The Geography of Civic Crowdfunding: Implications for Social Inequality and Donor-Project Dynamics

Daniel Brent[a*] *& Katie Lorah*[b]

[a]*Louisiana State University*

[b]*ioby*

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Abstract

Civic crowdfunding combines the power of private crowdfunding with grassroots organization to directly fund local public projects. This article analyzes fine scale geographic data on 18,000 donations to roughly 800 campaigns from a leading civic crowdfunding platform to examine the implications of civic crowdfunding for inequality and the link between donors and projects. The neighborhood characteristics of projects, including median household income, do not impact the ability to raise capital, which addresses a common concern that civic crowdfunding will exacerbate inequality in neighborhood amenities. The average distance of a donor to a project is over 300 miles and the median distance is 8 miles, indicating that while projects elicit donations from outside their community local donations are very important. Donors' income does not influence whether donors contribute to projects in low income or high income neighborhoods. The findings serve as a guide to future research on civic crowdfunding and inform how the expansion of this new funding mechanism can integrate into local government policy.

Keywords: civic crowdfunding; social inequality; spatial analysis; charitable giving

JEL Codes: L31; H41; D71; D64

[*]Corresponding Author: email: dbrent@lsu.edu; mailing: 2300 Business Education Complex, Department of Economics, Louisiana State University Baton Rouge, LA, 70803.

1 Introduction

Crowdfunding is a relatively recent development of the digital economy where individuals or firms without access to traditional forms of capital raise money online through small contributions from many donors. Kickstarter, a well-known platform that funds creative projects including entrepreneurs and artists, has raised more than $3 billion from 11 million individuals to fund over 120,000 projects.[1] Civic crowdfunding borrows principles from both private crowdfunding and grassroots community organization to collect individual donations to fund community projects. Advocates of civic crowdfunding argue that it empowers community leaders to initiate worthwhile public projects in their neighborhoods and allows citizens to vote with their pocketbooks. Community decisions regarding the type of project to initiate and where to allocate personal resources serve as a guide to policy-makers for future investments. However, challenges for civic crowdfunding include the possibility of increasing the unequal distribution of neighborhood amenities and the abrogation of government responsibilities (Davies 2015; Stiver et al. 2015). Before civic crowdfunding fills a major role in public policy it is critical to understand the details behind how civic crowdfunding operates.

We analyze data from ioby ("In our Backyards"), one of the leading civic crowdfunding platforms that targets projects in under-served communities. When considering the expansion of civic crowdfunding in improving local communities it is important to consider what types of projects are feasible to fund in this setting. Civic crowdfunding is not a replacement for traditional government spending on infrastructure. Projects are generally small scale in comparison to municipal capital budgets. The median funding level of a project is $3,190 and over 80% are less $5,000. Many of the projects involve local public goods such as parks, green infrastructure, and community gardens; streetscape enhancements such as crosswalks and bike lanes; and public art. Others are temporary or less place-based, such as volunteer cleanup days; youth after-school programs; and street festivals. Although civic crowdfunding does not typically provide large-scale public goods, the projects improve the lives of the community members and represent a shift to a more participatory form of urban planning.

[1] Statistics for Kickstarter are available at https://www.kickstarter.com/help/stats.

We address three key questions in this research. First, do neighborhood characteristics, such as median income, determine the ability for civic crowdfunding campaigns to raise capital? A major concern of civic crowdfunding is that eliciting private funds to improve neighborhoods will exacerbate inequalities in the quality of public amenities if projects in wealthier neighborhoods are more likely to be funded. We directly address this concern by examining data on crowdfunding campaigns at a fine spatial resolution. We do not find any evidence for this concern; rather neighborhood characteristics are poor predictors of both the total donations and the number of donors to civic crowdfunding campaigns. This finding holds is a setting with a wide range of neighborhood income levels; the median income of neighborhoods for funded projects extends from under $10,000 to over $250,000.

Second, who are the donors and to what types of projects do they choose to contribute? Understanding donor behavior is important to contextualize the type of projects that can be successfully funded and how the financial responsibility for projects is shared. Donor behavior is also related to the first question regarding the ability of civic crowdfunding to engage a wide cross section of the population, and attract resources from outside the immediate community. Donors from wealthier areas contribute more on average, however, donors from less affluent areas contribute a larger percentage of their income. The income of the neighborhood where the project is conducted does not affect the size of the donation.

Lastly, we analyze the relationship between donors and projects, with a particular focus on geographic distance. We geocode the exact address of both projects and donors to calculate a very precise metric for distance. The mean distance between a donor and project is 364 miles, while the median distance is only 8 miles. Therefore, while most donors are very local, some projects are able to attract donations from distant locations. Additionally, there is significant heterogeneity in the geographic distribution of donors across projects. Analyzing representative projects (by total donations and number of donors) shows that some projects primarily attract donors within the metropolitan area while other receive donations from across the country. Donors who are very close (< 5 miles) give more than those who are those within 5-100 miles, and then the size of donations increases for donors further than 100 miles away. This pattern is consistent for

donations in dollar terms and as a percentage of income. Hyper-local donors likely receive direct benefit from the projects, and distant donors may be connected to the cause or the project leader's social network. The spatial pattern of donors is important to both understand the ability of different types of neighborhood to attract funding for local projects, as well as the interpretation of donations as public support for specific types of public amenities.

2 Related Literature

Since civic crowdfunding is a relatively new phenomenon there is a lack of research from economists on the subject.[2] There is some recent research that serves as a foundation to build upon, though no studies utilize fine grain geographic information on projects and donors that allow an accurate measure of the neighborhood characteristic for the main agents in civic crowdfunding. The closest research that explicitly explores civic crowdfunding is based on a masters thesis by R. Davies (2014). This research provides some of the background for civic crowdfunding and examines data from a variety of public-good crowdfunding on more general crowdfunding platforms such as Kickstarter and Indiegogo, as well as civic crowdfunding platforms including ioby. Stiver et al. (2015) also study civic crowdfunding and, among other insights, highlight the challenge of the potential for a "social wedge" where projects are only funded in wealthy areas.

