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**CROWDFUNDING AS ‘DONATIONS’:  
THEORY & EVIDENCE**

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Abstract

For a wide class of crowdfunding approaches, we argue that the reward structure (for funders) is closer to that of charitable donations to public goods than it is to traditional entrepreneurial finance. Many features of the design of crowdfunding platforms can therefore be understood as attempts to deal with attendant “free-rider” problems in motivating contributions. Reviewing institutional features of today’s crowdfunding, we clarify that there are often limits in the extent to which tangible rewards can be used to motivate contributions. Drawing on analogies with charitable donations, we theorize that intangible sources of motivation—(i) direct psychological rewards, (ii) reciprocity and (iii) social interactions—can play a role in entrepreneurial crowdfunding. In our detailed empirical analysis of a representative project we find abundant evidence consistent with this characterization and we proceed to discuss implications for platform design and entrepreneurial funding and unique and defining characteristics of crowdfunding.

Keywords: *Crowdfunding platforms, entrepreneurial finance, free-riding, voluntary contributions to public goods.*

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## 1 Introduction

Still in its infancy, crowdfunding has attracted a surge of interest from industry practitioners, researchers and even the general public, intrigued by the prospect that modern digital platforms might be harnessed to expand entrepreneurial funding opportunities (e.g., Burtch et al., 2013; Agrawal et al. 2014; Kuppuswamy and Bayus, 2014; Belleflame et al., 2014; Mollick, 2014; Mollick and Nanda, forthcoming; Lin, et al., forthcoming). Although crowdfunding remains a small minority of the dollar value of new venture funding, it is already an important source of deal flow. The crowdfunding platform Kickstarter alone funded 22,252 projects in 2014. By comparison, the entire US venture capital industry funded 4356 registered new projects in 2015 in the United States, according to the PwC/NVCA/MoneyTree Report. As we clarify herein, crowdfunding should also be of particular interest to organizational and finance scholars, as it fundamentally re-organizes entrepreneurial funding to a kind of public goods provision problem: if enough individuals “chip in” the entire community of future users can benefit from eventually purchasing and consuming project outputs that might not be available otherwise. The key contribution of this paper is to clarify that in the context of this public goods provision problem, there are limits to relying upon usual “tangible” economic incentives to motivate contributions. Instead, entrepreneurs (and crowdfunding platforms designers) must harness a series of “intangible” (behavioral, psychological, sociological) rewards to motivate contributions from the crowd.

Crowdfunding remains a topic of hot debate, with questions raised about whether the wide public should participate in investments characterized by many as highly risky and yielding low return and lacking investor protections (Griffin, 2012; Hazen, 2012; US News and World Report, 2012; Evans, 2015). Strictly speaking, the terms explicitly stipulated in crowdfunding agreements are not just low—they are often *negative*. For example, Oculus’s well-known 2012 Kickstarter crowdfunding campaign that raised \$2,437,429 from 9,522 funders in order to fund the development of a virtual reality headset.<sup>1</sup> The campaign offered a schedule of funding options, including the possibility for individuals to contribute \$40 for which funders would have a t-shirt shipped to them (whose material value was worth considerably less than the \$40 paid). For \$10, funders would merely receive a “thank you” from the company.

However, the main tangible rewards from crowdfunding are not these sorts of incremental gifts and acknowledgements. Most important rewards from successfully funding a project relate to the prospect of one day purchasing and *consuming* project outputs (Varian, 2013). Oculus, for example, prominently described its crowdfunding campaign as a means for the public—and particularly for future users—“to help bring this project to life.” These main rewards from crowdfunding, however, are available both to those who make contributions and thus underwrite fixed development costs (funders), and those who do not (non-funders).

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<sup>1</sup> <https://www.kickstarter.com/projects/1523379957/oculus-rift-step-into-the-game>

Therefore, the funding of fixed development costs via crowdfunding is a textbook “public good” from the perspective of future users, with attendant free-rider problems. As we argue herein, typical structural conditions surrounding crowdfunding will mean that main tangible project outputs will fail to motivate contributions on their own. We further clarify that attempts to stimulate funding by providing incremental tangible rewards to funders only, such as Oculus’ t-shirts, will be limited in their ability to economically motivate contributions. Therefore, if crowdfunding campaigns depend exclusively on tangible rewards, we should expect funding will tend to unravel.

Having provided this context, we then turn to possible *intangible* rewards. Specifically, we observe that as crowdfunding amounts to voluntary contributions to funding a public good, its natural analogue is charitable donations (cf. Lambert and Schwenbacher, 2010; Burtch, et al. 2013; Varian, 2013), where intangible factors (psychological, behavioral, behavioral motivations) have been studied extensively. We consider how three main categories of “intangible” factors that are well documented in charitable donations might manifest and motivate funding in light of institutional differences in entrepreneurial crowdfunding: (i) *direct psychological rewards* (e.g., Andreoni, 1990), (ii) *reciprocity* (e.g., Fehr and Gächter, 1999), and (iii) *signaling and social interaction* (e.g., Glazer and Konrad, 1989).

The goal of our empirical analysis is then to evaluate whether indeed intangible factors play a primary role in relation to tangible factors—and to more deeply explore the nature and workings of intangible factors. We judged it would be most informative to study multiple detailed data sets on a representative project, the crowdfunding campaign for popular online game Natural Selection. As we elaborate herein, institutional, technological and market features of this context each conform to archetypal crowdfunded projects documented in the literature. Further, software and games are among leading categories in crowdfunding to date (Mollick, 2014). This empirical context, in particular, allows us to observe fine-grained variation in policies and project communications and variation in funding over an extended period (2002-2008). Crucially, this context also provides us with detailed survey data from funders. One of the authors carried out a survey of funders, providing us with self-reported accounts of motivations for funding (with a remarkable 66 percent response rate).

Consistent with our characterization of funder payoffs and pervasive free-rider problems, we find no evidence whatsoever of systematic links between funding decisions and variation in the main tangible project outputs that are available to funders and non-funders alike. By contrast, (much smaller) tangible project outputs going only to funders are positively related to funding. Also broadly consistent with our characterization, we find large positive relationships between funding decisions and variation in measures of intangible factors. The empirical findings uniformly indicate that intangible factors were at least as important as tangible ones in motivating funding. We find these empirical findings to be robust to a wide range of alternative

constructions of our key measures. Relevant patterns in the data are also readily apparent and robust within a range of dynamic econometric models, along with simple examination of first-order descriptive patterns in the data. Most important, we find these empirical findings to be corroborated in two entirely independently collected—observational and survey—data sets.

We then proceed to characterize the nature and workings of intangible factors using detailed, self-reported survey evidence. We find *direct psychological rewards* manifested in fans/users who experienced an enthusiastic sense of “common cause” and affinity with the project. (This is distinct from “warm glow” and altruistic impulses experienced by charitable donors, but similar in its effect on motivating contributions.) We find that *social interactions* played a clear role too, as funders wished to have their funding observed by others, so as to encourage others to contribute. (This contrasts with the use of visible donations as a means of signaling virtue, wealth or status, as has been documented in charitable donations.) Evidence of *reciprocity* and a motivating sentiment of “paying back” is easiest to discern from the data. (In contrast to “generalized” reciprocity in donations, where donors may pay back for others, here reciprocity related to funders own consumption of project outputs.) We also note that a sentiment of “paying back” may be less relevant in the case of crowdfunding fledgling, pre-product projects.

Most narrowly, this paper directly builds on and contributes to a growing body of very recent research making strides towards theorizing crowdfunders’ behavior (e.g., Schwienbacher and Larralde, 2010; Agrawal et al., 2011; Zhang and Liu, 2012; Burtch et al., 2013; Belleflamme et al., 2014; Parker, 2014). This past work has raised the possibility of motivations rooted in, for example, “community participation incentives,” “social influence” and “philanthropy.” In relation to this emerging stream of work, through its novel theory and novel empirical research design is able to contribute added precision in understanding the workings, nature and role of these and other related factors in motivating contributions. Our finding of the importance of intangible factors also underlines the critical importance of building “community” around a project in a deeper sense than simply a large set of consumers, in order to activate relevant behavioral, psychological and sociological factors. In this, we also highlight an added dimension to the crucial role of users of project outputs within this community.

More broadly, our analysis clarifies a fundamental distinction between traditional entrepreneurial funding approaches organized as *private* claims to future cash flows (e.g., equity, debt, revenue sharing, etc.) and a wide class of today’s most popular crowdfunding approaches that effectively organize the funding of fixed project development costs as *public* goods. We also discuss that this transformation of entrepreneurial funding from traditionally private arrangements to public good organization within a digital context is somewhat analogous to a similar transformation in the supply of software as a private-collective organization of open source software development (von Hippel and von Krogh, 2003).

## 2 Motivating Crowdfunding: Theory and Hypothesis Development

In this section we begin by characterizing the payoff structure to crowdfunders, showing to highlight that it conforms to a textbook free-rider problem. We also discuss how structural conditions surrounding crowdfunding limit the extent to which tangible rewards can be used to motivate funding. We then shift to describing how intangible rewards can then play a role in this environment.

### 2.1 Free-Riding on Tangible Project Outputs ( $R$ )

If a project is successfully funded, funders can look forward to eventually purchasing and consuming project outputs—products and services that might not be available otherwise (cf. Varian, 2013). This is consistent with crowdfunders largely being drawn from the ranks of *users* of project outputs (Galuszka and Bystrov, 2014) and crowdfunded projects often relate to unique and creative ideas and outputs (Kuppaswamy and Bayus, 2014).

However, these expected rewards from successfully funding a project are not only available to funders, but also to non-funders. Non-funders effectively enjoy a free option to later purchase and consume project outputs should they wish to do so. To help organize our discussion, denote the value of these main project rewards to be  $R$  and the value of funds contributed to be  $f$ . Therefore, funders receive  $R-f$  and non-funders simply receive  $R$  in this simplest formulation, the difference in these payoffs being an incentive to free-ride and to let others fund the project.

