

The Promise of Reward Crowdfunding

Finance Working Paper N° 542/2017

January 2018

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Abstract

We study reward crowdfunding, the most innovative segment of the crowdfunding market, where, instead of a debt or equity contract, fund providers are promised some good or service in the future in exchange for their contribution to the funding of the investment project under a contract that does not penalize the creator's failure to deliver. The existing economic and legal literature is puzzled by the platforms use of this seemingly inefficient contract where a standard pre-sale contract would appear to work better. Counter intuitively, we prove that the no-penalty contract is the optimal contract between creators of unknown talent and early adopters of their products when creators can benefit from being discovered as talented and from the goodwill generated by delivering on their promise to early adopters. Our analysis has important policy implications on how backers should be protected. Standard measures of consumer or investor protection may be counterproductive.

Keywords: Reward crowdfunding, best efforts, presale contract, talent discovery

JEL Classifications: G23, G24, K22

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1 Introduction

Extremoduro is a legendary Spanish rock band ranked number 6 on Rolling Stone's "50 Greatest Spanish rock bands". It was founded by Robe Iniesta in 1987 in Plasencia, a small town in the region of Extremadura. In year 1989 the band was able to finance its first studio album offering ballots which, for an amount of 1,000 pesetas (€6), could be exchanged for a copy of their first album if it was ever recorded. Advertising by word of mouth they managed to raise 250,000 pesetas, which was just enough to pay for the studio production of their first album "Transgressive Rock". The band paid tribute to their initial backers by listing all their names on the back cover of the album. Although this happened many years before internet, it is a very good example of a successful reward crowdfunding campaign, where a creator of unproven talent, offers early followers a reward in order to raise the funds needed to launch the product on a wide scale. Interestingly, the example also illustrates the similitude of this type of fund-raising with long existing pre-selling funding schemes, raising the question of which is the real novelty that reward crowdfunding offers for the financing of new ventures.

Nowadays reward crowdfunding is the most innovative segment of the crowdfunding market. Reward crowdfunding is fundamentally different from both debt and equity crowdfunding because the provider of funds does not buy a financial security. But it is also different from charity since, in exchange for the money given, the provider of funds is promised some good or service in the future. Interestingly, and depending on the money provided, the promise can range from a promotional T-shirt to a full unit of the good or service that is being funded. Nevertheless, the promise is very vague because the contract between the creator, who is raising money, and the backer, who provides the funds, only states that the creator must make his/her¹ "best-efforts" to deliver the good or service, but there is no

¹Throughout the paper, for the sake of readability, we will use the masculine pronoun to refer to both male and female creators or backers.

specification of any compensation whatsoever if the promise is not kept. Therefore, this is a contract according to which the fund's provider does not get a right over the potential outcomes from the venture he is financing in any state of the world. We will refer to this arrangement as the no-penalty contract². At first sight this contractual arrangement seems to generate huge moral hazard costs and to make funding very difficult. One could argue that the no-penalty contract is based on trust and reputation, like other contracts where state verification or enforcement of penalties is not possible. But this does not seem sustainable in a one-shot game, where most of the creators raising funds may never come back to the market. In this one-shot game the creator would be expected to behave in a opportunistic manner and not deliver the good. Anticipating the potential for this type of behavior, backers may be deterred from giving funds in this setting, leading to market failure. This poses a puzzle for understanding (and regulating) the reward crowdfunding market.

In this paper we offer a solution to this puzzle by presenting a one-shot model of reward crowdfunding (RC) where the no-penalty contract is found to be the optimal contract between a creator of unknown talent, who wants to be discovered by the wider market as highly talented, and early adopters of the product. We contribute to the literature on crowdfunding showing the importance of the innovative contractual arrangements offered by the RC platforms in the context of a market for talent discovery.

We model RC as the first stage of a game where a creator is discovered to be talented when early adopters support his RC campaign. There is a second stage of production where,

²The difficult position of the backers when things go wrong is clearly illustrated by the famous Zano's case. This started when in January 2015 Torquing Group Ltd. raised more than \$3 million in pledges from 12,075 backers on Kickstarter (20 times its original funding goal) for its mini-drone prototype, Zano. Because of the great success of the crowdfunding campaign the company started pre-selling the device on its website right after the campaign closed, receiving 3,000 additional orders. After several delays, when the first 600 drones were shipped on September 2015 Kickstarter backers were infuriated when they discovered that pre-order customers were receiving drones before them and pre-order customers were infuriated because their Zanos were barely operational. The company then announced the Kickstarter rewards would not be delivered until February 2016. But this would never happen because on 18 November 2015 Torquing announced that it was entering a creditor's voluntary liquidation. A liquidation where, unlike pre-order customers, the original backers could not present any claim.

if the creator was successful in the RC campaign, he can capitalize on the discovery of his talent by selling to late adopters and benefiting from goodwill generated in the delivery to the early adopters³. Introducing penalties for non-delivery in the crowdfunding stage makes funding easier because penalties induce a higher probability of delivery. But, the higher delivery rate for all ability levels makes the information on the creator's ability that the funding provides to the market a weaker signal. This, in turn, reduces the chance of "being discovered" and accessing second stage benefits. In particular, as the penalty increases, the creator will need to raise a higher amount of funds in the RC campaign to be able to prove to the market that he is talented. But, as the amount of funds that have to be raised increases, the probability that the campaign is successful decreases, and this reduces the possibilities of accessing the second stage production level. We prove that this game has a corner solution were the platform fixes the penalty at zero, i.e. it has an solution were the no-penalty contract is optimal. This equilibrium obtains when only creators perceived as having very high quality are considered talented enough to access the second stage but the benefits from the second stage and the goodwill coming from delivering to the early adopters are high⁴. In

³WobbleWorks founded in 2010 as a small toy company is an example of how the growth opportunities that a successful RC campaign can convey. In 2013 the company launched in Kickstarter its 3Doodler, a 3D printing pen, which raised \$2.3 (which would be considered in our model as the first stage). The company now has annual sales of \$20 million and \$20 million from three different lines of pens and licensing deals with the Cartoon Network and CBS for kits featuring, respectively, the Powerpuff Girls and Star Trek (representing second stage benefits). According to 3Doodler cofounder Daniel Cowen one of the biggest advantages of the Kickstarter campaigns is that inventors can circumvent the stage of begging retailers for an audience. Instead, they can simply prove the concept in a crowdfunding campaign, and then line up stores that want to sell it.

⁴Two very different success stories clarify how different projects can have very different continuation benefits. The Less Mess Happy Mat is a one-piece silicone plate and mat designed for children use that suctions to the table. It is easy to clean and prevents bowls from breaking or tipping over. Lindsey Laurain, its creator, raised over \$70,000 on Kickstarter to finance the initial production of her mat, which she now sells online through her own company's website ezipfun.com. The campaign provided her with the capital she needed, product testers and much welcomed publicity but the product has not changed much from its original design and is targeted at a niche market. At the other end of the spectrum we find Oculus, a prototype of a virtual reality headset designed by teenager Palmer Luckey working from his parents' garage. With a fund-raising goal of \$250,000, Oculus Rift raised \$2.4 million on Kickstarter in August 2012. During the following two years the project raised additional funding from Venture capital firm Spark Partners and hedge fund Matrix Partners, each investing \$19 million. In March 2014, while Oculus was still in the prototype stage, Facebook acquired it for \$2 billion in cash and stock. Oculus opened pre-orders for its first commercial

this case talent discovery is very valuable and the no-penalty contract is optimal to preserve the talent discovery function of the RC market.

Interestingly, the equilibrium of the game only resembles the actual features of the RC market when the benefits from scaling up projects are large, making talent discovery valuable. In this case the optimal contract includes no penalties for non-delivery, and a very low rate of projects can get funding but, among the projects that get funding, there is a high delivery rate, and a high probability of the funded projects being scaled up afterwards. When the continuation benefits are low, the equilibrium becomes a standard pre-sale market with high penalties in case of non-delivery and with a higher number of projects getting funds from backers and a high probability of delivery but not many projects being scaled up afterwards.

Summing up, our analysis contributes to understanding RC by showing that the no-penalty RC contract is a contractual innovation suitable for talent discovery, and that it has been made possible thanks to the platform technology that allows unknown creators to contact many potential early adopters that can evaluate their ability. In this sense, RC is radically different from equity or debt crowdfunding, where standard financial contracts are sold through online platforms to small investors. Moreover, it is also different from standard pre-sale contracts. This conclusion has important policy implications because it calls for the RC contract to be exempted from the application of consumer protection rules that impose warranties upon the seller for product failure.

We also contribute to the literature on relationship contracts, showing that even in a one-shot game it is possible to sustain a contract in the desire to build a reputation that will be useful in a future contract with a third party. Interestingly, in this setting the two incentives that the creator has to deliver in the first stage -the monetary penalty and the desire to be discovered as talented- are substitutes and cannot be used together.

The rest of the paper proceeds as follows. The next section explains how RC works. In the literature review section we discuss the existing literature on RC. The model is presented

version priced at \$599 in January 2016.

in the following section. We then have a section where we discuss the key assumptions of the model and the potential extensions. The last two sections offer respectively the policy implications and a brief conclusion.

2 The Reward Crowdfunding Market

Crowdfunding allows someone with a project (the creator) to raise money from many small uncoordinated individuals (the fund providers) through an online platform⁵. There are four types of crowdfunding depending on the contract between the creator and the fund providers: equity, debt, charity and reward crowdfunding⁶. Equity and debt crowdfunding are used to finance for-profit ventures using standard equity and debt contracts that commit the creator to pay out financial returns to the fund providers, who are small and disperse financial investors. Charity crowdfunding is a way of raising money for non-for-profit projects where the money is given as a donation. RC raises money in exchange for some project outcome, which may range from a mere acknowledgement of the funds received to the promise of delivery of one unit of the final product or service, with the creator committing to making "best-efforts" to deliver⁷. In each of the four cases the market is dominated by a different

⁵Crowdfunding is considered one type of "alternative finance" (i.e. financing obtained outside the traditional financial markets). Alternative finance also includes consumer lending, peer-to-peer business lending and invoice trading. Consumer lending represents over 80% of all alternative finance in both the US and Europe.

⁶In year 2015 the reward based model amounted to \$601.2 million in the US and €139.27 million in Europe (Cambridge Center for Alternative Finance, 2016 and 2017). The average deal size in the US was around \$25,000 contributed by 180 backers. The size of reward crowdfunding is similar to that of the equity based model (which amounted to \$590.9 million in the US and €159.32 million in Europe) and bigger than the donation model (amounting respectively to \$139.7 million and €21.71million). Nevertheless, debt based business lending is the largest source of alternative finance for businesses representing over \$5 US billion in the US and €224million in Europe.

