Quality versus quantity in two-sided markets competition: Evidence from crowdfunding websites

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Abstract

In this paper, we study how mechanisms like minimum quality standards shape competition in two-sided markets in terms of quantity and quality of members. We investigate the reward-based crowdfunding industry, a growing and (yet) weakly regulated model, where entrepreneurs pitch to receive financial support from investors and receive pledges in exchange for special prizes. In our setting, two platforms compete head to head, and one of them softens its minimum quality standards. By potentially opening up its system to lower quality entrepreneurs, the platform sharply increases entry in comparison to its rival while the relative average quality decreases. Our results highlight the complex competitive dynamics in two-sided markets, as changes on the one side also impact the other. In particular, we feature the challenging task of balancing quantity and quality in platform competition as well as the potential usefulness of the findings to platform operators set their strategies.

Keywords: crowdfunding, two-sided market, competition

JEL Codes: G23, L13, L25, L26

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1 Introduction

Platforms are ubiquitous nowadays: we communicate, exchange, commute, purchase, compare prices, travel, study, find jobs, houses, and partners using them. Rankings of the most valuable firms reflect the prominent role of platforms and their importance in the market. In September 2017, 20% of firms figuring on the top of Crunchbase, a directory of large firms, venture capitalists, and startups, were platform-based. (Table A.1 in the Appendix).[1] On the same period, five of the ten most valuable brands belong to companies at the core of platform ecosystems: Apple, Google, Facebook, Amazon, and Microsoft (Figure A.1 in the Appendix). These facts show how platforms are increasingly changing the way we make several choices. As a consequence, competition between platforms becomes a central subject in the economic debate.

The core feature of platforms is indirect network effects, implying interdependent demand between two or more distinct groups of agents (buyers and sellers, travelers and hotels, entrepreneurs and investors, etc.). The two-sidedness requires that platforms create mechanisms to coordinate the diffusion process within the distinct groups as to create a critical mass on both sides, as the utility of members of one group increases with the number of members in the other group. Very often, platform users also care about the quality, which means that attracting a large number of members on the one side can be detrimental to the utility of on the other side if the former are of "low quality". In other words, platforms often find themselves in an attempt to find the balance between quantity and quality of players on both sides.

The analysis in Claussen, Kretschmer and Mayrhofer (2013) about how Facebook set incentives to attract high-quality apps after a period of "free entry" illustrates the challenge. The authors report that the social media website's app store was launched in 2007 with very low entry costs for developers, as the platform provided tools to facilitate integration and imposed very few restrictions regarding quality. As the market was flooded with low-quality applications, the platform changed its rules in 2008 in an attempt to increase quality – the possibility of promoting through notifications and invites would be allocated based on the users' feedback (ratings). As a result, the authors find that quality matters more than quantity for usage intensity of applications.

As the example of Facebook, several types of platforms use rules to regulate entry – either creating incentives for high-quality players or imposing entry costs to low-quality agents. In this paper, we study the challenge of balancing quantity versus quality in platform competition.

[1] Crunchbase rank uses, among other variables, the total funding amount and the popularity of its record in terms of recent visualizations.

The context of the study is the reward-based crowdfunding,[2] a growing and (yet) weakly regulated model where entrepreneurs (or project owners) can receive financial support for their ideas from investors (or contributors).[3] In order to balance quantity and quality, crowdfunding platforms use a variety of control levels, from very strict quality standards to cases where entrepreneurs publish their ideas directly on the websites.

Our data comes from the Brazilian reward-based crowdfunding market, where two platforms compete head to head for 93% of the market. Catarse (the "incumbent"), launched in 2011, was the first crowdfunding platform in the country, setting entry costs to entrepreneurs as its staff manually approved every project before allowing it to join the platform in order to verify its adherence to its minimum quality standards. Kickante (the "entrant") entered the market in 2013 with much more flexible rules, including the possibility for entrepreneurs to publish their projects directly on the website. On May 3rd 2016, Catarse opened its system, allowing entrepreneurs to publish their projects directly on the website.

The reduction of entry costs in the incumbent arguably led to an increase in the entries on the entrepreneurs' side and a decrease in the average quality level in comparison to its rival. We aim at investigating if we confirm these hypotheses empirically and also understanding what happens in the supporters' side, as the results are not easily predictable, as we explain later.

We use publicly available data collected from both platforms since their respective inception until December 2016. In order to focus on potential changes in the competitive position between the platforms, we limit our sample to projects launched within the period of 20 weeks prior to the policy change and 20 after.[4]

Our results show that, in line with our hypotheses, the incumbent enjoys an increase in the number of projects in comparison to the competitor with a consequent decrease in quality. However, the number of supporters remains unchanged in comparison to the rival and to the period prior to the change. As this result can be driven by the increase in competition for the supporters' pockets and a decrease in quality, we perform an alternative analysis and find that,

[2] Four crowdfunding models distinguish platforms: in the reward-based model, contributors can receive non-monetary compensations for their financial support. The donation-based crowdfunding facilitates private contributions to public goods. In the lending-based crowdfunding, investors supply funds to individuals, groups or companies, expecting to be reimbursed after a given period, with or without interest rates. Finally, in equity-based crowdfunding, investors become startup shareholders.

[3] In reward-based crowdfunding, investors receive non-monetary payoffs from their monetary participation, and it might be more accurate to refer to them as "contributors". This paper will use both terms indiscriminately as the individual(s) who provide monetary support to entrepreneurs through a crowdfunding platform.

[4] The restriction of 20 weeks before and 20 weeks after allows us to concentrate on a period where both platforms had similar offers. Catarse opened its flexible funding 32 weeks before the policy change we are interested in.

when controlling for quality, the number of supporters increase, suggesting that the degradation in the average quality penalized the platform.

The paper is organized as follows. Section 2 presents the literature review, positioning our contribution in relationship to the existing research. Section 3 sets the theoretical framework and presents the hypotheses. Section 4 presents the data and the empirical strategy. Section 5 presents the results, and Section 6 concludes.