Free-riding incentives might be especially high for several reasons. First, small contributions mean that removing any one individual's contribution has negligible impact on project outcomes (i.e., the value of  $R$  or the likelihood it is realized); it is only collectively that funding decisions have any real impact on outcomes. Second, there is little practical scope for achieving “coordinated” funding decisions across funders. For example, in principle, individuals should prefer to contribute the bare minimum amount to fully fund the project (conditional on what all others have contributed) to assure a desirable project goes ahead than to see funding unravel from free riding. However, this effectively requires all parties knowing the actions and intents of other parties—and then committing to these funding decisions. This extraordinary level of coordination is achieved in cases of small numbers of actors within say venture capitalists, with abundant transparency, common knowledge, contractual and social embeddedness, ability to credibly commit and the absence of a free rider problem. In crowdfunding, such coordination and commitment would need to be achieved despite there often being hundreds or thousands of geographically dispersed and unfamiliar actors (Agrawal et al., 2011). Making matters worse, the

identities of the relevant actors might not even be known until funding is complete. For example, Indiegogo posts funder profiles, but the platform cannot identify relevant non-funders.<sup>2</sup>

Also impeding the ability to implement coordinated funding decisions is the limited effectiveness of mechanism design and contractual interventions. A natural sort of mechanism frequently used to generate coordinated, collective behavior in areas such as equity or buyer syndicates are assurance contracts or provision point mechanisms (Tabarrok, 1998). Indeed a form of assurance contract involving a need to hit a certain minimum threshold of project before funding proceeds exists in many cases of today's crowdfunding (Zubrickas, 2014). However, instituting a minimum threshold as this does nothing, in the case of crowdfunding, to resolve the free-rider problem or limits of tangible rewards. What it does is imply to avoid a downside of losing one's pledged funds in the event the project does not proceed (i.e., assuring the funder receives zero rather than losing  $f$ , within the terms of the framework here, in the event the project fails to attract minimum sufficient funds).

We summarize key implications of foregoing points in the following hypothesis.

**HYPOTHESIS I** Crowdfunding is unrelated to tangible rewards that are available to project funders and non-funders alike.

Therefore, the problem of funding fixed development costs of a project via crowdfunding involves a sort of *public goods provision problem* (cf. Lambert and Schwiendbacher, 2010; Burtch, et al. 2013; Varian, 2013). If enough individuals contribute to the project to cover fixed development costs, the entire "public" of future users will benefit, as they will then have the opportunity to eventually purchase and consume project outputs that might not otherwise be available.

## 2.2 Limits to Tangible Rewards to Funders only ( $r$ )

One approach to mitigating free-rider problems is to offer rewards to funders that exceed those that go to non-funders. Therefore, there may be some value,  $r$ , that goes above and beyond the main project outputs and total tangible rewards going to funders (conditional on the project being successfully funded),  $\Pi$ , are as follows,

$$\Pi = -f + r + R. \quad (1.i)$$

This implies that net benefits to funding rather than not funding (i.e., tangible incentives to contribute funds),  $\pi$ , are as follows,

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<sup>2</sup>To appreciate the complexity of establishing coordinated funding decisions, consider that even the simplest expression of a cooperative equilibrium from which no party would prefer to deviate consists of each individual contributing a bare minimum of funding  $f^*$  that still assures some minimal necessary total funding,  $F_{min}$ , conditional on others' contribution, or  $f_i^* = F_{min} - \sum_{-i} f_{-i}$ . Indeed this is the textbook Economics formulation of the public goods provision game. This set-up implies that the funder will receive  $-f+R+r$  if the project is successfully funded or  $-f$  if the project is not successfully funded (or zero, if there is an assurance contract in place with minimal threshold). If the individual does not contribute funds, she will receive  $R$  if the project is funded and simply zero if it is not funded. Therefore, only under very perfect coordination is the choice to fund optimal. Any breakdown in coordination and the dominant strategy is to not fund, whether the project is successfully funded or not.



$$\pi = -f + r \quad (1.ii)$$

If tangible rewards are to motivate funding, then expression (1.ii) must be greater than zero—implying that differential rewards,  $r$ , are greater than the value of funds contributed,  $f$ . (Note, our discussion here focuses on the discrete decision to contribute funds. We do not consider the question of levels of funding.)

One way of providing differential rewards,  $r$ , is to simply diminish the value of main project outputs going to non-funders. This can be done by say delaying product availability, offering an inferior version, selling at higher prices or withholding sales to non-funders (equivalently, boosting these things for funders). Although these strategies might promote funding *ex ante*, they have the perverse effect of conflicting with the goal of bringing the project to market, *ex post*, once the project comes to fruition.<sup>3</sup>

An alternative means of conferring differential rewards is to directly stipulate *extra* rewards to funders—“gifts” and add-ons—in the funding agreement. A first constraint here is to not distract scarce resources and attention of the project organization to the production of  $r$  rather than main project outputs  $R$ . For this reason, these extra rewards typically often small, easily outsourced paraphernalia such as coffee mugs and t-shirts.

A more profound limitation of add-ons and gifts is that, as earlier raised, funding must be less than the value of such add-ons to motivate funding,  $f < r$ . But, on the other hand, if funding is to capitalize project coffers, the opposite condition must be met—that funds exceed the value of these add-ons and gifts, or  $f > r$  (as in “charging” extraordinary premia on gifts, such as a \$40 t-shirts). In effect, we still need a reason why funders should be willing to “pay” a large markup for these gifts. Thus, a tangible exchange of value on its own does not explain this willingness to pay a premium to capitalize the project. Therefore, in sum, although differential rewards for funders should indeed promote funding, there are limits to the impact or economic effectiveness.

HYPOTHESIS II Crowdfunding is positively related to differential tangible rewards provided to project funders and not to non-funders.

### 2.3 Intangible Factors to Motivate Crowdfunding (B)

Overcoming free-rider problems in the provision of public goods—where it is difficult to provide tangible rewards to induce contributions—is a classical problem of economic organization with many applications. In cases of public works and services, for example, these are often dealt with through *mandatory* taxation and spending by the state. Closer to crowdfunding, cases of *voluntary* contributions to a public good relates to the class of funding

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<sup>3</sup> Nevertheless, we certainly do observe such strategies. It remains a question as to whether the tradeoff struck is an economical one. For example, in 2015, Eric Ries, author of the popular “Lean Startup” book, raised funds on Kickstarter to support a new book entitled “The Leader’s Guide.” The campaign included a funding option to contribute \$21 and thus gain access to a *digital* copy of the book that was to *only* be available through the Kickstarter campaign. The campaign raised \$588,903 (<https://www.kickstarter.com/projects/881308232/only-on-kickstarter-the-leaders-guide-by-eric-ries/description>).

problems typically known as charitable donations. For example, charitable donations  $f$  are collected in order to realize some broadly consumed benefits,  $R$ , that might be enjoyed by some broader public. Donors might also enjoy tangible rewards,  $r$ , such as access to special events or gifts for their contributions.

Here, we consider lessons from research on donations, which suggests that where there might be limits to the use of tangible rewards in motivating contributions, a range of intangible factors might instead play an important role (Harbaugh, 1998). Donations research identifies three broad categories of intangible factors motivating contributions: (i) direct psychological rewards (Andreoni, 1990), (ii) reciprocity (Fehr and Gächter, 1999), and (iii) signaling and social interaction (Glazer and Konrad, 1996; Harbaugh, 1998). These sorts of benefits, which we broadly denote as  $B$ , will be useful in motivating funding inasmuch as they provide benefits of funders only, and thus sidestep the free-rider problem.<sup>4</sup> We summarize *total* rewards to funders—including both tangible and intangible components— $V$ , and total net rewards to funding versus not funding,  $v$ , as follows:

$$V = -f + r + B + R \quad (2.i)$$

$$v = -f + r + B \quad (2.ii)$$

As simple as the above expressions may be, they provide a crucial accounting of rewards and payoffs from funding, while clarifying the nature of the problem in motivating funding. From expression (2.ii), this simple characterization directly implies that intangible factors may directly make up for whatever shortfall there might be from differential tangible rewards, alone. (Equivalently, this expression implies why an individual is willing to “pay” more to receive  $r$  than its material value.)

The first category of intangible factors ( $B$ ) in research on donations, *direct psychological rewards*, is imbued with such characteristics as altruism, “warm glow,” “selfless giving,” enhanced self-esteem, guilt reduction, et cetera (see, for example, Andreoni, 1990; Cornes and Sandler, 1994; Croson and Marks, 1998; Batson and Shaw, 1991). However, we might expect that altruism and “selfless-giving” are not entirely salient when funding private, entrepreneurial, profit-seeking, commercially-oriented causes intended to enrich the project owners, as in entrepreneurial crowdfunding (Belleflamme et al., 2013, Schwienbacher and Larralde, 2010). Nonetheless, prior research suggests that the orientation of crowds and communities forming around crowdfunded projects may be of a kind to support other sorts of psychological rewards from funding. For example, “enthusiasts” (Fosfuri et al., 2013) and “fans”<sup>5</sup> among future users—frequently exhibit

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<sup>4</sup> It is plausible that there are interactions among tangible and intangible rewards, and we might still imagine plausible spillovers of such benefits to non-funders. However, we focus here on this simplest characterizations, given clear and important first-order implications. We are not able, within our data, to investigate these second order issues.

<sup>5</sup> For example, TV personality Bill Nye, seeking to raise \$200,000 on Kickstarter to fund construction, testing, and development of a small, solar sail powered concept spaceship, is offering posters, jackets, and signed paraphernalia as tangible rewards to funders. Bill Nye is a well-respected, science-oriented personality supporting a mission to space, his “LightSail” project, originally conceptualized by popular futurist, author, and scientist Carl Sagan as a “solar sailer,” a spacecraft that uses the sun’s radiation for propulsion. The campaign therefore quickly captured the imagination of many funders, accounting for its rapidly raising funds. The project raised

signs of psychologically-based links to and goodwill towards crowdfunding projects. Funders have also been documented to exhibit affinity and empathy with projects and their founders (e.g., Kuppaswamy and Bayus, 2014; Greenberg and Mollick, 2014; Mollick, 2014; Lin et al., forthcoming). We summarize the possibility that such conditions might give rise to funders deriving some form of psychologically-based rewards from contributing funds, which we refer to as a sense of “common cause”:

HYPOTHESIS III Crowdfunding is related to the degree to which individuals experience a sense of “common cause” with a project, its team, outputs, and goals.