⁷This classification of crowdfunding into four categories based on the type of contract used, promoted by consulting agency Massolution (2013), is widely used by the industry. Nevertheless, different authors have proposed different classifications based on alternative criteria. Hemer (2011) proposes a classification based on the complexity of the relationship between the creator and the crowd which includes (from less to more complex) donations, sponsoring, pre-ordering or pre-selling, fees for membership in clubs, crediting or lending and Private Equity (PE) investments. Interestingly for our purposes this classification does not include reward crowdfunding, which is probably considered similar to pre-ordering. Belleflamme et al. (2013) also

specialized on-line platform (such as Kickstarter for reward, Causes for charity and CircleUp for equity), probably because of first mover advantages similar to the ones behind Google or Facebook. When a creator starts a campaign in one of this platforms he commits not to start simultaneous campaigns in the other platforms.

Interestingly, charity crowdfunding has been the less controversial, while equity and debt crowdfunding have attracted the most attention, especially after the first attempts to regulate this growing phenomenon, and in particular after the adoption of the JOBS act that went into effect on May 16, 2016 in the US. National governments of the European Union are also engaging in equity and debt crowdfunding regulation for their markets. The German Retail Investor's Protection Act (Kleinanlegerschutzgesetz – KASG), which came into force on 10 July 2015, introduced the so-called "Crowdfunding-Exception" which excludes crowdfunding from most requirements of the VermAnlG, especially the duty to publish a prospectus. The Spanish law 5/2015 of 27 April to promote business financing, separates qualified from unqualified investors, and sets limits of investment for each type of investors in equity and debt crowdfunding. However, little regulatory attention has been devoted to RC, which is a significant segment of crowdfunding and the most novel in the approach to raising funds, offering a contractual innovation which does not seem to fit standard contracting paradigms, both because of the huge asymmetric information problems under which it operates and because of the contractual terms fixed by the RC platforms. We now analyze in detail each of this particular characteristics of the RC market.

identify reward and pre-ordering, failing to consider the difference in the penalty for not delivering. Hass et al. (2014) classify crowdfunding according to the motivation of the backers and distinguish between hedonistic, altruistic and for profit crowdfunding, with reward crowdfunding falling into the hedonistic category together with pre-selling. Bradford (2012) distinguishes between rewards and pre-selling, but notices that both types have in common the absence of a financial contract between the creator and the backers.

2.1 Asymmetric Information Problems in the RC Market

A RC campaign starts when the creator asks the platform to accept his project. The platform will make an effort to detect and screen out fraudulent projects and it also imposes some minimum requirements about the degree of disclosure by the creators. But, ultimately, it is still the backers' role to perform due diligence on the competence of creators. Once the project is publicized on the platform, the potential backers can request information by communicating directly with the creator, and there is a very active feedback process going in both directions on social media. Differently from equity and debt crowdfunding platforms, in RC there are no restrictions on the identity or sophistication of the backers. In this case, backers are considered to be the early adopters of the product or service. Nevertheless, in most RC platforms, such as Kickstarter, there is a provision point mechanism or all-or-nothing scheme, so that the funds are delivered to the entrepreneur only after a certain percentage of the required investment has been reached⁸. As explained by Agrawal et al. (2014) this alleviates the asymmetric information problems of the uncoordinated backers, by eliminating the possibility that they lose their money because the total funding is not enough to cover the fixed cost of the project, but it also means that most projects never get any funding. By early 2017 Kickstarter lists about 64% of failed projects – that is, not reaching their initial funding goal⁹. For those that get funding the platform gets 4 to 5% of

⁸Cumming, Leboeuf, and Schwiendbacher (2015) provide evidence consistent with the idea that All-or-Nothing schemes dominate Keep-it-All schemes. Following the "All-or-Nothing" rule, the project is funded if, by the end of the funding window, the total pledged amount equals or exceeds the funding target, in which case the entrepreneur gets all the pledged money, otherwise the project is unfunded and no money is transferred to the entrepreneur.

⁹However Mollick and Kuppaswamy (2014) report a higher rate of failures of 72% and Agrawal, Catalini, and Goldfarb (2011), using data from the Sellaband platform, report a much higher rate of failure. Only 34 artists in the platform (approximately 1%) raised the threshold required to access their capital to finance the making of their album. Moreover, they show that a small number of projects accounts for a very large proportion of funds raised: the 34 successful projects account for 73% of the total amount invested on Sellaband over the period. Belleflamme, Lambert, and Schwiendbacher (2013) draw similar conclusions from summary statistics of their sample of individually crowdfunded projects. Interestingly, conditioning on sample on successfully (unsuccessfully) funded projects, Mollick (2014) stresses skewed distributions in the dollar amounts by which projects exceed (do not exceed) their funding goal.

the total funding raised.

Crowdfunding is intended to provide early-stage financing. Therefore, it is characterized by very high risk, uncertainty and asymmetric information. Traditionally seed capital and early stage financing has been limited to family and friends and business angels and venture capital funds precisely because they are assumed to have the information and abilities to solve these important drawbacks. Family and friends are supposed to have better information about the creator and the ability to impose informal punishments in case of failure, while angels and venture capitalists are assumed to have better information about the quality of the project and management and monitoring abilities that reduce the risk of failure¹⁰.

This is why the surge of crowdfunding is so shocking. Given the huge asymmetry of information, raising money from small, uncoordinated individuals faces huge adverse selection and moral hazard problems. Adverse selection is expected to be a major problem when investors lack the capabilities to screen projects. In this case backers, unlike family and friends, don't know the creator, and unlike angels and venture capital funds they are not experts in valuing projects.

However, some authors have stressed that backers as early adopters are able to evaluate entrepreneurial quality through a "wisdom of the crowd" effect, implying that a population's collective assessment often dominates the assessment of any single individual (Li, 2016). Just like venture capital specialists, backers have to perform some "due diligence" to decide whether to put their money into a project without recourse to past performance data or a working product (Agrawal et al. 2013). But, as potential early adopters and trend setters, they evaluate the project based on the information provided by the creator in the campaign. This usually includes the qualifications of the creator, videos and technical details of the prototypes and a detailed description of what the creator wishes to accomplish with the money obtained. In fact, Mollick (2013, 2014) finds that entrepreneurial quality is assessed

¹⁰These ideas have been extensively discussed in the literature on venture capital and are explained in detail in Metrick and Yasuda (2009 and 2010).

in similar ways by both VCs and crowdfunders, and that, unlike those of VCs, the crowd's decisions are less biased by geographic and gender characteristics. Therefore, the crowd's decision to fund a project can be considered a valuable signal on its entrepreneurial quality¹¹.

This ability of the backers to evaluate the quality of the projects may ameliorate the adverse selection problem and backers could be expected to be a valuable source of information. Nevertheless, moral hazard will remain an important problem because, once they have pledged the funds, the backers lack the capabilities to monitor or discipline the creator. Unlike family and friends they cannot impose informal punishments, and unlike angels and venture capital funds they cannot supervise management.

Surprisingly the data contradict the intuitive predictions that one could make. According to available data, although 37% of the projects that get funding go over budget and many are delayed, only 5% to 14% of the projects fail to deliver the reward, with 50% of rewards delivered late¹². Thus, the data confirm that uncertainty about budget and time to delivery is very high but nevertheless it seems that, somehow, the creators seem actually to be providing their "best-efforts" to deliver. Additionally, data confirm that over 90% of the projects that get funding turn out into ongoing organizations that are later able to raise additional money from venture capitalists, angel investors, or banks after the campaign concluded, but less

¹¹In fact it is very common to find cases like Pebble, where the creator sets up a RC campaign after failing to raise funds from VC or traditional finance, but is able to do it after a successful RC campaign. Pebble raised over \$10 million in 37 days on April 2012 offering a prototype of one of the first smart watches on the market that many VC companies had rejected. After several production delays many backers complained of being left empty handed, which led Kickstarter to the announcement that "Kickstarter Is Not a Store". However, after raising an additional \$15 million from VC fund Charles River Ventures Pebble delivered their first round of smart watches 10 months after their crowdfunding campaign ended. This reliance of market participants on the signal of quality provided by a successful RC campaign is also clear in the cases of WobbleWorks and Oculus (see footnotes 3 and 4).

¹²For technology and design projects on Kickstarter, only 14 cases of potential fraud are identified out of 381 projects, accounting for less than 0.5% of dollars in pledges (Mollick, 2014). However, there are more concerns about the ability of entrepreneurs to deliver on their initial promises. According to Mollick (2014), the majority of products are delivered late. In delayed projects, the mean delay is 2.4 months. Empirical evidence also suggests that larger projects tend to have longer delays than smaller projects. He gives two reasons that may explain the delays: (1) entrepreneurs tend to be overoptimistic about outcomes and (2) when unexpected success occurs, entrepreneurs may face a range of problems such as shipping and manufacturing problems, changes in scale and scope, administrative/certification issues.

than 25% of the projects that fail to raise funds from backers are completed¹³.

2.2 Contractual Terms in the RC Market

In the case of RC the asymmetric information problems that we have discussed are exacerbated because of the type of contract that is agreed between the creator and the backers, which we will call the no-penalty contract. The backer is promised some project outcome. Nevertheless, the promise is very vague because the contract between the creator and the backers only states that the creator must engage in “best-efforts” to deliver the good or service, but there is no compensation whatsoever if delivery does not take place. As an example, Kickstarter makes potential backers know that *“Some projects won’t go as planned. Even with a creator’s best efforts, a project may not work out the way everyone hopes. Kickstarter creators have a remarkable track record, but nothing’s guaranteed. Keep this in mind when you back a project.”* On a similar vein Ulule explains potential backers what to do if a project which they supported is never completed *“There is “risk” involved with any project, from the idea stage through to pre-production: some projects have to be postponed, while others simply (and unfortunately) have to be abandoned. You can always contact project owners to request an explanation if none has been provided directly through the project page. Either by clicking on the link “Send a message” of the Creator section in the right column or by leaving a comment in the “Comments” tab.”* Therefore, this is a one-shot contract according to which the fund’s provider does not get a right over the potential outcome from the venture that they are funding in any state of the world, and the creator does not face any precise liability for failing to deliver¹⁴.

¹³Mollick and Kuppaswamy (2014) report that one year and a half after a successful Kickstarter campaign, 90% of projects were still active. Moreover, a total of 38.5% of entities who successfully raised funds reported yearly revenues of 0-\$25,000, 24.5% reported \$25,000-\$100,000, and 32% reported over \$100,000.

