0.891)
PhD	0.0001	−0.0007	0.099	0.040
	(0.220)	(0.219)	(0.456)	(0.529)
Previous New Ventures	−0.006	0.034	−0.062	0.063
	(0.161)	(0.158)	(0.413)	(0.427)
Previous Funded or Sold New Ventures	−0.006	−0.014	1.193**	1.399**
	(0.196)	(0.198)	(0.560)	(0.585)
Previous Professional Funding	–	–	−0.036	−0.694
	–	–	(0.505)	(0.557)
Patents	−0.554**	−0.552**	1.436**	2.401*
	(0.226)	(0.225)	(0.667)	(1.389)
Total LinkedIn Connections	−0.0007***	−0.0006***	0.0008	0.478
	(0.0002)	(0.0002)	(0.0005)	(0.386)
B2B	−1.072***	−1.096***	–	–
	(0.254)	(0.255)	–	–
Goal (Ln)	–	–	0.125	0.296*
	–	–	(0.165)	(0.179)
Kickstarter Pick	–	–	0.296	0.307
	–	–	(0.306)	(0.358)
Pledged Amount (Ln)	–	–	0.433**	0.221
	–	–	(0.197)	(0.196)
Pledged Amount (Ln) X Patents	–	–		6.123**
	–	–		(2.499)
Pledged Amount (Ln) X Total LinkedIn Connections	–	–		0.359**
	–	–		(0.183)
Year of Establishment (dummies)	Included	Included	Included	Included
Subcategories (dummies)	Included	Included	Included	Included
Constant	0.156	−0.173	−8.515***	−5.967***
	(0.327)	(0.330)	(3.060)	(2.135)
N	939 (834)	939 (834)	105	105
Wald test rho = 0 (p-value)	–	–	0.980	0.566
rho	–	–	0.015	0.488

Standard errors in parentheses − * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Ratio Pledged Amount over Goal instead tends to capture the positive benefits (in terms of subsequent funding from professional investors) of largely exceeding the goal in the campaign irrespective of the goal set. In contrast, in the main model the informative role of the crowdfunding campaign is entirely captured by the variable *Pledged Amount* as this variable itself provides an indication of consumers' interest and willingness to pay for the new product idea and as such it is not particularly affected by the goal set by the entrepreneur.

To verify the result obtained under the main model that the performance in the crowdfunding campaign exerts a positive influence on the likelihood of attracting funding from professional investors only when it is complemented by positive evidences with regard to the patents granted for the new product idea and/or the entrepreneur social capital, we introduce the interactions between the variable *Ratio Pledged Amount over Goal* and these two variables in the second column of Table 6. However, in order to mitigate the problems associated with using the variable *Ratio Pledged Amount over Goal* we need to follow the same logic. That is, in addition to controlling for the *Goal*, we need to control for the interactions between this variable and the measures of patents and entrepreneur social capital. Indeed, for those less risk-averse new ventures that set more challenging goals and thus can hardly reach high ratios even in the presence of a large amount pledged, the interaction between the ratio and the entrepreneur social capital (patents) may not capture the benefits of a joint increase in the entrepreneur social capital (or the presence of patents) and the amount of backers' commitments to the project. For these new ventures, these benefits (in terms of subsequent funding from professional investors) may be better captured by the interactions of the *Goal* and the two other determinants of new venture financing, namely entrepreneur social capital and patents. In addition, missing to control for these interactions might artificially reduce the effect of a joint increase of the ratio and these determinants on the likelihood of subsequent funding. This is because in this case such effect would be affected by the presence of projects that display largely inflated ratios but are less likely to attract professional investors because their large ratios are not the consequence of large interest and commitments from the crowd, but simply the result of low goals set by these entrepreneurs. For these reasons, in Table 6, column 2, we report the results of a regression model where the interactions between the *Goal* and the measures of patents and entrepreneur social capital are included, in addition to the interactions involving the variable *Ratio Pledged Amount over Goal*. At any rate, we verified that our results are robust even when the interactions involving the *Goal* are removed, though the level of significance is slightly reduced, as expected. The results presented in Table 6, column 2, show that the interactions of the variable *Ratio Pledged Amount over Goal* with the variables *Patents* and *Total LinkedIn Connections* are significant and positive, whereas the variable *Ratio Pledged Amount over Goal* becomes no longer significant. The interactions of the variable *Goal* with the variables *Patents* and *Total LinkedIn Connections* are also positive and significant, whereas the variable *Goal* becomes no longer significant. Hence, our message that the positive performance in the crowdfunding is effective in raising the odds of subsequent professional financing only when complemented by the presence of patents and/or a large network of social ties still holds. However, this new analysis helps provide additional insights as it reveals that, when coupled with the presence of patents and/or large social capital, not only the ability to significantly

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Table 6
Additional probit regression models for robustness check.

