Women’s Academic Entrepreneurship: Understanding Gender Disparities

Financing A Free-for-All: Crowdfunding Open-Source Software

Abstract

This paper examines whether open-source software (OSS) provides unique advantages in the entrepreneurial crowdfunding context. The economic model for new ventures with business plans centered on OSS is often counterintuitive to early-stage investors. On the one hand, the non-restrictive OSS approach reduces the barriers to widespread product adoption and collaboration; on the other, OSS is essentially a public good, creating a scenario where anyone can appropriate value from the product without compensating its creators. As such, an OSS approach can dissuade investors primarily concerned with appropriating value for themselves, making it difficult for early-stage OSS ventures to attract investors. However, the rapid rise of crowdfunding has created a communally minded investor base that might instead find OSS projects enticing. We theorize that the attributes of OSS projects align with the communal expectations of crowdfunding investors and thus create supportive environments for OSS-based ventures. We illustrate this alignment through the community-based resource mobilization framework and suggest that the OSS approach yields greater investor trust, leading to superior financing outcomes. Our mixed methods approach blends archival analyses of Kickstarter data with a constructive replication through a randomized experiment, providing consistent support that an OSS approach can be advantageous in the crowdfunding context.

Plain English Summary

Can rewards-based crowdfunding open new doors to finance open-source software (OSS) projects? Our research suggests that crowdfunding backers are more likely to support OSS projects because they are perceived as more trustworthy. While the economic principles of OSS can be counterintuitive, OSS promotes widespread product adoption and collaboration. This allows anyone to benefit from OSS. Our research builds on the notion that crowdfunding, much like OSS, is a communal endeavor. We leverage data from the rewards-based crowdfunding platform Kickstarter.com and a controlled experiment, finding a connection between projects that espouse the OSS approach and crowdfunding success. The culmination of the two studies advances knowledge of the unique preferences of crowdfunding backers and suggests that the crowdfunding context is fertile ground to bring new insights into OSS-focused start-ups.

Key words: open-source software; OSS; crowdfunding; entrepreneurship; trust

JEL Classification: O30 O34 O36

1. Introduction

An overwhelming majority of the digital economy has relied on innovative start-ups that create open-source software (OSS), with an estimated 60% of the world's websites powered by OSS (Lifshitz-Assaf & Nagle, 2021). In contrast to protected intellectual property (IP) strategies, which seek to protect the proprietary value of the software and restrict its usage, OSS provides maximum access to users with minimal restrictions and provides any user the opportunity to appropriate value without compensating the creator. While this economic model is counter-intuitive (Lerner & Tirole, 2002), start-ups may find the collaborative potentials of OSS to be advantageous (Lin & Maruping, 2022). Open projects are inherently communal endeavors (Stam, 2009), and thus, they defy the constraints of local knowledge (Hayek, 1945), resulting in expanded access to external knowledge that would otherwise not be possible (Torres de Oliveira et al., 2022).

Despite the benefits, the economic principles of OSS come with a set of challenges. OSS products are offered to audiences for free (Lerner & Tirole, 2002), making the path toward generating stable revenues less certain. Such uncertainty can complicate the process of resource acquisition in traditional entrepreneurial finance settings where investors want to see a viable revenue model before they invest (Colombo et al., 2016) and prefer limited openness until the firm matures (Lin & Maruping, 2022). Whereas larger, established firms can finance OSS projects with existing resources, small-scale nascent ventures face a more tumultuous path. Indeed, there is increasing recognition among the OSS community that there is a funding problem (Turner, 2021).

The emergence of rewards-based crowdfunding provides an alternative funding mechanism and presents a potential paradigm shift for aspiring OSS entrepreneurs. Crowdfunding, like OSS, is driven by a community (Hassna, 2022; Josefy et al., 2017; Murray et al., 2020) and has repeatedly inspired reconsiderations of entrepreneurial outcomes (e.g., Kaminski & Hopp, 2019; Meoli et al., 2019). While evidence suggests that traditional entrepreneurial financiers value patent protection (Audretsch et al., 2012; Hsu & Ziedonis, 2013), this does not hold in the crowdfunding context (Meoli et al., 2019). Instead, the typically amateur investors of the rewards-based crowdfunding community value the participatory nature of openness (Stanko & Henard, 2017) and shared enthusiasm for the product (Oo et al., 2019)—both of which are common elements of crowdfunding campaigns who espouse the OSS approach. This issue gives rise to our primary research question: is OSS a superior IP strategy in the rewards-based crowdfunding context?

To answer this high-level research question, we build on insights from the crowdfunding-centric lens of community-based resource mobilization (Murray et al., 2020). Like crowdfunding, OSS is an inherently communal endeavor driven by ideological values, and as such, aligns with the logic of 'the crowd,' who are intrinsically motivated (Allison et al., 2015), participatory (Stanko & Henard, 2017), and purposeful in whom they support (Hassna, 2022). Furthermore, OSS is explicitly transparent in that the product can be studied, modified, and redistributed in any way users see fit. In turn, OSS projects are more likely to be perceived as trustworthy (for a review,

see Schnackenberg & Tomlinson, 2016), which is a key antecedent to backer support (Johnson et al., 2018). In summary, because OSS and crowdfunding both draw on community-based values, crowdfunding presents a promising avenue to raise capital for highly uncertain, entrepreneurial OSS projects.

This research advances our understanding of entrepreneurial OSS ventures and rewards-based crowdfunding in several ways. First, establishing a viable resource base is crucial for nascent firms. Whereas large firms can finance open projects as part of their vast research and development portfolios, entrepreneurs leveraging OSS face a more difficult path filled with uncertainty. Thus, we offer new insights into the crucial step of resource acquisition by focusing on the congruencies between the stakeholders in the OSS community and supporter expectations found in crowdfunding backers. Critically, we illustrate that barriers to accessing capital for early-stage ventures diminish in the rewards-based crowdfunding context, as 'the crowd' favors projects espousing an OSS approach over projects signaling a patented approach. While prior research suggests that traditional investors approach OSS more cautiously (Colombo et al., 2016), our research demonstrates that crowdfunding offers an alternative pathway toward early-stage financing. Crowdfunding can provide a simple runway to build the venture unimpeded by expectations from early-stage investors focused on financial returns.

Our second contribution connects the principles of OSS with those of the community-based resource mobilization framework (Murray et al., 2020). Just as crowdfunding relies on building a wide group of individual supporters, the success of OSS projects relies on the community that the project attracts (von Hippel & von Krogh, 2003). The allure of OSS includes shared ideology (Stewart & Gosain, 2006), the ability to contribute (Lerner & Tirole, 2002), and virtually limitless collaboration opportunities. Community-based resource mobilization is similar in that success is beget by establishing, engaging, and expanding the community so the project can succeed in perpetuity (Hassna, 2022; Murray et al., 2020).

Finally, this work offers substantial practical implications concerning the OSS funding problem. OSS speeds up technology adoption and removes operational barriers. For example, OSS projects like the OSS-based Raspberry Pi made it possible for dozens of start-ups to help less fortunate communities close the 'digital divide' (Colligan, 2021). Crowdfunding can play a significant role in funding these types of ventures, complementing and even supplementing alternative finance methods in ways that allow the venture to grow and succeed.

2. Entrepreneurial OSS

The concept of OSS has been influential since the advent of digital technologies and, as such, has drawn a great deal of scholarly interest (Lerner & Tirole, 2002; Malgonde et al., 2023; von Hippel & von Krogh, 2003; von Krogh & von Hippel, 2006). Furthermore, OSS itself has enjoyed immense growth. Firms previously opposed to OSS, like Microsoft, have dramatically

changed their IP strategy and are now prolific participants in the OSS community (Warren, 2020). However, there is a stark difference between the established firms developing OSS and start-ups. Ironically, Microsoft founder Bill Gates (1976) identified this problem via 'An Open Letter to Hobbyist" when the software industry was in its nascent stage. He argued that giving away software for free will impede software quality and sustainability, succinctly stating - "Who can afford to do professional work for nothing?". This issue is most salient among nascent OSS-based ventures that are resource-constrained. The OSS community has recently reignited its focus on financial sustainability, yet solutions to the problem remain elusive (see, e.g., Claburn, 2021; Turner, 2021).