¹⁴Interestingly many of the creators that fail to deliver follow the suggestions of the platforms and are open to discuss the failure with the backers. This was the case of Yogcast, a popular YouTube gaming channel with seven million subscribers that, in 2012, launched a very successful Kickstarter campaign to create its own open-world video game through first-time developer Winterkewl Games. The developer missed all the deadlines, underestimated the development cost and turned in disappointing work until Yogcast announced

Although the use of digital platforms as market places is new, consumer financed ventures are not. Nevertheless, the no-penalty contract used in RC is radically different from the contractual arrangements that have traditionally been used for this purpose: pre-sales and subscription contracts. Pre-sale contracts usually involve the payment of the good or service in advance¹⁵. The money is refundable if the creator does not deliver the good or service within the time frames and specifications set out in the contract. Interestingly, this type of contract is widely used in digital platforms for the sale of tickets for arts, sports and music events, and also for books, CDs, video games, and software items, and even as a follow up after a successful RC campaign¹⁶. In subscription contracts, the consumer contributes a sum of money for a designated purpose in consideration of an equivalent to be rendered, as a subscription to a periodical, a forthcoming book, a series of entertainments, or the like. A subscription is a repeated pre-sale contract, and, therefore, the remedies for its breach are the same as those for breach of contract and include damages and specific performance (if feasible).

Clearly, at first sight RC contracts look very similar to pre-order or pre-sale contracts, but the "best-efforts" stipulation used in RC contracts is a substantial change. To understand

in 2014 the cancellation of the project. An e-mail from Yogcast to backers read "The project was proving too ambitious and difficult for Winterkewl Games to complete with their six-man team". Yogcast co-founder Lewis Brindley also said in an e-mail to backers "Although we're under no obligation to do anything, instead we're going to do our best to make this right, and make you really glad you backed the project!". Yogcast announced that as a compensation it would give backers early access keys for the game TUG, an open-world survival game that was also crowdfunded on Kickstarter. This contrasts with the Zano's case (see footnote 2) where after announcing its cancellation the founders refused to engage with backers. This induced Kickstarter to commission investigative tech journalist Mark Harris to find out what went wrong in this case. In his report (available at <https://medium.com/kickstarter/how-zano-raised-millions-on-kickstarter-and-left-backers-with-nearly-nothing-85c0abe4a6cb>) Harris concluded that there had been no dishonesty and that the main problem was that none of the members of the team "possessed the technical or commercial competencies necessary to deliver the Zano as specified in the original campaign".

¹⁵As defined by Xie and Shugan (2009), advance selling refers to the general practice that a seller induces buyers to commit to purchasing a good before the time of consumption, which can take many different forms. In contrast, pre-order usually refers to the practice that the seller allows buyers to purchase a product at a particular price until a specified time prior to its release. Therefore, pre-order is often associated with the introduction of new products.

¹⁶For example, Hui et al. (2008) analyze the pre-order and sales pattern for DVDs through a consumer behavior model.

what "best-efforts" means in this context it is interesting to refer to the agreement between backers and creators stipulated by Kickstarter which specifies that "*If a creator is unable to complete their project and fulfill rewards, they've failed to live up to the basic obligations of this agreement. To right this, they must make every reasonable effort to find another way of bringing the project to the best possible conclusion for backers*"¹⁷. In fact, a pre-order type contract that only requires "best-efforts" can no longer be considered a pre-order type contract. The crucial difference is that pre-order contracts clearly release ex-post remedies in case of default, and the RC contract does not: it is the backers who bear the whole risk of non-performance (other than when lack of "best-efforts" may be verified)¹⁸.

The approach to liability for non-performance in contracts (pre-order or otherwise) differs across legal systems, and can be based on fault (very often presumed to exist if there is non-delivery) or on strict liability. But, at the end of the day, one can say that all systems recognize two types of liability: liability based on fault and a stricter kind of liability. Or, in

¹⁷According to Kikstarter it is understood that: If a creator is unable to complete their project and fulfill rewards [. . .], he has only remedied the situation and met their obligations to backers if: (i) they post an update that explains what work has been done, how funds were used, and what prevents them from finishing the project as planned; (ii) they work diligently and in good faith to bring the project to the best possible conclusion in a time frame that's communicated to backers; (iii) they're able to demonstrate that they've used funds appropriately and made every reasonable effort to complete the project as promised; (iv) they've been honest, and have made no material misrepresentations in their communication to backers; and (v) they offer to return any remaining funds to backers who have not received their reward (in proportion to the amounts pledged), or else explain how those funds will be used to complete the project in some alternate form.

The creator is solely responsible for fulfilling the promises made in their project. If they're unable to satisfy the terms of this agreement, they may be subject to legal action by backers.

¹⁸This difference between the backers and the consumers that pre-ordered the product is clear in Zanos case (see footnote 2). Another interesting case is the Breathometer, a small portable breathalyzer that plugged into the audio jack of a smartphone read the user's blood alcohol content. In April 2013 it received \$140,000 via an Indiegogo campaign and later raised an additional \$2million from venture capital firms Structure Capital and Dillon Hill Capital. In January 2017 the US Federal Trade Commission filed a lawsuit against Breathometer, alleging "deceptive" advertising, arguing that the company, while claiming accurate readings, was aware that the device understated alcohol levels but failed to notify users of these problems and continued their deceptive advertising. The order required the company, who had already made more than \$5million in sales, to pay full refunds to consumers who request them. The FTC Complaint released on January 23th 2017 does not make any explicit reference to backers. The company discontinued production of the Breathometer in 2015, but is now selling Mint, a device that measures anaerobic bacteria in the mouth, in a bundle with Philips Sonicare electric toothbrushes.

other words, every system allows for some cases in which the seller will be liable without fault. So, it is safe to say, that if RC used a pre-order contract, in cases in which the outcome is not achieved, the creator would be liable to compensate the backers for losses arising from such non-performance. In this respect, "I did my best" is almost never an exculpatory defense. Of course, one must take into account that the consumers may not seek compensation if the fixed costs of a legal lawsuit are high, and that monetary remedies may be ineffective if the creator is insolvent. But, it is important to distinguish the shortcomings of enforcement from the choices made in contract design.

We have argued that the RC contracts are not standard pre-order type contracts in terms of liability. It is also important to notice that RC contracts don't respond neither to the rationality of distinctive "best-efforts" contracts. The breach of "best-efforts" clauses typically entails contract consequences. Best-effort clauses are used in very specific settings. For example, they are used in corporate acquisitions to discourage the seller from engaging in post-sale (but pre-completion) actions detrimental to the buyer, or to encourage the seller to do whatever is in her power to preserve the value of the sold assets. In these settings, "best-efforts" clauses allow the seller to provide some degree of bonding (but short of precise requirements or guarantees about certain states of the world) to assure that she will not reduce the value of the asset by future actions. But "best-efforts" clauses are not found neither in professional services, where the effort is measured by other standards (like reasonable skill and care), nor in uncertain creative undertakings, which are typical in RC. Notice also that, although best-effort clauses are on occasion litigated, it is hard to determine how a court will respond to claims that a "best-efforts" obligation has not been fulfilled. Nevertheless, exerting "best-efforts" implies satisfying a standard of diligence, and the common view in the legal literature is that the "best-efforts" standard is a high threshold for diligence. In contrast, in RC contracts the "best-efforts" notion that transpires the platform's explanations seems to imply no more than honest behavior. The backers bear

the risk of projects that default or fail to deliver as long as the creator has worked in good faith and has not ostensible shrank.

Of course, there exists a very large literature on relational contracts studying contractual relationships without explicit penalties. This literature shows that, when enforcement is inefficient, the parties can write a relational self-enforcing contract sustained on the value of future interactions (Klein and Leffer, 1981; MacLeod 2007). Nevertheless, in most cases, the RC market is a one-shot game, where creators getting funds may never again come back to the market, especially if they are successful and can afterwards have access to financial markets. So the question remains: given that, in a one-shot game, standard contractual forms, such as a pre-sale contract, seem much more appropriate to solve the verification and information aggregation problems, while also minimizing moral hazard and adverse selection problems, why do RC platforms raise funding under a no-penalty contract?

This combination of important asymmetric information problems, the use of a no-penalty contract that lacks explicit punishments, and the short-term or one-shot nature of the funding campaign poises an unsolved puzzle for understanding the nature of the RC market.

3 Literature Review

There is a small but growing literature explaining the attractiveness of crowdfunding over other traditional financing schemes and the way it works. Here we will only discuss the papers that have focused on reward crowdfunding.

3.1 Financial Literature on RC

The financial literature on RC has tried to explain why creators raise money from product users in exchange for a project outcome rather than using debt or equity contracts from investors. Two explanations have been put forward.

The first explanation is that for some projects cash flows may be too difficult to verify

and/or the creator may be unable to appropriate cash flows if the project has some public good features. In this sense, it is clear that many entrepreneurial ventures cannot be funded through equity or debt because of lack of sufficient assets that can be pledged to financial investors (Casamatta and Haritchabalet, 2014; Chenet et al.,2009; Hellmann,2007; Shane and Cable, 2002). This is typical of creative projects such as music, films, and books, which have suffered a lot from very cheap distribution through internet. These projects are impossible to fund using financial contracts offering future cash flows, since these are highly dubious. Debt and equity funding both require the that entrepreneur gets paid for selling the product or service. Moreover, those payments must be verified and shared with the investors according to the terms of the financial contract. If the payments from consumers are not received or cannot be verified, these projects will never be financed. Financing by users themselves solves these problems. The inability to appropriate cash-flows upon delivery is no longer a problem because the entrepreneur receives *ex ante* the payments from consumers, and the verification problem disappears because any *ex post* cash-flows go the entrepreneur.

The second explanation has to do with uncertainty about future cash flows. For some products it is too difficult or costly to estimate potential demand. Raising funds will be particularly difficult when funding only makes sense for a high enough consumer interest, and (costly) marketing campaigns to gauge demand need previous financing. A RC campaign is *per se* a targeted marketing campaign, because it allows the entrepreneur to estimate consumer interest from early adopters at a very low cost¹⁹. This reduces the total cost of both raising funds and estimating demand. Agrawal et al. (2014) and Belleflamme et al. (2015) emphasize the use of crowdfunding for market testing under uncertain aggregate demand. Chemla and Tinn (2016) show that the information gathered while raising funds from consumers provides firms with a real option to invest if demand is sufficiently high.

¹⁹As Ding (2007) points out marketing research mainly relies on voluntary, non-incentivized reporting by consumers. He emphasizes that consumers need to be given explicit incentives for revealing their information truthfully. RC guarantees truthful revelation of demand at no additional cost.