2 Literature review

Crowdfunding platforms can be considered as two-sided markets for they connect two distinct types of economic agents (project owners and investors) and facilitate transactions that would otherwise imply high transaction costs (Belleflamme, Omrani and Peitz, 2015; Viotto da Cruz, 2015).[5] The main characteristic of two-sided markets is the interdependence of different groups of users due to cross-group network effects (see, for example, Caillaud and Julien, 2003), although intragroup network effects may also exist and affect platforms' membership (see, for example, Belleflamme and Toulemonde, 2016). Crowdfunding platforms exhibit positive cross-group network effects as the number of new entries on one side increases entry (and contributions) on the other side (Belleflamme, Lambert and Schwienbacher, 2017). Intragroup externalities on the supporters' side are also positive expected to be positive as the number of new members on one side increases with past participation (Belleflamme et al., 2017).

In two-sided markets, the users' decision of joining any given platform generally depends not only on the relative size of the market on each side, but also on the quality pool each platform attracts, and it might enhance positive network effects (Tellis, Yin and Niraj, 2009; Li and Pénard, 2014), which explains why a monopolist incumbent might be outsold by a higher quality entrant (Evans, 2003).

As platforms do not have control over how much the complementors will supply, or at what quality, they rely on some mechanisms to govern both features. One of the mechanisms used by Internet-based two-sided markets is rules and regulation that aim at encouraging certain types of members to join the platform and sorting out the "lemons" (Damiano and Li, 2008; Viecens, 2006).

[5] Even though there are documented individual initiatives of crowdfunding (Belleflamme, Lambert and Schwienbacher, 2013).

Two main forms of regulation are used by crowdfunding platforms. The first one concerns the mode of access to capital – fixed funding ("all or nothing") or flexible funding ("keep it all"). The former conditions access to capital to a financial threshold established at the beginning of the campaign, while the latter allows project owners to withdraw any positive amount pledged during the campaign. The fixed funding mechanism has the property of a commitment device (Ellman and Hurkens, 2016) and signals project and entrepreneur's quality (Cumming et al., 2014). Projects using this type of mechanism receive greater support,[6] and are more likely to reach the funding goal (Cumming, Leboeuf and Schwienbacher, 2014; Chang, 2016).

Fixed funding is also seen as a reinforcement mechanism to avoid moral hazard problems (Strausz, 2017; Chemla and Tinn 2016). Flexible funding can be efficient for projects that can be produced at any level of financial support such as charities (Chang, 2016). Platforms allowing both modes attract predominantly "flexible funding" projects (Cumming et al., 2014). The two types of financing modes also determine the platform compensation: in the fixed funding model, platforms retain a fraction of what successful entrepreneurs receive while in the flexible funding model, any project having received positive support generates revenues (also a fraction of the total amount raised).[7]

The second form of regulation used by crowdfunding platforms relates to minimum quality standards. Many platforms establish due diligence rules as manual review of projects in order to ensure the compliance with minimum quality standards. The level of minimum requirements varies widely, from very strict rules where platforms interfere with content and requests entrepreneurs' documents, to cases where entrepreneurs publish their ideas directly on the websites.

Empirical evidence suggests that the overall project performance improves with platform control. When platforms perform due diligence, average project quality is higher than when platforms are more open. As a consequence, projects are more likely to reach their financial objective (Cumming and Zhang, 2016; Gaessler and Xu, 2017; Geva, Barzilay and Oestreicher-

[6] As platform revenues come from a percentage of the amount collected by each project owner having access to capital, fixed funding offers revenues per project for successful projects while flexible funding provides lower revenues per project over all the projects. Depending on the magnitude of potential entries in each model and the amount collected, one model may be more profitable than the other – but which one is that is not an easy question.

[7] Catarse fees: 13% over the collected amount for the successful projects in fixed funding and 13% for all projects having raised any amount of money. Kickante fees: 12% for successful projects under both models, 17,5% for projects under flexible funding not having reached their objective. Because most flexible funding projects do not reach their goal, overall fees are 17,5%.

Singer, 2017; Wessel, Thies and Benlian, 2015). However, many platforms – in particular those operating in models not subject to policy scrutiny, like reward-based crowdfunding – might lack means to scale the process as the platform grows without incurring costs. Furthermore, open platforms have shown the ability to attract projects that raise a disproportional amount of pledges (Gaessler and Xu, 2017).

We directly relate to three contemporaneous papers exploring the abolishment of manual review process on Kickstarter, in 2014. They find that a reduction in platform control led to an increase in the number of projects entering the platform and a decrease in the average quality of outcomes (Gaessler and Xu, 2017; Wessel, Thies and Benlian, 2015), and of success rate (Geva, Barzilay and Oestreicher-Singer, 2017). Additionally, opening a platform increases project diversity quality and higher level of competition and decreased campaign quality. Our empirical strategy borrows from Doshi (2015), who studies the impact of the arrival of "high performance" projects (i.e., projects raising a disproportional amount of pledges) on subsequent entries and contributions. Finally, we contribute to the two-sided market literature exploring competition between platforms (Rysman, 2004; George and Waldfogel, 2006; Zhu and Iansiti, 2012; Cennamo and Santaló, 2013; Kim and Lee, 2017; Seamans and Zhu, 2014, 2017) and the role of agents' quality (Viecens, 2006; Hagiu, 2009; Tellis et al., 2009; Bohme and Muller, 2012; Claussen et al., 2013; Gabszewicz and Wauthy, 2014; Kim, Prince and Qiu, 2014; Li and Pénard, 2014; Duch-Brown, 2017).

3 Theoretical framework and hypotheses

Crowdfunding platforms coordinate interactions between entrepreneurs searching for capital and investors. On the reward-based form, entrepreneurs set their financing objective, the duration, and pitch using videos and texts – features that signal the project's quality. Contributors observe the presentation of the project, the rewards offered, and decide whether to participate, and at what price.

Contributors tend to be attracted by particular projects or pool of projects. They decide to pitch if the project conveys enough information about the entrepreneurs' trustfulness and the project quality (see, for example, Mollick, 2014). Therefore, when deciding to join a reward-based crowdfunding platform, contributors do not consider the quantity of entrepreneurs, but their

quality.[8] Contributors tend to prefer platforms where there are more contributors, as it increases the probability of a given project to reach enough capital.

On the entrepreneurs' side, we expect the cross-group network effect to be positive for the same reason: a greater number of supporters arguably increases the likelihood of projects to be financed. The within-side effect is ambiguous. Entrepreneurs might prefer platforms with lower number of other projects as to face less competition. In contrast, more entrepreneurs might bring more supporters.

