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LIMITED AVAILABILITY IN CROWDFUNDING PROJECTS – GUARANTEE FOR PROFITABILITY?

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Abstract

Scarcity is an instrument that is often used in crowdfunding. Crowdfunding is an alternative form of financing, especially for entrepreneurs in the early-stage development phase. This paper deals with the characteristics of profitable crowdfunding projects. Hereby, we examine the impact factors of crowdfunding's profitability, with a special focus on limited availability (scarcity), depth of project description and the size of pledging goals as follows. Therefore, we analyze data from kickstarter.com, one of the world's largest crowdfunding platforms, and used 494 projects and 4,224 pledge levels from the broad category technology as our database. Technology projects lend themselves particularly well to the study, as they usually contain the project result as a tangible return, thus facilitating or even enabling the monetary evaluation of the success in contrast to, for example, cultural projects. Hence, our sample includes 32% of pledge levels with limited availability. We provide empirical evidence that the limited availability in the crowdfunding projects in terms of scarcity management is positively related to the profitability of the included pledge levels. We conclude that crowdfunding projects with limited availability on pledge levels are more profitable for investors.

Keywords: Crowdfunding, Scarcity Management, Profitability, Determinants

JEL Classifications: G02, G11, G23, G24, L26

1. Introduction

The popularity of crowdfunding has risen immensely in the last decade, and crowdfunding has become an alternative and additional source for entrepreneurs looking for funding, but crowdfunding is also an interesting alternative for charitable projects (Tomczak and Brem, 2013; Moritz and Block, 2014; Bouncken *et al.* 2015; Fox *et al.* 2015). Crowdfunding is generally used to generate funds for a project through a large number of people, typically with the help of the Internet (Lehner, 2013). Hereby, crowdfunding can be classified by definition in different ways, as a look at publications from theory and practice shows (for an overview, e.g. Moritz and Block,

2014). Looking at the capital provider side, investors are usually individuals (Hemer *et al.* 2011; Belleflame *et al.* 2014; Mollick, 2014). Communication takes place largely through the use of an Internet platform as an intermediary (indirect crowdfunding), whereby this restriction is not mandatory, since general project calls on the Internet without the use of social networks (direct crowdfunding) are also conceivable and also practiced (Hemer *et al.* 2011; Fox *et al.* 2015). It is certainly undisputed that communication among the participants is, above all, conducive to increasing the level of awareness of a crowdfunding campaign, and thus, social media has a decisive influence on the success of a crowdfunding campaign by reducing information asymmetries and transaction costs (Moritz and Block, 2014).

However, it is not a prerequisite for successful project financing. The often-cited Belleflame *et al.* (2014, pp. 588) define crowdfunding as "…an open call, mostly through the Internet, for the provision of financial resources either in the form of donation or in exchange for the future product or some form of reward to support initiatives for specific purposes". Taking into account this definition, crowdfunding is a process in which individuals, as well as organizations, initiate commercial or non-commercial projects in a public announcement to ask for financing commitments, estimate market demand and build customer relationships. Participants in the crowdfunding campaign can subscribe to monetary or non-monetary funds, the amount of which they are free to choose, on an online or offline platform over a specified period of time. The promised funds will be made available to the project if the prespecified conditions are met. Material or even only intangible compensation for the funding agencies can, but does not have to, be provided (Kuppuswamy and Bayus, 2013; Cordova *et al.* 2015; Müllerleile and Joenssen, 2015).

While the success factors and the motives on the part of the capital seekers have already been examined empirically in detail (for an overview, e.g. Trost *et al.* 2017), there is a need for even more research into the success of investors and their motives. In the current literature, it is already indicated that there is an impact of social and intrinsic determinants on the success of crowdfunding investors (Ordanini *et al.* 2011; Van Wingerden and Ryan, 2011; Belleflame *et al.* 2014; Allison *et al.* 2015; Trost *et al.* 2017; Steigenberger, 2017; Bretschneider and Leimeister, 2017; Cox *et al.* 2018). In contrast to previous studies, which mainly concentrate on analyzing the determinants of financial success based on monetary returns to investors, we analyze the determinants of financial success based on non-monetary returns to investors (reward-based crowdfunding). In reward-based crowdfunding, project supporters receive tangible and intangible returns for their financial contribution (Kuppuswamy and Bayus, 2013; Frydrych *et al.* 2014; Müllerleile and Joenssen, 2015).