Large firms like Microsoft have vast resources to build and invest in open projects, with little to no business pressure to make them independently sustainable. Felin and Zenger (2020) point out that the benefits of openness are derived from the problems the firm aims to solve through an open strategy. For example, Microsoft's CEO, Satya Nadella, pivoted the firm toward the open paradigm and now, through the acquisition of GitHub, is a de facto leader in the OSS movement. Microsoft is not emulating 'open first' firms like RedHat, however, and is instead leveraging openness to expand the adoption of other proprietary products, such as their cloud computing environment, Azure (Warren, 2020).

In contrast, entrepreneurs building OSS products face a set of stark differences (Lin & Maruping, 2022). First, nascent ventures are resource-constrained. Entrepreneurs often make do with what they have (e.g., bricolage; Baker & Nelson, 2005). Indeed, many entrepreneurial open innovations begin as a "labor of love," cobbled together by passionate people trying to solve some explicit problem they collectively share. For example, WordPress was born out of the abandonment of a blogging project, and Linux was built out of frustration with alternative

operating systems available at the time. Though these world-renowned successes are outliers, many entrepreneurial OSS projects face serious challenges before they become self-sustaining, most notably when resource constraints become too burdensome to bear (e.g., the recent issues with the 'core.js' project).[1] Although a key benefit of OSS is contributions and involvement from the community, start-ups based on OSS realize benefits from external financial investments similar to any other firm (i.e., critical resource acquisition). However, the path toward obtaining capital for OSS startups is often more difficult than other IP approaches.

2.1. OSS and Entrepreneurial Finance

A wide body of literature suggests that new ventures benefit from creating high-quality, protected IP, and this is evident in the earliest stages of the firm. For example, the mere act of filing a patent, regardless of whether it is ultimately awarded or not, acts as a springboard for venture capital investment (Haeussler et al., 2014). This positive effect compounds as patents are finally awarded; a patent can mitigate other firm deficiencies, such as low social capital (Hsu & Ziedonis, 2013). Thus, protected IP generally offers professional investors a clear and positive signal that the IP is valuable (Audretsch et al., 2012).

However, when OSS-based start-ups engage with professional investors, such as venture capitalists, their business plans undergo greater scrutiny because the path to profitability is less clear. OSS-based start-ups often face more complexity as they try to raise money (Colombo et al., 2016), primarily because OSS contributions can impede value capture. When this becomes a problem is still unclear; however, Conti et al. (2021) found that start-ups accelerate their participation in OSS in the first twelve months leading to their first round of financing, but then decline over the following year. The authors suggest the possibility of investor's concerns with value appropriation. Lin and Maruping (2022) found that start-ups that had more outbound OSS, where the start-up was the creator of the project, in their earliest stages had lower firm valuations. Interestingly, outbound OSS was helpful as the firm matured.

[1] https://github.com/zloirock/core-js/issues/767#issuecomment-600839713

Also notable is that the motives for creating OSS differ. Stewart and Gosain (2006) note that many OSS creators are in part driven by a non-pecuniary ideology, such as reputation among peers, the freedom of software, and aiding others. In essence, OSS-based start-ups might find stakeholder congruency to be an issue when those stakeholders are financially motivated. Software developers have increasingly bemoaned the challenges of financing OSS projects (see Turner, 2021), suggesting that seeking out alternative financing structures might be valuable.

2.2. Crowdfunding as an Alternative Financing Solution

Crowdfunding is a rapidly growing fund-raising mechanism in the entrepreneurial finance landscape and is largely viewed as a legitimate alternative source of capital acquisition for new ventures (Pollack et al., 2019). For example, high-profile projects such as the Oculus Rift (acquired later by Facebook) and the Pebble smartwatch (acquired later by Fitbit) leveraged the reward-based platform Kickstarter to launch their products. Because investor risk is spread across many backers who invest lower amounts of capital, reward-based crowdfunding is generally thought to be a low-stakes investment, which makes the crowdfunding context conducive to projects that might be perceived as less conventional. Most importantly, crowdfunding backers often emphasize two critical aspects: (1) the quality and viability of the product (Stanko & Henard, 2017) and (2) the community that is built around the product (Murray et al., 2020).

While crowdfunding backers are ultimately pre-ordering a product, the evidence suggests that the creator-backer relationship is more sophisticated than a product-consumer exchange. For example, Bitterl & Schreier (2018) conducted experiments comparing backers and consumers, finding that the backers had a stronger psychological bond with the projects they were backing. Many backers are attracted to 'user' entrepreneurs who also signal a greater connection to the product (e.g., lead users, early pioneers, and passionate innovators; Oo et al., 2019). In some cases, backers even take an active role in the development process and view their involvement as an important attribute of the project they support (Song & Tian, 2020). There is also evidence that backers support projects that espouse similar values to their own (Nielsen & Binder, 2021).

In contrast to traditional methods of entrepreneurial finance, there is exploratory evidence that closed IP does not sway backers in reward-based crowdfunding (Meoli et al., 2019). This finding is interesting given that closed IP, such as a patent, offers signals of competence and/or an objective assessment that the product is unique from others. What closed IP does not signal, however, is a commitment to the community. Thus, the question is whether OSS, as the antithesis of a patent, could be a superior approach to attracting backers. Figure 1 displays our conceptual model, which we elaborate on below as we develop our hypotheses.

Insert Figure 1 about here

3. Hypothesis Development

Both OSS (West & Gallagher, 2006) and crowdfunding (Murray et al., 2020) projects are inherently communal endeavors. Given the evidence that crowdfunding backers are a distinct stakeholder group (Fisher et al., 2017) and interpret signals of intellectual property differently (Meoli et al., 2019), the theoretical mechanisms that drive backer support lean towards communal logics rather than economic logics. Thus, to understand why OSS projects are attractive to crowdfunding backers, we outline how the OSS approach aligns with the crowdfunding-centric community-based resource mobilization framework (CBRM; Murray et al., 2020) and how this alignment influences backer support. CBRM posits that successful campaigns engage stakeholders through the building, engaging, and expanding of their communities.

First, members must share and espouse similar values to build a community. Murray and colleagues (2020) note that community building in crowdfunding is oriented toward identifying and building psychological bonds with future users of the product. OSS communities operate under a shared ideological view on IP (Stewart & Gosain, 2006) and hold very clear delineations as to what constitutes open. For example, the database company MongoDB withdrew a modified OSS license because of a lack of support from the OSS governing body, the Open Source Initiative (see Horowitz, 2019). Because the OSS community closely guards the conceptualization of openness, projects that adhere to its ideologies offer a common language to build communal psychological bonds. As such, OSS projects will have an advantage in attracting a larger community to pledge the small dollar investment germane to crowdfunding, in addition to more typical human capital contributions.

Next, the CBRM framework suggests that crowdfunding projects must engage the community they have established. Stanko and Henard (2017) offer a related insight, suggesting that crowdfunding backers place a premium on being able to participate in the process of creating the project. Many crowdfunding projects provide periodic updates to their backers throughout the project's lifecycle to draw in new backers and keep current backers interested. OSS repositories offer a more extreme version of these updates in that users can follow progress each day as the developers and community update code in real time. In addition, OSS communities tend to spill over into other popular internet-based forums. For example, the creator of OSS Adobe Illustrator alternative, VGC Illustrator, successfully raised $14,000 (USD) on Kickstarter and did so partly by engaging with the community on the popular open source subreddit,[2] '/r/opensource.' As the project launched, the creator rallied support around the idea that "patents are poison" (see post by BorisDalstein, 2021). This type of engagement also demonstrates the ideological tendencies of the OSS community (Stewart & Gosain, 2006) and highlights their shared enthusiasm for these values, which ultimately drives financial support.

[2] Subreddit is a term for Internet based forums hosted by the website Reddit.com, and are typically referred to by their URL pattern i.e., '/r/wallstreetbets'.