A second category of intangible rewards (*B*), *reciprocity*, has been documented in research on donations (Stanca, 2009). This is also understood to be based on psychological rewards or avoidance of psychic costs rather than any kind of instrumental or strategic form of reciprocity. Individuals experience a compulsion to commit funds out of a sense of obligation or desire to avoid a sense of guilt (Simpson and Willer, 2008; Nowak and Sigmund, 2005). Reciprocity in donations has been found to manifest more often as a sense of “paying back” after having realized outputs, rather than “paying forward” in anticipation of project outputs (Falk and Fischbacher, 2006; Gouldner, 1960; Goranson, and Berkowitz, 1966). Further, in the case of donations, reciprocity is often understood to take a “generalized” form, as when individuals’ desire to reciprocate persists even when benefits accrue to others beyond themselves (Stanca, 2009).

Given any sort of psychological or social link or “common cause” between funders and projects, as hypothesized above, we might then expect an analogous sense of reciprocity to manifest in entrepreneurial crowdfunding (see Zvilichovsky et al., 2014). Further, the small scale of crowdfunders would imply that if any form of reciprocity is to operate, it should be of psychologically based, rather than based on strategic interactions between funders and the project. Therefore, although it is difficult to know *a priori* precisely how this mechanism should operate, there is reason to believe that reciprocity can play some role in supporting crowdfunding.

HYPOTHESIS IV Crowdfunding is related to funders’ desire to “pay back” to the project.

A third category of intangible rewards (*B*), *social interaction* with and *signaling* to third parties including other funders (see, for example, Glazer and Conrad, 1996; Harbaugh, 1998; DellaVigna et al., 2012; Kumru and Vesterlund, 2010), has been shown by the donations research to often

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many times its stated goal, \$1,241,615. (See <https://www.kickstarter.com/projects/theplanetarysociety/lightsail-a-revolutionary-solar-sailing-spacecraft/>).

reflect funders' desire to signal wealth, good character, and philanthropic interest or, closely associated, earn status that can serve as a societal "ticket of admission" to a social group (Glazer and Conrad, 1996; Harbaugh, 1998; Posner, 1997; Fremling and Posner, 1999).

Questions of social interactions and signaling are likely to be quite complex and subject to a number of factors. However, it might at least be said that in the case of entrepreneurial crowdfunding, the signaling of virtue and wealth are likely to be far less relevant than in donations, given that the missions of projects and the amounts funded are hardly oriented to signaling virtue, status, wealth or signaling much at all (Ordanini et al., 2011). We might however expect there to be some form of positive effect of signaling and social interaction—at least in many instances—given the conspicuous role that social network regularly plays in today's crowdfunding (Belleflamme et al., 2013; Kuppuswamy and Bayus, 2014). This might be, for example, signaling one's funding as a means of encouraging others to fund, as by "leading-by-example" in donations (Vesterlund, 2003; Potters et al., 2007) or signaling one's funding simply leads others to become aware of it or to look more favorably upon a project (Naroditskiy et al., 2014). These points are consistent with herd behavior and bandwagon effects documented in crowdfunding (see Agrawal et al., 2011; Burtch et al., 2013; Zhang and Liu, 2012), along with prevalent use of social media. We summarize these points in the following hypothesis:

HYPOTHESIS V Crowdfunding is related to funders' ability to signal their funding to others.

### 3 Empirical Research Design

Investigating the earlier hypotheses requires us to relate funding to variation in tangible and intangible rewards—and underlying motivational mechanisms. We judged we would require more than usual broad correlational evidence to more deeply probe relevant factors. We therefore here proceed to study an appropriately representative project using a combination of observational data and survey data. These data provide both considerable depth of detail and fine-grained representation, while also allowing us the ability to corroborate observed relationships in independently collected data sets.

#### 3.1 Empirical Context

We analyze data from the crowdfunding campaign of the popular online game *Natural Selection*. The game—in which two teams of players, the "Kharaa" (alien species) and "Frontiersmen" (human space marines), engage in combat—was publicly released on Halloween, October 31, 2002 by software developer Charlie Cleveland. We examine data for the 2002-2008 period during which all funding derived from the project's crowdfunding campaign and the game was freely available to both funders and non-funders. The simplicity of this funding model maps

straightforwardly onto the earlier theoretical characterization, facilitating interpretation of the empirical analysis. The extended period of the campaign allows us to study meaningful variation in funding levels over time. The project's output, a technology consumer product (and a software game in particular), is typical of contemporary crowdfunding campaigns (see Mollick, 2014).

Project goals reflected both commercial interests and Cleveland's unique product vision of an online, team-based massively multiplayer game distinguished by alien vs. soldier play. This ran counter to the then prevailing trend of human-human conflict (e.g., soldiers vs. terrorists). Cleveland hoped the project would ultimately yield financial returns through leading eventually to a commercial version of the game, venture financing, and growth of the company (personal interview, March 2004).<sup>6</sup>

The first version of the game was released in February 2002, following roughly 18 months of development during which Cleveland covered his own expenses. An immediate success, the game quickly became popular with enthusiasts and began to earn recognition from industry authorities. Hailed by online game magazine Gamespy (February 07, 2003, Gamespy.com) as "possibly the most ambitious user-made [game] ever brought to fruition," Natural Selection was soon registering tens of thousands of unique downloads and several thousand active players per week.

A crowdfunding campaign was launched in the wake of the game's release to support on-going development. The campaign was managed on the game's website, and featured brief explanations of the project, its background and goals, and what the funds were to be used for, as well as a bio of Cleveland. Payments were received electronically via the web-based escrow service PayPal. Cleveland, as the project founder, maintained regular communication with funders and posted on the blog associated with the game a steady stream of news and other communications regarding progress on the game and the campaign. Gross contributions over the 314 weeks covered by our data set (spanning week 50 in 2002 to week 52 in 2008) totaled \$112,000.

The game and funding framework remained relatively stable over the life of the project, save for an exceptional discontinuity in February 2003, when Cleveland announced a change in the crowdfunding campaign called "Constellation." The program would install into the game an icon to be awarded to any contributor of at least \$20; it would then be attached to the avatar of any who chose to adopt it and be visible to other gamers. (We investigate funding patterns around this discontinuity in Section 5.4.)

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<sup>6</sup> All interviews were carried out in-person by Jeppesen in summer 2004.

## 3.2 Observational Data Set

Data were generously compiled and provided by the project’s developers. The observational data set includes 314 weekly observations from October 31, 2002 to December 31, 2008. The data set matches (i) funding data drawn from the project’s PayPal account, (ii) all blog entries and “news” announcements, (iii) the schedule of version releases, and (iv) a record of game activity from the project’s server account. We construct from these data, measures of the key concepts described in Section 2. Definitions and descriptive statistics of these variables are summarized in Tables 1 and 2 and described in following discussion.

### 3.2.1 Measuring Crowdfunding Levels

Our theoretical development in Section 2 focused closest on individuals’ discrete decisions to proceed to contribute funds or not to do so. Therefore, our main dependent variable is a closest cognate, *FUNDERS*, which counts the number of funders each week. The variable *FUNDERS* is also transformed to the logarithm of this value. Basic results are not sensitive to this transformation but are more statistically significant and have the advantage of placing less weight on outliers.

### 3.2.2 Measuring Tangible Factors to Funders and Non-Funders (R)

Our main approach for capturing variation in explanatory variables that reflect the key elements of the reward structure described in Section 2— $R$ ,  $r$  and  $B$ —is to construct measures to project news related to these benefits to funders.

The variable  $r\_TANGIBLE$  is switched on for all time periods in which communications related to main tangible outputs of the project, as captured by a regular lexicon of words used in project news to indicate such things: “announce,” “release,” “update,” “introduce,” “patch,” “fixes,” “change,” “optimization,” and “tweak”—available to both funders and non-funders. We establish this lexicon by first visually inspecting of the entire history of news releases and seeing the recurrence of this language as a means of systematically identifying announcements of relevant releases. We supplement these announcement data with a closely related schedule of the precise dates of new releases (as distinct from the dates of announcements).

Given we hypothesize a *zero* relationship with such tangible factors that are general outputs to funders and non-funders (H1), we go to special lengths to attempt to disprove the zero result. This begins in the definition of this variable above in relation to a relatively wide range of ways of describing project outputs. We then exhaustively examine all possible alternative definitions using all possible subcombinations of keywords, word and message counts (rather than indicators). We also are able to directly observe the true schedule of releases, apart from the announcements to further assure the result is zero. Most important, we can corroborate the zero result in the independently collected survey data set (to follow).

### 3.2.3 Measuring Tangible Factors to Funders Only (r)

The variable  $r\_TANGIBLE\_FOR\_FUNDERS$  captures announcements of tangible rewards that went only to funders and not to non-funders. As earlier noted, these sorts of benefits in this context consisted of the possibility for funders to participate in pre-release bug-testing (i.e., pre-play) of early beta versions of new game versions/releases. Therefore, we use the keyword “beta” to identify all relevant project news announcements items regarding these outputs. (Given this measure maps to a single and unambiguous phenomenon, we do not have the same need to assess the robustness of the variable definition as with the other measures.)