	Ratio Pledged Amount Pledged over Goal as independent variable (no interactions)	*Ratio Pledged Amount over Goal* as independent variable (all interactions)	Controlling for whether the campaign is successful (no interactions)	Controlling for whether the campaign is successful (all interactions)	Controlling for *Delivery* (no interactions)	Controlling for *Delivery* (all interactions)	Selection threshold on the *Pledged Amount* equal to $30,000 (no interactions)	Selection threshold on the *Pledged Amount* equal to $30,000 (all interactions)
Top Startup Ecosystems	−0.255	−0.157	−0.255	−0.435	−0.271	−0.406	−0.273	−0.289
	(0.310)	(0.395)	(0.310)	(0.394)	(0.23)	(0.392)	(0.272)	(0.322)
Average Industry Experience	−0.019	−0.006	−0.022	−0.040	−0.008	−0.023	−0.031	−0.037
	(0.023)	(0.030)	(0.024)	(0.030)	(0.023)	(0.026)	(0.021)	(0.026)
MBA	0.291	0.020	0.294	−0.284	0.537	−0.023	0.410	0.095
	(0.651)	(0.910)	(0.638)	(0.855)	(0.624)	(0.849)	(0.496)	(0.598)
PhD	0.097	−0.743	0.107	−0.084	−0.010	−0.214	0.656	0.627
	(0.456)	(0.708)	(0.460)	(0.518)	(0.451)	(0.504)	(0.459)	(0.491)
Previous New Ventures	−0.061	0.266	−0.037	0.159	0.003	0.096	0.108	0.245
	(0.399)	(0.464)	(0.401)	(0.450)	(0.404)	(0.434)	(0.337)	(0.366)
Previous Funded or Sold New Ventures	1.189**	1.485**	1.187**	1.389**	1.048*	1.259**	1.059**	1.207**
	(0.534)	(0.638)	(0.530)	(0.620)	(0.566)	(0.637)	(0.511)	(0.545)
Previous Professional Funding	−0.036	−0.152	0.029	−0.521	−0.300	−0.975	0.291	0.029
	(0.505)	(0.612)	(0.530)	(0.633)	(0.586)	(0.690)	(0.418)	(0.492)
Patents	1.443**	16.819***	1.431**	2.816***	1.426**	2.798***	1.390**	0.808
	(0.629)	(1.367)	(0.636)	(0.993)	(0.628)	(0.965)	(0.553)	(0.756)
Total LinkedIn Connections	0.0008**	0.573**	0.0008**	0.625**	0.0008**	0.655**	0.0006**	0.395**
	(0.0004)	(0.278)	(0.0004)	(0.251)	(0.0004)	(0.258)	(0.0003)	(0.181)
Goal (Ln)	0.557**	0.222	0.074	0.114	0.326	0.438*	0.032	0.150
	(0.230)	(0.348)	(0.204)	(0.247)	(0.204)	(0.237)	(0.143)	(0.159)
Kickstarter Pick	0.296	0.600	0.312	0.378	0.136	0.145	0.271	0.272
	(0.306)	(0.379)	(0.306)	(0.381)	(0.319)	(0.391)	(0.282)	(0.320)
Pledged Amount (Ln)			0.449**	0.279	0.375*	0.176	0.307*	0.116
			(0.205)	(0.222)	(0.213)	(0.219)	(0.160)	(0.194)
Pledged Amount (Ln) X Patents				7.039***		6.092***		5.557***
				(2.124)		(2.180)		(2.119)
Pledged Amount (Ln) X Total LinkedIn Connections				0.352*		0.398**		0.337**
				(0.181)		(0.182)		(0.171)
Ratio Pledged Amount over Goal (Ln)	0.432**	0.417						
	(0.195)	(0.298)						
Ratio Pledged Amount over Goal (Ln) X Patents		2.151***						
		(0.181)						
Ratio Pledged Amount over Goal (Ln) X Total LinkedIn Connections		0.515***						
		(0.197)						
Goal (Ln) X Patents		2.371***						
		(0.207)						
Goal (Ln) X Total LinkedIn Connections		0.294*						
		(0.178)						
Successful Crowdfunding			−0.321	−0.918				
			(0.701)	(0.856)				
Delivery					1.182**	0.938		
					(0.565)	(0.579)		
Year of Establishment (dummies)	Included	Included	Included	Included	Included	Included	Included	Included