There is somewhat more research on general crowdfunding models that fund private companies, products, or individuals. Belleflamme, Lambert, and Schwienbacher (2013) set up a model that predicts entrepreneurs prefer pre-ordering models of crowdfunding when the capital goal is small and profit sharing when capital requirements are large. The same authors examine individual crowdfunding campaigns and analyze the factors that determine success; among other factors, non-profits have higher success rates (Belleflamme, Lambert, and Schwienbacher 2014). Pitschner and Pitschner-Finn (2014) expand on that research by collecting a larger sample of products and find that while non-profit campaigns have a higher probability of success and attract higher average contributions, for-profit campaigns raise more money from more donors. However, the

[2] A search on IDEAS on July 13, 2017 showed 1 English language paper matching the term "civic crowdfunding".

authors claim that the the advantages of for-profit campaigns are driven by a small number of very successful campaigns, and excluding these cases non-profits are more successful by all four metrics (probability of success, average contribution, number of donors, and total contributions).

Crowdfunding platforms such as Kickstarter use reward-based crowdfunding that gives backers advance access to a product or service. In 2012 the JOBS act opened the door for companies to issue equity on crowdfunding platforms, and the rule became active in 2015.[3] Agrawal, Catalini, and Goldfarb (2014) address the economic implications of equity crowdfunding in the context of current crowdfunding trends. They identify seven stylized facts of crowdfunding that are important as crowdfunding expands into other realms including equity financing. Agrawal, Catalini, and Goldfarb (2015) analyse the role of geography in traditional crowdfunding, finding that funding comes from diverse and distant locations. Geography is still important in the context of initial funding as local donors are not responsive to initial funding, but distant donors are much more likely to fund a project if others have previously contributed. The theory is that local donors are likely to be friends and family who will support a project unconditionally, while more neutral donors select from the whole set of alternative projects. The notion that early funding success leads to greater success in the future has been validated in a set of field experiments by Rijt et al. (2014). They find support for the rich-get-richer hypothesis by contributing to randomly selected Kickstarter campaigns and observing that these campaigns attract more funding than control campaigns. We extend the geographical analysis of crowdfunding to civic crowdfunding, where the spatial scope of the final project is fixed, unlike a physical or digital product produced via traditional crowdfunding campaigns.

Due to the incentives in civic crowdfunding, it is inherently different than both traditional crowdfunding and charitable giving. Donating to a civic crowdfunding campaign in one's neighborhood may generate benefits that are more tangible than donating to an organization that funds a variety of projects and services, potentially in many locations. Additionally, social connections work differently when a campaign is led by a specific

[3] See details at https://www.sec.gov/news/pressrelease/2015-249.html

member of the community. These differences make civic crowdfunding an interesting setting to study conventional theories of charitable giving such as the theory of impure altruism and warm glow developed by James Andreoni (Andreoni 1988; Andreoni 1989; Andreoni 1990). In this context agents not only care about the aggregate level of the public good, but also receive utility from the act of donating. List (2011) provides an excellent overview on the economic research on charitable giving as a form of private provision of public goods, many of which apply to civic crowdfunding.

The growth of civic crowdfunding also has implications for many other fields of economics, urban planning, and sustainability science. In environmental economics analyzing direct donations to community projects that provide environmental benefits is related to using donations for nonmarket valuation (Champ et al. 1997; Champ and Bishop 2001; Newell and Swallow 2013; Kotchen 2015) and the spatial distribution of nonmarket values (Loomis 2000; Bateman et al. 2006; Campbell, Hutchinson, and Scarpa 2009; Tait et al. 2012; Schaafsma et al. 2013; Abildtrup et al. 2013; Jørgensen et al. 2013; Johnston et al. 2015). Since many civic crowdfunding campaigns provide community green space, and public open space and lot size are substitutes (Cho et al. 2010), there are implications for urban planning and sprawl. Civic crowdfunding also displays the overlap between the environmental and social goals discussed in A. R. Davies and Mullin (2011).

There is also a link between civic crowdfunding and social capital. Campaign leaders develop valuable skills while running a campaign, and both leaders and donors can become more connected to their community through the course of engaging in a campaign. This is important since social capital is correlated with increased economic performance (Knack and Keefer 1997; Kemeny et al. 2016) and reduced crime (Buonanno, Montolio, and Vanin 2009), although identifying a causal relationship is difficult Durlauf (2002). Specific mechanisms investigated are increased industrial diversification (Cortinovis et al. 2017), firm size (Bürker and Minerva 2014), and local government (Di Porto et al. 2017). While we do not address the impact of civic crowdfunding on community outcomes, future research should address the secondary and long-term benefits of civic crowdfunding related to building social capital. Another set of long-term questions of civic crowdfunding relate to distributional consequences. For example, does private provision of local goods crowd out public provision? Most of the

literature focuses on the reverse question and Andreoni and Payne (2011) provide evidence that the crowding out effect for charities receiving government grants is due to a reduction in fundraising activities. This is related to the literature on residential sorting and environmental justice (S. H. Banzhaf and Walsh 2008; H. S. Banzhaf, Sidon, and Walsh 2012; H. S. Banzhaf and Walsh 2013; Shertzer and Walsh 2016; Shertzer, Twinam, and Walsh 2016). We take a first approach at addressing distributional concerns by analyzing the set of communities able to attract funding in civic crowdfunding campaigns.

3 Civic Crowdfunding/ioby

The pooling of small monetary contributions, whether micro-investments or donations, toward a common goal is not a new concept, but the growing prevalence of online platforms in the past decade has caused "crowdfunding" to become a household word. More than 20% of Americans have participated in an online crowdfunding campaign as of 2016 (Pew Research Center, 2016). Crowdfunding platforms comprise a broad spectrum, with a focus on areas from creative projects to personal medical expenses. The sub-field of civic crowdfunding is focused on pooling small contributions for public or community goods, and in this way is situated somewhat at the intersection of private-interest crowdfunding and traditional philanthropy.

There is another distinction to be made between public-good crowdfunding by government entities for typically publicly-financed goods, such as infrastructure improvements, and civic crowdfunding wherein projects are primarily planned, funded, and implemented by private citizens, residents and community groups looking to improve their own surroundings. While the former model has been employed by platforms like Citizinvester and Spacehive as a response to shrinking public budgets, the latter model, wherein project leaders and donors are community members, is the focus of this study.