The last parallel between the CBRM framework and OSS is in community spanning. OSS creators and contributors have a variety of popular platforms to share their work. For example, GitHub—the largest OSS code-sharing platform—offers community-oriented features such as trending projects, collections of projects based on similar interests, and even sponsored OSS-focused events. These modern platforms greatly lower the barrier to participation and allow communities to easily share and promote the projects they are engaged with. In contrast, the underlying value proposition of protected IP reflects the logics of equity investors, who seek benefits that they exclusively capture. The value created by these protections in the crowdfunding context is retained solely by the project creator, which might be why projects that leverage patents are less successful in a crowdfunding context (Meoli et al., 2019). We hypothesize that crowdfunding backers will be more likely to support OSS projects.

Hypothesis 1: In reward-based crowdfunding, projects that espouse OSS have superior fund-raising outcomes.

While the communal attributes of OSS—similar to other findings focused on community in crowdfunding (Hassna, 2022; Josefy et al., 2017; Murray et al., 2020)—can offer a critical advantage to OSS campaigns in crowdfunding, we next turn our attention to the critical role of trust with OSS campaigns. A unique feature of OSS, distinct from the communal aspects, is that OSS is inherently transparent (Han et al., 2012). Transparency in the organizational context includes the provision of information from the venture to stakeholders that is complete, clear, and accurate (see, e.g., Schnackenberg & Tomlinson, 2016). Providing transparent information can be especially beneficial in the entrepreneurial context, where uncertainty serves as a barrier between the entrepreneur and their stakeholders (Burns et al., 2016).

An important benefit of transparency is that it increases trust from potential stakeholders (see Schnackenberg & Tomlinson, 2016). Trust is a multi-faceted construct and includes perceptions of an actor's integrity and ability (Mayer & Davis, 1999). Integrity reflects a perception that the other party is honest, while ability refers to the perception that the other party has the competencies to complete a specific task. As opposed to protected IP, OSS projects offer a translucent view of their technical aspects (Fleming & Waguespack, 2007), which allows community members to verify the creator's claims in terms of both integrity and ability.

Notably, even if they fail, OSS projects can live on whether the project creator ultimately delivers. In the software community, this can be in the form of spin-off projects that build on or revive the original project (e.g., MySQL becoming MariaDB). Thus, the transparent nature of OSS suggests a certain level of integrity between the project creators and allows the backers to assess the project creator's abilities as well if they so desire, especially in projects where backers are more participatory (Stanko & Henard, 2017). Therefore, we argue backers will perceive OSS as more trustworthy and hypothesize the following:

Hypothesis 2: In the reward-based crowdfunding context, projects that espouse OSS are perceived as more trustworthy, which manifests in perceptions of integrity and ability.

Reward-based crowdfunding campaigns are conducted online, and in many cases, the product being promoted is merely a prototype when the entrepreneur completes the campaign and launches the product. In other words, what the campaign promises and ultimately delivers can be highly uncertain. Murray and Fisher (2020) found that unbounded product claims would drive up financial support but also increase the propensity of failure post-campaign. Backers are becoming increasingly aware of these uncertainties as the crowdfunding community tracks these failures closely (e.g., kickscammed.com).

As such, trust between project creators and their backers is paramount to project success (Johnson et al., 2018). We previously established that due to the inherent transparency in OSS, backers would perceive OSS projects as more trustworthy. Trust is a powerful mechanism that alleviates two common deficiencies faced by creators—information asymmetry and legitimacy. First, information asymmetry is a common problem in reward-based crowdfunding. Courtney and colleagues (2017) found that backers look for cues, including the insights of other backers, as a means to resolve asymmetry and ultimately build trust in the project's ability to deliver.

A parallel issue in reward-based crowdfunding is establishing legitimacy (Soublière & Gehman, 2020). Fisher and colleagues (2017) further note that community logics serves as the basis for perceptions of legitimacy in crowdfunding and that crowdfunding backers are fundamentally concerned with trust and reciprocity. Given that OSS increases trust, and trust is a powerful mechanism to overcome common challenges in reward-based crowdfunding, our concluding hypothesis is:

> *Hypothesis 3: In rewards-based crowdfunding, perceptions of trustworthiness, which manifest via ability and integrity, mediate the relationship between projects that espouse OSS and fund-raising performance.*

4. Overview of Studies

To test our model, we leverage a multi-methodological approach, blending insights from archival data and a randomized experiment. In Study 1, we glean insights from the largest reward-based crowdfunding platform, Kickerster.com. To augment the findings from our archival dataset and to better pinpoint causal relationships (cf. Grégoire et al., 2019), we designed Study 2 to constructively replicate and extend our findings from Study 1 via a randomized experiment (cf. Köhler & Cortina, 2019). Aligning with the spirit of OSS and open science, we offer these materials—including datasets, survey instruments, and related code—for download on the Open Science Framework (OSF) website.[3] [note to reviewers: the link in the footnote provides anonymous access].

4.1. Study 1: Kickstarter Sample

The purpose of Study 1 is to test our first hypothesis, which suggested that OSS projects would have superior outcomes in crowdfunding. To this end, we leverage data from Kickstarter, the

[3] https://osf.io/2r3sp/?view_only=a723986b090043e0b2435e277e3ee4c2

largest and most influential rewards-based crowdfunding platform (Soublière & Gehman, 2020). Entrepreneurs across a myriad of categories seek funding on Kickstarter and thus offer a highly diverse pool of projects, both successful and unsuccessful, to test our hypothesis.

Our initial sample contained 37,432 projects and focused on categories that were technical in nature and thus more likely to offer linguistic cues in terms of how they handle IP. Next, to reduce the influence of projects without potential commercial significance (i.e., hobby projects), we removed projects with a goal of less than $5,000 (USD) (cf. Greenberg & Mollick, 2017).[4] We also filtered out projects that were missing data, generally attributed to a missing creator profile. To evaluate the potential impact of missingness on key variables, we ran a series of t-tests, revealing that the differences between the selected sample and the sample with missing data were marginal and insignificant. This process yielded 27,970 projects.

While our focus is on the performance of OSS projects, we also identified projects signaling protected IP in the form of a reference to patents. Three hundred thirty-six projects referred to 'open source' and 236 to a 'patent,' inclusive of 'patent-pending,' for a total of resulting in 562 projects.[5] This number is consistent with text-based searches via the Kickstarter search function and other previous studies addressing research questions focused on intellectual property in crowdfunding (e.g., Meoli et al., 2019). Previous studies have explored the performance of patents in reward-crowdfunding research (e.g., Meoli et al., 2019), and drawing a comparison against OSS projects offers new insights concerning IP strategy in this context.

Notably, however, projects that make an explicit reference to how the creators handle IP may carry idiosyncrasies not found in other projects. For example, it is plausible that creators who choose to identify an IP strategy systematically seek out a higher amount of capital, have sharper skills, or have more experience. All of these possibilities may bias their fundraising outcomes. This is a common problem among variables that are observed in real-world settings rather than randomly assigned by a research design (see e.g., Rosenbaum & Rubin, 1983). Thus, to strengthen our results and allow a better comparison between open, protected, and non-identified strategies, we also created a one-to-one matched dataset using coarsened exact matching (CEM; Iacus et al., 2019) via the *CEM* R package (Iacus et al., 2009). CEM offers a statistical approach to creating counter-factual cases of non-randomly assigned dichotomous variables, referred to as treatment effects, and has grown in popularity in the entrepreneurship literature (Burton et al., 2018; Ostrovsky & Picot, 2021). We created a dichotomous variable flagging the 562 projects indicating an IP strategy and used CEM to identify a counterfactual for each project from the larger sample. Appendix A illustrates pre- and post-balance diagnostics.

4.1.1. Study 1: Measures

Dependent Variable. Performance in reward-based crowdfunding can be measured in multiple ways. First, most crowdfunding platforms operate an all-or-nothing funding approach, meaning

[4] We also tested a minimum goal $1,000 USD and found consistent results.