(continued on next page)

Table 6 (*continued*)

	Ratio Pledged Amount Pledged over Goal as independent variable (no interactions)	*Ratio Pledged Amount over Goal* as independent variable (all interactions)	Controlling for whether the campaign is successful (no interactions)	Controlling for whether the campaign is successful (all interactions)	Controlling for *Delivery* (no interactions)	Controlling for *Delivery* (all interactions)	Selection threshold on the *Pledged Amount* equal to \$30,000 (no interactions)	Selection threshold on the *Pledged Amount* equal to \$30,000 (all interactions)
Subcategories (dummies)	Included	Included	Included	Included	Included	Included	Included	Included
Constant	−8.486***	−7.376***	−7.787***	−2.796	−11.188***	−7.894***	−5.994***	−3.857**
	(2.738)	(0.905)	(2.930)	(3.324)	(3.150)	(2.914)	(1.945)	(1.797)
N	105	105	105	105	105	105	136	136
Pseudo R^2	0.303	0.492	0.304	0.403	0.322	0.409	0.297	0.367

Standard errors in parentheses – $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

exceed the goal has a positive impact on the likelihood of securing funding from professional investors, but also setting a challenging goal plays an important role.

Finally, we also analyze some additional effects of the performance in crowdfunding in relation to the ability to deliver the promised rewards to the backers. Indeed, on the one hand, it may be argued that projects raising large amounts in the campaign (far in excess of the goal) are more likely to face troubles fulfilling their promises because they may be unprepared to manage the excess of requests received. On the other hand, obtaining much more funding than requested may protect the new venture from wrong estimates of the cost needed to fulfill the promises and/or from unexpected events that may occur in the new product development process, and thus it may actually facilitate the delivery of rewards. Understanding how the amount raised in the campaign influences ability to deliver of the new venture is important because the ability to deliver may be a potential factor of success, which may in turn have a positive impact on the likelihood of receiving subsequent funding from professional investors. In this case, the role of the performance in crowdfunding in attracting professional investors might not be attributable to the arguments we propose, but mostly to these dynamics related to the ability to deliver. To cope with this issue, we first regress the dummy variable *Delivery*, indicating for each project whether the rewards were delivered to the backers during our observation period or not, against several measures of crowdfunding performance, in turn *Pledged Amount*, *Ratio Pledged Amount over Goal* and also the real amount of money transferred to the entrepreneur, i.e., *Pledged Amount* x *Successful Crowdfunding*, as well as the usual control variables. The results of these regressions (unreported in the interest of length) show that new ventures better performing in crowdfunding (e.g., those far exceeding their goal) are significantly more likely to deliver the rewards to backers. Therefore, the positive effect of the crowdfunding performance on the ability to deliver seems to prevail over the negative effect. That is, receiving much larger amounts than requested increases the chances to deliver the rewards, possibly because the benefits derived from the larger availability of money to use in the new product development process outweigh the disadvantages of managing such large excess demand. The limited impact of the negative effect is also supported by the evidence that the great majority of the projects actually deliver (Mollick, 2014). Specifically, Mollick (2014) documents that most of the projects do face some troubles delivering the rewards, but this mostly results in delayed delivery, not on failure to deliver. In line with this evidence, in our sample only 14% of new ventures failed to deliver. The next step is to disentangle the positive effect of the crowdfunding performance due to the arguments we propose − namely the fact that the crowdfunding campaign informs professional investors about the market potential of the new entrepreneurial venture − from the influence that the crowdfunding performance may indirectly exert on the likelihood of receiving subsequent funding from professional investors through its positive influence on the ability to deliver. To accomplish this, the most reasonable approach is to add the dummy *Delivery* to the main model in Table 3. By doing so, indeed, we explicitly control for the effect of the ability to deliver and thus also for this potential indirect effect of the crowdfunding performance. The results in Table 6 column 5 (model with no interactions) show that the effect of the amount pledged in the campaign remains significant even after controlling for the ability to deliver (the same result can be obtained using the *Ratio Pledged Amount over Goal*). This further increases our confidence that the positive effect of the performance in the crowdfunding campaign due to its informational value still emerges. Indeed, if it were only due to the influence on the ability to deliver, the direct effect of the crowdfunding performance should have been largely insignificant after the introduction of the dummy *Delivery*. However, we recognize that the ability to deliver does matter, as demonstrated by the positive and significant coefficient of the dummy *Delivery*. In particular, this implies that professional investors take into account the ability to deliver and tend to be more