The data used here comes from the civic crowdfunding platform ioby, or "In Our Backyards" a nonprofit organization operating in the United States that focuses deliberately on using the crowdfunding model as a community development tool in neighborhoods with a history of public disinvestment. Fundraising campaigns, which must have a public benefit and occur in the neighborhood where the project leader lives

or works, have an average budget size of under $4,000, with a median donation size of $30. The organization operates through an online site that resembles most crowdfunding platforms, but a large portion of its service model is offline, with staff providing one-on-one coaching and resources in fundraising, community organizing, project implementation and other topics.

ioby's focus on historically under-served neighborhoods is a deliberate attempt to address a common fear that tech-based tools for civic engagement and investment are contributing to the "digital divide" and exacerbating inequality. This model of civic crowdfunding does not focus on advertising a need to a diffuse and unknown network of investors or donors through online channels, as many others do. Instead, campaign leaders are trained in mobilizing their existing social networks, and in particular, the portion of their networks within their physical, local community. The fact that ioby specifically focuses on combating social inequality needs to be considered when interpreting and extrapolating the empirical results in this article to civic crowdfunding conducted on alternative platforms.

This model of civic crowdfunding, and in fact the larger civic crowdfunding field, is unlikely to grow to such a degree that it becomes a viable replacement for public funding, or even traditional philanthropy. Nor is that a desirable goal for communities or government entities, as challenging as budget shortfalls may be. Instead, a primary question within the field is: how can civic crowdfunding be leveraged not as a replacement to, but as a way to indicate need and collective valuation within a community, to better guide investment from the government and philanthropic sectors?

It also bears mention that there is some preliminary evidence that some of the primary benefits of participating in a place-based civic crowdfunding campaign, whether as a campaign leader or contributor, are non-monetary. Anecdotal evidence suggests that this participation contributes to a greater sense of social resilience; a greater sense of community agency; an increased knowledge of and connection to official decision-making processes; and increased awareness of other opportunities for civic participation, such as voting or running for office. These reports indicate a need to further study the non-monetary benefits of this kind of participation in order to truly quantify the value of civic crowdfunding. Meanwhile, it remains crucial to determine whether the monetary

effects of civic crowdfunding are equitably distributed, or whether there is indication that the field is in fact exacerbating inequality.

4 Data

There are two data sources used in the analysis. The first is project and donor data obtained from ioby. The project data has information on each crowdfunding campaign. The variables of interest for this article are the project address, total number of donors, amount of money raised, and project budget. There are also additional variables such as the start date of the campaign and characteristics of the type of project (environmental, art, etc). There are 673 projects that have completed the funding round and an additional 165 that were currently fundraising at the time the data were obtained. When conducting analysis at the project level we focus on campaigns that have concluded fundraising. The total amount of funding raised at the time the data were pulled was $2,006,725.

The donor data has information on each unique donation to a campaign. The primary donor variables are the donor address, the beneficiary project, the size of the donation, and whether there were any matching funds. There are 18,478 individual donations, however 594 donations were not able to be geocoded. Of the remaining donations, there are 13,184 unique donors.

In order to calculate distances, we geocoded the addresses to acquire geographic coordinates (latitude-longitude) using the Data Science Toolkit in R. We performed several quality control checks to ensure that addresses were correctly geocoded.[4] Geographic coordinates for projects and donors generates precise distance calculations for each donor-project pair and allow us to obtain census data at the block level. We link the coordinates of projects and donors to census geographies using the Federal Communication Commission's geocoding API to obtain the Census FIPS code for each coordinate. Lastly, we download census block group level data from the American Community Survey (2010-2014) for several socioeconomic characteristics. A census block is a geographic area consisting of 600-3000 people. There are over 200,000 block groups in the U.S., representing a relatively fine geographic resolution.

[4] For example, we checked if the state from the geocoded longitude and latitude matched with the administrative data. We also manually examined records that generated missing values for geographic coordinates.

4.1 Summary Statistics

We begin by providing a basic set of summary statistics on projects and donors. Table 1 shows the mean, standard deviation, median, minimum and maximum values for several relevant variables. The average donation is $109, and the median donation is $30. The average and median amount raised for a campaign are $3,190 and $1,271 respectively.[5]

The distance variable is particularly interesting. The average distance between a donor and a project was over 364 miles, however the median distance was only 8 miles. This indicates that most donations are local, but many donors live far away from the project site. When weighting the distance from donor to project by the monetary value of the donation the average distance increases slightly to 388, indicating that more distant donors give larger amounts on average.

Table 1: Summary Statistics of Donations

Variable	Mean	Std. Dev.	Median	Min	Max	Observations
Donation ($)	109	598	30	0	24000	18478
Total Donations ($)	3190	5984	1271	2	68928	673
Total Donors (#)	23	35	13	1	453	673
Distance (miles)	364	786	8	0	10167	17873
Weighted Distance (miles)	388	780	-	-	-	17873

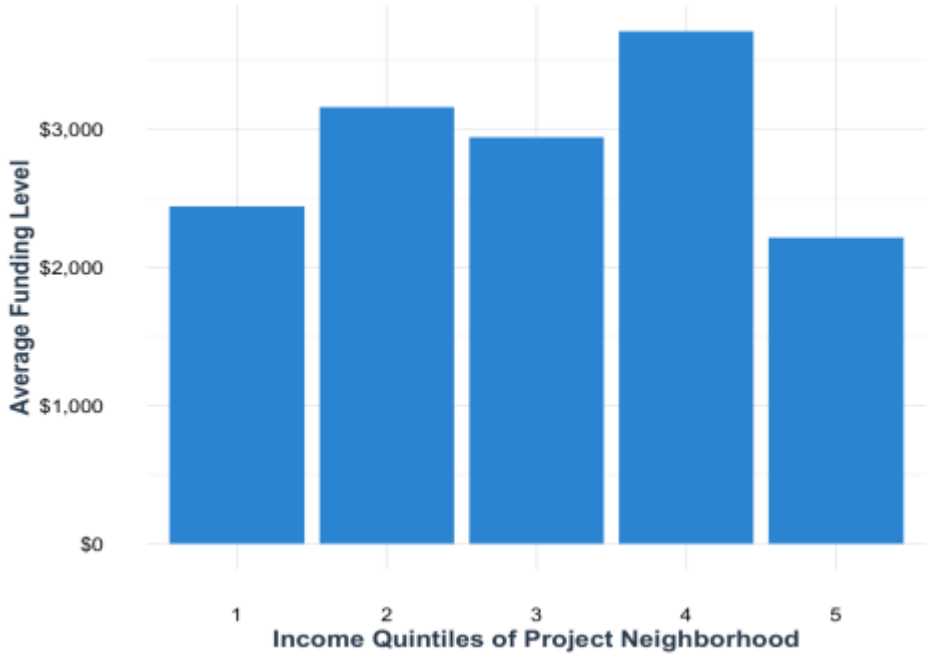
5 Project-Level Analysis

We begin the analysis of project characteristics by examining if higher income areas are able to fund larger more expensive projects. Figure 1 shows the average value of funded projects by quintiles of the median household income of the project neighborhood. The average incomes within the quintiles in our sample ($24,342, $38,908, $50,840, $66,637, $108,383) are relatively similar to the entire country during the same period ($18,817, $31,282, $45,159, $64,617 $110,716). The figure shows that the largest projects are actually in middle-income neighborhoods. The lowest income neighborhoods actually fund slightly more expensive projects than the highest income neighborhoods. This could