Additionally, the price discrimination implicit in the different rewards that the fund providers are offered, depending on how much they contribute, is consistent with this idea. This type of “price discrimination” allows for a more efficient information aggregation, since we do not lose the information of people with low valuations or high risk aversion. Chang (2016) and Ellman and Hurkens (2015) present models showing that the currently employed ad hoc types of crowdfunding schemes, even though suboptimal in general, help firms to price-discriminate.

Both economic explanations highlight the advantages that customer financing has over standard third-party finance for some particular projects that would not get funding otherwise. These advantages seem important enough to overcome the moral hazard and adverse selection costs inherent in raising money from small backers. In fact, some of these costs may be ameliorated in case of customer financing. In particular, by eliminating the need for verification of the cash-flows, customer financing reduces some dimensions of the moral hazard problem. And allowing for a more precise estimation of demand reduces adverse selection costs. Notice, however, that customer financing is not new. It has been widely used in the real economy through standard pre-sale contracts that have been studied in the industrial organization literature on pre-selling. Long before the advent of RC, firms were already using sophisticated pre-sale contracts to estimate and manage demand and to market new products to early adopters. Chu and Zhang (2011) point out that sellers engage in advance selling (or pre-order) for many plausible reasons, including pricing of new products and services, as in Chatterjee (2009), and demand forecasts and inventory management, as discussed by Chen (2001), Moe and Fader (2002) and Li and Zhang (2010).

Summing up, we can conclude from the economic literature that RC simply uses new digital communication technologies to attract customers, but this literature fails to explain why this one-shot game is based on a no-penalty contract. Most papers assume RC under a standard pre-sale contract, ignoring the actual contractual arrangements being used. And

when they acknowledge the difference, they argue that the benefits of demand discovery are large enough to overcome the inefficiency caused by the absence of penalties in this one-shot game. In fact, in the paper most closely related to ours, Strausz (2016), also presents a model where RC, by allowing to contract with consumers before investment, improves screening for valuable projects and shows that entrepreneurial moral hazard, due to lack of penalties for non-delivery, threatens this benefit. He argues that the lack of penalties is an inefficiency that limits the use of RC for purposes of project screening. Thus, this literature fails to explain why RC platforms favour the no-penalty contract over standard pre-sale contracts that are amply used in the real economy for the purpose of demand estimation.

3.2 Legal Literature on RC

Legal commentators, while divided on the nature of the contract, have not considered the no-penalty nature as a contractual innovation. They agree on the usefulness of RC when there is asymmetric information because of the difficulties to verify cash flows or consumer demand, but they classify RC either as pre-sale or as charity²⁰. Therefore, they also view RC as a new media that offers the well known advantages of customer funding under standard contracts.

Some legal authors think of the contract as a donation because, unlike financial contracts, there are no cash flows for the backers, and unlike commercial contracts, there is no obligation (enforceable through legal remedies that appear as effective and likely to be implemented) to deliver the product²¹. In this respect, material and immaterial rewarding

²⁰Nevertheless, some legal commentaries also analyze reward crowdfunding through the lens of equity funding, as an example, see Wroldsen (2017): "The rewards-based model of crowdfunding remains highly successful, though it has an important limitation: contributors cannot share in the upside of the projects they support". This limitation becomes very clear in cases such as that of Oculus (see footnote 4) which Groshoff, Nguyen and Urien (2015) cite at page 296: "As a result, in approximately a year-and-a-half, Oculus went from having only option value to a value of \$2 Billion, and many crowdfunders from Oculus' Kickstarter campaign were not pleased that they were unable to share in the riches".

²¹O'Connor (2014) reports that "there is neither an "investment" (other than as we might say that a philanthropist "invests" in a charitable project) nor interest in financial return by the funder".

(like an acknowledgement of the funds or a promotional T-shirt) corresponds to the donation model. When donors expect to become future users, or simply consider that the project is a public good and should be pursued, they may support a project by donating money so that the entrepreneur can carry the project forward. According to this vision, RC follows a donation model: backers finance the project without sharing any profits with the entrepreneur because they get an intangible benefit from doing so²². In this sense, the solicitation of funds as gifts or donations is a substantially unregulated activity, since it is clear that there is no commitment or obligation that must be legally honored. The problem with this view is that most donations to charities are channeled to highly reputed no-for-profit for profits, while RC channels money to creators who seek profits but lack a reputation²³. In contrast with this view of RC as donation, our model does not require any intangibles but just the self-interest of the backers in pursuing the reward to show that the no-penalty contract can be optimal.

On the other hand, others think of the reward as the critical motivation, and explain the relationship between the creator and the backers as a type of consumer financing. In this regard, the RC relationship performs the same economic function that pre-sale or pre-order contracts but lacks effective penalties for non-delivery. Armour and Enriques (2017) argue that this different risk allocation from that normally found in a pre-sale contract, with risk sharing between the creator and the backers, can be useful in some cases where products are highly innovative, and may explain the success of reward CF. Other authors view the “best efforts” agreement as a flaw that needs to be addressed²⁴.

²²In fact, the economic literature does consider intangibles as a key aspect of crowdfunding. Schwienbacher and Larralde (2010) and Belleflamme, et al. (2013), argue that (i) backers usually have a high willingness to pay, and pay more than regular consumers, who wait until production takes place before purchasing directly (ii) backers receive private benefits as part of a community of “special” or “privileged” consumers/investors.

²³Glaeser and Shleifer (2001) argue that previous reputation is necessary to sustain donations when funders are simply acting altruistically, and this is why most donations are channeled to well reputed non-for profits (such as the Red Cross). Nevertheless, Belleflamme et al. (2013), argue that in crowdfunding, crowdfunders donate because they expect to be consumers or enjoy sufficient community benefits.

²⁴This is the approach taken by Cumming et al. (2016) who argue that “under a reward-based model, fraud generally occurs because founders do not develop or deliver promised products”, therefore they conclude

In the next sections we will present a one-shot model of RC that shows that the no-penalty contract may arise as an optimal contractual arrangement between a creator of unknown talent and the early adopters of his products. Therefore, we contribute to the literature showing that the no-penalty contract is in fact a contractual innovation that allows for talent discovery in this context, and show that the application of standard consumer protection measures (such as the imposition of a standard per-sale contract) to the RC market could kill the market. We argue that RC is not simply a new media for offering standard contracts. The practice of raising funds from consumers and attempts at demand discovery existed long before the advent of RC and can be achieved using standard contracts. Summing up, we defend that RC platforms with no-penalty contracts serve a talent discovery function only made possible by the online technology that allows creators to contact many new early adopters and requires new contractual solutions.

4 The Model

4.1 Agents and Outcomes

Consider a two-period economy where all agents are risk neutral and the discount rate is normalized to zero. A creator wants to develop a product (or service) but he has no initial wealth and wants to raise the funds he needs through a RC campaign.

The project consists of the development of a product which requires an initial capital outlay of an amount I . Additionally, delivering the product to the final consumer has a cost for the creator k , which depends on the creator's ability, i.e. $k(a) = \kappa - \alpha a$. Ability follows a uniform distribution in the interval $[0, 1]$. But at time $t = 0$, when the creators attempt to raise funds through a RC campaign, nobody (not even the creator) knows his ability.

that specific regulation aimed at protecting less sophisticated crowd members is needed and fully effective enforcement must come from government agencies. Notice that they use a wide concept of fraud, in which strategic non delivery would be included ("perceived (suspected) fraud, occurs when rewards are substantially delayed or changed, to the disadvantage of the backers"). So, in their study, a case where the creator fails to deliver the quality and features promised is considered fraudulent crowdfunding.

During the campaign the creator offers potential backers a unit of the product in exchange for a contribution to the campaign r . Moreover, the RC campaign includes a requirement to raise a minimum amount, \underline{F} , from the backers at the time of the offering before any funds can be released to the creator, i.e. a provision point mechanism. Both r and \underline{F} are fixed by the creator at the beginning of the RC campaign.

Each customer has a private valuation for the product which may be either 1 or 0 and the fraction of consumers with a high valuation is h . Nevertheless, there are two types of consumers of the product: early adopters and late adopters. There are N potential early adopters and M late adopters. Early adopters can determine their valuation of the product based on the prototype available at the time of the crowdfunding campaign. Late adopters can only find out their valuation once there exists a commercial version, therefore, they do not participate in the RC campaign.

When the RC starts the early adopters with valuation 1 need to estimate the probability that the promised product will be delivered to them. We follow Mollick (2013, 2014) in assuming that the early adopters will evaluate the information provided by the entrepreneur about his qualifications, his previous experience and the prototype and also the information provided by third-party endorsers and by other backers through the platform and other social media. This provides backers with a signal on the creators ability to deliver the product $a_b = a + \tilde{v}$, where \tilde{v} is a random variable that follows a uniform distribution in the interval $[-v, +v]$. The backers with valuation equal to 1 decide whether to pledge funds based on this signal.

The early adopters/backers' decision on whether to pledge funds, together with the contribution being asked for r and the provision point \underline{F} are readily observable and produce valuable information to the market. Upon success in the funding campaign, the market's expected ability of the creator is updated upwards to $E(a/r)$. If the creator is funded during the process of production he learns his ability a and his delivery costs and must decide

wether to deliver the product to the backers incurring cost k per unit delivered.

If the creator does not deliver the product to the backers the consequences will depend on the contract that the platform establishes to regulate the relationship between the creators and the backers. Our basic contract is a "pre-sale" contract according to which failure to deliver the product to the backers results in a penalty for the creator P per unit. Since we are assuming that the creator has zero initial wealth, the total amount of the penalty, to be paid by the creator in case he does not deliver, is bounded at $F - I$, which is the amount of funds that is raised from the backers at time $t = 0$ and not committed to be paid into the initial investment, I . The "no-penalty" contract is the limit case when $P = 0$, so that failure to deliver at time $t = 1$ does not entail any monetary penalty whatsoever.

Additionally, in the second period, if the market's updated expected ability is higher than some threshold \hat{a} (with $\hat{a} > 0.5$) the creator has access to a follow-up investment that will generate benefits B at time $t = 2$. These benefits may come from scaling up production to reach the late adopters or from new investment opportunities that are only available to talented enough creators. We will assume that some goodwill Δ is generated when the creator keeps his promise to a backer and delivers the product at time $t = 1$. This goodwill adds to the benefits that the creator obtains in the second period if the follow up investment takes place. Both B and Δ may be increasing functions on the size of the late adopters market M . Second stage benefits are zero if there is no follow-up investment.

4.2 Timing

- At time $t = 0$ the creator tries to raise funds through a RC campaign. The sequence of events during the campaign is as follows:
 - The platform fixes the penalty P .
 - The creator chooses the contribution required to obtain the reward r and the provision point \underline{F} .