### 3.2.4 Measuring Intangible Factors (B)

An important challenge in constructing our measure of intangible factors within the observational data set,  $B\_INTANGIBLE$ , is the *wide range* of possible mechanisms through which intangible factors might operate. One approach might then be to construct a *long* list of topic keywords and associated variables to capture the full range of plausible workings of intangible factors. However, this approach risks producing false positive results by introducing a great many sources of variation. In contrast to our concerns in constructing a measure of  $R$ , where we hypothesize (and attempt to disprove a) a zero relationship and therefore examine a wide range of liberal measures—in this case if measuring  $B$ , we predict a positive relationship and therefore we should take the opposite conservative slant in constructing this variable so as to avoid a false positive result. This rationale suggests a narrow, conservative definition is most appropriate.

A second rationale for taking a narrow, conservative definition of this variable is that the precise relevant dimensions that might be encoded are not well understood *a priori*. Indeed it is a task and goal of this paper to attempt to document and interpret patterns in this regard. Thus, our approach is to use our observational data to define our measure of  $B$  with the goal of simply capturing meaningful variation in intangible factors so as to *detect* any relationship with funding, rather than attempt with these data to provide more detailed characterization or comprehensive calibration. We leave the task of more probing analysis and characterization to the more explicit survey data, and particularly the self-reported accounts of sources of motivation coming directly from funders.

Following this thinking, we define  $B\_INTANGIBLE$  to focus on a component of intangible factors that can be motivated *a priori* and within the context. Our main measure of  $B$  in the observational data,  $B\_INTANGIBLE$ , is a simple indicator variable, switched on for weeks in which project news contained keywords “we,” “us,” “community,” or “members.” Rather than reflect any one possible narrow mechanism or possible range of manifestation of that mechanism (i.e., directly psychological rewards, reciprocity, or social interactions, see Section 2.2), this variable was designed to instead simply capture a component of the relevant phenomenon. The use of “we,” “us,” “community,” and “members” carries a special resonance and meaning in this context. Project leader Cleveland overtly stressed the importance of building a “community”

around the project and game, and that this was quite distinct and apart from any tangible exchange (personal interview, March 2004). Rather than refer to the users of the game as consumers or buyers, Cleveland thought of these individuals as “members” of the community and often referred to them such. Accordingly, pronouns “we” and “us” were often used by Cleveland in relation to the entire set of users and project developers or either group. (It is also the case that first-person plural pronouns have been found to signal a sense of group identity, and positive affectation within studies of linguistic inquiry (Tausczik and Pennebaker, 2010).)

Given the above each of these measures should be considered only a rough proxy for concepts theorized in Section 2 and given the importance of intangible factors in our theory and hypotheses, our analysis considers the robustness of results in several ways. First, we examine alternative variable definitions based on all possible combinations of keywords, word and message counts (rather than indicators). We also investigate several related policy changes in the history of the crowdfunding campaign that directly relate to theorized mechanisms (Section 2). Finally, and most importantly, we assess the independently collected survey data (below) to assess whether that analysis leads to similar conclusions.

### **3.2.5 Control Variables**

Control variables include the incidence, number of messages, and word counts of project news (i.e., measures of the amplitude and volume of messages, as distinct from the content of messages captured by the earlier variables). We also employ measures of the number of active players and year. Summary definitions and descriptive statistics of each of these main observational variables are provided in Tables 1 and 2.

<Tables 1 & 2>

### **3.3 Survey-Based Data Set**

With the support and close collaboration of the project team, one of the authors carried out a large-scale survey of funders to better understand the precise motivations of contributors to the crowdfunding campaign. The survey was disseminated on May 6, 2004, 19 months after launch. A total of 762 individuals of 1,155 contributors to the campaign to that point responded to the survey. We expect this unusually high survey response rate—66%—is the result of project leader Cleveland’s active support of the survey and his disseminating the survey to funders. Further, we suspect that the response rate was aided by having carried out the web-based survey in 2004, at a time when such surveys were far less common. Survey responses included both structured Likert-scale style responses along with open-ended text responses related to motivations to contribute.

Just as with the earlier-described observational data, we construct measures of our main concepts— $r$ ,  $R$  and  $B$ —from Section 2 with our survey data. The exception here is that we go



further in breaking down our measures of *B*, in terms of the three broad categories of intangible mechanisms described in Section 2. Thus, these data are considerably more granular and discerning than the earlier described observational data. This is particularly so in relation to open-ended responses.

To create quantitative measures, we took a simple approach of coding each individual's response 1-0, in relation to whether the response indicates a clear responsiveness to (i) tangible rewards available to funders and non-funders (i.e., project outputs), (H1) (ii) tangible rewards available only to funders (i.e., beta testing) (H2). Our key thrust and interest here is to capture intangible related to (iii) direct psychological motivations and rewards (H3), (iv) reciprocity (H4), or (v) social interaction and signaling (H5). Therefore each response could be coded as reflecting any number of motivations. Based on the discussion and analysis and desire to further characterize the nature of motivations, we describe additional breakdowns within the analysis, itself.

We coded responses as one rather than zero in relation to each motivation if at least one of two criteria was met: either the respondent clearly indicated the relevant category within their open ended text description of their motivations; or they marked the relevant structured Likert scale question at the highest possible level (seven on a seven-point scale). We chose this rather high bar for coding responses presuming that there could be a tendency for respondents to produce inflated responses given the campaign that referred to as "donation-based" crowdfunding and might carry normative implications in the minds of respondents. (Dropping the threshold to six out of seven does not change basic patterns documented here.)

In the case of intangible rewards and direct psychological rewards in particular (H3), the relevant (seven-point) Likert scale response relates to "*I donated simply because it makes me feel good.*" For intangible factors related to reciprocity (H4), the structured question relates to, "*I donated because the developers deserve a reward for their work.*" For intangible factors related to social interaction and signaling (H5), the structured question relates to, "*It is important that others can see I have donated.*"

In the case of tangible rewards, the structured question relates to the statement, "*When I donate I expect developers to provide me with a better game in the future.*" In the survey data, we are less able to develop quantitative measures distinguishing tangible rewards available only to funders from the quantitative responses on their own.<sup>7</sup> Therefore we refer to more detailed comparison of open-ended text within the analysis to gauge relative importance here.

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<sup>7</sup> The survey was designed prior to developing the theory in this paper.

### 3.4 Empirical Strategy

Our discussion here focuses greatest attention on the econometric specification in relation to the analysis of patterns in the observational data. The analysis of survey data is essentially descriptive. However, the following discussion also pinpoints the role of the analysis of survey data in relation to what can and cannot be done with the observational data.

The number of unique contributions per week, *FUNDERS*, should reflect the number of individuals for whom net benefits from funding exceed those of not funding, as summarized in expression (2.ii) within the earlier theoretical development. Practically speaking, within the actual data, this likely depends on a wide array of factors including all relevant heterogeneous characteristics of individuals, which we might summarize as some distribution of relevant factor  $\alpha$ , distributed in with density  $h(\alpha)$ . Apart from responsiveness to particular tangible and intangible factors, this even includes basic points like whether they are aware of the crowdfunding campaign, or even part of the game playing population at a point in time. Therefore, the earlier theory implies a quite particular governing model of crowdfunding:

$$FUNDERS_t = \int_{\alpha} I\{B_{it} + r_{it} - f_{it}^* > 0\} \cdot h(\alpha_i) \cdot d\alpha_i$$

Therefore, as summarized above, specific funding choices may depend on individual heterogeneity in responses to motivations, evolving heterogeneity over time, added considerations in choosing preferred contribution levels (i.e.,  $f_{it}^*$ ), etc.. We approximate this relationship in a simple linear regression framework with a minimum of econometric manipulation. This has the advantage of exhibiting patterns in the data (and their sensitivity or robustness) to alternative specifications as transparent as possible. Our simple linear framework to approximate the earlier characterization is as follows:

$$FUNDERS_t = \alpha(t) + \beta \cdot R\_TANGIBLE_t + \gamma \cdot r\_TANGIBLE\_FOR\_FUNDERS_t + \delta \cdot B\_INTANGIBLE_t + \varepsilon_t \quad (3)$$

Therefore, in this simple linear approximation, we see the familiar terms reflecting tangible and intangible rewards (i.e.,  $R$ ,  $r$ ,  $B$ ). To this basic linear model, we add a zero-mean error term,  $\varepsilon_t$  and the term  $\alpha(t)$  that can be interpreted as a trending variable that captures all other factors, including the size of the pool of prospective funders. Coefficients  $\beta$ ,  $\gamma$  and  $\delta$  will be interpreted directly in relation to our hypotheses in Section 2.

As earlier noted in the definition of our variables, our econometric analysis of observational data does not distinguish the different types of intangible factors (as in H3, H4, and H5). Rather, in the observational data our goal is to simply attempt to detect any intangible mechanisms, as a group, as outlined further in the description of variables (Section 3.3) and the analysis, itself (Section 4). It is in the survey data that we more deeply probe and distinguish

intangible mechanisms, along with validating results from the analysis of observational data (Section 3.2).

### 3.4.1 Estimating Model Coefficients

To estimate relationships of interest, we require there to be (i) meaningful variation in key variables that is (ii) not largely correlated with other uncontrolled, potentially spurious influences on funding.<sup>8</sup>

On the point of meaningful variation in key variables, there is abundant reason to expect this is the case. Our main measures of  $R\_TANGIBLE$ ,  $r\_TANGIBLE\_FOR\_FUNDERS$  and  $B\_INTANGIBLE$  relate to project leader Charlie Cleveland's posting project news (Section 3.1, 3.2). Cleveland saw it as important to maintain an open line of communication with the project's public and attempted to post most weeks. However, as he was a single person and not one engaged in programmatic marketing communications, the particular timing of communications could easily slip or be advanced from week to week, depending upon particular responsibilities at a point in time (personal interview, March 2004).

Regarding the possibility of spurious influences, a first and at least partial assurance is that Cleveland's own accounts emphasize the level of happenstance and his own discretion in choosing topics and timing of communications (personal interview, March 2004). A second, partial assurance is that rather than explanatory variables being intended to capture communications per se (controlling for actual goings on in the project) these variables are *intended* to reflect a wide range of possible things that could be going on with the project that update users regarding tangible and intangible things. Therefore, the concern for econometric controls is considerably lower than it might be otherwise.