[5] These values differ somewhat from the statistics that appear on ioby's website - https://www.ioby.org/about. The data on ioby's website may not include all the projects considered in this analysis, and the website may include data on cancelled campaigns, which this analysis excludes. In the future, it would be worthwhile analyzing which campaigns were cancelled to search for predictors of cancellation.

be due to the features of the projects or other correlated attributes of projects, so we continue the analysis in a multivariate regression framework.

Figure 1: Average Project Size by Median Household Income



5.1 Determinants of Total Donations

In order to understand how income and demographics affect campaign success we analyze the effect of neighborhood characteristics on the total donations that campaigns receive using multivariate regression. The total level of funding that a campaign raises represents is our preferred measure of success. Other metrics, such as achieving the original funding goal, are complicated by ioby's flex funding model whereby a leader can increase or decrease the total level of funding midway through the campaign. The results are presented in Table 2. Median income is in thousands of dollars and the other neighborhood characteristics represent the change in the total donations for a 10% change in the characteristics. The standard errors are in parentheses below the estimated effect and the stars denote statistical significance. Column (1) shows that increasing the size of the budget by $1 is associated with $0.42 in extra donations. At the project level we also calculate the average and median distance of donors, neither of which is statistically significant.

Column (3) adds neighborhood characteristics to explain the funding level of projects. Most of the neighborhood characteristics are not statistically significant, indicating that neighborhood income and demographics are not the primary determinants of funding success. This is consistent with the results in Figure 1. We also examine project categories such as environmental improvements, safe streets or art to determine if certain types of projects attract more donations; none of the categories generated statistically different levels of funding. Adding in the average donor income in column (4) shows that projects that attract donors from wealthier neighborhoods do not raise more money. The one neighborhood characteristic that is statistically significant is the percentage of active transportation - defined as the share of commuters either walking, biking, or using public transportation. Projects in these neighborhoods are smaller on average, which is perhaps a function of the type of project that these communities undertake. The primary lesson from the total donations regression models is that income and other neighborhood characteristics are not the primary drivers of total donations, which refutes a common critique that civic crowdfunding will exacerbate inequality due to larger private funding in wealthier areas. Since the projects are not randomly assigned to neighborhoods the estimates provide general associations and should not be interpreted as causal parameters.

Table 2: The Effect of Project Characteristics on Total Donations

	Model 1	Model 2	Model 3	Model 4
(Intercept)	810.09***	907.35***	610.04	23.97
	(243.05)	(212.51)	(815.28)	(1030.33)
Budget Size	0.42***	0.42***	0.41***	0.41***
	(0.02)	(0.02)	(0.02)	(0.02)
Avg. Distance	0.62		0.67	0.63
	(0.49)		(0.51)	(0.52)
Median Distance		0.58		
		(0.48)		
Median Income			2.92	1.69
			(7.08)	(7.30)
% Non-White			17.49	24.13
			(81.88)	(82.63)
% Active Transportation			-68.84	-74.08*
			(37.11)	(37.67)
% College Educated			144.39	151.37
			(202.81)	(204.20)
% Gov. Assistance			-31.56	-48.48
			(400.36)	(402.69)
Vacancy Rate			113.72	135.00
			(180.47)	(182.86)
Avg. Income of Donors				8.72
				(9.57)
R-squared	0.4	0.4	0.4	0.4
N	589	589	572	568

Notes: Budget size is measured in dollars, Avg. and Median Distance are measured in miles, Median income is measured in thousands of dollars, the percentage variables are in units of 10%, and the average income of donors is measured in thousands of dollars.

5.2 Project-level Cluster Analysis

As an extension to the regression models we also perform cluster analysis to group projects together. Cluster analysis is an unsupervised learning algorithm that iteratively groups observations together that are most similar. We use the partitioning around medioids (PAM) approach developed by Kaufman and Rousseeuw (1990), which is a more robust method of k-means clustering. PAM requires a user-defined number of clusters and we select the number of clusters using optimum average silhouette width criteria. In our setting the optimal number of clusters is two. The clusters are formed using standardized project neighborhood demographics; campaign characteristics are not

used to generate the clusters. We then examine if clusters with different demographics vary in their project characteristics such as the total funding raised and the distance of donors. In the sense the demographics are our "input variables" and project characteristics are out "output variables".

Table 3 shows summary statistics for the demographics used to define the clusters (in italics) as well as the project characteristics for each of the clusters. Cluster 1 can roughly be defined as the "high socioeconomic status (SES) cluster" and Cluster 2 is the "low SES cluster". The projects in Cluster 1 are in neighborhoods with a median income of over $70,000, roughly 25% non-white population and over half has a college degree or higher. Conversely, Cluster 2 contains projects in neighborhoods with median incomes of roughly $30,000 with over 75% of the population as people of color, and less than 20% have a college degree. The projects in Cluster 1 have a higher average funding level of over $3,700 as compared to $2,800 for Cluster 2, and this difference is statistically significant at the 10% level.[6] Projects in Cluster 1 also generate more donations and attract donors from further away, however, only the difference in median distance is statistically significant at conventional levels.[7]

[6] The p-value from a two-sided t-test is 0.07.
[7] The p-values from two-sided t-tests for total donors, average distance and median distance are 0.22 and 0.16, 0.06.