Besides the network effects and quality of other players, the decision to join a crowdfunding platform is governed by the costs incurred on both sides. Reward-based crowdfunding platforms typically do not charge membership fees, only transaction fees. Supporters are not charged for their participation and do not incur the platform fee.[9] The platform fee is incurred by entrepreneurs and represents a fraction of the amount successfully raised – i.e., a percentage of any amount raised under the flexible funding mode or the total money pledged to projects that reach their goal under the fixed funding model.

Entrepreneurs also incur entry costs related to the production of the pitch – preparing videos, writing and revising texts, defining rewards etc. These costs vary with entry requirements defined by the platform – higher standards translate into higher entry costs, implying greater entrepreneurs' effort to prepare their campaigns. In order to guarantee the compliance with minimum quality standards, platforms can manually control the projects before putting them online.

In this paper, we consider a duopoly competition between platform *I*, initially displaying higher minimum quality standards and manually controlling the compliance with these standards, and platform *E*, initially displaying lower quality standards and allowing project owners to publish directly on their website. An entrepreneur that has already decided to join one of the platforms will prefer platform *I* if the expected utility is larger than platform *E*. In other words, if the participation benefit as well as the potential of transaction is higher.

When platform *I* reduces the entry costs by abolishing the manual control, it will attract entrepreneurs who would not consider joining it under the manual control policy. We expect that the number of entrepreneurs increases in comparison to its rival. Formally, we write our first hypothesis:

[8] Incentives might be different in lending and equity-based crowdfunding, where investors might be also interested in the quantity of entrepreneurs on the other side of the platform as it potentially allows them to diversify their portfolio.

[9] They pay a fee related to the transaction platforms (credit card, PayPal etc.).

H1. The reduction of entry costs for entrepreneurs on the incumbent increases the advantage of the incumbent in weekly entries on the entrepreneurs' side.

As evidenced in the two-sided platform literature, lower entry costs entail consequences on the overall platform quality due to the fact that agents who would not have been able to pass the minimum quality standards will now have access to the platform. An alternative possibility is that entrepreneurs who would be willing to engage greater effort to pass the review process will lower their own efforts. In both cases, these entrepreneurs can either be in a pool that would have chosen the rival platform (substitution effect) or new entrepreneurs that profit the new rules to potentially enjoy greater reputation of the incumbent (market expansion). In either case, we expect that the relative quality might suffer decay. We posit that:

H2. The reduction of entry costs for entrepreneurs on the incumbent decreases the advantage of the incumbent in average quality on the entrepreneurs' side.

Should the number of entrepreneurs increase without a decrease in the average quality, the expected result on the supporters' side would be an increase in the number of contributors joining the platform. However, with the expected decrease in the quality, the consequences on the supporters' side are unclear and depend on the strength of both forces. We then write two hypotheses to account for the supporters' side.

H3a. The reduction of entry costs for entrepreneurs on the incumbent increases the advantage of the incumbent in weekly entries on the supporters' side.

H3b. The reduction of entry costs for entrepreneurs on the incumbent decreases the advantage of the incumbent in weekly entries on the supporters' side.

4 Data and empirical strategy

4.1 Context

There exist today 1,362 crowdfunding platforms worldwide (Rau, 2017), most of them competing within their headquarters' country borders. Fourteen of these platforms are in Brazil, a country occupying the twelfth position in number of platforms (Rau, 2017). Forty percent of the active Brazilian population owns a business, but according to the Global Entrepreneurship Monitor

(GEM)[10], Brazilian entrepreneurs struggle to find financial resources – the 2016 edition of the GEM shows that in 2016 it rated 2.65, below other emerging countries like India (3.43) and China (3.32). It is also the worse rate regarding governmental programs aiming at entrepreneurship.

Crowdfunding platforms can alleviate the burden by connecting small investors and entrepreneurs. This possibility, however, depends on the development of the crowdfunding market, which in turn relies on how the platforms evolve themselves.

Two platforms dispute 93% of the reward-based crowdfunding market. The first platform to enter the market was Catarse, launched in 2011 as a fixed funding platform only. Mirroring reward-based crowdfunding platforms in other countries, particularly Kickstarter, it implemented a strict policy regarding minimum quality standards. Catarse's staff manually reviewed every project to ensure it complied with its policy.

Kickante was launched in 2013, offering both fixed and flexible funding, and allowing project owners to publish their ideas directly on their website. Although the average support was historically lower than on its rival (see Table 2.A in the Appendix for the numbers regarding the years 2014 and 2015), the platform managed to attract "high performance" projects (Doshi, 2015), i.e., projects that attract a disproportional amount of support and potentially help the platform development. Figure 1 shows the twenty most successful projects on both websites during all the period.

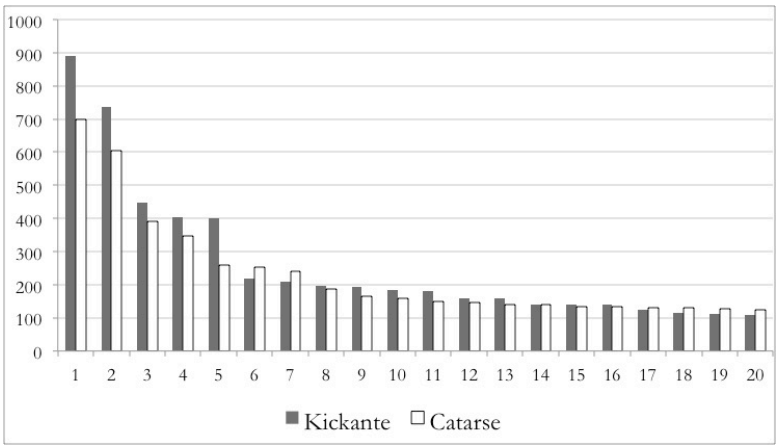

Figure 1: Distribution of the twenty most successful projects on the two Brazilian reward-based crowdfunding platforms in terms of amount raised (in thousand Brazilian Reais).

[10] Results on the Global Entrepreneurship Monitor 2016 are available at www.gemconsortium.org. Last consulted on September 15th, 2017

Both platforms compete in art and creative-related categories (cinema, music, literature), social-related categories (charity-based projects), and entrepreneurial and technological categories. The two platforms accept projects from all over Brazil, and focus on the national market (neither has an English version of their website, for example). In 2015, both platforms had a similar size in terms of number of entries on the entrepreneurs' and the supporters' side (see Figures A.2a and A.2b in the Appendix).