However, studies dealing with investor behavior in reward-based crowdfunding regularly neglect the fact that there are several crowdfunding projects on crowdfunding platforms with limited availabilities in their pledge levels.[1] This topic is interesting because young innovative entrepreneurs usually have problems in raising sufficient money; while on the other hand, limitations on investors actually contradict this original intention to generate sufficient financial resources. However, only Joenssen and Müllerleile (2016) have so far investigated the connection between a limited availability of crowdfunding compensations and scarcity management but without addressing the financial success of investors. Understanding scarcity as a fundamental economic problem, which is dealing with the problem of how attractive scarce goods are to customers, we identified a special gap in crowdfunding research. This shows that there is a need for empirical research on the relationship between the success of crowdfunding investors and the limited availability of funding. Therefore, we investigate the relationship between such limitations in crowdfunding projects and the profitability of pledge levels. Our research especially addresses technological projects on kickstarter.com, one of the largest crowdfunding platforms in the world, continuing the research from Trost *et al.* (2017).

In the second section of this paper, we provide a literature review and develop our hypothesis. The sample selection as well as the development of the empirical model are discussed in section three. The results of the empirical analysis are presented in section four. Finally, the paper ends with a conclusion in section five.

[1] Pledge levels are the reward tiers that are offered to the backers of a campaign.

2. Literature review

Crowdfunding practices and mechanisms are widely discussed in the literature. Prior research has already investigated the motivation of project initiators to use crowdfunding as a platform for raising capital. Belleflamme *et al.* (2014) identified essential motives of crowdfunding, such as gaining public attention and obtaining feedback, on products. Another study by Gerber and Hui (2013) shows that the main motivation for raising capital on the platform results from the intention to replicate the successful experiences of others by obtaining full control over the project. In addition, Belleflamme *et al.* (2014) identified the preselling process as an important factor because crowdfunding gives entrepreneurs the chance to practice price discrimination.

Moreover, existing research has identified that project characteristics (e.g. category, goal, duration) are related to its success. Greenberg *et al.* (2013), for instance, defined determinants to predict the funding success of projects. Cordova *et al.* (2015) indicated size, duration as well as the projects' contribution frequency as the main determinants of crowdfunding success. Hereby, the results from Mollick (2014) as well as from Kuppuswamy and Bayus (2013) were confirmed. Kunz *et al.* (2017) also analyzed several determinants of crowdfunding success. They documented, to name just a few results, a relationship between success and the length of a campaign as well as the number of updates and the number of images in crowdfunding projects.

Focusing on motives of investors' decisions to support crowdfunding projects, there are several studies in Behavioral Finance research, which deal with herd behavior (Zhang and Liu, 2012; Agrawal *et al.* 2015; Stadler *et al.* 2015; Bretschneider and Leimeister, 2017), home bias (Brem and Wassong, 2014; Lin and Viswanathan, 2015) the feeling of solidarity (Ordanini *et al.* 2011; Van Wingerden and Ryan, 2011; Berglin and Strandberg, 2013).

Although the factors of motivation are explored, little is known about the determinants of the crowdfunding projects' profitability with a focus on reward-based projects. In this context, Brem and Wassong (2014) showed in their explorative study using fictitious examples of crowdfunding projects that profitability is the main motivation of investors ahead of the delivery of the product itself, the support aspect and the sense of belonging to a project. To conduct their study, they interviewed 221 students. However, it should be noted that this study is only based on a hypothetical situation and, as a result, the emotional factors may play a lesser role than in reality (Trost *et al.* 2017). Ordanini *et al.* (2011) concentrated on an interview of seven crowdfunding platform founders. The focus of the survey was on identifying possible investors' motivations. The authors also assumed that profitability is an important incentive for investors. It has to be critically noted that the founder's opinions are highly subjective and speculative; therefore, the results of the study should be scrutinized. Harms (2007) concluded that the investors' decision to invest depends on the possible economic value of the project as well as the presence of a possible tangible innovative output of the project. However, his study is also only based on the results of an online survey with a hypothetical character. Even though previous studies partially used hypothetical projects in empirical analysis, the relationship between profitability and the investors' decision process really seems to be an important determinant.