Table 3: Summary Statistics of Project Clusters

Project Cluster 1 (High SES)

	Observations	Mean	Median	Std. Dev	SE
Median Income	294	74512	68986	37806	2205
% Non-White	294	0.26	0.23	0.18	0.01
% Degree	294	0.54	0.54	0.2	0.012
Vacancy Rate	294	0.11	0.091	0.099	0.0058
Total Donations	294	3705	1392	6678	389
# of Donors	294	28	16	38	2.2
Mean Distance	294	293	145	431	25
Median Distance	294	159	5.1	471	27

Project Cluster 2 (Low SES)

	Observations	Mean	Median	Std. Dev	SE
Median Income	290	31079	27991	13843	813
% Non-White	290	0.77	0.83	0.23	0.013
% Degree	290	0.17	0.16	0.11	0.0065
Vacancy Rate	290	0.17	0.14	0.12	0.0073
Total Donations	290	2775	1391	5558	326
# of Donors	290	24	14	36	2.1
Mean Distance	290	253	148	343	20
Median Distance	290	96	7.3	337	20

Notes: Clustering is performed on the demographic variables of project locations in italics (Median Income, % Non-White, % Degree, and Vacancy Rate). The clusters are then used to examine project-specific outcomes (Total Donations, # of Donors, Mean Distance, and Median Distance).

Upon further analysis, some of the differences in the clusters are primarily due to very large atypical projects. When comparing the projects across clusters after excluding projects that brought in over $20,000 in donations (only 2% of all projects), many of the differences disappear. After removing the large-budget projects the average project size is $2,700 in Cluster 1 and $2,400 in Cluster 2 - a difference that is not statistically significant.[8] The number of donors are also relatively similar across clusters. The one feature of the projects themselves that is maintained after removing outliers is that projects in the low-income cluster are generated from donors who live closer to the project.

[8] The p-value from a two-sided t-test is 0.26.

In order to help visualize the cluster analysis we plot the neighborhood characteristics for each cluster in Figure 2. There is a clear pattern in the demographics data of the two clusters. Panel (a) of Figure 2 shows that Cluster 1 has projects in wealthier and less diverse neighborhood, while the panel (b) shows that there is no clear pattern across clusters based on data from the projects themselves in terms of the number of donors and total revenue generated. This supports the finding that demographics of the neighborhoods do not dictate project funding levels.

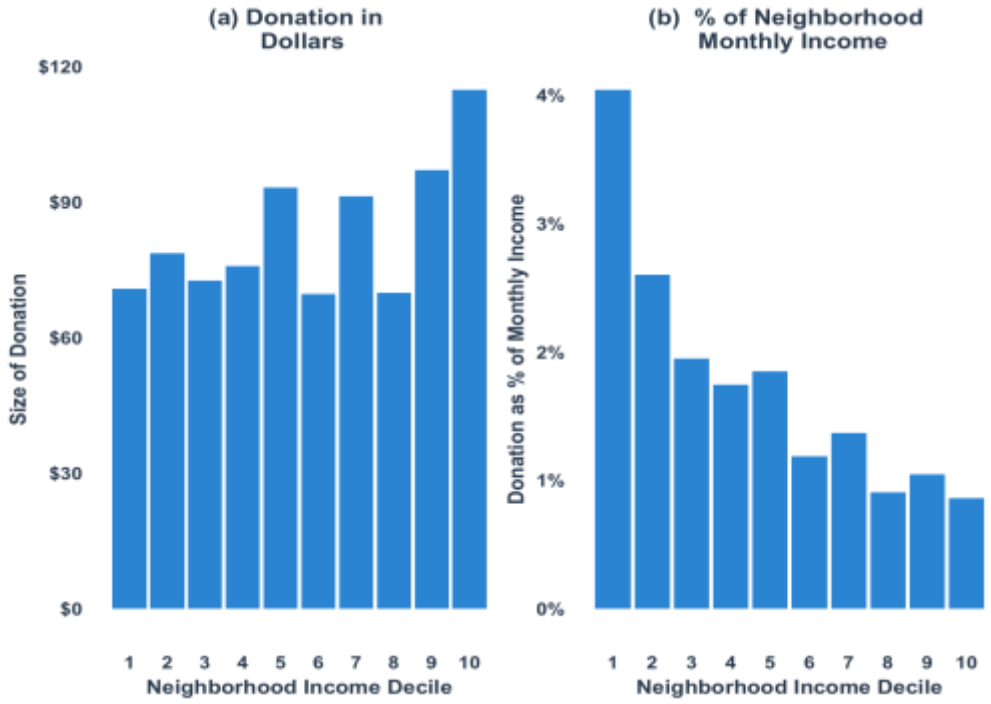
Figure 2: Visualizing Project Clusters

6 Donor-Level Analysis

This section moves to analyzing individual donor decisions, where the donor is the unit of analysis, as opposed to an entire campaign. Incorporating data on individual donations represents one of the contributions relative to existing research on civic crowdfunding (R. Davies 2014; R. Davies 2015; Stiver et al. 2015). Since all projects must be funded by individual donors learning about donor behavior is critical to understand the viability and expansion of civic crowdfunding. We begin the analysis by examining the average size of donations across the income distribution of donors' neighborhoods. It should be noted that similar to the project data our demographic data on donors are based on census data,

so we are actually describing the characteristics of the donors' neighborhoods as opposed to the donors themselves. We use income deciles as opposed to quintiles because we have much more data on donors compared to projects. Panel (a) of Figure 3 shows the average donation for each income decile. The average donation is relatively constant for the first 8 income deciles at roughly $75, and then the average donation increases dramatically for the top 20% of the income distribution to over $100. Panel (b) of Figure 3 shows that donors from poorer neighborhood donate a higher proportion of their neighborhood median income.

Figure 3: Donation Size and Median Household Income



6.1 Determinants of the Size of Donations

Next, we analyze the determinants of donations to campaigns as a function of both donor and project neighborhood demographics. Similar to the regression analysis of project characteristics the parameters should not be interpreted as causal estimates. We also include the distance of the donor to the project as a predictor of the size of donations. Table 4 fits several linear regression models where the size of the donation is the dependent variable and the independent variables are donor and project neighborhood demographics. The variables represent the marginal change in the size of the donation for a one unit change in the variable of interest. Projects with larger budgets attract slightly

larger donations, but more individual donors to a given project decreases the average size of the donation. Donors who are further away from the project site contribute more on average; these may be people with a personal connection to the campaign and/or the campaign leader. Having a matching fund increases the size of the donation by approximately 30%, however we do not control for any selection effects with regards to the type of campaigns that have matching funds. Column (3) replaces the distance variables with dummy variables specifying whether the donor lives in the same zip code or state as the project. The results are similar to the Columns (1) and (2); donors contribute less to projects located within the same zip code and state, though the impact for zip codes is not significant. The neighborhood median income of the project location does not have an impact on the size of the donation, but donors from wealthier neighborhoods donate more.