[5] We also manually inspected a random sample of 1% of the unflagged projects to check the accuracy of our text search.

that a project must meet its funding goal to receive the pledged financing. However, projects are heterogeneous in terms of funding ambitions (i.e., funding goals). Thus, we take a ratio-based approach (cf. Scheaf et al., 2018) to measure *fundraising performance* as outlined in the formula below. Given the non-normal distribution commonly found in crowdfunding outcomes (Li et al., 2017; Taeuscher et al., 2020), we log transform the variable to account for skewness (Becker et al., 2019). We also provide several other measures of performance as robustness tests in our online supplement (e.g., pledged support).

$$crowdfunding\ performance = log\ (\ (\textit{funds raised / project funding goal})\ )$$

Independent Variables. To capture the project's approach towards IP, we created two dichotomous variables, *patent* and *open,* using a text search for 'patent' and 'open source,' respectively. The subset of projects with an explicit reference to how they handle IP was then split and manually inspected to identify any ambiguous language. Table 1 illustrates extracted text examples from patent and open projects.

Insert Table 1 about here

Control Variables. The attributes of successful crowdfunding projects vary; as such, we account for several theoretically important attributes from the crowdfunding literature (Mollick, 2014; Pollack et al., 2019). These include project-level variables: *project goal, project length, project year, project country, category,* and *staff pick.* Staff picks are endorsed by Kickstarter and reflect a strong signal of project quality. We also include variables relevant to the project creator, including their *education*, which was derived from their biography, and the lead creator's *gender,* which is acknowledged to be influential across reward-based platforms (e.g., Greenberg & Mollick, 2017; Johnson et al., 2018).

We also control for variables related to previous experiences on the platform that might influence the project creator's perceived legitimacy, including the *number of projects created, the number of projects backed,* and *membership time* (e.g., Soublière & Gehman, 2020). We also included dummy coded control variables that offer insights into the creator's professionalism via the presence of a (non-social media) *web presence* and social capital via their *social presence* across three major social media platforms (i.e., Facebook, Instagram, or Twitter).

4.1.2. Study 1: Results

Table 2 displays the correlations between variables for the CEM-matched sample.[6] One notable correlation is that the OSS projects were more likely to be chosen as a staff pick, whereas those with a patent reflected a negative correlation with staff pick. While outside the scope of this inquiry, we revisit this relationship and its potential implications in the discussion section.

Table 3 displays the results from OLS models. Model 1 displays the control variables for the unmatched sample. Models 2 and 3 display the effect of OSS and patent for the unmatched and matched sample, respectively. The regression estimates in model 2 suggest a negative effect for projects using a patent ($b = -0.54$; $p < 0.001$), which is consistent with previous findings (Meoli et al., 2019) and is positive for OSS ($b = 0.30$; $p < 0.001$). Model 3 illustrates support for more consistent, albeit more conservative, support for the matched sample for both the patent ($b = -0.28$; $p < 0.001$) and OSS ($b = 0.33$; $p = 0.036$). Thus, in terms of effect size, OSS projects out-raise all projects by approximately 39%, while patents see a 33% penalty against all other projects. We replicated these results using propensity score matching and provided these results in our online supplement. Further, we also ran isolated versions of the matching process, comparing OSS versus all projects, patents versus all projects, and finally, OSS versus patents. These results can be found in our online supplement, Appendix S.5.

Insert Table 2 about here

Insert Table 3 about here

4.1.3. Study 1: Discussion

Study 1 suggests broad support for the notion that OSS projects receive superior support in reward-based crowdfunding contexts. Furthermore, support for Hypothesis 1 was held across different analytical techniques. Despite the robustness of these findings, we cannot rule out challenges of endogeneity, most specifically if people who create OSS projects in this context produce materially higher quality projects than those who use a protected approach. Furthermore, we noted in our correlation table that OSS projects have a higher probability of being selected as a "staff pick, " boosting project visibility across the platform. We conducted an additional analysis removing projects flagged as a staff pick and found similar results (see Appendix S.4). This suggests a potential preference for OSS projects on the Kickstarter platform—but is an effect we can mitigate via experimental methods. While the results from Kickstarter data suggest that OSS projects tend to have superior fundraising outcomes, they do not provide insights into causal mechanisms. Therefore, we augment these findings via a randomized experiment reconstructing a Kickstarter project.

4.2. Study 2: Experiment [OSS vs. Patent]

Using crowdfunding as the context, we conducted a randomized experiment to test the mediating

[6] See Appendix S.2 & S.3 for PSM correlations and OLS results.

hypotheses associated with the effect of OSS on crowdfunding funding outcomes. To test our overall hypothesized model, we recruited a sample of experienced crowdfunding backers from a Prolific[7] panel of 159 adults (average age = 30.69, *SD* = 9.44). As part of the screening process, we sampled participants who indicated prior experience in crowdfunding, and we also assessed the number of projects they have previously supported to gauge overall experience as a 'backer.' To emulate a real-world Kickstarter project, our hypothetical project included all the typical Kickstarter features, including the overall story of the project, the pitch, funding details, funding requests, and information about the project's team. We also included the project's goal (stated at $20,000), the progress towards the goal, and the reward amounts for each level of pledged support (ranging from $0 *No Support* to $200 *Mobile Device + Priority Handling*).

During the experimental study, in line with our archival text search patterns, participants were randomly assigned to either a patent-pending condition or an OSS condition. Because *open* and *protected* reflect underlying IP approaches for the development of products and services, we designed our hypothetical Kickstarter project to outwardly emphasize this approach. To do so, our experimental project promoted a hand-held social gaming console based on a combination of open and protected IP. The hypothetical "Retro ToGo" gaming console used in our manipulation was loosely based on the *Raspberry Pi* computer board system—a popular motherboard used widely by the OSS community and emphasized that the software eco-system was either open to all or patented. Our project represented the gaming category, which represents the most funded category on Kickstarter, having received over $1.64 billion in pledged support (Kickstarter.com, 2021).

Because our intentions for the experiment were to emphasize the approach towards IP, we designed our project to promote a product with relatively low complexity. Therefore, the *Retro ToGo* project reflected relatively low levels of overall complexity in product design, thereby making the product more universally understandable. To ensure that the overall complexity of the project was relatively low, we used Allen et al.'s (2018) two-item complexity measure on a five-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly agree*). Items included "The design of this product seems highly complex, and "This product appears very technical" (α = .86; ω = .86). Assessing the differences between the conditions, a t-test revealed no significant difference in project complexity between closed and protected approaches ($t_{(157)} = 0.79$, $p = 0.433$; *closed*: $M = 2.54$, $SD = 1.01$; *open*: $M = 2.68$, $SD = 1.08$). Thus, we were able to control for product complexity, which enabled us to better examine the impact of OSS on our hypothesized relationships.

Upon beginning the experimental study, participants were provided with instructions that they were to review a Kickstarter project and then respond to a few questions about the project. Participants were also provided brief descriptions of relevant IP terms, including *intellectual property* (i.e., the commercial value associated with and owned by the product creator and their respective company), *patent/patent pending technology* (i.e., the legal protection for a product and/or invention files with a government agency), and *open source* (i.e., a license in which

[7] Prolific (https://prolific.co) is a service that helps recruit and verify subjects, similar to Qualtrics Panels.

individuals external to the company or product creator can inspect, contribute or modify the project's source materials [for example, the code or design of the product]). After reviewing the instructions, each participant was provided 90 seconds to review the project material for their randomly assigned condition (average time = 137.49, *SD* = 48.52). To assess the manipulation of the approach to IP, participants reflected on the project they reviewed by responding to the question, "Please add a brief description of the project you saw and any notable attributes. [Write 2-3 sentences]." At the end of the experiment, we assessed a condition check by asking the participants to properly identify the type of project they evaluated ("The project I evaluated was… 1 = *Open Source*, 2 = *Patent/Patent Pending*; 3 = *Did not Say*"). Two authors coded the brief description text as a manipulation check and had 93.08 percent agreement. The remaining cases were reviewed until a full consensus was reached. Between the two condition checks, 153 of the respondents correctly identified the way the project handled IP (96.23%). All analyses below drop all cases that missed the condition check; however, retaining the observations does not yield statistically different results.

Of the final participants, 50.98 percent were female, 46.41 percent were male, and 2.61 percent were non-binary. On average, the participants had prior experience in crowdfunding, supporting 6.88 projects (*SD* = 18.84) with an average prior dollar pledged amount of $389.18 (*SD* = 774.98). Complete measures, along with full-detail descriptions of the Kickstarter project and conditions, can be found in supplementary materials.[8]

4.2.1. Study 2: Measures

Mediating Variables. To measure the trust in the *integrity* of the project, we used Mayer and Davis's (1999) 6-item measure, assessed on a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly agree*). Participants were given the instructions, "Reflecting on the project, for each statement, please select how much you agree or disagree with each statement." Sample items include, "The project creator is trying to be fair in dealings with backers" and "I don't have to wonder whether the project creator will stick to their word" (α = .84; ω = .89).