In contrast to previous studies on the behavior of investors in reward-based crowdfunding, Trost *et al.* (2017) started to analyze real projects from kickstarter.com (with the focus on technological projects) and the impact of the profitability of crowdfunding projects on investors' decisions. Their study indicates that profitability is an essential element of an investor's bundle of motivation. However, Trost *et al.* (2017), like other studies, neglect the fact that there are several crowdfunding projects on crowdfunding platforms with limited availabilities in their pledge levels. Therefore, it seems reasonable to close this gap in crowdfunding research and to analyze the financial success of investors in crowdfunding more closely against the background of scarcity management. Therefore, this study will examine the following empirical research question: What are the characteristics of profitable crowdfunding projects?

3. Hypothesis development

Hence, we analyze the impact factors of crowdfunding's profitability, with a special focus on

limited availability (scarcity), depth of project description and the size of pledging goals as follows.

3.1. Limited availability (scarcity)

The commodity theory (Brock, 1968) deals with the psychological conceptualization of traditionally economic variables such as supply and demand and utility. In this theory, the valuation of a commodity is said to depend not just on intrinsic functional product attributes but also on supply and demand characteristics (Verhallen, 1982). In the original theory, commodities (messages, experiences or material objects) have to meet three criteria. They have to be useful things, tradable and have the potential to be possessed (Brock, 1968). Later, Brock and Bannon (1992) liberalized the assumptions and expanded them to include traits and skills. Furthermore, the theory was also extended to negative elements, and the valuation of elements is posited to become more extreme as a result of standard commodifying treatments: scarcity, effort, restriction and delay (Brock, 1968; Brock and Bannon, 1992).

The main focus of the commodity theory is on scarcity, a concept that diverts attention to the underlying assumption that goods or services appear more attractive to customers if these are combined with limited availability (Verhallen, 1982; Verhallen and Robben, 1994; Cialdini, 2009). This unavailability was operationalized by Brock (1968) in different ways: limits on the supply or the number of suppliers of a commodity; costs of acquiring, of keeping or of providing a commodity; restrictions limiting possession of a commodity and delays in providing a commodity (Lynn, 1991; Verhallen and Robben, 1994). As a result, it is stated that consumers associate limited availability with uniqueness, high quality or a particularly attractive offer, whereby people want to express a certain status or their superiority, regardless of whether that is true or not (Lynn, 1992; Snyder and Fromkin, 1980; Verhallen and Robben, 1994; Inman *et al*. 1997; Barone and Roy, 2010).

This strategy could also be applied to crowdfunding. Concentrating on reward-based projects, former research has already mentioned that project initiators use limited availabilities of returns as an incentive for investors in their projects. It is possible to distinguish between natural limitations (e.g. meeting with project initiators) and artificially created limitations (Joenssen and Müllerleile, 2016). Artificially created limitations are usually special discounts on a limited number of products, like reward limits or early-bird rewards (Stegmaier, 2015; Joenssen and Müllerleile, 2016; Shi, 2018). In addition, it is also possible that limited availabilities are temporal. The goal is to convince potential investors to invest in a project more easily by claiming the existence of a finite commodity (Shi 2018). Joenssen and Müllerleile (2016) argue that crowdfunding projects provide transparent information to potential investors by pointing out special facts about the project (e.g. offered and requested donations, prices of limited available products and services). As a result, they argue that it is questionable whether scarcity can be usefully utilized in crowdfunding projects, as potential investors can refrain from investing in sold-out early-bird rewards because the unlimited pledge levels are no longer as attractive as the limited ones. In their study, they show a negative relationship between limited availability and the financial success of crowdfunding projects (Joenssen and Müllerleile, 2016).

We argue that the profitability of a crowdfunding project for the investors depends on the availability of investments because limited orders simulate to backers a higher profitability. As a result, the first hypothesis is formulated as follows:

H_1: There is a positive relationship between limited availability (scarcity) and the profitability of the pledge level for investors.

3.2. Depth of project description

In line with Mudambi and Schuff (2010), we argue that the decision-making process for investors can be influenced by the amount of published information. Therefore, using the information diagnosticity theory, we focus on the question of whether specific information for investors is helpful or not (Barbi and Bigelli, 2017; Mudambi and Schuff, 2010) in identifying profitable investments in crowdfunding. In addition, it is already known that an increasing text length can be associated with better utility for its readers (Cheung *et al.* 2008). With respect to that, a more

detailed description of projects encourages project realization. Consequently, investors are better informed, and founders are able to publish detailed information through which they increase transparency and trust (Usman *et al.* 2019). Research from Koch (2016) as well as Koch and Siering (2015) provided evidence that a good description of projects reduces funders' uncertainty and fosters trust towards project founders. In fact, Ahlers *et al.* (2015) already investigated ambiguous information reducing the funding probability. Mollick (2014) also found a positive relationship between provided comments on crowdfunding projects and their success.