- Early adopters learn whether their valuation for the product is 1 or 0 and receive signal a_b . They estimate their expected utility, considering the probability of delivery, and pledge r if this expected utility is positive. If they choose not to pledge the game ends.
- If backers choose to pledge and the total funds pledged hNr are higher than \underline{F} the project is funded. The market participants observe the level of funding and update the expected ability of the creator to $E(a/r)$.
- At time $t = 1$ the creator learns the delivery cost $k(a)$ and makes a decision on whether to deliver the product. The creator suffers penalty P if he does not deliver.
- At time $t = 2$, if the updated creator's expected ability $E(a/r)$ is higher than the threshold \hat{a} , he gets payoffs B , plus the additional goodwill Δ per delivery if the product was delivered to backers at time $t = 1$. Otherwise creator's payoffs at time $t = 2$ are zero.

We solve the game by backwards induction and, since the outcome of the second period is automatic, we start the analysis at time $t = 1$ when the creator has to decide on product delivery.

4.3 Creator's Decision on Delivery

At time $t = 1$ the creator that has raised funds and invested I learns the realization of the delivery costs $k(a)$ and must decide whether to deliver the product to the backers. There are two reasons for delivering the product. First, the creator will deliver if the cost of delivering, $k(a)$, is lower than the non-delivery penalty P . Second, the creator may deliver if, having access to the second period benefits from scaling up production, delivering generates enough goodwill, i.e. if Δ is larger than the delivery costs. Notice this second reason for delivering only exists when raising funds from backers is a powerful enough signal to grant access to

the second stage investment opportunity, this is if

$$E(a/r) \geq \hat{a}. \quad (1)$$

In what follows we will denote by i an indicator function that takes on the value 1 when success in raising funds is a strong enough signal on the creator's ability, i.e. when condition (1) holds, and 0 otherwise. Then, combining both reasons for delivery we know that the creator will deliver if

$$k(a) = \kappa - \alpha a \leq \text{Max}(i\Delta, P), \quad (2)$$

so that only creators with ability above a delivery threshold a_d will deliver, with a_d given by

$$a_d = \frac{\kappa - \text{Max}(i\Delta, P)}{\alpha}. \quad (3)$$

Throughout the analysis we will assume that, since the creator has no initial wealth, the total penalty that he can pay is bounded by the funds that the creator can raise from the backers and have not been used at the initial stage, while goodwill generated by each delivery maybe higher or lower than the penalty, i.e.

$$r - \frac{I}{hN} \geq P \leq \Delta \quad (4)$$

Therefore, if the creator is not considered talented enough to have access to a follow up investment (i.e. if $i = 0$). he will only deliver for a high enough P . On the other hand, a creator whose talent has been discovered, and has access to the second period investment may deliver even in the absence of a penalty. But a high penalty will nevertheless raise incentives for delivery.

4.4 Backers' Decision on Pledging Funds

When the creator initiates the RC campaign the early adopters learn their individual valuations. The early adopters that value the product at 0 will not take part in the RC campaign.

The early adopters with valuation 1, which represent a fraction h of the total number N , are now the potential backers, and they will evaluate the information provided by the creator to ascertain his ability and estimate the probability of receiving the promised reward. This evaluation provides these potential backers with a signal on the creator's ability $a_b = a + \tilde{v}$ with $\tilde{v} \rightsquigarrow U[-v, +v]$. For simplicity we will assume that they can obtain the signal at no cost and that the signal is the same for all of them.

Given the signal and the creator's incentives to deliver, potential backers can estimate the probability of delivery as the probability that the creator's true ability a is above the delivery threshold a_d given the signal received a_b , $\Pr(a \geq a_d/a_b)$. It is important to notice that the provision point mechanism alleviates any concerns that the potential backers may have that the product may be underfunded, in which case the creator would be unable to pay the fixed cost I or the penalty P . For $\underline{F} \geq I + hNP$, the expected payoff of a potential backer at this stage is given by:

$$\Pi_b(r) = 1 \Pr(a \geq a_d/a_b) + P \Pr(a < a_d/a_b) - r. \quad (5)$$

So he will pledge r if his expected payoff is positive.

Proposition 1 *When the provision point \underline{F} is fixed above $I + hNP$ the early adopters willingness to pledge funds is increasing in the signal that they receive on the creator's ability. In particular:*

(i) *If the signal of the backers is high enough, so that the creator's ability is expected to be above the delivery threshold ($a_b \geq a_d + v$), the conditional probability of delivery is one, and the maximum amount that the backers will pledge is $\bar{r} = 1$.*

(ii) *If the signal of the backers is low enough, so that the backers take the creator's ability to be below the delivery threshold ($a_b < a_d - v$), funding is not possible because they would not pledge more than P and this does not cover fixed production costs and is not enough to satisfy the provision point.*

(iii) *For intermediate values of the signal ($a_d + v > a_b \geq a_d - v$) the probability of delivery*

is

$$\Pr(a \geq a_d/a_b) = \Pr(a \geq a_d/a_b + v \geq a \geq a_b - v) = \int_{a_d}^{a_b+v} \frac{1}{2v} da = \frac{a_b - (a_d - v)}{2v}, \quad (6)$$

and the maximum amount that the backers will pledge is

$$\bar{r} = P + \frac{a_b - (a_d - v)}{2v}(1 - P), \quad (7)$$

which is increasing in both a_b and P .

The outcome of the funding campaign depends critically on a_b and on P . A higher signal a_b translates into a higher maximum pledge \bar{r} . But, for any value of the signal, this maximum pledge increases with P . A higher value of P increases the expected utility of the backers both directly and indirectly. There is a direct effect on expected payoff in case of non-delivery, and there may also be an indirect effect in making the delivery threshold decrease and ensuring delivery for more ability levels. So clearly, for a given required contribution r , the probability of getting funding increases with P .

If r is below \bar{r} the total amount of funds that will be pledged is given by $F = hNr$. The campaign will be successful and the funds will be released to the creator only if the provision point is reached, implying $F \geq \underline{F}$.

4.5 Market's Assessment of Successful Creators

If the RC campaign is successful market participants can observe the amount pledged by each backer r , the number of backers hN , the provision point \underline{F} , and the established penalty P . With this information they can infer the minimum value of the signal that the backers have received and update their estimation of the creator's ability.

Proposition 2. *After a successful RC campaign, the market can infer that the signal that the backers have received is above a minimum threshold*

$$\underline{a}_b = a_d - v + \frac{2v(r - P)}{1 - P}, \quad (8)$$

and update its assessment of the creator's ability to

$$E(a/r) = \frac{1 + a_d}{2} + \frac{v[2(r - P) - (1 - P)]}{2(1 - P)}. \quad (9)$$

After a successful campaign the updated expected ability of the creator is above its unconditional value of $1/2$. The updated expectation is increasing in the delivery threshold a_d and the required contribution r , but decreasing in the penalty P . This is consistent with the idea that backers only pay a high price when they expect a high probability of delivery. But a high probability of delivery can be induced either by the threat of the penalty or by high ability expectations. Therefore, other things equal, an increase in the penalty translates into lower market expectations of the ability of a successful creator. This makes talent discovery more difficult for any given contribution r .

4.6 Creator's Decision on Required Contribution and Provision Point

At the initial stage the creator has to decide on the contribution r and the provision point F . In setting these two variables the creator has to balance three different requirements.

First, the early adopters will pledge only if $r \leq \bar{r}$. This implies that the probability of success of the campaign decreases with r .

Corollary 1. *For a given contribution r the probability that the backers receive a high enough signal so as to pledge funds is given by*

$$\Pr(a_b \geq \underline{a}_b) = 1 - \underline{a}_b = 1 - \left[a_d - v + \frac{2v(r - P)}{1 - P} \right]. \quad (10)$$

Second, because the creator has no initial wealth he needs to raise enough funds to pay the fixed costs of production and to satisfy the penalty in case he does not deliver, since we can assume that not paying the penalty is verifiable and can be punished by a court of justice. This implies that the provision point has to satisfy $F \geq I + hNP$ and that there is a minimum required contribution $\underline{r} = F/hN$.

Third, meeting the previous two conditions, i.e. setting $r \in [\underline{r}, \bar{r}]$ guarantees success in the campaign, but this is only the first stage of the game. A successful creator will only be able to access the benefits from scaling up in the second period if the market expectations about his ability are high enough. As we saw in the previous subsection, these expectations increase with the price. Therefore, the creator needs to fix a high enough price if he wants to be recognized as talented and to access the benefits from scaling up the project.

Corollary 2. *A successful creator will only have access to the second period benefits from scaling up the project if the price of the reward is set above a minimum threshold \hat{r} , such that the market's assessment of his ability is above the threshold \hat{a} , i.e. $E(a/\hat{r}) = \hat{a}$. Specifically, a successful creator will only access the second period benefits if*

$$r \geq \hat{r} = P + \frac{(2\hat{a} - 1) - a_d + v}{2v}(1 - P). \quad (11)$$

Considering these three conditions together it is clear that there is no advantage in raising the provision point beyond the minimum amount required. Therefore, the creator will optimally set $\underline{F}^* = hNP + I$ and then choose a contribution above the minimum required to reach this provision point $\underline{r} = P + \frac{I}{hN}$.

In particular the creator will choose the contribution r so as to maximize his expected payoff. His maximization problem is as follows:

$$\text{Max} \Pi_c(r) = \Pr(a_b \geq \underline{a}_b) [hN(r - P) - I + iB + \Pr(a \geq a_d/r)hN [P + i\Delta - \kappa + \alpha E[a/a \geq a_d]]]. \quad (12)$$

subject to

$$r \geq \underline{r} = P + \frac{I}{hN} \quad (13)$$

and

$$i = 1 \text{ iff } r \geq \hat{r} = P + \frac{(2\hat{a} - 1) - a_d + v}{2v}(1 - P). \quad (14)$$

The first term in this equation, $\Pr(a_b \geq \underline{a}_b)$, reflects the first requirement in fixing the contribution, which implies that the backers will only pledge for a high enough signal which is increasing in r . Therefore, the probability of getting funds is decreasing in r . But the term in brackets reflects the expected payoff of a successful campaign, and this is increasing in r . This includes the amount of funds raised hNr minus the penalty for non delivery hNP and the fixed production costs I plus any continuation benefits iB . But is also reflects the extra benefits in case of delivery, which include not paying the penalty P , generating goodwill $i\Delta$ and paying the expected variable costs $\kappa - \alpha E[a/a \geq a_d]$. Finally, the two conditions in the maximization problem reflect the second and third requirements for fixing the contribution. First, the contribution has to be high enough to satisfy the provision point. Second, the creator will be discovered as talented only if the contribution is high enough to imply an ability higher than \hat{a} .