Our main concern for controls in the econometric model rather relate to other factors such as changes in the size of the pool of prospective funders, or a secular increase in willingness to contribute funds during the period, changes in the macro environment, or simultaneous trending or cyclicity in model variables and error term. To better understand possible challenges in these

A an examination of time series properties of our dependent variable indicate some form of non-random patterns over time, and that  $\alpha(t)$  is not just a matter of controlling for added noise for the sake of precision. High regular peaks in periodograms (Figure 1) suggest possible periodic effect rather than necessarily than the result of any structural change (see Chatfield, 2004). We used Bartlett's periodogram-based white noise test to assess whether the data resembled noise with no structure or a systematic pattern. The test statistic proved significant,

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<sup>8</sup> We are focused only on spurious correlation, or possible omitted variable bias, rather than say reverse causality or simultaneity (i.e., that somehow funding shapes project news rather than the other way around). Detailed reviews of the history of the campaign and of all news suggested no reason to believe that users' funding levels were ever the *cause* of the project issuing news.

indicating the time series has structural, non-random properties. The Dickey-Fuller test indicates that we are not able to rule out a unit root suggesting the time series is statistically stationary.

Our main approach to controlling for any such possible non-random structures in the time series is primarily to investigate a variety of dynamic specifications (including comparisons of specifications in including time dummies, control variables, first differences, lagged dependent variable, alternative measures of explanatory variables and combinations thereof). Details of specifications are more fully motivated and discussed within the analysis. We estimate model coefficients with OLS and we estimate autocorrelation robust standard errors, unless otherwise specified.

<Figure 1>

## 4 Analysis: Tangible versus Intangible Factors in Observational Data

Here we report results of our analysis of observational data, following the approach described in Section 3.4. We first establish the validity of our baseline model related to project communications, generally, before proceeding to introduce our main explanatory variables, which each relate to the content of project communications. We probe robustness throughout the analysis.

### 4.1 Baseline Model

We begin by regressing the log number of funders in a given week (*FUNDERS*) on an indicator variable for periods in which project news was posted (*NEWS*). Table 3 reports all OLS linear model estimates with robust standard errors.<sup>9</sup> We allow for the possibility of some lag structure in response by including four lags of this variable. As reported in model (1), we find significant positive coefficients on *NEWS* and the single-period lag. Adding year dummies, as in model (2), and number of game players, as in model (3), yields similar estimates, only with greater statistical significance. The results are consistent with a relatively rapid response of funders to news.

<Table 3>

As earlier discussed (Section 3.4) our main concern in interpreting coefficients relates to possible unobserved, uncontrolled spurious factors linking *FUNDERS* and explanatory variables of interest. To investigate this possibility, our approach is to re-estimate the model using a specification that, although less efficient, should far better control for any such spurious factors—a fully dynamic specification. We therefore wish to see whether this estimate is similar to or whether it differs from the earlier baseline estimates.

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<sup>9</sup> Estimating model in a count data framework, such as in Poisson or Negative Binomial, with maximum likelihood produces similar results. We prefer and report our linear specification given that the integer values of *FUNDERS* are large and the linear model offers simpler interpretation. This is especially so when examining a series of alternative dynamic specifications.

Our fully dynamic specification re-estimates the model on the basis of “first differences” or changes week-to-week in our variables rather than with variation in the absolute levels of our variables. Further, to more directly control for possible trending, we include a lag of the (first-differenced) dependent variable, instrumenting this lagged dependent variable with a further lag of the absolute *level* of the dependent variable. As reported in model (4), the coefficients estimated in this fully dynamic model on *NEWS* and its lags are unchanged from earlier estimates. This is consistent with earlier estimates not being unduly influenced by spurious correlation.<sup>10</sup> Therefore, we proceed with model (3) as our preferred baseline model.

We next investigate whether the amplitude or volume of project communications plays a role (beyond just the incidence of communications in a given week, as is captured by *NEWS*). Model (5) adds the total number of distinct communications to our baseline model, again allowing for four lags. Model (6) adds a count of the total number of words in all communications in a week. In both cases, we find no evidence that particularly lengthy or frequent communications has a statistically significant relationship.<sup>11</sup> Thus, model (3) remains our preferred baseline specification. For simplicity, we also drop longer lags in upcoming results, as longer lags make no difference in results.

## 4.2 Tangible and Intangible Factors and Numbers of Funders

Here we begin to introduce our main explanatory variables of interest. Consistent with predictions, we find that although funding is unrelated with general project outputs (H1), it is positively related to just those outputs that are available to just funders (H2). Further, most significant of all is the positive relationship with our proxy for intangible factors (H3, H4, H5).

Model (1) of Table 4 begins by adding our main measure of tangible outputs to both funders and non-funders, *R\_TANGIBLE*. As reported in model (1), neither this measure nor any of its lags are significant. Introducing this variable also has no effect or impact on any other coefficients estimated within the model.

Given the crucial importance of this zero result to our contention of free-riding, and given inherent difficulty in affirming zero results, we proceed with an exhaustive series of attempts to attempt to find a non-zero result. We confirm our inability to find any systematic relationships when reconstructing *R\_TANGIBLE* according to all possible sub-combinations of keywords use in originally constructing this variable, or in using word counts or numbers of relevant communications. Apart from *communications* of outputs as our captured *R\_TANGIBLE*, we also

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<sup>10</sup> We also assessed a series of related models, finding results to be robust to dropping the lag of the dependent variable and/or the use of the instrumental variable, although these specifications were less statistically significant than our fully dynamic model.

<sup>11</sup> The lack of correlation with these measures of intensity and length of communication is also consistent with spurious correlation not playing an undue role in influencing our estimates. For example, we might expect to find a correspondence between particularly eventful weeks due to some unobserved event (triggering both funding and communications) and weeks with higher volume communications.

found not relationships with data on *actual* timing of project outputs. Affirming earlier results, we find no significant correlations between funding and major releases (releases 2 and 3 occur within our data set) or more minor patches.

In model (2), we introduce  $r\_TANGIBLE\_FOR\_FUNDERS$ . As reported in Model (6), the coefficient on this variable is positive and significant at  $p = 10$  percent. The lag of this variable is also positive and smaller in magnitude, as might be expected, but not statistically significant.

In model (3), we investigate intangible factors by introducing  $B\_INTANGIBLE$ . See Section 3.2 for further motivation and discussion of this important variable. We estimate the coefficient on this variable to be significant at  $p = 5$  percent, and its lag to be positive and smaller in magnitude, as might be expected, but not statistically significant. Apart from the magnitude of coefficient and statistical significance, at least as important in indicating the explanatory importance of this variable, its introduction leads the coefficient on  $NEWS$  to become statistically insignificant. Thus, as predicted, the evidence is consistent with intangible factors being an important correlate of funding.

Given the importance of intangible factors in our theory and there being some judgment in constructing this variable (see discussion in Section 3.2), we assessed robustness in a range of ways. For example, when we reconstruct our measure of  $B\_INTANGIBLE$  based on any subset of keywords, we find significant results. Moreover, the greatest significance comes when including *all* keywords (consistent with our vector of keywords capturing some larger meaning). More importantly, we will also find these results later echoed and amplified in our analysis of survey data.

For one particular factor theorized in Section 2—social interaction and signaling—the observational data provide an opportunity for corroborating analysis within the observational data. Within our observational data set, initiation of the “Constellation” program in February 2003 (Section 3.1) afforded funders who pledged a minimum of \$20 the option of attaching to their player profile an icon indicating that they had donated. Placement of the icon was optional, but nearly every eligible individual chose to adopt it. As shown in Figure 2, initiation of this program to increase visibility led to a step function jump in levels of funding. The change in funding levels following introduction of the Constellation program is statistically significant at  $p = 10$  percent when used as a dummy variable to capture differences before and after the change within the earlier regression framework.

<Figure 2>

Lending further weight to earlier findings and especially those related to intangible factors, when we include each of measures of  $R$ ,  $r$  and  $B$  at once, as in model (4), point estimates on  $B\_INTANGIBLE$  and  $r\_TANGIBLE\_FOR\_FUNDERS$  are unchanged. Although adding so many variables inevitably reduces precision, and estimated standard errors increase, the coefficient on  $B\_INTANGIBLE$  nevertheless remains significant at  $p = 10$  percent.

Although the model and variables are better suited to detecting the role of factors rather than to precisely calibrate their importance, it should nevertheless be noted that estimated coefficients on proxy variables for  $r$  and  $B$  (roughly 0.3) are about one-fifth the magnitude of the sample mean of the dependent variable.

## 5 Analysis: Characterization of Intangible Factors in Survey Data

In this section we affirm and corroborate results in the earlier section, while more deeply characterizing the nature of intangible mechanisms using our survey data.

### 5.1 Breakdown of Categories of Factors

Figure 3 reports the fraction of responses coded (following coding approaches described in Section 3.3) according to the various types of intangible and tangible factors. The fraction of responses that reflect at least one kind of intangible factor is 86 percent. (Standard errors, being quite small relative to reported means, are not reported in this section.) Reciprocation is most common, with 76 percent of responses coded as either explicitly indicating such a motivation (Section 3.3). Signaling and social interaction was second most common at 54 percent. A smaller, but still quite large fraction of 32 percent were coded as indicating a motivation on the basis of direct psychological rewards and sense of common cause with the project.

<Figure 3>

In contrast to the abundant evidence of intangible factors at work, only 15 percent of respondents provided any indication of motivation on the basis of any sort of tangible payoff. Within the open-ended questions, we found almost there were many more responses coded in relation to tangible outputs related to funders one ( $r$ ), i.e., specifically mentioning the opportunity to beta test. Nearly four times as many mentioned beta-testing the game than made any mention of simply having the game delivered—at all—as an output of interest (i.e.,  $R$ ). These results are thus broadly consistent with the earlier results based on observational data (Section 4.2), particularly in relation to H1 and H2.