In contrast, de Larrera *et al.* (2019) analyzed the comprehensiveness of the descriptions in projects and could not show that there is an association between the depth of description and funding success. Moreover, Feldman and Gimpel (2016) only show an indirect effect of description length on fundraising success.

Besides, even crowdfunding characterization differs from common financial instruments; it can also be suggested that because of the close working relationship between investors and entrepreneurs, we can find agency dynamics in crowdfunding (Ley and Weaven, 2011). Therefore, information asymmetry leads to a higher need for information from the investor's perspective. For this reason, additional information may be helpful in understanding projects' objectives and investment processes in detail (de Larrea *et al.* 2019; Calic and Mosakowski, 2016; Ahlers *et al.* 2015). Based on arguments from the signaling theory (Spence, 1973), a study from Xiao *et al.* (2014) provided evidence for a positive association between the depth of communication and projects' crowdfunding performance, suggesting that the value of reward items in each project signals the underlying quality to investors. In this context, a study from Inchausti (1997) also argued that founders provide detailed information to signal "good news" to the market and identified a positive association between profitability and detailed disclosure. This is due to the underlying assumption that the project description provides the possibility of publishing essential information for funders; therefore, transparency ensures a high degree of content validity. Accordingly, we assume our second hypothesis and suggest the following:

H_2: There is a positive association between the depth of the project description and the profitability of the pledge level for the investors.

3.3. Size of pledge level amount

Crowdfunding differs from other methods of start-up funding because founders and investors are connected in a special relationship with respect to the nature of the funding goal (Mollick, 2014; Belleflamme *et al.* 2013). Furthermore, Kickstarter follows a special threshold model, where funders' pledge money is only collected when the goal is reached completely. Previous studies already investigated the funding goal as an important influence on funding success (e.g. Barbi and Bigelli, 2017; Mollick, 2014). Typically, larger goals can be associated with larger projects that benefit from economies of scale (Callaghan, 2014; Kuppuswamy and Bayus, 2015). In addition, the size of the pledging goal can be understood as a signal for information about the overall size and complexity of the project (Koch and Sierling, 2015). In this context, Frydrych *et al.* (2014) consider that lower funding targets signal legitimacy by setting a modest goal. Other studies conclude that the higher the funding goal, the lower the probability of completing the project successfully (Mollick, 2014; Cumming *et al.* 2015; Ahlers *et al.* 2015). Thus, projects with a larger pledging goal are more expensive and difficult (Assaf and Al-Hejji, 2006). Therefore, Koch and Siering (2015) reach the conclusion that higher funding goals also lead to increased uncertainty regarding the project, which might also be judged to be riskier.

This view can also be applied to the size of the pledge level amount. Trost *et al.* (2017) show that the behavior of both project initiators and supporters is strongly dependent on the amount of investment. According to Frydrych *et al.* (2014, p. 254) there are two different lines of argument: On the one hand, a "high funding per backer indicates a project attracting less backers transacting a higher financial support", and on the other hand, project initiators "were successful in communicating organizational legitimacy to stimulate backers to perform higher financial injections into the project". This leads to the suggestion that the size of the pledge level amount

can be discussed as a factor for the projects' profitability too and therefore to the following hypothesis:

H_3: There is a relationship between the size of a pledge level amount and the profitability for the investors.

4. Methodology

4.1. Research design

To investigate the three hypotheses, we focus on the relationship between scarcity management and profitability, as well as the relationship between the depth of description and the size of the pledge level amount on profitability. We estimate a generalized regression model by testing the significance and influence of limited availability with an ordinary least squares (OLS) regression. To test H_1, H_2 and H_3, therefore, we propose the following model:

$$\begin{aligned} Profitability_{i,j} = {} & \beta_0 + \alpha_1 Scarcity_{i,j} + \beta_2 Depth\_of\_Description_{i,j} \\ & + \beta_3 Size\_of\_Pledgelevel\_Amount_{i,j} + \beta_4 Goal_{i,j} + \beta_5 Nr\_of\_Backer_{i,j} \\ & + \beta_6 Duration_{i,j} + \beta_7 Preselling_{i,j} + \beta_8 Intangibility_{i,j} + \varepsilon_{i,j} \end{aligned} \quad (1)$$