To find a solution to this complex problem we first solve for the unconstrained optimal value of r . This will allow us to understand how the optimal required contribution changes when there are opportunities for talent discovery that yield benefits B .

Proposition 3. *The unconstrained optimal value of the contribution required of the backers r is*

$$r_u^i = P + \frac{1 - a_d + v}{4v}(1 - P) - \frac{iB - I}{2hN}. \quad (15)$$

When the continuation benefits are large the creator has an incentive for lowering the required contribution. This happens because lowering r reduces the potential benefit from the first stage, but it increases the probability of getting funding and being able to access the second stage. Nevertheless, this desire for a lower contribution faces the constraints imposed by the provision point and the need to signal a high enough ability in order to access the second period. Because of this restrictions the creator will choose different solutions for different parameter values.

Proposition 4. *The creator will choose a different value for the contribution required of*

the backers r depending on the opportunities available for talented creators. Specifically, the creator's choice of r depends on the values of the probability of being discovered as talented, \hat{a} , and the continuation benefits for talented creators, B , in the following way:

(i) When the required expected ability for accessing the second period is high (\hat{a} is high) but the continuation benefits are small (small B) the creator will choose $r^* = \max(\underline{r}, r_u^{i=0})$, and he will not be able to access the second period even if the RC campaign is successful.

(ii) When the required expected ability for accessing the second period is high (\hat{a} is high) and the continuation benefits are large (large B) the creator will choose $r^* = \max(\underline{r}, \hat{r})$, and, if the RC campaign is successful, he will be able to access the second stage and obtain B .

(iii) When the required expected ability for accessing the second period is low (\hat{a} is low) the creator will choose $r^* = \max(\underline{r}, r_u^{i=1})$, and, if the RC campaign is successful, he will be able to access the second period and obtain the continuation benefits for talented creators B .

In fixing r the creator is comparing the first and second period benefits. When \hat{a} is high it is necessary to fix a very high contribution to be able to access the second period in case of success. This high contribution diminishes the expected profits from the first stage. Because of this, if the second stage benefits B are low, the creator prefers to forego the possibility of being discovered as talented and selects a lower contribution that maximizes the first period benefits.

When \hat{a} is high and B is also high the creator wants to be discovered as talented. This forces him to raise the contribution r up to a level that reduces the first period profits and the probability of success, but guarantees talent discovery and access to the second stage in case of success.

Finally, when \hat{a} is low it is possible to access the second stage even with a low contribution. Therefore, the creator can maximize both the first and second period profits simultaneously.

4.7 Fixing the Penalty

At the initial stage of the game the platform will fix the penalty P for non-delivery. The minimum feasible value for the penalty is zero (corresponding to the no-penalty contract). And because the maximum contribution that the creator can require is 1 the maximum feasible value of the penalty is $1 - \frac{I}{hN}$. The penalty will be fixed by the platform with the objective of maximizing total surplus. This is a reasonable assumption because the platform is an intermediary between the creator and the backers and therefore it needs to satisfy both sides of the market. Total surplus Π is the sum of the expected payoffs of the all the backers and the creator

$$\Pi = \Pi_b(r^*)hN + \Pi_c(r^*). \quad (16)$$

Therefore, the platform chooses P to maximize

$$\Pi = \Pr(a_b \geq \underline{a}_b) \left[hN - I + iB + \Pr(a \geq a_d/a_b \geq \underline{a}_b)hN [i\Delta - (\kappa - \alpha E[a/a \geq a_d])] \right]. \quad (17)$$

Interestingly, the penalty P does not have a direct effect on total surplus because it works as a transfer of surplus from one party to the other. But P has an important indirect effect on several key parameters of the model. First, on the delivery threshold a_d , which is decreasing with P . Second, on the market's assessment of the creators ability $E(a/r)$, which is decreasing in P for a given contribution r . And third, on the funding threshold \underline{a}_b , which depends on P directly but also indirectly through a_d and r^* .

Thus, there are many effects to consider when setting the penalty. Raising P lowers the delivery threshold a_d . On the one hand, this increases the probability of delivery and the funds that the creator can obtain from the backers in the first period. But on the other hand, for a given r , this reduces the market's assessment of the ability of the successful creator $E(a/r)$ and the possibilities of being discovered as talented. The creator can cancel out this

second effect by raising r , which allows for a higher market assessment for any value of P . Raising r does in turn imply higher profits from the first stage in case of success but a lower probability of success.

Because of the interplay of all these effects the optimal value of P depends on the values of the parameters, and it may be optimal to choose intermediate values between zero and the maximum possible value $1 - \frac{I}{hN}$. However, there are two special cases with corner solutions.

Proposition 5. *There exist two equilibria of the game with corner solutions for the penalty P^* :*

(i) *When the required expected ability for accessing the second period is high (\hat{a} is high) but the continuation benefits are small (small B) the platform will choose $P^* = 1 - \frac{I}{hN}$, the maximum possible penalty. The creator will choose $r^* = 1$ and he will not be able to access the second period even if the RC campaign is successful.*

(ii) *When the required expected ability for accessing the second period is high (\hat{a} is high), the continuation benefits are large (large B) and the goodwill from delivering to the early adopters is high (large Δ) the platform will choose $P^* = 0$. The creator will choose $r^* = \max(\underline{r}, \hat{r})$ and, if the RC campaign is successful, he will be able to access the second stage and obtain B .*

The first equilibrium corresponds with the case in which the creator chooses to maximize first period benefits and foregoes any chance of being discovered as talented (case i in Proposition 4). This equilibrium can be interpreted as a pre-sale market with a high value of r and a high penalty P in case of non-delivery, but no continuation opportunities.

The second equilibrium is a subset of the case in which the creator chooses to maximize the second period benefits, even if this means sacrificing first period benefits (case ii in Proposition 4). In this case the incentives provided by the goodwill are large enough to render the penalty unnecessary as an incentive to deliver. Therefore, it is optimal to eliminate the penalty so as to facilitate talent discovery. The no-penalty contract allows the creator to

fix a low contribution while still signalling high ability. The lower value of the contribution increases the chances of being successful in the RC campaign and accessing the second period. This equilibrium can be interpreted as a RC market where the objective of the creators is to use the campaign as a platform for talent discovery and there are significant benefits both from continuation and a significant goodwill can be generated by satisfying the early adopters.

5 Discussion, Key Assumptions and Extensions

In this section we discuss the key assumptions of the model that are needed to generate the main result and explain how other non-key assumptions can be relaxed while obtaining a similar outcome.

The model we have presented explains the use of the no penalty contract in RC. The key assumptions that are necessary to obtain this result are three. First, the early adopters decision on whether to provide funding is linked to the information they have about the probability of delivery. Second, the wider market can see the funds pledged by the backers. And third, the creators can benefit from a more favorable market assessment and from better treatment of early adopters. The first assumption is well rooted on the previous literature on RC and on customer financing in general, which, as we have discussed in the section about asymmetric information problems in the RC market, stresses the "wisdom of the crowd" effect and the role of the early adopters as sources of valuable information. The second assumption holds because the amount raised in RC campaigns is public information. The third assumption is supported by the empirical evidence showing that creators that run successful RC campaigns go on to raise funds from financial investors afterwards and it is our crucial departure from previous models of RC.

We have made the rest of the assumptions and modeling choices with the objective of keeping the model as simple as possible and as close as possible to a standard customer fi-

nancing model where pre-sale contracts are routinely used. This assumptions can be changed to make the model more realistic (albeit more complex).

For example, we have assumed that the backers have information on the creators ability. But, as an alternative, it would be possible to assume that ability does not pay any role and that the information of the backers is about the value that the consumers assign to the product, which we have taken as given. In that alternative setting only the most valuable products would have access to the second period and there would be a delivery threshold based on the product's value.

Another assumption that could be changed refers to the time when the information is released to the market. We have assumed that the market observes the amount of funding and updates its beliefs about the creator's ability when the campaign ends but before delivery decisions are made. It is possible to assume that the information is about whether the creator delivered or not. In this alternative setting, the incentive for delivering would come from the penalty and from being able to get a favorable market assessment, but if the penalty goes up, the delivery threshold goes down and delivering is not a powerful signal. Notice that the creators that get funding are still the ones that the backers believe to be above the delivery threshold given the penalty (with higher penalties implying lower delivery thresholds and requiring higher contributions from backers to provide a powerful signal). Therefore, the basic result would be the same: introducing penalties makes talent discovery more difficult.

We have also assumed that the creator does not know his type. Assuming that he knows his type would turn the model into a signalling game in which delivery could be a potential signal because it is costly but relatively less costly for the high ability type, so that only high ability types would deliver. The problem is that, as long as the second period benefits are large, the low ability type will mimic the high ability one. Then the separating equilibrium would unravel, so it is still necessary to assume that the backers have some information about types when they make the funding decision. What role would the penalty play in

these alternative setting? Notice that we are assuming that the creator is penniless, therefore he pays the penalty out of the funds received from the backers. Raising the penalty would make this signalling mechanism more expensive for all creators and therefore less efficient as a signal. The only setting in which we could think of a signaling equilibrium would, therefore, require that the creator not only knows his type, but also that he has some previous wealth that he would lose if the penalty is high and he fails to deliver. This model would deliver the opposite result: signaling would require high penalties, up to the level where the low ability types do not want to mimic the high ability types.

Finally, it is often claimed that the existence of important intangible benefits for both backers and creators is one of the key characteristics of the crowdfunding market. In fact, as we discussed in the literature review, some authors claim that, because of the absence of penalties for no-delivery, the RC market is driven by charitable motives, since the only reward that can be expected is the good feeling that comes from helping. We have so far shown that the RC market can work without any recourse to intangibles, but we do not claim that there are no intangibles and, in fact, it is important to understand which is the impact that intangibles may have in the power of the talent signal.

The importance of intangibles in crowdfunding has been reported by Gerber and Hui (2013) who conduct a survey to ask both creators and backers their motivations to participate in crowdfunding campaigns. In consistency with the main assumptions of our model they find that creators are motivated to participate to raise funds, to advertise their product and to receive validation and public recognition of their ability. But they also put a high weight in intangible benefits such as connecting with others with similar interests. Meanwhile backers main motivation is to seek rewards but they also seek to strengthen connections with people with similar interests. The importance of intangibles is consistent with the empirical findings of Giuduci et al. (2017), who show empirically that the probability of success of a crowdfunding campaign increases with the altruism and the strength of social

relations in the geographical area where the creator resides. André et al. (2017) claim that in reward crowdfunding, because of the ambiguous status of the reward, neither purely material (tangible) or completely immaterial (intangible) motivations are enough to guarantee the success of a campaign. Using a sample of projects posted on Ulule during year 2015, and measuring the difference in value of the individual pledges relative to the rewards offered, they find that the probability of success of the campaign is significantly increased by strong expectations of reciprocal giving (i.e. expectations that the creator will deliver the “gift” because he has received a “gift” from the backers).