To measure the trust in the *ability* of the project's creator, we used Mayer and Davis's (1999) 5-item scale, assessed on a 5-point Likert scale (1 = *Strongly disagree* to 5 = *Strongly agree*). Sample items include, "I feel confident about the skills of this project creator" and "This project creator is very capable of performing the job" (α = .84; ω = .89).

Dependent Variables. We assess project support using two different measures. The first measure, derived from Johnson et al. (2018), reflected the backer's *likelihood of investing* in the project. Using a 7-point Likert scale (1 = *Extremely unlikely* to 7 = *Extremely likely*), participants indicated their likelihood of investing in the crowdfunding project by responding to the following question, "Based on your review of the project, what is the likelihood that you would financially support this project?" (*M* = 3.56, *SD* = 1.87). We also assessed project support by using the log of dollars allocated to the project (e.g., Li et al., 2017). Participants were asked, "Thinking about your financial support of this project, if you could support the project with any

[8] [anonymized link: https://osf.io/2r3sp/?view_only=a723986b090043e0b2435e277e3ee4c2]

amount of money, how much would you pay?" (M = 1.76, SD = 1.63).

Additional controls. For the indirect effects (H3), we included several controls to account for the individual differences in crowdfunding backers, which included the participant's overall knowledge of the crowdfunding process, the number of previously backed projects, age, education level, and gender. Results are similar both with and without the control variables; therefore, we report the results for the indirect effects with the controls. Results without the control variables can be found in our online supplement.

Insert Table 4 about here

4.2.2. Study 2: Results

Descriptive statistics and correlations between the experimental conditions and variables can be found in Table 4. To test our main hypotheses regarding the impact of open source on the outcomes of the likelihood of investing, dollars pledge, integrity, and ability, we used a combined approach of one-tailed t-tests (where open > closed) to assess the difference between conditions and path analysis modeling using the *lavaan* package in *R* (Rosseel, 2012), reporting unstandardized regression coefficients (b). These results are reported in Table 5. For mediation analyses regarding the indirect effects via integrity and ability, we constructed 95% bias-corrected confidence intervals (CI_{95}) using a 10,000 bootstrapped approach (Preacher & Selig, 2012).

Insert Table 5 about here

Hypothesis 1 proposed that OSS projects would have superior outcomes. A one-tailed t-test indicated that open source was significantly greater than the patent approach for the outcome of likelihood to invest ($t_{(151)}$ = 2.471, p = .007; *open* = 3.913, SD = 1.74; *closed* = 3.18, SD = 1.94) and dollars supported ($t_{(151)}$ = 1.96, p = .026; *open* = 2.01, SD = 1.61; *closed* = 1.49, SD = 1.62). Further analysis of the results indicated that open source was positively associated with the likelihood of investing (b = *0*.734, p = .014) but only marginally significant for dollars supported (b = *0*.513, p = .050), thus providing partial support for our first hypothesis. Figure 2 illustrates these results.

Hypothesis 2 posited that OSS projects would be perceived as more trustworthy (via integrity and ability) than projects signaling a patent. A one-tailed t-test indicated that open source was significantly greater than closed for both integrity ($t_{(151)}$ = 5.433, p < 0.001; *open* = 3.81, SD = 0.63; *closed* = 3.22, SD = 0.72) and ability ($t_{(151)}$ = 2.84, p = .003; *open* = 3.69, SD = 0.83; *closed* = 3.28, SD = 0.94). Additionally, OSS was positively associated with both integrity (b = 0.596, p < 0.001) and ability (b = 0.408, p = 0.005), thus providing support for Hypothesis 2 (see Figure 3).

Insert Figures 2 & 3 about here

Recall that Hypothesis 3 examines the positive indirect effect of leveraging an OSS approach on project support via trust in the integrity of the project and trust in the ability of the project's creator. Table 5 reports the 10,000 bootstrapped bias-corrected 95% confidence intervals for H3 for each project support outcome, respectively. Regarding the result for the impact of open source on investment likelihood via integrity, we found a positive effect that excluded zero (b = 0.556, SE = 0.17, CI_{95} [0.253, 0.928], $p < 0.001$). Regarding the path via ability, we also found a positive and significant path that excluded zero (b = 0.295, SE = 0.13, CI_{95} [0.083, 0.585])), thus providing support for Hypothesis 3 with the outcome of the likelihood of investing. The results for dollars supported were positive and excluded zero via both integrity (b = 0.402, SE = 0.15, CI_{95} [0.152, 0.745]) and ability (b = 0.164, SE = 0.10, CI_{95} [.027, .412]). Overall, we found strong support for Hypothesis 3 across the two trust mechanisms and the two funding outcomes.

4.2.3. Study 2: Discussion

Study 2 constructively replicates the archival findings from Study 1 and extends these results in several important ways. First, to better pinpoint causality, we utilized a randomized experiment with several attention checks to ensure that subjects understood the project's approach toward IP. As noted in the discussion for Study 1, archival data has several limitations that limit inferences from its results (e.g., Anderson et al., 2019); however, with Study 2, we were able to provide internal validity for the posited mechanisms associated with OSS and crowdfunding. Additionally, the subjects in Study 2 had experience backing crowdfunding projects, which further helps bolster the validity of the study while offering important insights into the micro-level 'demand-side' of crowdfunding (Pollack et al., 2019). Finally, we were also able to test the role of trust in the relationship between IP strategy and project support through the introduction of two mediating variables, *integrity* and *ability*, which both offer further insights into our overall findings and help bolster extant crowdfunding research regarding the role of trust (Johnson et al., 2018).

5. General Discussion

The goal of this research is to advance theory of entrepreneurial OSS and crowdfunding. We chose reward-based crowdfunding as our primary context due to its rapid growth as an alternative means to raise early-stage capital. Further, there is a growing body of evidence highlighting that commonly held assumptions in entrepreneurial finance (Drover et al., 2017) and IP (Meoli et al., 2019) might not hold in crowdfunding settings, suggesting there is still much to learn (Pollack et al., 2019).

To aid in the robustness and better identify causality in our findings, we took a multi-method approach. More specifically, we combine archival insights from the field with a controlled, randomized experiment. This approach balances external and internal validity and allows for sharper inferences. Further, the materials used in this study are open source as well, heeding calls from leading scholars and journals for research to offer greater transparency (Anderson et al., 2019; Bettis et al., 2016; DeCelles et al., 2021).

Our findings are consistent across both studies. The archival data collected from Kickstarter

suggests that OSS projects outperform those that reference a patent (as well as a control group). We followed this study with a constructive replication via a randomized experiment and found support for two common dependent variables in crowdfunding studies: the likelihood of support and dollars pledged. Further, we identified a mediating relationship that suggests OSS projects are perceived as more trustworthy—via perceived integrity and ability—than those utilizing patents and, thereby, are more likely to be better funded.

5.1. Theoretical Implications

The findings in this study advance knowledge of entrepreneurial OSS and crowdfunding. First, enticing stakeholders to support entrepreneurial ventures is a challenge for aspiring entrepreneurs in the face of uncertainty (Burns et al., 2016), and even more so with business models that appear counterintuitive to leveraging critical and valuable resources associated with IP, like OSS ventures (Lerner & Tirole, 2002). As such, the path towards resource acquisition for entrepreneurial OSS projects is generally more complicated in traditional fund-raising contexts (Colombo et al., 2016) as entrepreneurs lose out on the many benefits associated with protected IP, including monopolizing the property, external validation of the IP, and the creation a tangible, tradeable asset (Audretsch et al., 2012; Hsu & Ziedonis, 2013).