In November 2015, Catarse started a series of changes on the platform to encourage more entrepreneurs to join it. The first one was the launch of "flexible funding". On the firm's blog,[11] they wrote: "Overall, this new model will reach a wider range of projects than Catarse had up to today. The idea is to simplify the crowdfunding process." The minimum standard quality requirements were maintained until May 31st 2016, when Catarse unexpectedly announced it was abolishing the review procedure, allowing project owners to publish directly on the platform.[12]

According to their blog, the idea was to transfer the screening process to the supporters: "We have chosen to withdraw the analysis process because, in addition to simplifying the creation of a campaign, we believe that the evaluation of the community itself is very effective. Nothing better than the very people who use Catarse every day to validate if an idea is good enough to go ahead and succeed in raising funds. With this we can dedicate ourselves to creating more and more educational materials, and to make projects leave the paper with more and more autonomy!"

The blog post suggests that the decision was based on the idea of scalability mentioned in the literature review (Gaessler and Xu, 2017). The choice of the reward-based crowdfunding in Brazil enables us to compare two similar platforms competing head-to-head in several features, and holding important distinctions about the entry costs. This setting allows us to isolate the result of the policy change in the competitive dynamics, teasing out other potential distinctions between both platforms. Figures 2a and 2b display the distribution of entrepreneurs and contributors on both platforms 20 weeks period and after the policy change on Catarse (vertical line).

[11] "Catarse flex: flexible crowdfunding on Catarse" ("Catarse flex: crowdfunding flexível no Catarse"), available at http://blog.catarse.me/catarse-flex-crowdfunding-flexivel-no-catarse/. Last consulted on August 15th 2017.
[12] "Your crowdfunding project one button away" ("Seu projeto de financiamento coletivo a um botao de distância"), available at http://blog.catarse.me/sem-analise/#more-23554582760. Last consulted on August 15th 2017.

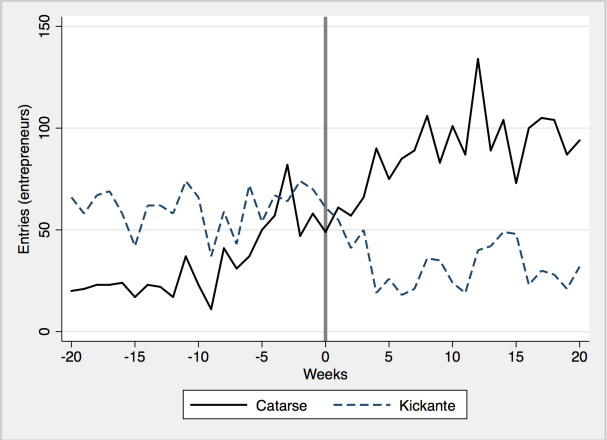

Figure 2a: Number of entries on the entrepreneurs' side on both platforms 20 weeks before and 20 weeks after the policy change.

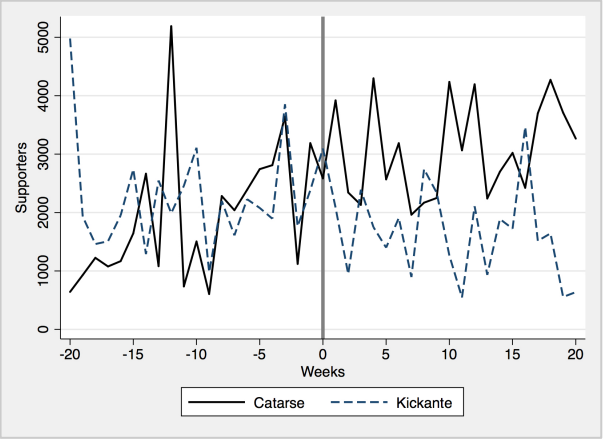

Figure 2b: Number of entries on the supporters' side on both platforms 20 weeks before and 20 weeks after the policy change.

4.2 Data

As many reward-based crowdfunding websites, Catarse and Kickante keep the finished projects online with all the public information available as in the last day of campaign. This enables the collection of publicly available data using web-scrapping techniques.

We collected information from each platform's inception to December 2016, yielding a dataset of 12,338 projects. For each project, we have the following information: the financing mode (fixed funding or flexible funding), the financing goal, the total amount collected, the total number of supporters, the category, the location (city and state), and the first and last day of each project. We also collected information about the elements used in the description of each project (videos, images, texts), as they traditionally serve as proxy of quality in the crowdfunding literature (see, for example, Mollick, 2014).

We dropped projects that were "tests" or "drafts" as well as those under R$2,000 of goal, in line with the literature on crowdfunding (see, for example, Mollick, 2014). We further limit the sample to projects whose first day is within the 20 weeks prior the policy change and 20 weeks after.[13] The final sample contains 2,012 projects, aiming at goals from R$2,000 to R$490,000, and effectively raising from R$10 to R$448,893 from up to 1,913 supporters (considering only projects having had access to capital, please note that flexible funding projects can withdraw any positive amount raised, even not reaching the goal).

[13] The restriction of 20 weeks before and 20 weeks after allows us to concentrate on a period where both platforms had similar offers. Catarse opened its flexible funding 32 weeks before the policy change we are interested in.

4.3 Empirical strategy

Crowdfunding platforms use categories to facilitate search and matching, and each entrepreneur chooses one category for her project. We expect that projects in the same categories hold certain similarities, and supporters of one category have interest in projects of similar categories (Doshi, 2015). For this reason, our empirical analysis relies on a panel of weekly categories within each platform. Only categories that are common to both platforms are used (categories that do not fall into this description represent a very small sample of projects and supporters).

Our dependent variables are the number of projects, the number of supporters, and the average number of videos. Videos are traditionally a proxy for quality on the crowdfunding literature as it implies an effort of the entrepreneur to pitch besides the textual description. As an alternative, we use the average number of words as a proxy of the efforts entrepreneurs engaged to pitch. We assume that higher quality project owners engage greater efforts to pitch. Due to data constraints, one substantial assumption is that all supporters arrive at the last day of the campaign. Another assumption is that both platforms account for the whole market, disregarding fringe platforms.

Our main independent variables are *after*, a dummy taking the value 1 if the week occurs after the change and 0 otherwise, and *incumbent*, a dummy takes the value 1 if the observation is on Catarse, and 0 otherwise.