How can intangibles be incorporated into our model and which is their impact on the power of the talent discovery signal? We can think of two different, but mutually compatible ways, for introducing intangibles for backers into the model.

The simplest way of introducing intangibles is to assume that backers derive a benefit from supporting their preferred projects and causes. These intangibles, coming from achieving some outcome valuable in the eyes of the backer, should be similar in both reward and donation models. In this case, delivery of the product or service would bring an immaterial benefit to backers. In the model this would amount to increasing the value of the product to the backers from 1 to $1 + B_b$, with B_b denoting the immaterial benefit for the backers. This would allow for an additional number of projects to get funding but would not interfere with any of the effects identified before, and does not change the nature of the optimal contract.

A second possibility is that backers derive an intangible benefit from recognition for discovering talent and innovations. Backers may get an immaterial benefit when the creator is successful and the product is scaled up. This type of intangible seems particularly well suited to the crowdfunding market, where backers are often described as early adopters that value trend-setting. Moreover, it is also consistent with some backers giving funding in exchange for rewards different from the delivery of the product or service, such as simple acknowledgement of having contributed to the project²⁵. In the model this type of intangible

²⁵Continuing with our previous examples, it is clear that the immaterial value that a backer can derive

would be captured by increasing the value of the product to the backers from 1 to $1 + iB_b$. The crucial difference between both types of intangibles is that, in the second case, the backers obtain an intangible benefit only if they help discover a new talent. In this case the intangibles amplify the impact of talent discovery and increase the funding possibilities to the extent that talent discovery is preserved, therefore reinforcing the desirability of avoiding penalties for non-delivery.

6 Policy Implications

The RC market has developed in a legal vacuum. The success of this market has attracted the interest of economists and lawyers. Differently from equity and debt, however, it remains largely unregulated. In this paper we have explained the logic behind the no-penalty contract that characterizes the typical relationship between backers and creators in RC. Our model has clear implications on the desirability of legal regimes. The basic conclusion from our analysis is that RC uses the no-penalty contract because it is primarily a market for talent discovery. Therefore, regulatory measures that reinforce this discovery mechanism will make RC thrive, while measures that assimilate backers either to financial investors or to regular consumers may be counterproductive. In particular, we consider the potential impact of rules about backers access to the market, rules about information disclosure, rules about the role of the platforms and, particularly, rules about delivery of the final product.

Let's consider first rules about backers access to the market. The regulation of equity crowdfunding deals with financial investors and asks whether access of small investors to this particular investment should be restricted, either in terms of amounts, or number of projects funded, similarly to what happens with other financial investments such as hedge funds. In the case of RC we have argued that backers are early adopters that think they

from having his name shown on the back cover of the first album of a rock band or from a T-shirt showing that they helped fund the first virtual reality headset, Oculus (see footnote 2), clearly depends on the subsequent fortunes of the projects in the wider market of late adopters.

can evaluate the attractiveness of a new and highly specific product or service, and stand to receive the final product or a related outcome. From this perspective, limiting the number of projects or total amounts per backer would reduce the information flow for talent discovery and cannot be defended on diversification grounds. Therefore, regulators shouldn't think of backers primarily as small financial investors that need to be protected.

Nevertheless, backers, just like financial investors, may benefit from rules about information disclosure. In fact, information disclosure seems an important concern for the platforms, who actively encourage backers to seek and ask for information before making a decision, and to be especially aware of the risks and challenges that a creator has to identify to ask for funding. The better the information the backers have, the easier talent discovery will be. Moreover, the platforms claim that they actively monitor and cancel campaigns when they suspect fraud. Clearly, avoiding fraud is crucial to build backers' trust. A large number of backers is necessary to generate a powerful signal for talent. However, the platforms only request information in a very informal manner. This seems inevitable in an early funding market for talent discovery, since there is a limit to the information creators can disclose without risking copycat imitators.

Additionally, the regulator may consider the platform as an information intermediary similar to a securities underwriter. The law may impose obligations on the platform to evaluate a project's specific claims to potential backers, resolve disputes, or offer refunds. Currently, the platforms state very clearly that they do not take these responsibilities on, and claim that they act as mere technical intermediaries and rule-setters. In our model, it is the backers and not the platforms who have information about the quality of projects or creators, therefore it would be counterproductive to impose those legal responsibilities on platforms. On the other hand, the platforms have a key role as rule-setters. As we have seen in our model, depending on the rules on provision points and penalties we can have specialized platforms catering to different creators depending on the continuation benefits.

Some platforms may specialize in talent discovery, and some may become standard markets for products with customer pre-order funding. However, the current rules are somehow ambiguous, with unclear content on what is understood as "best-efforts", and what compensation can be obtained in case of non-delivery. This may be due to the uncertainty that the platforms face about how courts will interpret claims resolutions (depending on whether they consider backers as consumers or investors) or doubts about the validity of a naked no-penalty contract (is it truly a legal contract?). Which brings us to our last and most important policy implication: whether backers should be considered and protected as consumers.

In fact, we have seen that most of the literature considers backers essentially as consumers. This is of particular concern in Europe, given the mandatory framework designed for consumer protection²⁶. The mandatory framework displays three different layers of consumer protection.

The first one protects the consumer as buyer. According to Directive 1999/44/EC on the sale of consumer goods, sellers of consumer goods within the EU are obliged to guarantee the conformity of the goods with a contract. The guarantee applies for a period of two years after the delivery of the goods and there exists certain standards for assessing conformity. In particular, if the goods are not delivered in conformity with the sales contract, consumers can ask for the goods to be repaired, replaced, and reduced in price, or for the contract to be rescinded. If one thinks of backers in this way, legal rights of the consumer in case of product failure would automatically apply (which in our simplified model translates into an automatic penalty for non delivery). This means that an unsatisfied backer would be protected by the remedies it contemplates, since the legal warranty created by the Directive cannot be waived nor restricted. We have shown that it is the initial low probability of delivery what makes it difficult to be successful in raising funds, since only creators that backers think of very high ability can obtain funding in the absence of penalties. This characteristic of the RC

²⁶For a detailed discussion of this framework see Armour and Enriques (2017).

market is necessary to guarantee that a successful campaign leads to a new talented creator being discovered, and to the scaling up of the project. Therefore, mandatory penalties for non-delivery (or any type of product failure broadly conceived) would interfere with the talent discovery function of the RC market. The application of the Directive would turn this market into a standard pre-sale market where it is not possible to signal ability and scale up projects.

The second layer offers protection to the consumer as a distance buyer. Directive 2011/83/EU on consumer rights regulates the right of withdrawal in distance sales. In addition to the non-conformity warranty granted to all consumer sales, this Directive protects consumers from a change of mind in case of distance sales. As Reward CF operates through electronic platforms, backers would have the non-waivable right to return the reward within 14 days after receipt and obtain the refund.

The third layer protects the consumer from unfair contract terms, understood as significant imbalances in the rights and obligations of consumers on the one hand and sellers and suppliers on the other hand. It provides additional legal ammunition to combat the exclusion of liability for non-delivery in the contract (which is the case of the reward CF contract). According to this directive the exclusion of liability for non-delivery could be considered as an unfair imbalance in the contract at the expense of the backer-consumer, who bears all the risks if the reward is not delivered.

So far, the lack of litigation has allowed the RC market to develop in a legal vacuum, and the platforms have been able to operate under the "best-efforts" model. Nevertheless, if backers ask for judicial protection it is to be expected that the consumer protection framework would be enforced, which would put the no-penalty contract in jeopardy. It is true that the mandatory rules are conceived to protect consumers from professional business sellers, and it could be argued that reward CF entrepreneurs might not be considered as such as long as the product is not yet developed and commercialized. However, in order to preserve

the RC market, legal intervention establishing a crowdfunding exception is required to keep RC contracts out of the scope of the consumer protection framework. One excellent way to accomplish this objective, would be to exclude Reward CF in the new proposal for a maximum harmonization directive regulating online and other distant sale of tangible goods: the proposal of Directive of the European Parliament and of the Council on certain aspects concerning contracts for the online and other distance sales of goods (Dec 2015).

The crowdfunding exception is justified because legal warranties are not the only schemes able to induce incentives for reducing the risk of product failure. As we have seen in our analysis, the no-penalty contract already produces incentives for the creator to avoid product failure. The expectation of discovery and the continuation opportunities induce the creator to deliver what he promised, and the price that the backers are willing to pay adjusts to the strength of these incentives. Moreover, the provision point rule prevents situations where the possibility of discovery is remote and incentives are too low. Introducing the penalty would not necessarily increase incentives to avoid failure, and it may be counterproductive, because it would eliminate the incentives created by the expectation of discovery.

7 Conclusions

In reward crowdfunding, instead of a debt or equity contract, fund providers are promised some good or service in the future in exchange for their contribution to the funding of the investment project under a contract that does not effectively penalize the creator's failure to deliver. The existing economic and legal literature is puzzled by the platforms using this seemingly inefficient contractual scheme where a standard pre-sale contract would appear to work better. Counter-intuitively, we prove that the no-penalty contract is the optimal contract between creators of unknown talent and early adopters of their products in a one-shot game where the funding provided by the early adopters offers valuable information about the creator's ability and the creator can benefit from a more favorable market assessment

and from goodwill generated by satisfying the early adopters. We show that, far from being a source of inefficiency, the no-penalty contract is a contractual innovation particularly apt at talent discovery.

Traditional pre-sale contracts penalize the sellers in case of non-delivery, which reduces the risk of strategic non-delivery and facilitates funding. However, we show that penalties distort the incentives of the creators in a way that reduces the potential for talent discovery and therefore are suboptimal in this context. Interestingly, neither intangibles nor demand uncertainty -which are considered key aspects of RC- are driving this result. Our analysis has important policy implications on how backers should be protected. Standard measures of consumer or investor protection may turn out to be counterproductive.

Appendix

This appendix collects the formal proofs.

Proof of Proposition 1: The potential backers know that the creator will only deliver if his ability is above a_d . They receive a signal $a_b = a + \tilde{v}$ with $\tilde{v} \rightsquigarrow U[-v, +v]$. Then they estimate $\Pi_b(r)$ using $\Pr(a \geq a_d/a_b)$.