likely to fund those new ventures able to fulfill their promises. Moreover, it suggests that the indirect effect of the performance in the crowdfunding campaign on the likelihood of securing subsequent funding from professional investors, i.e., the effect through its positive influence on the ability to deliver, is also likely to be at work. Finally, we note that the controlling for the ability to deliver does not change our main findings even after introducing the interaction of our measure of crowdfunding performance with patents and entrepreneur social capital. Indeed, in the sixth column of Table 6, in the presence of the interaction terms the variable *Amount Pledged* becomes no longer significant, whereas such interaction terms are largely positive and significant as in the main model in Table 3. This confirms the message that a relevant crowdfunding performance is really effective in favoring access to funding from professional investors when coupled with other important signals, namely the presence of patents and/or a large set of network ties.[16]

5.4. Additional robustness checks

We also perform a number of additional robustness checks. First, we check robustness of our results by evaluating the effects of our threshold for inclusion in our sample. Recall that we have included in our sample only those new technology-based ventures able to pledge at least $50,000 in order to significantly reduce the heterogeneity in terms of size and nature. We extend the analysis by considering less restrictive thresholds of $40,000 and $30,000 in terms of amount pledged, but still maintaining all other constraints imposed to ensure adequate homogeneity, e.g., only Technology category, alive, for-profit and of similar age new ventures in the same observation period, etc. By doing so, we should not lose much in terms of homogeneity, while raising number of observations from 105 to 113 and 136, respectively. As shown in columns 7–8 of Table 6 (where, in the interest of length, only the results under the threshold $30,000 are presented), slackening the threshold slightly does not change our main findings qualitatively, further confirming their robustness. In addition, to the purpose of showing that the exclusion of high-goal projects not able to reach an acceptable level of amount pledged does not influence our results, we add to the sample of projects reaching an amount pledged at least equal to $30,000, the projects reaching an amount pledged less than $30,000 but for which the entrepreneur set a goal at least equal to $50,000. The results demonstrate that the inclusion of these high-goal low-amount projects simply strengthens our message. Indeed, as discussed earlier, the large majority of high-goal low-amount projects are hardly funded by professional investors because the large unsuccessful performance in crowdfunding is indicative of the fact that they do not even possess the basic characteristics necessary to be potentially attractive to professional investors. This leads to neater differences in terms of likelihood of receiving funding from professional investors between these projects and those reaching sufficiently large amount pledged, thus resulting in an artificially increased significance of the positive effect of amount pledged. Nevertheless, we still find that the effect of the performance in the crowdfunding campaign emerges and gets reinforced only when coupled with the presence of patents and/or a large network of social ties (the analysis is available from the authors).

We also provide additional evidence that our main sample consists of new ventures comparable in terms of level of interest/need and thus our results are not biased by sample composition. If there exists different level of interest/need for subsequent funding across the new ventures in our sample, this should mostly depend on the different need for capital. That is, new ventures lacking of financial resources to a greater extent should be more interested in seeking subsequent funding. In our main model, by including the variable *Previous Professional Funding*, we already take into account the different need for funding across new ventures related to the fact that some new ventures may have received funding before the crowdfunding campaign, while other may have not. However, given that the crowdfunding campaign itself generates financial resources, it may be argued that new ventures receiving larger amounts of money in the campaign may still have less interest/need in seeking subsequent funding because crowdfunding money serves adequately. While we have pointed out that, by construction, our main sample consists of technology-based entrepreneurial projects for which crowdfunding only provides initial capital and thus further capital is needed for growth and expansion, here we provide further evidence to support this claim. Indeed, if the new ventures in our sample were not similar in terms of level of interest/need for funding, we should observe the existence of a counteracting effect of the crowdfunding performance that reduces new venture's need for seeking subsequent funding, in addition to the positive effect we posit in the paper. This counteracting effect can be captured by running a regression without interactions where the quadratic term of the variable measuring the crowdfunding performance is also included. Irrespective of the measure utilized (*Pledged Amount*, *Ratio Pledged Amount over Goal* and the real amount of money transferred to the entrepreneur, i.e., *Pledged Amount* x *Successful Crowdfunding*), we find that the quadratic term is never significant, whereas the linear term remains positive and significant (the analysis is available from the authors). Hence, raising larger amounts in crowdfunding does not reduce the need/interest for subsequent funding from professional investors. This strengthens our argument that the new ventures in our sample are comparable in this respect.