The identification strategy relies on the fact that the minimum standard with manual control policy was not announced until it was operational on the platform. In other words, project owners were unlikely to have anticipated the changes and strategically planned the campaign launch to the posterior period.

One potential concern relates to changes in the crowdfunding environment, for example, with growth in the overall adhesion that would increase the participation on both platforms. We include variables to control for time-varying events. The variable *category age*, the period in weeks from the first project on the focal category up to the focal week, aims at accounting for distinct trends in different categories depending on how long they are present on the platform (and consequently how many projects were presented under the focal platform over time, as in Doshi, 2015).

In order to deal with potential confounding factors arising from eventual shifts in the popularity of crowdfunding that would impact the number of entries on both sides, we follow

previous work (Choi and Varian, 2012; Wu and Brynjolfsson, 2015; Doshi, 2015) and use the Google Trends index to control for crowdfunding popularity. We use the words "crowdfunding" and its Portuguese counterpart ("financiament coletivo") as well as the name of both platforms (Catarse and Kickante). As the word "catarse" relates to other contexts, we multiply the word by "crowdfunding" and "financiamento coletivo" to moderate the search frequency (see Figure A.2 in the Appendix for the relative search frequencies as measured by Google Trends).

Finally, we account for network effects by using one-period lag of the number of entrepreneurs and number of supporters. Our assumption is that each agent observers the market at time t and makes the decision of which platform to join at time $t+1$. Contemporaneous agents do not observe each other's decisions before entering the platform. For example, consider an entrepreneur that decides to set a crowdfunding campaign. She will be more likely to consider the state of the market as it is prior to her decision to effectively enter the market. Likewise, on the supporters' side, the consideration will be more likely to take advantage of the information regarding past performance, and not contemporaneous. Although these assumptions are needed due to data limitations, they capture behavior observed in the market.

On the entrepreneurs' side, the situation tends to be more ambiguous. The number of entrepreneurs does not necessarily influence the supporters – as supporters are assumed to prefer quality to quantity. As for the direct network effect, it can go both ways. Entrepreneurs might prefer platforms with higher number of other similar entrepreneurs as it signals the presence of supporters who enjoy projects in a particular category. They might also dislike more entrepreneurs as it represents greater competition for the supporters' pockets.

Table 1 presents the main variables and Table 2 gives summary statistics at the category-platform-week level.

Table 1: Main Variables.

Entries	Total number of entries on the entrepreneurs' side by category-platform each month.
Supporters	Total number of entries on the supporters' side by category-platform each month.
After	=1 if the month is after the policy change, and 0 otherwise.
Incumbent	=1 if the category-platform pair refers to the incumbent, and 0 otherwise.
Category age	The time to date of the first project on the focal category and platform, in months.
Google Trends	A relative measure captured from Google Trends website using search words relative to crowdfunding and to the websites' names.

Table 2: Summary statistics at the category-platform-week level.

	Catarse				Kickante			
	Before		After		Before		After	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Entries - Projects	3.35	2.80	6.18	4.95	4.99	4.89	4.61	5.66
Total Pledged ($1,000)	19.67	42.92	22.08	45.39	17.10	29.92	20.07	38.59
Supporters	182.13	356.50	216.33	324.02	187.30	377.78	181.20	257.74
Projects w/ Access to Capital	1.76	1.93	3.96	3.15	4.59	4.72	3.14	2.92
Average # Videos	0.78	0.48	0.57	0.58	0.72	1.08	0.73	0.86
Average Words in Pitch	507.39	337.21	439.15	275.73	396.23	249.99	463.82	332.93

4.4 Hypotheses testing

To assess whether the policy change in the incumbent increased or decreased its competitive advantage in comparison to its rival on both sides of the market, we estimate the following model:

$$Y_{ct} = \beta_1 * after + \beta_2 * after * incumbent + \sigma_{ct} + \lambda_t + \varepsilon_{ct}, \qquad (1)$$

where c indexes each category-platform pair and t indexes time in months. In Equation 6, Y_{ct} represents entrepreneurs' entries, number of supporters, and the average of videos on platform-category c at time t. *Incumbent* and *after* are dummies as described in the previous subsection. The term σ_{ct} represents controls at the category-platform-week levels: the *category age* at the focal platform as measured by the number of months from the first project on that category, and lagged variables to account for network effects. When the dependent variable is the number of entrepreneurs, we use the lag of entrepreneurs and the lag of supporters (because both variables are highly correlated, we introduce them one at a time). When the dependent variable is the number of supporters, we only use the lag of supporters, as previously explained. The term λ_t represents the Google Trends index (as previously explained). Finally, ε_{ct} represents the idiosyncratic error term.

Please note that while the empirical specification has a design of a difference-in-difference model, both platforms operate in a competitive environment, and the change on a platform is

likely to impact the performance on the other – actually, this is part of our hypothesis and the reason of this study. Therefore, the coefficient of interest β_2 must be interpreted as the differential impact of the policy change on the incumbent in comparison to the entrant – and not the "classical" difference-in-difference (Doshi, 2015).

When the dependent variable is the number of entries, the expected result for β_2 is positive, as the platforms changing its entries might attract project owners that would otherwise not have joined.

When the dependent variable is the average quality as measured by the number of videos, the expected result for β_2 is negative, as the decrease in the entry costs might attract more low-quality project owners than the rival does.

As for the number of supporters, there are three possible results for β_2. The first one is $\beta_2 > 0$ implying that even if more lower quality project owners entered the platform, the net result of more entrepreneurs benefits the platform changing its policy also on the supporters' side (perhaps not proportionally). The second one is $\beta_2 < 0$ if the entrepreneurs' side is flooded with bad quality projects, crowding out the platform on the supporters' side.

5 Results

5.1 Weekly entries and average quality

As our variables of interest are non-negative and highly-skewed, we estimate Equation 1 using the Poisson model with standard errors clustered at the category-platform-week level (Santos Silva and Tenreyro, 2006). Tables 3 display the results of the estimation of Equation 1 using the number of entrepreneurs as the dependent variable. The main results with the time-varying variables and the week fixed effects are displayed in Columns 1 and 2. Column 1 accounts for direct network effects using one lag for the number of entrepreneurs and Column 2 controls for indirect network effects using the lag for the number of supporters. Columns 3-6 display alternative specifications without week fixed effects and Google Trends, for comparison.

Table 3: Incumbent's advantage concerning entrepreneurs' entry.