Table 4: The Effect of Donor Characteristics on the Size of Donations

	Model 1	Model 2	Model 3	Model 4
(Intercept)	70.57***	64.04***	81.67***	46.35***
	(3.36)	(3.40)	(5.26)	(6.75)
Budget Size	0.27***	0.26***	0.26***	0.26***
	(0.02)	(0.02)	(0.02)	(0.02)
# of Donors	-0.32***	-0.30***	-0.30***	-0.31***
	(0.04)	(0.04)	(0.04)	(0.04)
Distance	0.01	0.01*		0.01*
	(0.00)	(0.00)		(0.00)
Fund		0.34***	0.34***	0.29***
		(0.03)	(0.03)	(0.03)
Same State			-24.78***	
			(5.77)	
Same Zip			-8.28	
			(7.76)	
Project Median Income				0.03
				(0.08)
Donor Median Income				0.22***
				(0.06)
R-squared	0.0	0.0	0.0	0.0
N	13696	13696	13710	13276

Notes: The dependent variable is the size of the donation. Budget size is measured in dollars, Distance are measured in miles, Fund is a dummy for a matching fund, Same State and Same Zip are dummy variables. The median income of project and donor neighborhood is measured in thousands of dollars.

6.2 Donor-level Cluster Analysis

Similar to the project cluster analysis, we perform a cluster analysis using PAM for the donor data. In this specification, we cluster solely on the neighborhood demographics of the donors; the optimal number of clusters for the donor data is also two. Once we have clustered donors based on their neighborhood demographics we analyze if the clusters differ in terms of the average donation, distance from the project, and demographics of projects that they fund. Table 5 shows the summary statistics of the two donor clusters, which, similar to the project clusters, can also be broadly defined by socioeconomic status of both donors and projects. Cluster 1 is the "low SES" cluster and Cluster 2 is the "high SES" cluster. Relative to Cluster 1, donors in Cluster 2 come from wealthier, less diverse, and more educated neighborhoods. Not surprisingly, the donors in the high SES cluster (Cluster 2) average larger contributions. Consistent with the previous results, the donors in the high SES cluster donate to projects that are further away on average, although the median distance is quite similar.

The donors in the two clusters don't systematically donate to projects in different types of neighborhoods. The average neighborhood median income for a project funded by Cluster 1 donors is $49,000 compared to $56,000 by Cluster 2 donors.[9] The results are similar for other demographics of the project neighborhoods. This is a promising development because donors from both wealthy and less affluent areas donate to projects in similar types of neighborhoods.

To help visualize the differences in the donor clusters we plot several project and donor characteristics by cluster. Panel (a) of Figure 4 shows the donor and project median income by cluster and panel (b) shows this for the percentage of the neighborhoods that are non-white. If the donors in wealthy areas only donated to projects in wealthy areas we would expect Cluster 2 (green) to be concentrated in the top right corner and Cluster 1 (blue) to be concentrated in the bottom left corner. Both graphs show that clusters are more concentrated horizontally (by donor) compared to vertically (by project). Thus, the donors are from quite different neighborhoods but they contribute to projects in relatively similar neighborhoods, as evidenced by the vertical mix of the two clusters.

[9] The average median income of the projects in the donor sample is $53,000.

Table 5: Summary Statistics of Donor Clusters

Donor Cluster 1

	Observations	Mean	Median	Std. Dev	SE
Donor Median Income	5738	43915	42364	17353	229
Donor % Non-White	5738	0.51	0.5	0.29	0.0039
Donor % Degree	5738	0.29	0.28	0.15	0.0019
Donor Vacancy Rate	5738	0.15	0.12	0.13	0.0017
Donations	5738	71	25	196	2.6
Distance	5738	331	7.7	661	8.7
Project Median Income	5738	49357	41313	29986	396
Project % Non-White	5738	0.52	0.49	0.32	0.0042
Project % Degree	5738	0.34	0.25	0.22	0.0029
Project Vacancy Rate	5738	0.15	0.12	0.12	0.0016

Donor Cluster 2

	Observations	Mean	Median	Std. Dev	SE
Donor Median Income	9193	91979	84219	39048	407
Donor % Non-White	9193	0.18	0.15	0.14	0.0014
Donor % Degree	9193	0.62	0.64	0.17	0.0017
Donor Vacancy Rate	9193	0.081	0.064	0.08	0.00084
Donations	9193	93	40	364	3.8
Distance	9193	371	9	730	7.6
Project Median Income	9193	55576	46797	33643	351
Project % Non-White	9193	0.46	0.41	0.31	0.0032
Project % Degree	9193	0.38	0.34	0.23	0.0024
Project Vacancy Rate	9193	0.14	0.11	0.11	0.0012

Notes: Clustering is performed on the demographic variables of donor locations in italics (Donor Median Income, Donor % Non-White, Donor % Degree, and Donor Vacancy Rate). The clusters are then used to examine project-specific outcomes (Donations and Distance) and project neighborhood demographics (Project Median Income, Project % Non-White, Project % Degree, and Project Vacancy Rate).

Figure 4: Visualizing Donor Clusters

7 Distance from Donors to Projects

In the previous sections, we summarized average and median distances as well as used distance as a determinant of project funding and donor behavior. In this section we analyze distance in more detail and describe why distance is a particularly important characteristics in civic crowdfunding. Figure 7 maps the spatial distribution of donors for several representative projects with the red triangle representing the project location and the blue circles are the location of donors. The size of the circle is scaled by the monetary value of the donation so the maps show both the quantity and intensity of donations across space. We define representative projects as having budgets within $75 of the average project budget and having at least 10 unique donors. The key takeaway from the map is the substantial heterogeneity with respect to the spatial distribution of donors. Projects 3, 4, and 6 primarily elicit donations from very local donors, whereas the rest of the projects raise funds from across the country. Identifying who is willing to contribute

is important when considering policies that expand the role of civic crowdfunding. For example, if donations are used to communicate public support for a certain type of project that will determine how the local government allocates funding, how should officials treat donations from outside their jurisdiction? Are donations outside the city or state representative of the preferences for the local community? There is not an obvious answer, but having a clear understanding of the spatial distribution of donors is important for extrapolating the lessons of civic crowdfunding.

We also plot histograms to show the full distribution of distances between donors and projects. Panel (a) of Figure 6 restricts the distances to 3000 miles, which represent over 99% of all donations. Panel (b) of Figure 6 restricts the sample to distances of less than 250 miles (75% of all donations) to better visualize the mass of donors very close to projects. Both graphs show that by far most donors live very close to the projects, and that there is small, but relatively consistent, support from about 50 to 3000 miles. Based on anecdotal and preliminary survey evidence, donors that contribute far from the project site are often from the primary and secondary social networks of the campaign leaders. Therefore, donors who are far away geographically may be quite close from the perspective of the project's social network.