### 5.2 Direct Psychological Rewards and “Common Cause”

In Section 2.2, we hypothesized enthusiast users pledging contributions could experience direct psychological rewards from doing so on account of affinity and a sense of shared or common cause with a project’s goals, mission, outputs, project team members, other players, etc.. Perhaps most basic facts that are consistent with this point of direct psychological rewards from those with high affinity to the project is that fully 100 percent of funders were game players and consumers of project outputs, and 92 percent indicated that contributing made them “feel good” in some measure.

Our expectation was to find funders were related to the unique vision of the game. We found several instances of this, such as a willingness to fund “*to promote the creation of unique mods that do not follow the current realism trend.*” However, this example was the most explicit and clear articulation of such a motivation, and was represented only in a small handful among hundreds of open-ended responses.

More relevant here were simpler and more straightforward enthusiastic expressions of support for the project and the game, along the lines of “*because you guys are doing a bloody good job*” and “*I donated because I love Natural Selection!!!*” A few broader, more generalized expressions, such as “*all things fun should be supported,*” were also encountered. Although such statements surely correlate with the perception of tangible rewards, R, the vast majority of those expressing such enthusiasm made no mention whatsoever of tangible outputs.

Adding to this general enthusiasm and fanatical support, 17 percent of open-ended responses expressed a psychological link to the project in form of a concern for and desire to help the project or team members in open-ended responses. Examples include, “*this is a HUGE project and therefore needs as much support as possible. I intend to contribute more in the future,*” “*I know that [Cleveland] has made large personal financial sacrifices and he needs my support,*” and “*so [Cleveland] can eat.*”

Empathy with the team was also directly expressed in the case of 10 percent of open-ended responses. Examples included, “*I’m particularly keen on the idea of patronage. I work in the theatre, where donations are vital for keeping some companies going,*” “*I am a coder myself, although not at the level of the folks developing Natural Selection. So there’s no way I can contribute to the game other than offering financial support,*” “*I’m a member of the gaming community [www.jarbedz.com](http://www.jarbedz.com) and I feel that by helping [the project] I’m helping to sustain a future for our communities NS future,*” and “*As a software engineer, I know what it is like to develop free software. I felt that NS was a great free software worthy of a donation.*”

Therefore, we find abundant evidence of direct psychological factors and rewards to funders underlying funding decisions. The nature of these links is a good deal different from the nature of such motivations in donations and can be interpreted as broadly reflecting a sense of “common cause” with project held by fanatical supporters.<sup>12</sup>

### 5.3 Psychologically-Based Reciprocity and “Paying Back”

Close review of the open-ended survey responses finds many features of the nature of reciprocity to be largely consistent with the particular form of that observed in donations in the sense of being psychologically-based reciprocity with a sense of obligation to “pay back” (Section 2). Most of the 36 percent of open-ended responses coded for reciprocity expressing some form of paying back with words such as “deserving,” “reward,” or “thank.” Examples included, “I

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<sup>12</sup> We emphasize that our grouping of subcategories (under the broader category of direct psychological effects and “common cause”)—enthusiastic support, concern and empathy—to be our attempt to simply summarize all coded responses in a simple and comprehensive manner. These subcategories were not anticipated in our theory, nor are these distinctions essential to supporting H3.



*donated because the NS developers deserve a reward for their work,*” and *“it was a way of thanking him for keeping the server running and being involved in the community of the mod he developed.”* We found zero responses that could be clearly interpreted “paying forward”. 100 percent of open-ended responses related to reciprocity were coded as reflecting a psychological basis rather than an instrumental or calculative interest in paying back.

In contrast to donations, where a generalized reciprocity has been documented, the vast majority of open-ended responses coded for reciprocity indicated a desire to reciprocate for their own consumption, with 36 percent of open-ended responses coded for reciprocity mentioning their own consumption. Examples include, *“I play the game more hours per day for longer than most games I went to the store and paid for and felt this was well worth the money,”* *“Simply put, I donated what I would pay for a real game because I think the game is definitely worth it,”* and *“I felt that the amount of enjoyment I received from NS was at least worth my \$20.”* The expressions of reciprocity were not tied to any particular episode or output, but appear to be a general accumulated sense of obligation and will to reciprocate.

#### **5.4 Signaling and Social Interaction**

In relation to signaling and social interaction, we are not only able to exploit open ended responses, but the survey included three relevant structured questions on a 7-point Likert scale in relation to detail motivations for why individuals wanted Constellation icons (Section 3.1) to signal their funding. Likert responses to these questions from highest to lowest were, *“I care about the development of the game”* (mean 5.55), *“because it shows I am part of a certain group of players”* (mean 3.85), *“because the icon gives me respect among players”* (3.23), and *“I can afford to donate”* (mean 1.73).

The predominant response, *“I care about the development of the game,”* is perhaps difficult to judge on its own. However, when we considered this response in conjunction with the preponderance of open-ended responses, we interpreted this first motivation as a matter of encouraging others. This is visible in responses such as, *“I wanted the blue bling so it might encourage other people to donate,”* *“I felt that I needed to spread the word, and telling people that I donated to a free online game does just that,”* *“I feel that as they see that SOME people have donated, they will be more likely to donate,”* *“I hope that seeing I have donated will encourage others to do the same,”* and *“I wanted to inspire others to donate.”* The following statement delineates these beliefs more succinctly: *“The icon shows that a person donated. If someone new joins a server and sees this icon, they’ll ask what it is. Once people know what it is and start to see a bunch of them, they might think ‘wow this is a great [game] and its cool that all these people are supporting it. Maybe I should too!’”*

Therefore, we certainly find abundant evidence of social interactions playing a role in in funding. However, as was suggested in Section 2.2, the preponderance of evidence points to a desire to encourage follow-on funding.

## 6 Summary and Discussion

In this paper, we developed a series of hypotheses related to tangible and intangible rewards of crowdfunding and whether and how they shape crowdfunding decisions. We argued that what will typically be the main benefit from funding a project—the prospect of later purchasing and consuming project outputs—will not significantly shape funding (H1). Consistent with this claim, we failed to uncover any systematic relationships between variation in project outputs in our empirical context (e.g., new releases, bug fixes, added server capacity, upgrades, patches, new tools and facilities, et cetera) and funding, despite attempting a wide range of formulations and specifications.

We argued that only those tangible rewards available only to funders (and not to non-funders) could influence funding (H2), although these might be small in relation to main project outputs. Our context allowed us to simply investigate this point, as there was only one form of unique benefit to funders, the ability to bug-test (play) new game versions early. Consistent with H2, we indeed found funding levels were correlated with this benefit—and again this point was corroborated in survey data.

We argued that despite limitations in the use of tangible factors in motivating contributions, intangible factors—rewards, reciprocity, and signaling and social interactions (H3, H4, H5)—could play a role in motivating contributions. Consistent with this, we found intangible factors manifested prominently in our econometric analysis. The survey evidence are consistent with this point, but allowed us to look far more deeply into the particular nature of these mechanisms.

Our analysis of detailed evidence from the survey data then allows us to go further in exploring the nature of intangible mechanisms. As regards *direct psychological rewards*, the survey evidence suggests that fanatical users of project experienced a sense of “common cause” or affinity with funders, the project, its goals, mission, outputs, and team. These psychological rewards are not the same as the “warm glow” and altruistic impulses experienced by donors to charitable causes, but nonetheless are functionally similar in their effect on motivations to contribute.

As regards *reciprocity* motivating funding, we find abundant evidence of a psychologically-based desire to “pay back” (rather than “pay forward”), akin to what has been documented in the case of charitable donations. However, rather than a generalized form of reciprocity, whereby donors pay back on the behalf of a wider group of users, in this case crowdfunders wished to pay back for their own consumption. Also important to note, paying back will be less relevant in crowdfunding focused on fledgling, pre-product projects.

As regards *social interactions*, the survey evidence suggests this was not so much a source of motivation in itself but rather it plays a role in the sense that funders engage in public signaling

of their funding as means of encouraging others to contribute to the same project. This departs from findings related to donations that stress public signaling of donations as a means of signaling one's virtue, personal virtue, wealth and status. There is no evidence of these factors playing out here.

Given the patterns we find, we also speculate that although we study patterns in relation to these three distinct categories, that these effects may be somewhat related. Our speculation is that most basic is the direct psychological rewards. This appears to be related to a fanatical enthusiasm, an affinity, identification and sense of common cause in one sense or another with the project (team, mission, etc.). This is consistent with and perhaps acts as a foundation for funders experiencing a psychologically-based motivation to “pay back;” absent the fanatical affinity and sense of common cause with the project, it is plausible the relationship would not be more than a simple market. Finally, it appears that social interactions and signaling might not be an independent source of value and motivation on their own (as in say signaling status), but are themselves motivated to simply bring more resources to the project—which might then simply amplify direct psychological rewards or serve as an amplified mode of paying back. We stress these last points are speculation and deserve greater study beyond what is possible in this study.

## 7 Conclusion

In this paper, we argued and found evidence that entrepreneurial crowdfunding fundamentally overturns the traditional economic logic of funding entrepreneurial projects. Most traditional sorts of entrepreneurial funding take the form of private contracts and claims to future income in exchange for financial contributions. By contrast, crowdfunding transforms the problem of funding fixed development costs into a kind of public good provision problem. If enough individuals “chip in” the entire community of future users can benefit from eventually purchasing and consuming project outputs that might not be available otherwise. Our analysis clarified, first, how the structural conditions surrounding today's crowdfunding institutions, including difficulties in resolving free-rider problems, should limit the extent to which *tangible* rewards can be relied upon as incentives to motivate contributions; and, second, our analysis clarified the role that *intangible* factors—direct psychological rewards, reciprocity and social interactions—have the potential to fill the gap in motivating contributions and overcoming free-rider problems. Our conceptualization generalizes a wide range of crowdfunding formats—including “gift-based” crowdfunding, “product preorder” crowdfunding, and “donations-based” crowdfunding (Dresner, 2014) that essentially each amount to a public goods provision problem, with various types of inducements.