Given the benefits of protecting IP, the notion that using an OSS approach can be advantageous counters prevailing logic around fundraising and supplements a growing list of studies that demonstrate the ways that crowdfunding can break theoretical boundaries. Openness, broadly speaking, is a theoretically rich concept to study in entrepreneurial settings. Given the limits of local knowledge (e.g., Hayek, 1945), opening up IP to the entire world has the potential to resolve knowledge problems (e.g., Townsend et al., 2018) in a much more efficient way. OSS is also an intriguing business model, similar to, but distinct from, social entrepreneurship (e.g., Stevens et al., 2015). Whereas OSS projects culminate in a public good (Chesbrough, 2003), the motivation is not necessarily with this end in mind. Instead, contributors and supporters might do so for ideological reasons (Stewart & Gosain, 2006) and status among fellow creators of OSS projects (von Krogh et al., 2012).

Critically, this study demonstrates a connection between crowdfunding backers and OSS creators because they both carry a different set of motivations. First, backers are less concerned with the performance of the firm and instead are more focused on the product they are supporting (Murray et al., 2020). Individuals who participate in the OSS community are also less concerned with a firm and instead seek to engage with the product (Stanko & Henard, 2017). This closely aligns with the inner workings of the OSS community (Stewart & Gosain, 2006). Thus, our study suggests that community-based resource mobilization (Murray et al., 2020) is not only a natural fit for OSS projects but is even superior to other approaches.

OSS projects are also explicitly transparent. In part due to the growing popularity of Internet-based tools like GitHub, which blends simple interfaces with communal features, supporters of OSS projects can participate and watch projects develop in real time as progress is documented and code updated in full view of the public. This is especially attractive given the recurring theme in crowdfunding, suggesting that backers are just as interested in the development process

as they are in the end result (Murray et al., 2020; Stanko & Henard, 2017). Thus, we theorize and find openness yields greater trust towards a project (e.g., Johnson et al., 2018), leading to superior funding outcomes.

To this end, we also note that a set of our models contribute to knowledge accumulation in crowdfunding in that they also affirm previous findings. First, we found a similar effect to that of Meoli and colleagues (2019), who, through an exploration of Kickstarter projects, found that projects signaling a patent generally did not perform well. Next, though we focus on an element of trust different from Johnson and colleagues' (2018), our experiment demonstrates that establishing trust is critical in the crowdfunding context and highlights that there are many levers that build (or dissuade) trust.

5.2. Practical Implications

Leading scholars have emphasized relevance (Wiklund et al., 2019) and solving grand challenges (George et al., 2016). This work employs a number of anecdotes that highlight the important role OSS plays in the real world. We also call attention to the challenge the open source community faces as they seek resources (Turner, 2021), which is a problem that spans projects of a myriad of aspirations. The democratic nature of crowdfunding offers an exciting avenue to help fund these projects that would otherwise be economically unattractive.

As our review uncovered, professional investors appreciate the benefits of IP protection as it creates tangible assets that can be capitalized on. Conversely, our study suggests that backers on crowdfunding platforms are an audience that does not share this concern and is instead interested in participating in the process of solving-knowledge problems. In this sense, OSS projects carry less risk for backers as they can inspect, contribute to, and even spin off the project if the situation calls for it. Importantly, projects that require financial resources to solve important problems but lack an appropriate revenue model for equity-based investors might find success by turning to the ‘crowd.’

5.3. Limitations and Future Research

Despite the efforts to make the findings of this study robust, they should be interpreted with acknowledgment of its limitations. First, large-scale data collection, such as in Study 1, relies on automation at various stages in the process. While control variables (e.g., staff picks proxy for quality) and statistical techniques (matching to create more accurate counterfactual cases) help alleviate some concerns, nuance is inevitably lost. Next, projects that signal a patent in crowdfunding might be of lower quality than those that seek venture capital. It is noteworthy that projects signaling a patent were much less likely to be featured as a staff pick, which could also suggest that these projects have lower potential.

We attempted to address these challenges with Study 2. However, our sampling procedure and choice of project for subjects to assess add some degree of caution in the generalizability of our findings as well. More specifically, in creating the Retro ToGo project, we sought a balance between familiarity with the product and the utility of an innovation strategy. Such attempts are

undoubtedly challenging. Further, we focused on a single mediator, trust, as it is a critical variable in crowdfunding and warrants further scrutiny. There is likely to be a range of theoretically relevant mediators (and moderators) that provide additional explanatory power. Our intent is only to advocate for a more robust conversation around entrepreneurial OSS (Lin & Maruping, 2022) and innovation strategy, more generally within the crowdfunding context.

Future projects can build on these findings by replicating and extending the findings with different samples. For example, using projects that differ in their level of innovativeness could provide further insights and possibly point to curvilinear effects (i.e., too-much-of-a-good-thing Pierce & Aguinis, 2013). Another question researchers should explore is whether socially oriented projects would benefit more acutely from open source. In other words, it would be theoretically interesting to uncover if a social orientation (e.g., Parhankangas & Renko, 2017) acts as a moderator.

We also note that this study is focused on patents as the competing protected IP strategy. Projects can also leverage copyrights or trade secrets as a means to protect their products. While patents are ubiquitous in the entrepreneurial finance literature (Meoli et al., 2019; Savage et al., 2020), there are potential insights to be gained from assessing other approaches to IP protection as well. Last, a majority of research on crowdfunding has focused on resource acquisition, yet we know little about what happens after the resources are obtained. Another worthwhile pursuit would be to see how these projects unfold after they are funded; for example, are closed more likely to be acquired? And will open projects survive even if the original creator fails or abandons them?

6. Conclusion

In conclusion, we find that reward-based crowdfunding platforms can provide important access to investors whose values and ideologies are congruent with open source. This runs in contrast to more traditional investors, who typically view protected intellectual property as a valuable asset. Instead, crowdfunding backers are concerned with the product and whether they can trust the creator to deliver. Openness is advantageous in this regard as it is inherently transparent—a building block of trust, which is an important link in the causal chain for whether a backer will support a crowdfunding project. Open-source projects can also have a wider impact and thereby solve critical societal problems as barriers to access are typically mitigated.

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TABLE 1. Study 1: Patent and OSS Text Examples

	Project Title Text	Project Description Text
Patent		
	BRICWAVE™ Xpress with Apple MFi Certified ICs & Connectors	FIRST EVER EXPRESS CHARGING CABLE INTEGRATED FLASH DRIVE" Patent Pended High-speed Charging and Data Back-up Solution
	Yoga Wheel fitness flexibility prop. Patent pending.	Patent Pending. Increase flexibility to the spine, strengthen back muscles, develop core strength and open chest area for better posture.
OSS		
	CloudPrint	Redefining the manufacturing industry through 3D printing. CloudPrint is an open source factory designed for the 21st Century.
	VLC for the new Windows 8 User Experience	VLC for Windows 8. A native app, fully featured and fully open source. Play all your files, streams and optical media.

TABLE 2. Study 1: Descriptive Statistics and Correlations (CEM Matched Sample)