Suppressing subscriptions, we measure the variables at the pledge level (i) for each project (j). The dependent variable is $Profitability$, as explained above. The profitability of a pledge level is measured in two ways. Our first proxy concentrates on the backer's point of view and is calculated as the quotient of the suggested comparison price of return and the offering price a backer has to invest (expected profitability). Equally, we focus on the backer's behavior and the profitability of a pledge level after the investment. This view can also be interesting with regard to finding out which choice backers prefer and if they consider profitability in their investment decision (demanded profitability). Therefore, we also use the expected profitability multiplied with the number of backers as an additional proxy for profitability.

For testing the relationship between profitability and scarcity management (H_1), we use a binary variable ($Scarcity$) and suggest a positive coefficient β_1. The variable of interest then takes the value "one" if the pledge level can be considered as limited availability and "zero" if not.

Analyzing the association between profitability and depth of project description (H_2), we use the number of strings from the project description ($Depth\_of\_Description$). In line with Lebrun and Lebrun (2017), we suggest that the abstract of a project can be seen as eye-catching for investors. Under the assumption that the products will be evaluated on the first impression, investors will read once the abstract above and keep that in mind. The project description is an elementary and necessary part of every Kickstarter project, where creators have to describe in detail what their project does and what makes it innovative (Calic and Mosakowski, 2016). Therefore, we identified the first text as an eye-catcher, printed on the right-hand side above the projects, next to the first picture. Therefore, we used this text as an identifier for the depth of the project description and suggest a positive coefficient β_2.

Moreover, our last hypothesis concentrates on testing the relationship between profitability and the size of pledge level amount (H_3); therefore, the size of pledge level is included in the regression model as the amount of pledge level ($Size\_of\_Pledgelevel\_Amount$) and suggests a positive coefficient β_3. To control the differences in profitability determinants, we include the following variables:

We include the size of the funding goal in the regression model as the amount of funding goal ($Goal$). In line with the discussion about the association of size of pledge level amount, the direction of the association with profitability is not clear (Mollick, 2014; Cumming *et al.* 2015; Koch and Sierling, 2015). Next, following Zvilichovsky *et al.* (2013), we include the number of backers ($Nr.of\ backers$) as an independent variable. In general, it can be assumed that the number of backers has a social influence on the project's success (Brem and Wassong, 2014). Therefore, you may consider the goal-gradient-hypothesis (Hull, 1932; Kivetz *et al.* 2006; Kuppuswamy and Bayus, 2015) when backers get the feeling of being a part of the project and expect a good deal (Ordanini *et al.* 2011; Beglin and Strandberg, 2013). As the relationship between the duration of

the project and its success has already been researched (Crosetto and Regner, 2014; Cordova *et al.* 2015), we include duration ($Duration$) as an additional control variable in our models. Frydrych *et al.* (2014) assumed that a longer fund-raising period might expose an uncertain narrative for the project, resulting in decreasing support for the project. Therefore, we suggest the longer the fundraising takes, the higher is the expected profitability of the pledge level. Next, we also control the crowdfunding category as a binary variable, which is equal to "one" if the pledge level can be identified as preselling ($Preselling$); otherwise, it is categorized as crowdsourcing and coded as "zero". Another independent variable to proxy the pledge level is the minimum payment ($Pledgelevel$), which is measured by the total amount of minimum payment for each pledge level. Therefore, it is important to know that each crowdfunding project has an individual number of pledge levels with its own return to investors (following Shi, 2018). Each incentive can be associated with a minimum payment. In this context, Stadler *et al.* (2015) argue that with increasing pledge levels with low minimum payments, a higher probability of success of the whole crowdfunding project can be expected. In addition, we use the intangibility ($Intangibility$) of returns as a binary variable to observe the impact of non-tangible returns on profitability, while we expect that tangible returns can be associated with higher profitability in contrast to intangible returns (Belleflamme *et al.* 2013).