Of course, public goods funding problems are regular features of the economy, as in public works funding by governments or charitable enterprise funding through donations (Bernheim, 1986). What is remarkable here is that crowdfunding appears to now offer entrepreneurs a *choice* between private and public models (so long that a project is able to

cultivate a “public” or community during the time of funding (Belleflamme et al., 2103)). What is also remarkable too is that the funding of private entrepreneurial projects is being arranged as a public good, albeit where the “public” in question is not a wide swathe of society but rather than considerably smaller “public” of the project, consisting of (future) users.

Naturally then, successful fundraising in crowdfunding (and the design of supporting platforms and institutions) depends on rather different priorities than does traditional entrepreneurial fundraising. Most centrally, the nature of the project itself will play a key role in enlisting a sense of common cause and distinguishing the project, so that it might build a community of interest around itself—particularly from future *users* of project outputs. Thus, crowdfunding should be better suited to entrepreneurs pursuing idiosyncratic, mission-led or visionary or at least differentiated projects, building links with like-minded funders. These points are also consistent with the emphasis in crowdfunding outreach on high production video, and providing rich narratives around key team members within a larger “story” around the project. Our results also add to prior results emphasizing the importance of social interactions, as supported by social media in generating bandwagon effects. As regards this last point, our findings here particularize the priority to be one of enabling funders to publicly signal that they have funded, so as to draw others into contributing.

The theory and findings here also highlight areas that might be *less* important in stimulating funding. For example, the points covered in this paper suggest not special emphasis on areas such as reporting and monitoring requirements, or any clear guidance or guarantee of positive returns or financial success of the project. This accords with the predominant use of entrepreneurial crowdfunding by early-stage, pre-product projects that, on the one hand, are able to appeal to intangible factors identified here, and, on the other hand, have little ability to commit to priorities of positive future returns, monitoring and controls. Given the public model of fundraising via crowdfunding raises new priorities while diminishing others, we should expect to see that companies choosing this route need to pursue rather different sorts of fundraising strategies than they would otherwise. Further, these differences in priorities suggest we should see selection on altogether different kinds of projects—and perhaps expansion of the range of entrepreneurial projects that can be funded. These latter points are questions deserving closer future study.

The aforementioned differences between crowdfunding and traditional entrepreneurial finance based on private claims are stark and fundamental. However, even as we built on analogies between entrepreneurial crowdfunding and charitable donations (as a problems of motivating voluntary funding to a public good), our analysis also points to important differences between these more similar funding institutions. The implications of these differences, as reviewed in both the theory and in the presentation and summary of results, are that categorically similar intangible mechanisms play out rather differently in these two funding environments. Key

points that were highlighted include: differences in the *missions* and character of entrepreneurial projects versus charitable organizations; a focus on *users* versus a broader donor public; users in the case of crowdfunding are both funders in addition to being the primary beneficiaries of project outputs, whereas donors are often entirely different from the population that benefits from charitable organizations; that crowdfunders are often more anonymous, distributed and atomistic as contributors than are donors in charitable and philanthropic organizations. Details on these points are discussed throughout the paper.

By conceptualizing wide classes of crowdfunding as having public goods provision and free-rider problems at their core, we hope this clarifies that there may be many particular means and incentives to put in place to attempt to solve the funding problem. The discussion and debate treating “reward-based” or “product preorder-based” or “donations-based” as discrete categories is largely misguided. There is any number of approaches to addressing the free-rider problem in these cases. There would appear to be no particular reason to falsely discretize these particular approaches (implying that they cannot be used at once or as alternatives within the same fundraising campaign). We speculate that there may indeed be some incremental differences between these forms, such as the sorts of funders they attract; however, they are secondary distinctions relative to the underlying public good provision problem common to them. Apart from generalizing the aforementioned sorts of problems, our analysis also sharply distinguishes these funding problems from those based on private claims to future income using say, debt, equity, revenue-sharing etc. (whether such funding is mediated on digital platforms or not). We also distinguish the entrepreneurial crowdfunding here from funding through donations to charitable and socially-oriented organization (whether such funding is mediated on digital platforms or not), for reasons summarized above.

We provide broadest and most speculative comments on questions of re-organizing a traditionally private activity as a public good in the context of digital platforms. Here, we note that von Hippel and von Krogh (2003) made an analogous observation in the case of “private-collective” models of innovation (rather than the provision of funding). In their analysis, demands that had traditionally been served by private entities competing in markets with private property rights and on the basis of private interests—as in enterprise software—eventually evolved to *also* be served by a model of production fundamentally re-oriented along the lines of public goods provision. They put open source software at the center of their analysis; however, the argument applies equally to Wikipedia in encyclopedia production and other forms of collaborative platforms. The authors observed, much as we do here, that a nuanced range of tangible and intangible payoffs need to be brought to bear in order to motivate contributions (in their case, contributions of effort and ingenuity rather than funding) and to solve free-rider problems that are inherent to public goods provision. (Also see Bagozzi & Dholakia, 2006; Roberts, Hann, & Slaughter, 2006.) This implies a sophisticated role of incentive and motivation

provision and institutional design that needs to be carefully exercised to build successful online organizations, where the particular blend, nature and workings of heterogeneous sorts of motivations increasingly appears to differ across alternative forms of online organization from crowdfunding, to open source, crowdfunding, multi-sided markets, open science and beyond

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## 9 Tables

Table 1 Variable Definitions

| Variable                          | Definition   |
|-----------------------------------|--|
| (1) <i>FUNDERS</i>                | Logarithm of number of crowdfunding contributions within a given week  |
| (2) <i>NEWS</i>                   | Indicator switched on if project makes a public communication within a given week  |
| (3) <i>NEWS_COUNT</i>             | Number of discrete public communications made by project within a given week   |
| (4) <i>WORD_COUNT</i>             | Total number of words across all public communications by  |
| (5) <i>PLAYERS</i>                | Total number of active players within a given week, in thousands   |
| (6) <i>YEAR</i>                   | Calendar year  |
| (7) <i>R_TANGIBLE</i>             | Indicator switched on for those weeks in which a communications includes one of the following words: "announce" "release" "update" "introduce" "patch" "fixes" "change" "optimization" "tweak" |
| (8) <i>r_TANGIBLE_FOR_FUNDERS</i> | Indicator switched on for those weeks in which a communications includes the word "beta"   |
| (9) <i>B_INTANGIBLE</i>           | Indicator switched on for those weeks in which a communications includes one of the following words: "we" "us" "community" "members"   |

Table 2 Variable Means, Standard Deviations and Correlations ( $N = 314$ )

| Variable                          | Mean    | Std. Dev. | (1)  | (2)  | (3)  | (4)  | (5)  | (6)  | (7) | (8) |
|-----------------------------------|---------|-----------|------|------|------|------|------|------|-----|-----|
| (1) <i>FUNDERS</i>                | 1.66    | 1.09      |      |      |      |      |      |      |     |     |
| (2) <i>NEWS</i>                   | .28     | .45       | .13  |      |      |      |      |      |     |     |
| (3) <i>NEWS_COUNT</i>             | .41     | .82       | .11  | .76  |      |      |      |      |     |     |
| (4) <i>WORD_COUNT</i>             | 90.58   | 221.52    | .06  | .61  | .69  |      |      |      |     |     |
| (5) <i>PLAYERS</i>                | .82     | .39       | .43  | -.06 | -.06 | -.03 |      |      |     |     |
| (6) <i>YEAR</i>                   | 2005.68 | 2.47      | -.22 | -.06 | -.06 | .03  | -.89 |      |     |     |
| (7) <i>R_TANGIBLE</i>             | .05     | .23       | .04  | .36  | .29  | .31  | .06  | -.14 |     |     |
| (8) <i>r_TANGIBLE_FOR_FUNDERS</i> | .04     | .18       | .20  | .29  | .29  | .27  | .15  | -.19 | .35 |     |
| (9) <i>B_INTANGIBLE</i>           | .22     | .42       | .15  | .84  | .64  | .62  | -.03 | -.04 | .33 | .32 |

Table 3 OLS Baseline Correlations of Number of Funders with Project Communications

| Dep. Var.:             | <i>FUNDERS</i>              |                  |                           |                    |                       |                   |
|------------------------|-----------------------------|------------------|---------------------------|--------------------|-----------------------|-------------------|
|                        | Incidence of Communications |                  |                           |                    | Frequency & Amplitude |                   |
|                        | Simple Correlation          | Year Dummies     | Players (Preferred Model) | Dynamic Model (FD) | Number of Comm's      | Total Word Count  |
|                        | 1                           | 2                | 3                         | 4                  | 5                     | 6                 |
| <i>NEWS</i>            | .296**<br>(.13)             | .297***<br>(.11) | .295***<br>(.10)          | .222**<br>(.09)    | .249*<br>(.15)        | 0.269**<br>(.13)  |
| <i>lag 1</i>           | .211+<br>(.13)              | .202*<br>(.11)   | .203**<br>(.10)           | .240**<br>(.11)    | .217+<br>(.15)        | 0.230*<br>(.13)   |
| <i>lag 2</i>           | .005<br>(.134)              | -.003<br>(.107)  | -.008<br>(.103)           | -.022<br>(.114)    | -.021<br>(.153)       | .071<br>(.131)    |
| <i>lag 3</i>           | .129<br>(.134)              | .121<br>(.107)   | .113<br>(.103)            | -.091<br>(.108)    | .173<br>(.153)        | .186<br>(.131)    |
| <i>lag 4</i>           | .106<br>(.133)              | .097<br>(.106)   | .072<br>(.103)            | -.041<br>(.089)    | .062<br>(.153)        | .081<br>(.131)    |
|                        |                             |                  |                           |                    | <i>NEWS_COUNT</i>     | <i>WORD_COUNT</i> |
| Amplitude Variable     |                             |                  |                           |                    | .030<br>(.073)        | .249<br>(.153)    |
| <i>lag 1</i>           |                             |                  |                           |                    | -.007<br>(.073)       | .217<br>(.153)    |
| <i>lag 2</i>           |                             |                  |                           |                    | .006<br>(.072)        | -.021<br>(.153)   |
| <i>lag 3</i>           |                             |                  |                           |                    | -.039<br>(.073)       | .173<br>(.153)    |
| <i>lag 4</i>           |                             |                  |                           |                    | .008<br>(.073)        | .062<br>(.153)    |
| <i>PLAYERS</i>         |                             |                  | 1.92***<br>(.39)          | -.0162<br>(.38)    | 1.91***<br>(.40)      | 1.90***<br>(.40)  |
| <i>FUNDERS</i> , lag 1 |                             |                  |                           | -0.880***<br>(.14) |                       |                   |
| Year Dummies           |                             | Y                | Y                         | Y                  | Y                     | Y                 |
| <i>R</i> <sup>2</sup>  |                             | .04              | .43                       | n/a                | .47                   | .47               |

Notes. +, \*, \*\*, and \*\*\* indicate statistical significance at the 15%, 10%, 5% and 1% levels, respectively; robust standard errors are reported; Number of observations = 314 weeks. All variables in model (4) are first differenced (i.e., values for the current week, less values for the previous week), except for year dummies; the instrumental variable for the lagged first difference of *FUNDERS* is the second lag of the absolute level of *FUNDERS*.