We also demonstrate the robustness of our findings by using the amount of funding from professional investors received by the new ventures instead of the dummy *Subsequent Professional Funding*. Our results are also robust when considering all the patents granted to the key people, even those not necessarily related to the entrepreneurial project they have launched on Kickstarter. Finally, to rule out the fact that crowdfunding money may be used to build a prototype, thus impeding the disentanglement of the role of reward-based crowdfunding as a vehicle to reduce market uncertainty, we check whether new ventures had developed a prototype for their product idea before launching the crowdfunding campaign. The fact that only one venture did not have a prototype already available suggests that, at least based on our main sample, the crowdfunding money is not utilized for prototyping. At any rate, the results are unchanged when restricting the sample to new ventures that had already developed a prototype before launching the crowdfunding campaign. In the interest of length, the results of these analyses are available from the authors.

6. Discussion and conclusion

Our research shows that new technology-based entrepreneurial ventures pledging more in the crowdfunding campaign can be associated with higher probability of attracting subsequent funding from professional investors than ventures pledging lower amounts. However, this actually occurs when the relevant performance in the reward-based crowdfunding campaign is complemented by positive evidences with regard to the patents granted for the new product idea and the entrepreneur social capital. These findings fully mirror VC investors' view. According to Sean O'Sullivan, managing director at SOSventures, reward-based crowdfunding sites helps shift the question from whether the idea "will have a product-market fit" to "can the company execute and scale manufacturing" (Cao, 2014). In other words, market validation via crowdfunding is a positive element, but in the eyes of VCs new technology-based ventures must also demonstrate that they can execute the project (Grant, 2013). This indeed suggests the need for additional positive attributes complementing the positive indications derived from crowdfunding to dissolve the uncertainty about new venture's capabilities and turn the acclaimed product idea into a profitable business.

[16] Our findings are confirmed even when restricting our sample to only those new ventures able to deliver.

6.1. Implications for theory

The valuable body of knowledge accumulated in crowdfunding literature has been heretofore mostly confined to the comprehension of the internal dynamics of the crowdfunding campaign, with a particular focus on the determinants of a successful campaign and behavior of backers (Ordanini et al., 2011; Burtch et al., 2013; Mollick, 2014; Ahlers et al., 2015; Colombo et al., 2015). In this paper, by examining the relationship between reward-based crowdfunding and traditional forms of financing, we advance the promising stream of research on crowdfunding and contribute to open up a new angle on the role of reward-based crowdfunding, which emphasizes its function of mechanism apt to provide professional investors with information on the market potential of new technology-based entrepreneurial ventures. In particular, our paper adds to the work from Drover et al. (2017), who have experimentally supported the positive role of several crowdfunding attributes in VCs' early stage screening decisions, by informing on the basis of real funding decisions that, for new technology-based ventures engaging in reward-based crowdfunding, the performance in this funding channel can play an important role in securing investments from professional investors when coupled with other important new venture attributes, namely patents and entrepreneur social capital.

Our findings have interesting implications also for the ample literature on the determinants of new venture financing (Shane and Cable, 2002; Shane and Stuart, 2002; Batjargal and Liu, 2004; Helmers and Rogers, 2011; Nofsinger and Wang, 2011; Conti et al., 2013a,b; Hsu and Ziedonis, 2013; Haeussler et al., 2014). First, future studies might be required to consider the performance in crowdfunding campaigns when examining new venture financing as professional investors seem to consider this factor in their funding decisions due to its feature of providing information that helps mitigate the relative market uncertainty. Second, our findings provide robust evidence that a relevant performance in the reward-based crowdfunding campaign is by itself not sufficient to fuel interest from professional investors and make them more prone to provide funding. Nevertheless, when the "kickstarted" new technology-based venture can complement the positive information derived from a relevant performance in the reward-based crowdfunding campaign with other "good stuff" indicating its ability to turn the new product idea into a profitable business, particularly patents and a wide network of social ties, then its appeal to these investors dramatically increases.