4.2. Sample selection

To construct the sample, we collected data from one of the world's largest crowdfunding platforms, kickstarter.com. We concentrate on reward-based projects with the broad category of technology. Technology projects lend themselves particularly well to the study, as they usually contain the project result as a tangible return, thus facilitating or even enabling the monetary evaluation of the success in contrast to, for example, cultural projects. A special characteristic of kickstarter.com is the "all-or-nothing approach" of fundraising on the online platform, meaning that a project can only be successful if it is fully funded. Nevertheless, it is also possible that funded projects can exceed their original funding goal. At the starting point, the database consists of 596 projects. We extracted information on all pledge levels of each project posted on the platform from its inception between the 16th of May 2013 and 19th of May 2013. Even if the projects date back to 2013, we assume that, according to conventional understanding, investors then also weighed the expected returns and the associated risks, and thus, there are no fundamental differences compared to the behavior of investors today.

Our first step was to collect data automatically from kickstarter.com, considering for each campaign its title, description, URL and webshop. In accordance with this, we also considered the minimum amount of each pledge level and the number of backers. Subsequently, we calculated the expected profitability in consideration of using the minimum amount of pledge level and a manually collected and quantified comparison price. Our next step was to evaluate each pledge level; a predefined category list following Trost *et al.* (2017), identifying intangible and tangible products as well as services and other returns backers may get for their donation, respectively, their investment. Another important subdivision of projects was to categorize the purposes of reward-based projects into preselling and crowd sponsoring types. While allocating the projects to these two types, it was necessary to get an overall impression of the estimated returns of a project. Projects without any identifiable return were deleted from the database. Therefore, in the end, this study uses a dataset containing 494 projects with 4,224 pledge levels. Table 1 describes the used dependent and independent variables and their expected impact on profitability measures.

Table 1. Definition of variables

	description	expected impact
expected profitability	quotient of the suggested comparison price of return and the offering price (minimum payment)	
demanded profitability	expected profitability multiplied with the number of backers	
scarcity	"one" if the pledge level contains limited availability, "zero" if not	(+)
depth of description	number of strings in the project description	(+)
size of pledge level amount	total amount of minimum payment for each pledge level	(+)
goal	log of the total project goal	(?)
nr. of backer	total number of backers for each pledge level	(+)
duration	total number of days the project is active	(?)
preselling	"one" if pledge level is categorized as preselling, "zero" if it is categorized as crowdsourcing	(?)
intangibility	"one" if pledge level contains intangible returns, "zero" if not	(-)

5. Empirical results

Our descriptive statistics show that 32% of pledge levels contain limited available returns, while founders use scarcity management in their projects. In addition, we can see that each pledge level tends to last for almost 34 weeks on average. Over 45% of pledge levels include an intangible feature. The average project receives approximately 85 backers per pledge level on average. Moreover, it can be recognized that 80% of pledge levels can be clustered as preselling projects. The descriptive statistics are reported in Table 2.

Table 2. Descriptive statistics

	count	mean	sd	min	max
expected profitability	4224	-0.20	0.98	-1.00	39.00
demanded profitability	4224	20.38	310.88	-1,822.95	14,386.31
scarcity	4224	0.32	0.46	0.00	1.00
depth of description	4224	115.03	24.04	12.00	150.00
size of pledge level amount	4224	497.03	1,411.10	1.00	10,000.00
goal (log of)	4224	9.41	1.53	4.61	13.53
goal (total)	4224	32,628.52	59,976.98	100	750,000.00
nr. of backer	4224	85.16	360.42	0.00	7,525.00
duration	4224	34.41	11.87	5.00	90.00
preselling	4224	0.80	0.40	0.00	1.00
intangibility	4224	0.45	0.50	0.00	1.00

Table 3 and Table 5 use Pearson correlation and show that profitability correlates with nearly all independent variables, but multicollinearity does not seem to be an issue for the subsequent regressions. Spearman correlations are reported in Table 4 and Table 6 with similar results. Limited availability, in particular, appears in a positive relation to high profitability. Pledge levels with a high number of backers seem more likely to provide high profitability, while pledge levels with intangible returns seem to expect lower profitability.