Figure 6: Distance of Donors to Projects

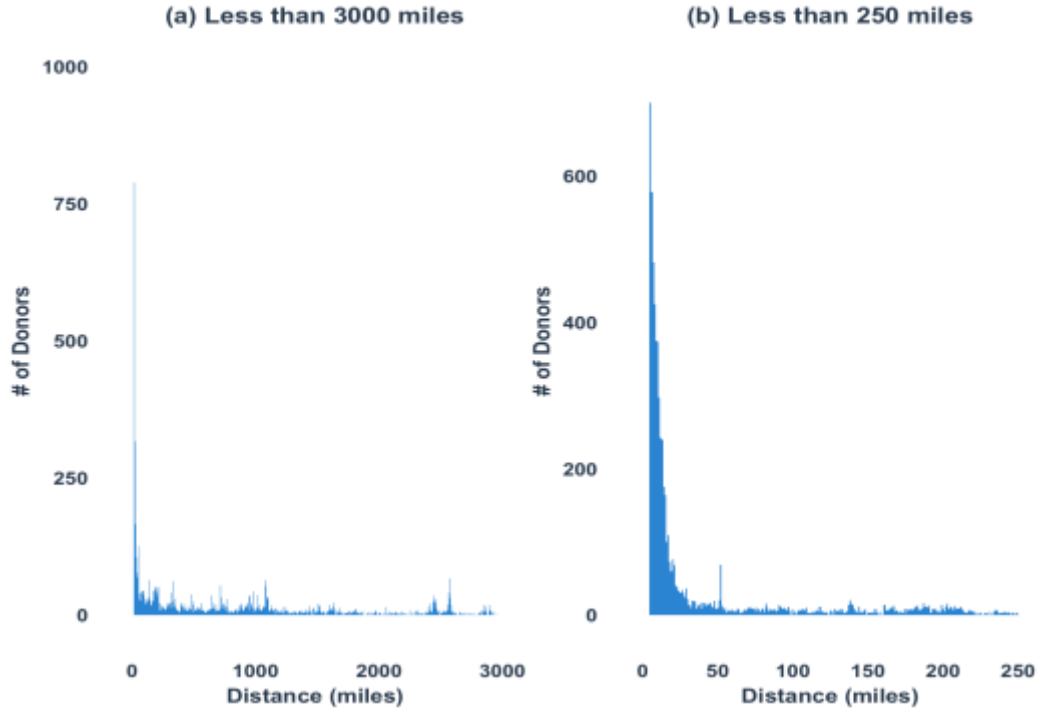
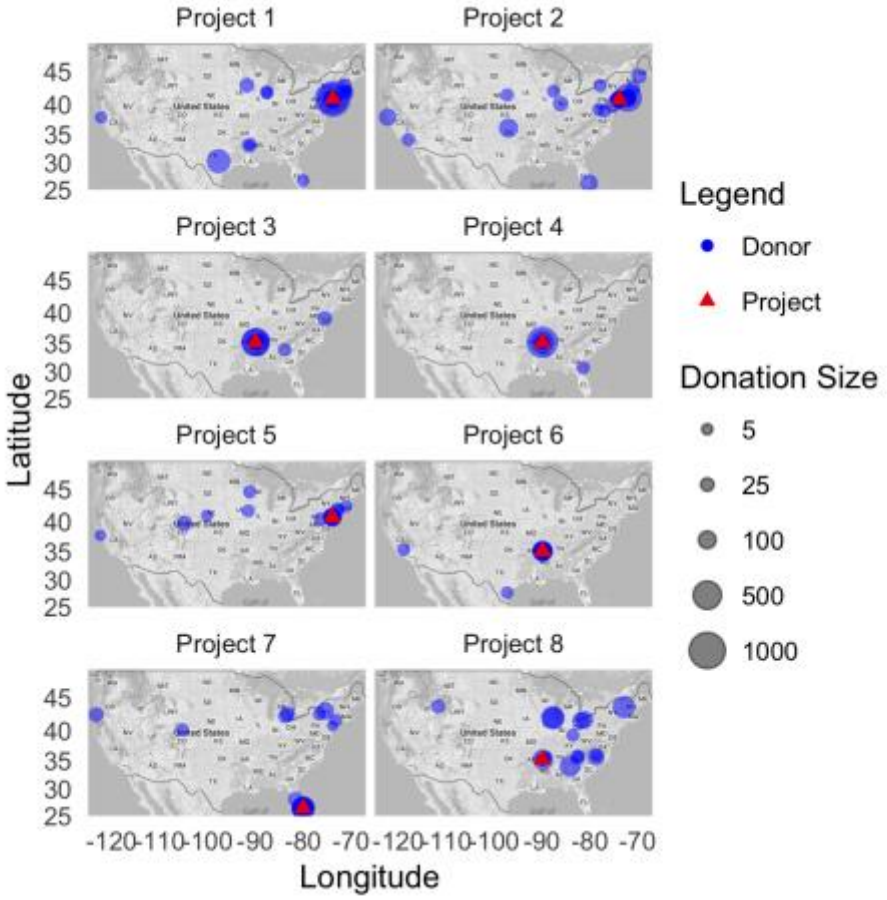