If $a_b \geq a_d + v$, substituting $a_b = a + \tilde{v}$, it is clear that $a \geq a_d + v - \tilde{v} \geq a_d$. Thus, $\Pr(a \geq a_d/a_b \geq a_d + v) = 1$. And $\Pi_b(r) = 1 - r$. So the maximum amount that the backers will pledge is $\bar{r} = 1$.

If $a_b < a_d - v$, substituting $a_b = a + \tilde{v}$, we have $a < a_d - v - \tilde{v} \leq a_d$. Thus, $\Pr(a \geq a_d/a_b \geq a_d - v) = 0$. And $\Pi_b(r) = P - r$. So the maximum amount that the backers will pledge is $\bar{r} = P$. This implies that the total contribution of the backers in this case, hNr , is insufficient to satisfy the provision point \underline{E} , because $hNr \leq hNP < I + hNP \leq \underline{E}$.

Finally, if $a_d + v > a_b \geq a_d - v$, we can compute

$$\Pr(a \geq a_d/a_b) = \Pr(a \geq a_d/a_b + v \geq a \geq a_b - v) = \int_{a_d}^{a_b+v} \frac{1}{2v} da = \frac{a_b - (a_d - v)}{2v}, \quad (18)$$

and this value is between 0 and 1. Substituting into $\Pi_b(r)$ we find

$$\Pi_b(r) = \frac{a_b - (a_d - v)}{2v} 1 + \left(1 - \frac{a_b - (a_d - v)}{2v}\right) P - r. \quad (19)$$

Rearranging this expression we find that $\Pi_b(r) \geq 0$ requires

$$r \leq \bar{r} = P + \frac{a_b - (a_d - v)}{2v} (1 - P). \quad (20)$$

And, in this case we have $\frac{d\bar{r}}{da_b} = \frac{(1-P)}{2v}$ and $\frac{d\bar{r}}{dP} = 1 - \frac{a_b - (a_d - v)}{2v} = \Pr(a < a_d/a_b)$. For feasible values of P ($P < 1$) both derivatives are positive. Q.E.D.

Proof of Proposition 2: The backers only pledge funds if $\Pi_b(r) \geq 0$. Given (19) this implies

$$a_b \geq \underline{a}_b = a_d - v + \frac{2v(r - P)}{(1 - P)}. \quad (21)$$

Therefore, after a successful campaign, the market's estimation of the creator's ability is

$$E(a/r) = E(a/a_b \geq \underline{a}_b) = E(a/a \geq \underline{a}_b - \tilde{v}) = E(a/a \geq \underline{a}_b). \quad (22)$$

Finally, substituting the value of \underline{a}_b from (21) we have

$$E(a/r) = E(a/a \geq \underline{a}_b) = \int_{\underline{a}_b}^1 a \frac{1}{1 - \underline{a}_b} da = \frac{1 + \underline{a}_b}{2} = \frac{1 + a_d}{2} + \frac{v[2(r - P) - (1 - P)]}{2(1 - P)}. \quad (23)$$

Q.E.D.

Proof of Corollary 1: Using $E(\tilde{v}) = 0$ and (21) we can compute

$$\Pr(a_b \geq \underline{a}_b) = \Pr(a + \tilde{v} \geq \underline{a}_b) = \Pr(a \geq \underline{a}_b) = 1 - \underline{a}_b = 1 - \left[a_d - v + \frac{2v(r - P)}{1 - P} \right]. \quad (24)$$

Q.E.D.

Proof of Corollary 2. Using (23) we have that $E(a/r) \geq \hat{a}$ requires

$$r \geq \hat{r} = P + \frac{(2\hat{a} - 1) - a_d + v}{2v}(1 - P). \quad (25)$$

Q.E.D.

Proof of Proposition 3. At the time of fixing the contribution, r , the expected payoff of the creator is

$$\Pi_c(r) = \Pr(a_b \geq \underline{a}_b) [hN(r - P) - I + iB + \Pr(a \geq a_d/r)hN[P + i\Delta - \kappa + \alpha E[a/a \geq a_d]]]. \quad (26)$$

We first estimate $\Pr(a \geq a_d/r)$ using $E(\tilde{v}) = 0$,

$$\Pr(a \geq a_d/r) = \Pr(a \geq a_d/a_b \geq \underline{a}_b) = \Pr(a \geq a_d/a + \tilde{v} \geq \underline{a}_b) = \Pr(a \geq a_d/a \geq \underline{a}_b) \quad (27)$$

which takes on the value 1 if $a_d < a_b$, and the value $\frac{1-a_d}{1-a_b}$ if $a_d \geq a_b$.

Given this result, and using (24) we can rewrite

$$\Pi_c(r) = \left(1 - a_d + v - \frac{2v(r-P)}{1-P}\right) [hN(r-P) - I + iB] + (1-a_d)hN \left[P + i\Delta - \kappa + \alpha \frac{1+a_d}{2} \right]. \quad (28)$$

Now we can compute

$$\frac{d\Pi_c(r)}{dr} = -\frac{2v}{1-P} [hN(r-P) - I + iB] + hN \left(1 - a_d + v - \frac{2v(r-P)}{1-P}\right). \quad (29)$$

The first order condition of the maximization problem requires finding the value of r that satisfies $\frac{d\Pi_c(r)}{dr} = 0$. And, rearranging we find this value to be

$$r_u^i = P + \frac{1-a_d+v}{4v}(1-P) - \frac{iB-I}{2hN}. \quad (30)$$

Finally, notice that the second order condition also holds because $\frac{d^2\Pi_c(r)}{dr^2} = -\frac{4vhN}{1-P} < 0$.

Q.E.D.

Proof of Proposition 4. When fixing r the creator will choose one value among r_u^i, \underline{r} and \hat{r} with

$$r_u^i = P + \frac{1-a_d+v}{4v}(1-P) - \frac{iB-I}{2hN}, \quad (31)$$

$$\underline{r} = P + \frac{I}{hN} \quad (32)$$

and

$$\hat{r} = P + \frac{(2\hat{a}-1) - a_d + v}{2v}(1-P). \quad (33)$$

It is straight forward to check that for values of \hat{a} below

$$\hat{a}_{\min} = \frac{3+a_d-v}{4} \quad (34)$$

the unconstrained choice of the creator r_u^i is always higher than \hat{r} . Therefore, for any value of r that the creator chooses, success in the CF campaign will be a high enough signal of

quality to access the second period, so that $i = 1$. Thus, when \hat{a} is below the threshold the creator will choose between $r^* = \max(\underline{r}, r_u^{i=1})$.

For values of \hat{a} above the threshold we have $r_u^i < \hat{r}$. In this situation the creator has two choices. He can choose $r_u^{i=0}$ and maximize the first period profits. Or he can choose \hat{r} and obtain lower first period profits but access the continuation benefits B . The payoff of the creator when $i = 1$ is increasing in B because

$$\frac{d\Pi_c(\hat{r})}{dB} = \Pr(a_b \geq \underline{a}_b(\hat{r}))B > 0. \quad (35)$$

Therefore, there exists a value of B above which $\Pi_c(\hat{r}) > \Pi_c(r_u^{i=0})$. When B is higher than this threshold the creator selects $r^* = \max(\underline{r}, \hat{r})$ and, if the campaign is successful, he will access second period benefits. When B is lower than this threshold the creator selects $r^* = \max(\underline{r}, r_u^{i=0})$ maximizing first period profits but he will not be able to access the second period profits. Q.E.D.

Proof of Proposition 5. The platform chooses P to maximize the total surplus, which can be written as

$$\Pi = (1 - a_d)hN \left[1 - \frac{I}{hN} + iB + i\Delta - \kappa + \alpha \frac{1 + a_d}{2} \right] + \left(1 - \frac{2(r^* - P)}{1 - P} \right) v(iB - I). \quad (36)$$

And the derivative of the surplus with respect to P is equal to

$$\frac{d\Pi}{dP} = \frac{-da_d}{dP} hN \left[1 - \frac{I}{hN} + iB + i\Delta - k + \alpha a_d \right] - \frac{2v[iB - I]}{(1 - P)^2} \left[\frac{dr^*}{dP}(1 - P) + r^* - P \right]. \quad (37)$$

We have several different cases depending on the value of a_d and r^* .

Starting with a_d we know that if $P > i\Delta$ then $a_d = (1 - P)/\alpha$ and $\frac{da_d}{dP} = -1/\alpha$. But for $P \leq i\Delta$ we have $a_d = (1 - \Delta)/\alpha$ and $\frac{da_d}{dP} = 0$.

We can also compute different values of $\frac{dr^*}{dP}$ for \underline{r} , r_u^i and \hat{r} ,

$$\frac{dr}{dP} = 1, \quad (38)$$

$$\frac{dr_u^i}{dP} = 1 - \frac{1 - a_d + v}{4v} - \frac{1 - P}{4v} \frac{da_d}{dP}, \quad (39)$$

and

$$\frac{d\hat{r}}{dP} = 1 + \frac{1 + a_d - v - 2\hat{a}}{2v} - \frac{1 - P}{2v} \frac{da_d}{dP}. \quad (40)$$

We have found, in the previous proof, that when \hat{a} is above \hat{a}_{\min} and B is low the creator chooses $r^* = \max(\underline{r}, r_u^{i=0})$ and $i = 0$. In this case $a_d = (1 - P)/\alpha$ and substituting for the two possible cases we find

$$\frac{d\Pi(\underline{r}, i = 0)}{dP} = \frac{hN}{\alpha} \left[1 - \frac{I}{nN} - k + \alpha a_d \right] + \frac{2vI^2}{(1 - P)^2 hN} > 0, \quad (41)$$

and

$$\frac{d\Pi(r_u^{i=0})}{dP} = \frac{hN}{\alpha} \left[1 - \frac{I}{nN} - k + \alpha a_d \right] + \frac{vI^2}{(1 - P)^2 hN} + \frac{I(1 - P)}{2v\alpha} > 0. \quad (42)$$

So, in this case the platform will choose the maximum possible penalty $P = 1 - \frac{I}{nN}$ which forces the creator to choose $r = 1$.

When \hat{a} is below \hat{a}_{\min} and B is high the creator chooses $r^* = \max(\underline{r}, \hat{r})$ and $i = 1$. Additionally, for $\Delta \geq 1 - \frac{I}{nN}$ we have $a_d = (1 - \Delta)/\alpha$ and $\frac{da_d}{dP} = 0$. Substituting for the two possible cases we find

$$\frac{d\Pi(\underline{r}, i = 1)}{dP} = -\frac{2vI(B - I)}{(1 - P)^2 hN} < 0 \text{ for } B > I, \quad (43)$$

and

$$\frac{d\Pi(\hat{r}, i = 1)}{dP} = 0. \quad (44)$$

So in this case it is optimal to choose the lowest possible penalty $P = 0$. Q.E.D

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