Table 3. Pearson correlation matrix expected (offered) profitability

	(1) profitability	(2) scarcity	(3) depth of description	(4) size of pledge-level amount	(5) goal (log of)	(6) nr. of backer	(7) duration	(8) preselling	(9) intangibility
(1)	1								
(2)	0.069***	1							
(3)	-0.172	-0.104***	1						
(4)	-0.023	0.211***	-0.050***	1					
(5)	0.138***	0.115***	-0.056***	0.190***	1				
(6)	0.105***	-0.001	0.170	0.065***	0.145***	1			
(7)	0.056***	-0.005	0.081***	0.488***	0.178***	0.289*	1		
(8)	0.264***	0.091***	-0.072***	0.007	0.333***	0.092***	0.025	1	
(9)	-0.357***	-0.705***	0.072***	-0.087***	-0.014***	-0.092***	-0.052***	0.347***	1

Note: Significance levels are shown as follows: *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 4. Spearman correlation matrix expected (offered) profitability

	(1) profitability	(2) scarcity	(3) depth of description	(4) size of pledge-level amount	(5) goal (log of)	(6) nr. of backer	(7) duration	(8) preselling	(9) intangibility
(1)	1	0.154***	0.000	0.317***	0.225***	0.626***	0.128***	0.436***	-0.588***
(2)		1	-0.066***	0.333***	0.118***	-0.028*	-0.004	0.092***	-0.071***
(3)			1	-0.026*	-0.006***	-0.016	0.098***	-0.070***	0.077***
(4)				1	0.273***	-0.317***	0.097***	0.087***	-0.147***
(5)					1	0.316***	0.241***	0.316***	-0.137***
(6)						1	0.075***	0.212***	-0.219***
(7)							1	0.042***	-0.063***
(8)								1	-0.034***
(9)									1

Note: Significance levels are shown as follows: *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 5. Pearson correlation matrix demanded profitability

	(1) profitability	(2) scarcity	(3) depth of description	(4) size of pledge-level amount	(5) goal (log of)	(6) nr. of backer	(7) duration	(8) pre-selling	(9) intangibility
(1)	1								
(2)	0.032**	1							
(3)	0.016	-0.104***	1						
(4)	-0.017	0.211***	0.050***	1					
(5)	0.055***	0.115***	0.056***	0.189***	1				
(6)	0.527***	-0.001	-0.017	-0.065***	0.145***	1			
(7)	0.022	-0.005	-0.085***	0.049***	0.178***	0.030*	1		
(8)	0.046***	0.916***	0.072***	0.008	0.332***	0.092***	0.025	1	
(9)	-0.096***	-0.071***	0.070***	-0.087***	-0.141***	-0.092***	-0.052***	0.347***	1

Note: Significance levels are shown as follows: *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 6. Spearman correlation matrix demanded profitability

	(1) profitability	(2) scarcity	(3) depth of description	(4) size of pledge-level amount	(5) goal (log of)	(6) nr. of backer	(7) duration	(8) preselling	(9) intangibility
(1)	1	0.205***	0.009	0.374***	0.122***	0.059***	0.095***	0.031***	-0.424***
(2)		1	-0.066***	0.333***	0.118***	-0.028	-0.004	0.092***	-0.071***
(3)			1	-0.026*	-0.066***	-0.016	0.098***	-0.070***	0.077***
(4)				1	0.273***	-0.317***	0.097***	0.089***	-0.147***
(5)					1	0.316***	0.241***	0.316***	-0.137***
(6)						1	0.075***	0.212***	-0.219***
(7)							1	0.042***	-0.063***
(8)								1	-0.346***
(9)									1

Note: Significance levels are shown as follows: *** p < 0.01, ** p < 0.05, * p < 0.1.

In addition, it seems to be clear that the number of backers is high when the goal is high. The low Pearson correlation as well as Spearman rank correlations among the predicted variables used in the model indicate no reason to suspect multicollinearity. Nevertheless, both correlation matrices, according to Pearson and according to Spearman, generally display the same pattern. We also examined multicollinearity using variance inflation factors (VIF). For all variables, the VIF (not reported) are below two. In the regression models, heteroscedasticity is present. Therefore, we subsequently use a robust standard error. Overall, it seems there are no serious concerns about violated assumptions of OLS regression. We investigated H_1, H_2 and H_3 using OLS regression. The results are presented in Table 7.