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Percent Raised	2.20	2.19																				
2. Amount Raised	6.69	3.62	0.89																			
3. Backers	277	1254	0.41	0.35																		
4. Patent	0.25	0.43	-0.17	-0.16	-0.07																	
5. OSS	0.25	0.43	0.19	0.18	0.01	-0.33																
6. Goal	10.49	1.11	-0.26	-0.09	0.05	0.06	-0.08															
7. Project Length	36.17	10.33	-0.09	-0.06	-0.05	0.11	-0.04	0.15														
8. Staff Pick (Yes)	0.13	0.33	0.47	0.41	0.17	-0.18	0.18	-0.07	-0.04													
9. Gender (Unknown)	0.35	0.48	0.33	0.35	0.13	-0.08	0.08	0.03	0.04	0.20												
10. Gender (F)	0.06	0.24	-0.06	-0.07	-0.03	0.05	-0.05	0.03	-0.02	-0.10	-0.19											
11. Gender (M)	0.59	0.49	-0.30	-0.31	-0.11	0.05	-0.05	-0.04	-0.03	-0.14	-0.88	-0.30										
12. Number Created	1.42	1.42	0.15	0.11	0.02	-0.05	0.07	-0.09	-0.01	0.04	-0.03	0.02	0.01									
13. Number Backed	2.36	5.86	0.36	0.31	0.05	-0.14	0.15	-0.14	-0.08	0.32	-0.02	-0.08	0.06	0.17								
14. Bio Length	369	388	-0.06	-0.07	-0.03	0.14	-0.09	0.06	0.04	0.00	-0.02	0.02	0.02	0.02	-0.05							
15. Member Time	0.55	1.08	0.12	0.10	0.04	-0.04	-0.02	-0.09	-0.04	0.04	-0.08	0.05	0.06	0.38	0.22	-0.04						
16. Social Presence	0.24	0.43	0.23	0.24	0.14	-0.07	0.05	0.00	-0.02	0.15	0.18	-0.03	-0.15	0.00	0.08	0.01	0.07					
17. Web Presence	0.77	0.42	0.25	0.28	0.08	-0.06	0.10	0.04	-0.04	0.17	0.18	-0.09	-0.12	0.06	0.10	0.00	0.07	0.24				
18. Education	0.18	0.39	-0.11	-0.10	-0.06	0.03	0.02	-0.04	0.04	0.02	-0.10	-0.03	0.11	0.07	-0.04	0.27	0.04	0.01	0.02			
19. Project Year	7.36	2.15	-0.06	-0.06	0.01	0.19	-0.23	0.10	0.12	-0.17	0.05	0.13	-0.12	0.05	-0.30	-0.03	0.12	-0.04	-0.05	0.00		
20. Project Month	6.43	3.42	0.00	0.01	0.00	0.01	0.01	0.04	-0.03	0.04	0.02	-0.03	-0.01	0.06	-0.09	0.08	0.00	-0.02	-0.01	0.05	-0.07	
21. Project Funded	0.23	0.42	0.81	0.65	0.34	-0.13	0.12	-0.15	-0.08	0.44	0.29	-0.03	-0.27	0.10	0.28	-0.03	0.08	0.19	0.19	-0.10	-0.01	-0.01

Notes: N=822; Values greater than 0.01 significant to $p < 0.05$; Category and Country not displayed for brevity

TABLE 3. Study 1: OLS Regressions (Percent Raised)

	Dependent variable: Percent Raised (Log)		
	(1)	(2)	(3)
Constant	6.15***	6.11***	5.62**
	(0.41)	(0.41)	(1.73)
OSS		0.30***	0.33*
		(0.09)	(0.16)
Patent		-0.54***	-0.28*
		(0.10)	(0.14)
Goal	-0.39***	-0.39***	-0.43***
	(0.01)	(0.01)	(0.05)
Campaign Length	-0.003***	-0.003***	-0.0000
	(0.001)	(0.001)	(0.01)
Staff Pick	2.19***	2.18***	1.87***
	(0.03)	(0.03)	(0.19)
Gender (F)	-0.43***	-0.43***	-0.44+
	(0.03)	(0.03)	(0.26)
Gender (M)	-0.74***	-0.73***	-1.01***
	(0.02)	(0.02)	(0.13)
Number Created	0.07***	0.07***	0.07+
	(0.01)	(0.01)	(0.04)
Number Backed	0.01***	0.01***	0.06***
	(0.0004)	(0.0004)	(0.01)
Bio Length	-0.0001***	-0.0001***	-0.0001
	(0.0000)	(0.0000)	(0.0002)
Member Time	0.08***	0.08***	0.01
	(0.01)	(0.01)	(0.06)

Education	-0.13***	-0.13***	-0.48**
	(0.03)	(0.03)	(0.15)
Social Presence	0.33***	0.33***	0.50***
	(0.02)	(0.02)	(0.14)
Web Presence	0.64***	0.64***	0.57***
	(0.02)	(0.02)	(0.14)
Month	-0.001	-0.001	0.02
	(0.003)	(0.003)	(0.02)
Year Created	YES	YES	YES
Category	YES	YES	YES
Country	YES	YES	YES
Observations	27,970	27,970	822
R^2	0.52	0.52	0.53
Note:	+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001		

TABLE 4. Study 2: Descriptive Statistics and Correlations

Variable	M	SD	1	2	3	4	5	6	7	8	9
1. Investor's age	30.46	9.11									
2. Investor's education	2.84	0.80	.323***								
3. Investor's sex	0.59	0.63	-.045	.054							
4. Crowdfunding knowledge	3.85	0.72	-.008	-.053	-.035						
5. Number of projects backed	6.88	18.85	-.019	.121	-.060	.223**					
6. Open Source (Yes)	0.52	0.50	-.118	-.090	-.022	-.054	.062				
7. Trust: integrity in process	3.53	0.74	.001	-.058	.086	.016	.151	.404***			
8. Trust: creator's ability	3.50	0.91	.030	-.108	.044	-.082	-.043	.225**	.631***		
9. Likelihood of investing	3.56	1.87	-.033	.020	-.031	.073	.142	.197*	.579***	.553***	
10. Dollars supported (log)	1.76	1.63	-.060	-.045	.032	.152	.161*	.158	.455***	.394***	.658***

Notes. N=153; * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Investor's sex coded as 0 = male, 1 = female. Education is coded as 1 = no education, 2 = high school diploma, 3 = college degree, 4 = bachelor's degree, 5 = master's degree, 6 = doctoral or professional degree.

TABLE 5. Study 2: Path Analysis Results

	Mediator: Integrity		Mediator: Ability		DV: Likelihood to Invest		DV: Dollars Supported (log)	
Variable	*b*	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*
Controls:								
Age	.01	(.01)	.01	(.01)	-.02	(.01)	-.01	(.01)
Education	-.07	(.08)	-.14	(.10)	.25	(.15)	.03	(.17)
Sex	.13	(.09)	.08	(.13)	-.24	(.19)	.01	(.26)
Crowdfunding knowledge	.01	(.09)	-.09	(.12)	.21	(.16)	.33	(.19)
Number of projects backed	.01	(.01)	-.00	(.01)	.01	(.01)	.01	(.01)
Open Source (Yes)	.59***	(.12)	.41**	(.15)	-.13	(.26)	-.07	(.25)
Mediators:								
Trust in integrity					.94***	(.22)	.68**	(.21)
Trust in ability					.73***	(.16)	.40*	(.16)
Intercept	3.06***	(.44)	3.68***	(.63)	-3.11**	(.95)	-3.01**	(1.05)
R^2	.20		.08		.33		.21	
					LL	**UL**	**LL**	**UL**
Indirect effects on project outcomes								

Open Source (Yes) → Integrity → Project support	**.268**	**.927**	**.152**	**.745**
Open Source (Yes) → Ability → Project support	**.083**	**.585**	**.027**	**.412**

Note. n = 153. * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Values presented in unstandardized regression coefficients with standard errors in parentheses. Indirect effects estimated using a 10,000 bias-corrected bootstrap approach with 95% CIs, LL = lower level, UL = upper level. Bolded CIs indicate zero is not included in the interval.

FIGURE 1. Conceptual Model

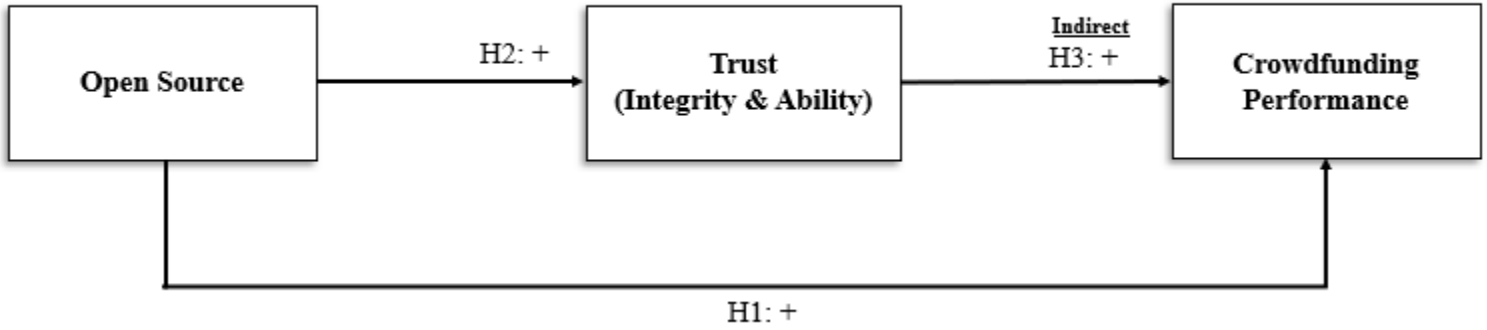


FIGURE 2. Bar Plots Hypothesis 1 [95% CI]