	(1)	(2)	(3)	(4)	(5)	(6)
After*Incumbent	0.721***	0.861***	0.687***	0.833***	0.720***	0.862***
	(0.225)	(0.311)	(0.228)	(0.316)	(0.224)	(0.311)
After	0.381*	0.453	0.202	0.240	0.355*	0.399
	(0.205)	(0.278)	(0.193)	(0.297)	(0.190)	(0.280)
$\Delta(\text{Projects})_{t-1}$	0.0302***		0.0307***		0.0303***	
	(0.00755)		(0.00713)		(0.00738)	
$\Delta(\text{Supporters})_{t-1}$		3.66e06		4.10e06		3.31e06
		(4.80e05)		(4.35e05)		(4.58e05)
Trends	Yes	Yes	No	No	Yes	Yes
Week FE	Yes	Yes	No	No	No	No
Observations	822	822	823	823	822	822
Number of groups	33	33	33	33	33	33
Wald chi2	(8)170.70	(8)55.09	(3)77.99	(3)30.50	(7)173.21	(7)55.43
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Dependent variable: number of entries on the entrepreneurs' side at the category-platform-week level. Coefficients calculated using the Poisson model with standard errors clustered at the category-platform level (in parenthesis), ***p>0.01, **p>0.05, *p>0.1.

The coefficient for *After*Incumbent* is β_2, our estimator of interest. The coefficient is positive and statistically significant at the 1% level for all the specifications, suggesting that after the change, the incumbent benefits of a steep increase in the number of new entries at the category-platform level in comparison to the entrant, providing support to H1.

We now turn to the analysis of H2, using the average videos as a proxy for quality. The main results are on Columns 1 and 2 of Table 4, similar to the previous presentation. The coefficient of interest is negative and statistically significant at the 1% level for all specifications, suggesting that, following the policy change, the incumbent saw a sharp decrease in average quality as measured by the average number of videos in comparison to the average performance of its rival. In other words, the incumbent loses competitive advantage in comparison to average quality of projects of the rival, in line with H2.

Table 4: Incumbent's advantage concerning average quality.

	(1)	(2)	(3)	(4)	(5)	(6)
After*Incumbent	-0.543***	-0.548***	-0.491***	-0.498***	-0.543***	-0.547***
	(0.125)	(0.128)	(0.114)	(0.117)	(0.126)	(0.129)
After	0.325**	0.328**	0.170*	0.169*	0.385***	0.387***
	(0.129)	(0.130)	(0.0904)	(0.0862)	(0.127)	(0.128)
Δ(Average Videos)$_{t-1}$	0.0211		0.0376		0.0207	
	(0.0672)		(0.0638)		(0.0675)	
Δ(Supporters)$_{t-1}$		2.51e-05		3.79e-05		2.78e-05
		(4.09e-05)		(4.41e-05)		(4.30e-05)
Trends	Yes	Yes	No	No	Yes	Yes
Week FE	Yes	Yes	No	No	No	No
Observations	822	822	823	823	822	822
Number of groups	33	33	33	33	33	33
Wald chi2	(8)25.74	(8)32.59	(3)21.95	(3)21.85	(7)25.34	(7)30.86
Prob > chi2	0.0012	0.0001	0.0001	0.0001	0.0007	0.0001

Dependent variable: average videos at the category-platform-week level. Coefficients calculated using the Poisson model with standard errors clustered at the category-platform level (in parenthesis), ***p>0.01, **p>0.05, *p>0.1.

Table 5 displays the results for the estimation of Equation 1 with the number of supporters as dependent variable. Column 1 displays the main results, and the main coefficient is not significantly different from zero, suggesting that the difference between both platforms remained the same after the policy change. On Column 2, we include controls for quality, namely the average videos per week and the average size of texts per week. The main coefficient is then statistically significant at the 1% level, suggesting that the decrease in the average quality did not allow the number of supporters to increase with the number of entrepreneurs. Columns 3-6 are displayed for comparison, with and without the time-varying variables as in the previous cases.

Table 5: Incumbent's advantage concerning entrepreneurs' entry.

	(1)	(2)	(4)	(3)	(5)	(6)
After*Incumbent	0.328	0.440**	0.176	0.425**	0.231	0.444**
	(0.189)	(0.215)	(0.160)	(0.190)	(0.131)	(0.210)
After	0.309	-0.347**	0.306	-0.228	0.313	-0.310**
	(0.215)	(0.176)	(0.199)	(0.156)	(0.214)	(0.134)
$\Delta(\text{Supporters})_{t-1}$	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Control for quality	No	Yes	Yes	No	No	Yes
Trends	Yes	Yes	No	No	No	No
Week FE	Yes	Yes	No	Yes	No	Yes
Observations	822	822	823	823	822	822
Number of groups	33	33	33	33	33	33
Wald chi2	(8)16.00	(10)53.41	(3)2.54	(5)46.05	(7)15.88	(9)53.41
Prob > chi2	0.0423	0.0000	0.4689	0.0000	0.0262	0.0000

Dependent variable: number of entries on the supporters' side at the category-platform-week level. Coefficients calculated using the Poisson model with standard errors clustered at the category-platform level (in parenthesis), ***p>0.01, **p>0.05, *p>0.1.

5.2 Market share

One question that emerges from our results, in line with the platform competition questions investigated in the present paper, is whether the policy change benefited the incumbent in terms of market share on both sides of the market. We are particularly interested in the platform revenues, which we calculate multiplying the total amount collected for each successful project under the fixed model and for all the projects under the flexible model by their respective platform fee.[14]

[14] Catarse fees: 13% over the collected amount for the successful projects in fixed funding and 13% for all projects having raised any amount of money. Kickante fees: 12% for successful projects under both models, 17,5% for projects under flexible funding not having reached their objective. Because most flexible funding projects do not reach their goal, overall fees are 17,5%.

Revenues are aggregated per project at the category-week level, and generate the variable "market share", which is the revenues of the incumbent divided by the revenues of both platforms. We estimate the following model:

$$Y_{ct} = \beta_1 * after + \lambda_t + \sigma_{ct} + \varepsilon_{ct}, \qquad (2)$$

where Y_{ct} is the incumbent's market share in revenues at the category-week level, and the coefficient of interest is β_1, the variation of market share after the policy change, controlling for other factors that might change the participation of market share. As the dependent variable is bounded between zero and one, we run a Linear Probability Model.[15] Table 6 displays the results for Equation 2.