Table 7. Results of the OLS regression

	expected profitability	demanded profitability
scarcity	0.036*** (0.002)	0.030** (0.005)
depth of description	0.018 (0.230)	0.012 (0.307)
size of pledge level amount	-0.010 (0.375)	0.023* (0.076)
goal (log of)	0.034*** (0.002)	-0.033* (0.064)
nr. of backer	0.059*** (0.000)	0.530*** (0.004)
duration	0.029*** (0.005)	0.006 (0.347)
preselling	0.143*** (0.000)	-0.013 (0.364)
intangibility	-0.294*** (0.000)	-0.057*** (0.000)
r2	0.158	0.284
N	4224	4224

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

For the expected profitability model, 16% of the variance, and for the demanded profitability model, 28% of the variance of the respective profitability proxy can be explained. Thus, the corrected r^2 value shows a good model fit. The regression results show a positive significant relationship between scarcity management, especially limited availabilities in pledge levels, and

profitability as expected with H_1 before. This indicates that crowdfunding projects with limited availabilities can be associated with higher profitable funding opportunities. The findings are consistent with that of prior literature. Potential reasons may be found in the theoretical assumptions of Cialdini (2009) with respect to studies from Verhallen and Robben (1994) or suggestions from Barone and Roy (2010). The data needed to test H_2 are also presented in Table 5 and indicates that there is no relationship between the depth of the project description and profitability.

Moreover, our results show that there is no clear evidence for a relationship between profitability and the size of the pledge level amount (H_3). Results analyzing H_3 are also shown in Table 5. Especially with respect to an association with the expected profitability, the results do not provide evidence to support this hypothesis. On the other hand, it is not surprising that we found a marginal positive relationship between the demanded profitability and the size of the pledge level amount. While project creators may offer their products without a special association regarding the size of the pledge level, investors tend to search for products that are more profitable. In the end, both cases are characterized by highly influenced subjective grounds that we could not identify using underlying data.

Besides focusing on the independent variables, we found evidence for a strong negative relationship between the intangibility of pledge levels and profitability. The number of backers is affected positively by profitability. Interestingly, the results show a very clear relationship with a high coefficient of 53% between the demanded profitability and the number of backers. Therefore, a higher demand by the backers for more profitable pledges can indeed be shown, so they request more profitable pledges. This was made clear by the aforementioned fact.

Results are robust across alternative models using different profitability measures and different control variables (not reported). We also used the number of limited available possibilities for backers as an alternative variable for scarcity and obtained the same results as above. For future research, it could be interesting to analyze the real motivations of backers using limited available products or services. As in most cases, this is only possible by conducting interviews; our actual study cannot provide evidence about more detailed interests of backers. However, the coefficients for the control variables are mainly in line with previous research and our expectations.

6. Conclusion

Despite the extensive research on crowdfunding, little is known about the relationship between limited availability in crowdfunding projects and the profitability of the included pledge levels. In this context, the theoretical framework of the commodity theory may help to analyze the psychological effects of scarcity (Brock, 1968) on crowdfunding projects. Following earlier research, we follow the approach that goods or services appear more attractive to customers if they are combined with limited availability (see Verhallen, 1982; Verhallen and Robben, 1994; Cialdini, 2009). Thus, uniqueness, quality and prestige are interesting incentives to investors and possible determinants for using scarcity management in crowdfunding projects for the initiators.

In contrast to earlier studies, we are not limited to a hypothetical sample. Furthermore, we do not only use small samples. Our empirical research focuses on reward-based projects with the category technology on kickstarter.com, continuing the research from Trost *et al*. (2017). In the end, this study uses a dataset containing 494 projects and 4,224 pledge levels.

In addressing our research question, this paper contributes evidence for an association between scarcity and crowdfunding profitability. Hence, our sample includes 32% of pledge levels with limited availability. More specifically, we provide empirical evidence that the limited availability in crowdfunding projects in terms of scarcity management is positively related to the profitability of the included pledge levels. Therefore, the results of this study provide an insight into the characteristics of crowdfunding projects that impact profitability. Furthermore, we cannot provide evidence to show that depth of description and size of pledging goals can be associated as determinants of crowdfunding's profitability. In addition, our results could not provide clear evidence that the depth of the project description and the size of pledging goals represents a relationship with crowdfunding's profitability. As a result, we conclude that crowdfunding projects

that include limited availability on pledge levels are more profitable for donators/investors. Future research may analyze whether or not these projects are also more likely to succeed in their funding goals.

Regarding the limitations of provided results, the current study selected only reward-based projects within the broad category of technology, with hand-collected data for profitability. Analyzing thereby the depth of project description, the scope of our study is restricted to quantitative information. Future research may provide a deeper insight into potential effects between project descriptions and profitability by using qualitatively analyzed data. As already mentioned, we do not focus on other methods to analyze the expectations of investors as well as creators. This gap may lead to other empirical questions for future research by using research designs with a focus on structured surveys and individual interviews.

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