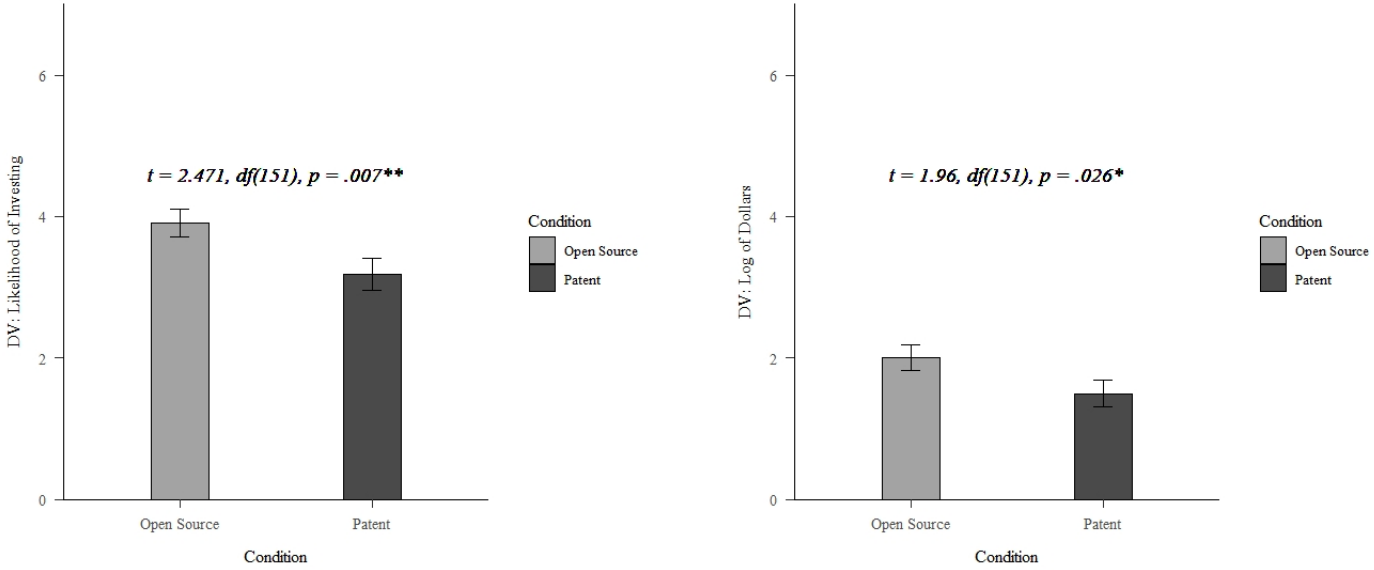
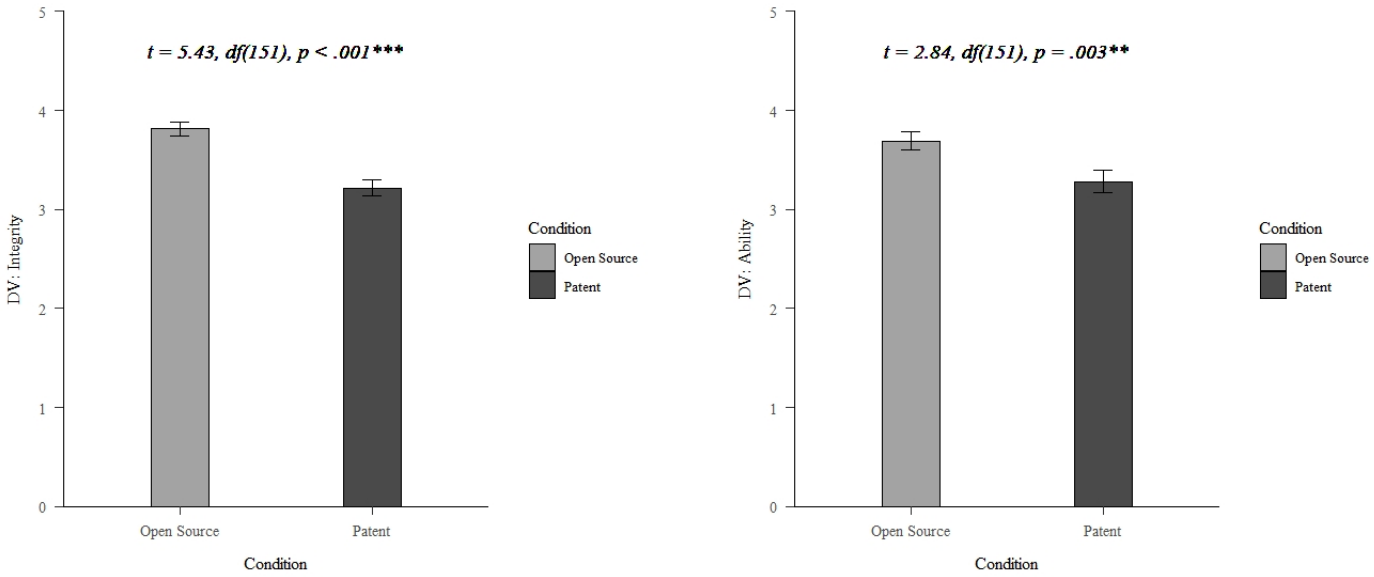


FIGURE 3. Bar Plots Hypothesis 2 [95% CI]



Appendix A. Balance Diagnostic (CEM)

	IP Strategy Identified		No IP Strategy Identified		Absolute Difference of Means	P Value
	Mean	S.D.	Mean	S.D.		
Panel A: Full sample						
Percent Raised	2.52	2.26	2.03	2.15	0.48	> 0.001
Matched Variables[t]						
Goal	10.45	1.18	10.38	1.17	0.07	0.145
Campaign Length	36.63	11.61	36.14	11.53	0.49	0.318
Staff Pick (Yes)	0.18	0.39	0.13	0.33	0.04	< 0.001
Gender (Unknown)	0.35	0.48	0.41	0.49	0.06	0.002
Gender (F)	0.07	0.26	0.09	0.28	0.01	0.212
Gender (M)	0.57	0.49	0.50	0.50	0.07	< 0.001
Number Created	1.77	2.51	1.49	1.74	0.28	0.009
Number Backed	9.88	65.77	4.60	19.85	5.28	0.057
Bio Length	346	393	314	321	31	0.066
Member Time	0.66	1.34	0.67	1.38	0.009	0.880
Social Presence	0.22	0.41	0.25	0.44	0.037	0.039
Web Presence	0.80	0.40	0.73	0.44	0.069	< 0.001
Education	0.20	0.39	0.15	0.36	0.04	0.010
Project Month	6.50	3.40	6.40	3.45	0.086	0.550
Observations	27,408		562			
Panel B: CEM Sample						
Percent Raised	2.39	2.23	2.24	2.13	0.008	0.954
Matched Variables[t]						
Goal	10.49	1.13	10.47	1.09	0.024	0.756
Project Length	35.59	9.71	36.76	10.90	1.176	0.103
Staff Pick (Yes)	0.13	0.33	0.13	0.33	0	1
Gender (Unknown)	0.35	0.47	0.35	0.47	0	1
Gender (F)	0.06	0.24	0.06	0.24	0	1
Gender (M)	0.59	0.49	0.59	0.19	0	1
Number Created	1.40	1.54	1.43	1.42	0.029	0.769
Number Backed	2.31	5.67	2.41	6.05	0.107	0.793
Bio Length	353	361	384	413	31	0.247
Member Time	0.60	1.11	0.49	1.04	0.105	0.165
Social Presence	0.25	0.43	0.23	0.42	0.015	0.624
Web Presence	0.76	0.43	0.79	0.41	0.022	0.453
Education	0.17	0.37	0.20	0.40	0.032	0.242
Project Month	6.38	3.45	6.49	3.40	0.110	0.647
Observations	411		411			

[t] Year, Category, and Country omitted for brevity