Table 4 OLS Regressions of Number of Funders on Proxies of Tangible and Intangible Funder Rewards

| Dep. Var.:                    | <i>FUNDERS</i>        |                   |                   |                   |                   |
|-------------------------------|-----------------------|-------------------|-------------------|-------------------|-------------------|
|                               | Simple<br>Correlation | <i>R</i>          | <i>r</i>          | <i>B</i>          | <i>R, r, B</i>    |
|                               | (1-3)                 | 1                 | 2                 | 3                 | 4                 |
| <i>Crowdfunding Payoffs</i>   |                       |                   |                   |                   |                   |
| <i>R_TANGIBLE</i>             |                       | .035<br>(.180)    |                   |                   | -.040<br>(.184)   |
| <i>lag 1</i>                  |                       | .175<br>(.180)    |                   |                   | .119<br>(.184)    |
| <i>R_TANGIBLE_FOR_FUNDERS</i> |                       |                   | .332*<br>(.202)   |                   | .292<br>(.211)    |
| <i>lag 1</i>                  |                       |                   | .283<br>(.202)    |                   | .243<br>(.211)    |
| <i>B_INTANGIBLE</i>           |                       |                   |                   | .346**<br>(.178)  | 0.297*<br>(.180)  |
| <i>lag 1</i>                  |                       |                   |                   | .068<br>(.178)    | .028<br>(.181)    |
| <i>Baseline Model</i>         |                       |                   |                   |                   |                   |
| <i>NEWS</i>                   | .295***<br>(.102)     | .278**<br>(.112)  | .225**<br>(.108)  | .008<br>(.174)    | .010<br>(.179)    |
| <i>lag 1</i>                  | .203**<br>(.103)      | .169<br>(.112)    | .153<br>(.108)    | .149<br>(.176)    | .100<br>(.181)    |
| <i>PLAYERS</i>                | 1.92***<br>(.394)     | 1.98***<br>(.394) | 1.94***<br>(.391) | 1.90***<br>(.395) | 1.88***<br>(.396) |
| Year Dummies                  | Y                     | Y                 | Y                 | Y                 | Y                 |
| <i>R</i> <sup>2</sup>         | .43                   | .47               | .48               | .47               | .48               |

Notes. +, \*, \*\*, and \*\*\* indicate statistical significance at the 15%, 10%, 5% and 1% levels, respectively; robust standard errors are reported; Number of observations = 314 weeks. All variables in model (4) are first differenced (i.e., values for the current week, less values for the previous week), except for year dummies; the instrumental variable for the lagged first difference of FUNDERS is the second lag of the absolute level of FUNDERS.

## 10 Figures

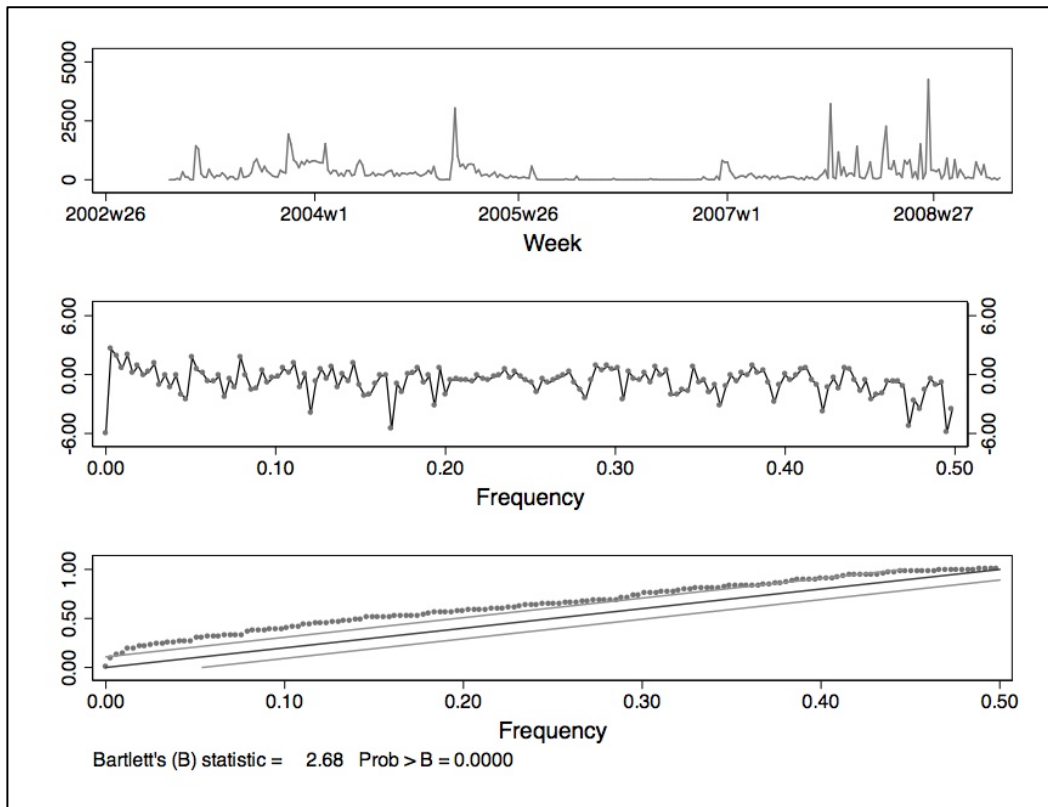


Figure 1 Descriptive Statics of Funding: Time series plot (top), Periodogram (middle), and Bartlett's periodogram based White Noise test (bottom)

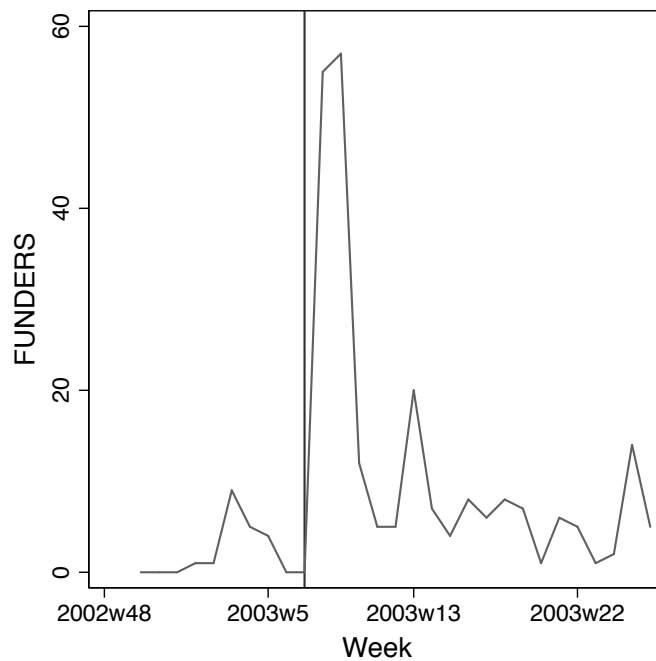


Figure 2 Absolute Number of Contributions Jumps Immediately Following Initiation of "Constellation Icon"

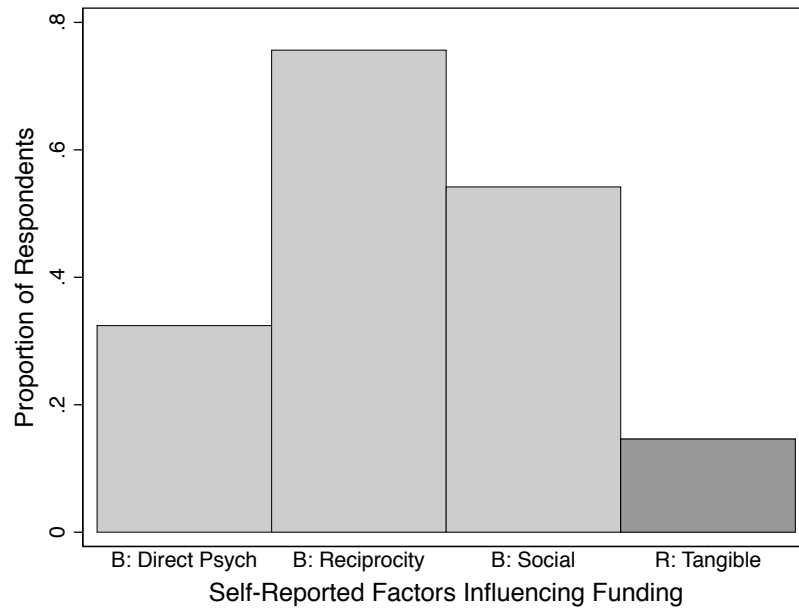


Figure 3 Absolute Number of Contributions Jumps Immediately Following Initiation of “Constellation Icon”