Table 6: Incumbent's advantage concerning market share (revenues).

	(1)	(2)	(3)
After	0.0562	0.168***	0.169***
	(0.0651)	(0.0324)	(0.0393)
Constant	-1.193	0.486***	0.460***
	(0.769)	(0.0231)	(0.0761)
Observations	495	495	495
R-squared	0.063	0.053	0.053
N. of groups	17	17	17
Category Age	Yes	Yes	Yes
Trends	Yes	No	Yes
Week FE	Yes	No	No
R2	0.0680	0.0545	0.0550
F	(4,474)=7.91	(1,477)=26.71	(3,475)=8.93
Prob > F	0.0000	0.0000	0.0000

Dependent variable: revenue share for the incumbent at the category-platform-week level. Coefficients calculated using the Linear Probability Model. Standard errors in parenthesis, ***p>0.01, **p>0.05, *p>0.1.

Column 1 shows that the coefficient of interest is positive, but not statistically significant, suggesting that the incumbent did not gain market share in revenues with the policy change.

6 Conclusion

[15] Qualitatively similar results are obtained using robust standard errors.

Our paper emphasizes the complex competitive dynamics in two-sided markets, particularly when platforms need to balance the generation of critical mass and the attraction of high-quality members. Platforms typically use minimum quality standards to avoid attracting "lemons" at the price of creating entry costs that might be detrimental to the generation of critical mass over time.

The context of our study is the reward-based crowdfunding, a financing model where entrepreneurs pitch on digital platforms for monetary support of investors offering special prizes in exchange. We focus on two platforms competing head to head in the Brazilian market. While one platform ("incumbent") has strict regulations, with *ex ante* review of projects, the other ("entrant") allows project owners to publish directly on their web page. On May, 2016, the first platform abolishes its rules and completely opens the access to project owners. The aim of this study was to understand how the reduction in entry costs in one platform shapes competition in the market.

Our results show that the reduction in entry costs benefits the incumbent in comparison to the entrant in the number of entrepreneurs' joining the platform. However, the relative average quality of projects suffers a sharp reduction. The countervailing forces between the increase in the number of entries and the decrease in the average quality yield a "null effect" on the supporters' side. When we moderate the entry on the supporters' side by the average quality of projects, we observe an increase in the number of supporters for the changing platform. The results evoke questions regarding the effects of the change in terms of market share. We show that the incumbent sharply increases the market share on the entrepreneurs' side while it remains steady on the supporters' side.

Overall, the paper suggest that attracting more entrepreneurs did not offer competitive advantage in terms of potential transactions to the incumbent reducing the entry costs.

While our study provides insights about competition on two-sided markets, it raises new questions that can be the theme of future research. For example, if keeping the manual review process might be not scalable over time, the focus on attracting high-quality entrepreneurs could have led to more advantageous outcomes. In order to confirm this intuition, new research could explore alternative responses to competition in two-sided platforms.

Our results also raise questions regarding alternative scenarios: what would have happened the competition landscape hadn't the incumbent changed? And what would be

the outcome had the incumbent changed on another period of time? An assessment using exercises with counterfactual simulations would enable a thorough understanding about these alternative scenarios regarding distinct possible decisions from the platform management.

New research could also explore questions regarding the social welfare. On the one hand, one might question whether reducing entry costs in crowdfunding platforms enables the entry and financing of projects that would otherwise remain unfinanced. On the other hand, whether this change will create a market of "lemons" in the long run.

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Appendix

Table A.1: Thirty-five first companies in the Crunchbase rank*

Rank	Firm	Country	Description (brief)
1	**Alibaba****	**China**	**Online marketplace**
2	Xiaomi	China	Mobile phones and consumer electronics provider
3	SpaceX	US	Rockets and spacecraft manufacturer
4	ASUS	Taiwan	Hardware and electronics manufacturer
5	Nvidia	US	Circuits manufacturer
6	**Netflix****	**US**	**Internet television network**
7	Blue Apron	US	Delivery service of recipes and the respective required
8	Medtronic	US	Medical device provider
9	Infosys	India	Consulting, technology and outsourcing firm
10	Siemens AG	Germany	Engineering and electronics company
11	HubSpot	US	Cloud-based, inbound marketing software
12	Singapore Post	Singapore	Mail, logistics and retail solutions provider
13	**Kickstarter****	**US**	**Crowdfunding platform for creative projects**
14	**Uber****	**US**	**Ride-hailing platform**
15	**BuzzFeed****	**US**	**News and social media**
16	**Reddit****	**US**	**Social media**
17	Dollar Shave Club	US	Shaving products delivery
18	Fitbit	US	Wearable sensors to track daily activities
19	Virgin Australia	Australia	Australia's second-largest airline
20	23andMe	US	Human genome research company
21	DJI	China	Drones
22	**Apple****	**US**	**Hardware, software and electronics manufacturer**
23	Bharti Airtel Ltd	India	Telecommunication service provider
24	JD.com	China	Online retalier
25	**MakeMyTrip ****	**India**	**Online travel company**
26	Lazada Indonesia	Indonesia	Online retalier
27	Charter	US	Telecommunication services provider
28	GoPro	US	Personal cameras for extreme action provider
29	Rosneft	Russia	Russia-based petroleum company
30	Tencent Holdings	China	Chinese internet service portal
31	**Yelp****	**US**	**Online "Yellow pages"**
32	**Grab****	**Singapore**	**Southeast Asia's ride-hailing platform**
33	University of	US	University
34	Symantec	US	Security solutions provider
35	General Motors	US	Cars and trucks manufacturer