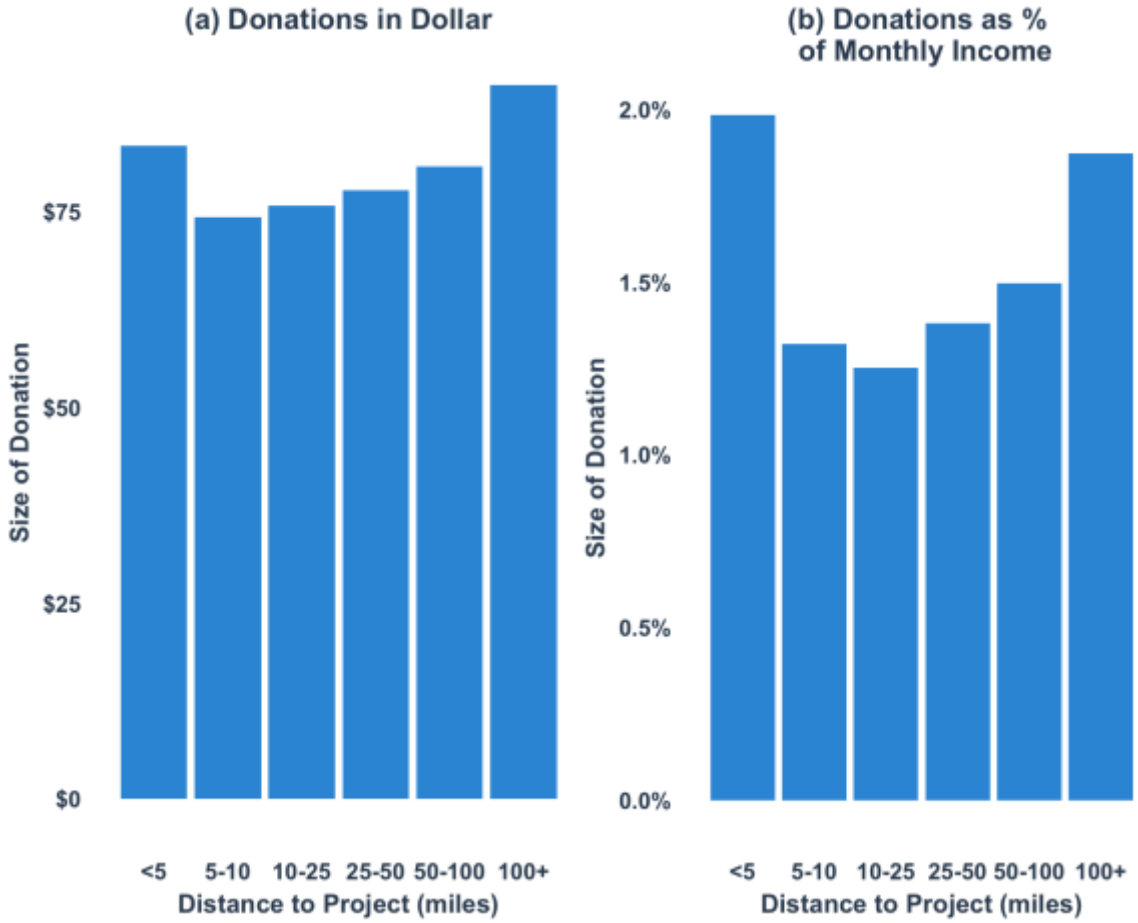
Figure 7: Mapping Representative Projects



Lastly, we relate the distance of the donors to the size of donations. We examine donations both in dollar terms and as a percentage of monthly median income. Panel (a) of Figure 8 shows the average donation size in dollars for different distance bins. The closest donors (< 5 miles) give roughly $83 dollars and this drops down to $74 for donors between 5-10 miles from the project. The average donation then gradually increases as the distance from the projects increases. Donors who live more than 100 miles from the project average over $90 per donation, which is more than the hyper-local donors give. This same pattern is even more pronounced when considering donation as a percentage of income, as seen in Panel (b) of Figure 8. Donations are highest for donors very close to the project, and then gradually increase with distance. One difference between panel (a) and panel (b) is that hyper-local donors actually give the most as a percentage of their income whereas distant donors give more in absolute terms. This is likely due to the fact that on average the median household income of donor

neighborhoods is greater than project neighborhoods. One potential explanation for the pattern of donations by distance is that both very local and very distant donors have the strongest preferences for a project. The local donors are those who will likely benefit of the project, whereas a distant donor may strongly believe in the mission of the project or have a personal connection to the project community or leader.

Figure 8: Donation Size by Distance to Project



8 Conclusions

There are several interesting conclusions from the analysis. The characteristics of the project neighborhood are not strong drivers of total donations. Through graphical analysis, multivariate regression, and cluster analysis we find that features of the neighborhood where projects take place, such as median income and the racial composition, do *not* systematically affect the ability to raise capital for those projects. This addresses an important concern that civic crowdfunding will exacerbate inequalities

in public amenities by predominantly funding projects in wealthy areas. Rather, we find that both poor and affluent neighborhoods are able to successfully fund projects, and the only impact of income on funding success comes from very large atypical projects.

Donor characteristics do have an impact on the size of donations. Donors from wealthy neighborhoods contribute more on average, but less as a proportion of their income. Cluster analysis grouping donors based on their neighborhood demographics shows two very different groups of donors. However, donors from both the high and low SES clusters fund projects in both high and low SES neighborhoods.

Distance plays an important role in donations. While the average distance between donor and project is over 300 miles, the median distance is roughly 8 miles. There is a nonlinear effect of distance on donation size. Very local donors average higher donations; average donations then quickly falls and then gradually increases for donors further away from the project. This is most pronounced when considering donations as a percentage of household income. There are is also substantial heterogeneity in the spatial distribution of donors across projects. Some projects are hyper local with almost all donations coming very close to the project site, whereas other projects attract donors from all over the United States and internationally as well. It is important to consider who is donating to the projects when using data from crowdfunding campaigns to inform broader investments in neighborhood amenities. All the results need to be interpreted in the context of analyzing data from only one civic crowdfunding platform. Additionally, ioby specifically works to address inequalities in disadvantaged communities, so some of the results regarding the equity concerns of civic crowdfunding are to be expected. However, it is important to display that civic crowdfunding can be used as an effective tool to tackle social inequality.

The analysis provides an initial empirical assessment of some important features of civic crowdfunding. However, there are many interesting and worthwhile avenues to pursue. The fact that donors very close to the project give the most as a proportion of the income suggests that communities rally around the crowdfunding campaigns. While we analyze geographic distance, it is also important to consider the donors' social networks to account for donors that live far away from the project site but have strong ties to the projects' community and/or campaign leader. A long-term assessment of neighborhood

outcomes such as economic development, health and crime can determine both the impact of the projects and spillover effects surrounding increased social capital. Civic crowdfunding also has the potential for a nonmarket valuation tool to help guide public funding. Observing how citizens donate to campaigns reveals information on the preferences for various types of community projects. There are also several insights into charitable giving from civic crowdfunding. For example, exploring the relative merits of seed vs. matching funds or the effect of the cumulative donations or number of unique donors has important implications for the design of crowdfunding campaigns in conjunction with government or foundation funding. Lastly, the interaction of multiple campaigns is interesting in the context of a donor considering where to spend her money. All of these are worthy avenues of research that can build on the findings of this study and can help expand the role of civic crowdfunding in local community development policy.

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