6.2. Implications for practice

As crowdfunding consolidates its role in early stage financing, more and more new technology-based entrepreneurial ventures are expected to utilize this funding channel before coming under the lens of professional investors. Thereby, our findings have valuable implications for tech entrepreneurs engaging in reward-based crowdfunding campaigns for their innovative product ideas. First, we urge tech entrepreneurs engaging in reward-based crowdfunding to pay significant attention on the campaign design because its consequences on the performance in crowdfunding may also heavily bear on the likelihood of securing the additional capital required for growth and expansion. Second, our study delivers an important message to tech entrepreneurs regarding the effect of the performance in the crowdfunding campaign in attracting professional investors. Specifically, our findings suggest that tech entrepreneurs pledging a larger amount of money in the crowdfunding campaign are not guaranteed to secure funding from professional investors. To render this positive evidence truly effective, tech entrepreneurs should endeavor to complement this positive effect with other positive signals, particularly the presence of patents and/or a dense network of social ties, which help reduce professional investors' uncertainty about the capabilities of the new venture to step − using Aristotelian words − from potentiality to actuality.

6.3. Limitations and future research

There are of course some limitations in our study, which may however offer opportunities for future research. First, we need to recognize the time-windowed nature of our study. In fact, as we have pointed out earlier, our period of observation after the crowdfunding campaign was about two-four years. Our choice on the observation period is coherent with the evidence that the first round of financing usually occurs within the first two-three years of the life of a new venture (Hall and Woodward, 2010; Forrest, 2014). However, the very recent emergence of the crowdfunding phenomenon imposes an intrinsic limit on our dataset, which can only be overcome by procrastinating possibly until a maturity stage to ensure a sufficiently long period of observation. In this paper, we instead espoused the logic of providing timely, yet empirically sound, evidence to support entrepreneurs' decisions when the phenomenon is in its infancy and most dynamics are still unknown. Future works could build upon the present study when the crowdfunding phenomenon reaches maturity in order to validate our findings. Second, we recognize that endogeneity may be a natural issue in our setting. However, to reduce this risk we have carefully monitored each entrepreneurial project and its related events for sufficiently long periods before, during, and after the crowdfunding campaign. We have controlled for the most relevant aspects of the new entrepreneurial project that could influence professional investors' decisions, as done by the extant literature on new venture financing (Baum and Silverman, 2004) and crowdfunding (Ahlers et al., 2015). In addition, we have increased our confidence that our model leads to robust findings and is unlikely to suffer from bias due to unobservables by using carefully chosen IVs, the Heckman selection model as well as a number of additional analyses. Third, we have removed from the final sample the new ventures that went bankruptcy during our period of observation. While this helps rule out the survival as a possible cause of subsequent financing from professional investors and as such it is a necessary choice, we recognize that eliminating these new ventures may in general create bias as the sample of bankruptcy ventures is not random. However, in our main sample, the bias is very unlikely to occur as only three new ventures are removed for such reason. With greater data availability, future studies could address the emergence of this issue by using a Heckman selection model that accounts for the likelihood not to go bankruptcy. Fourth, we considered new technology-based entrepreneurial projects available for funding on Kickstarter, due its leading role in reward-based crowdfunding. The extension to new technology-based entrepreneurial projects from different platforms is undoubtedly worthwhile.

By way of conclusion, we also draw three important lines for future research on the relationship between crowdfunding and traditional forms of new venture financing. First, in this paper we have focused on new technology-based entrepreneurial ventures that engage in reward-based crowdfunding campaign and examined how their performance in the campaign influences professional investors' funding decisions. However, it would also be important to investigate whether new technology-based entrepreneurial ventures successfully participating to crowdfunding exhibit greater likelihood of securing funding from professional investors as compared with carefully chosen new technology-based entrepreneurial ventures that decide not to engage in a crowdfunding campaign. Second, it would be interesting to compare reward-based versus equity-based types of crowdfunding in terms of their ability to increase the likelihood of receiving subsequent funding from professional investors. In this case, the effect of the performance in the crowdfunding campaign could also be explained by the different ownership dilution that is likely to arise between reward-based and equity-based crowdfunded ventures. As we examine only on reward-based crowdfunding, the impact of ownership dilution is naturally absent (or at least controlled for by the presence of professional funding preceding the crowdfunding campaign), but in a comparative study it is likely to be relevant and worthwhile to unravel. Finally, while we have

examined sequential investments of crowd and professional investors, in equity-based crowdfunding both types of investors often participate to funding at the same time. The study of simultaneous investment of crowd and professional investors in equity-based campaigns is also an interesting direction for research.

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