*As in September 15, 2017; ****Two-sided/multi-sided business model firms**

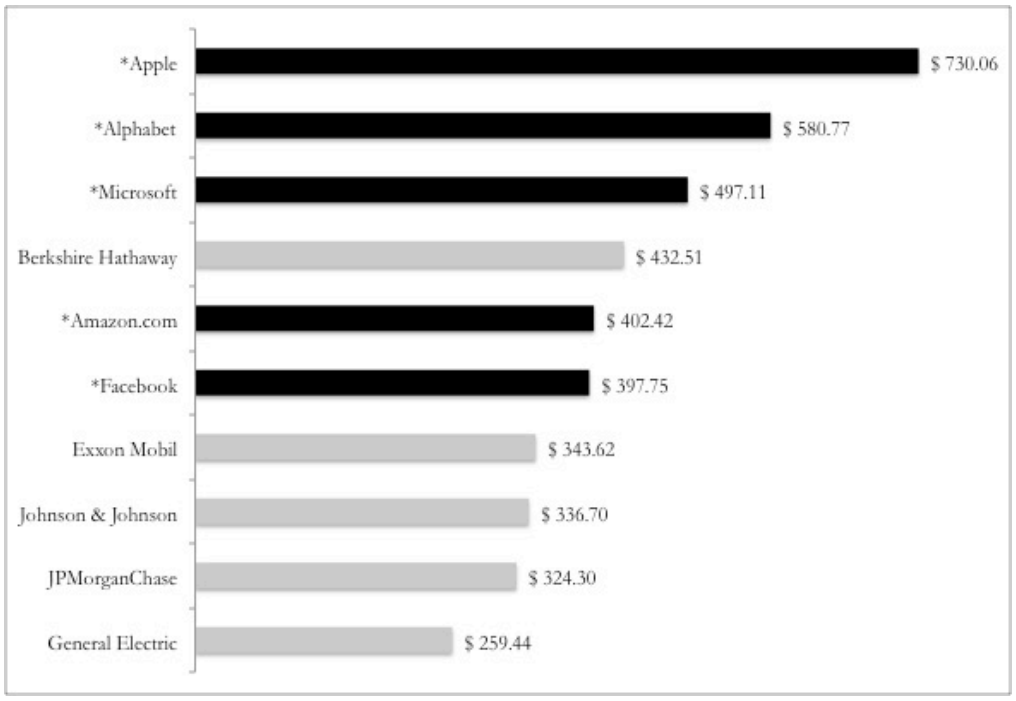

Figure A.1 The ten greatest US-based firms by market capitalization as of March.7th, 2017. In black, firms with business models based on two-sided markets. Sources: Google Finance / Yahoo Finance / MSN Money / CNBC.[1]

[1] Information available at https://www.cnbc.com/2017/03/08/the-top-10-us-companies-by-market-capitalization. Last consulted on September 10th, 2017.

Table A.2: Top countries in number of crowdfunding platforms (Rau, 2017). *

Position	Country	# Platforms
1	China	402
2	UK	143
3	USA	123
4	France	70
5	Germany	58
6	Netherlands	51
6	Spain	51
7	Australia	29
8	Italy	28
9	Canada	23
10	Poland	19
11	India	15
11	South Africa	15
11	South Korea	15
11	Switzerland	15
12	Brazil	14
12	Mexico	14
12	Singapore	14

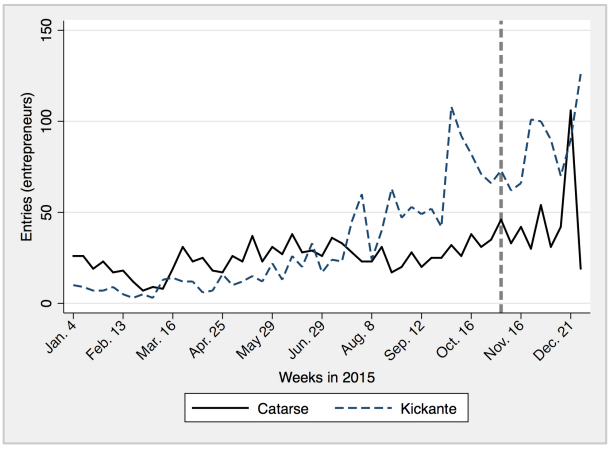

Figure A.2a: Number of weekly entries on the entrepreneurs' side on both platforms in 2015. The dashed vertical line represents the moment where Catarse includes the flexible funding in its menu.

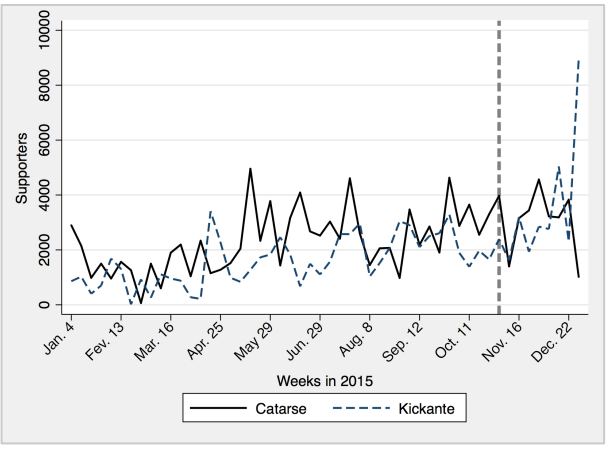

Figure A.2b: Number of weekly entries on the entrepreneurs' side on both platforms in 2015. The dashed vertical line represents the moment where Catarse includes the flexible funding in its menu.

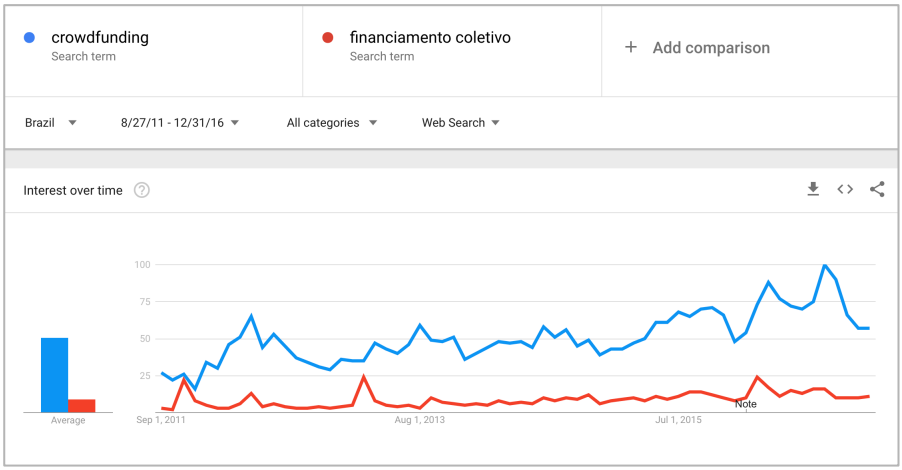

Figure A.3 Google Trends results for "Crowdfunding" and "Financiamento Coletivo" in Brazil, from 2011 to 2016.