Nonprofit Collaboration and the Resurrection of Market Failure:
How a Resource Sharing Environment Can Suppress Social Objectives

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Abstract

Collaboration and its promotion by funders continue to accelerate. Although research has identified significant transaction costs associated with collaboration, little empirical work has examined the broader, societal-level economic outcomes of a resource-sharing environment. Does an environment that encourages collaboration shift our focus toward certain types of social objectives and away from others? This paper uses agent-based Monte Carlo simulation to demonstrate that collaboration is particularly useful when resources are rare but a social objective is commonly held. However, collaboration can lead to bad outcomes when the objective is not commonly shared; in such cases, markets outperform collaborative arrangements. These findings suggest that encouraging a resource-sharing environment can lead to inefficiencies even worse than market failure. We also demonstrate that failure to account for transaction costs when prescribing collaboration can result in quantifiably lower outcome levels than expected.

Introduction

Public and private grantmakers have increasingly prescribed collaboration among their grantees as a means to achieve the greatest possible impact with limited resources in part by engaging a broad and diverse field of disparate actors (La Piana 1998; Suárez and Hwang 2008; Vangen and Huxham 2005). Thus, vying for large and relatively stable funding sources from government and private foundations, nonprofits have increasingly sought ways to coordinate and collaborate with one another in order to appear efficient and viable to funders (Jang and Feiock 2007; Hill and Lynn 2003; Guo and Acar 2005; Guo 2007). While the transaction costs associated with collaboration have been well documented (e.g., Jang and Feiock 2007; Huxham and Vangen 2005), collaboration is nonetheless viewed by many as desirable, valuable, and even a central value of nonprofit organizations (Vangen and Huxham 2005; Oster 1995; Hill and Lynn 2003).

We view "nonprofit collaboration" as it is defined by Guo and Acar (2005): "when different nonprofit organizations work together to address problems through joint effort, resources, and decision making and share ownership of the final product or service" (pp. 342–343). We are most particularly interested in the "joint resources" component of collaboration, the effects of which we examine here.

A growing body of research suggests a potential dark side to nonprofit collaboration (Brinkerhoff and Brinkerhoff 2002; Galaskiewicz and Colman 2006; Gazley and Brudney 2007; La Piana and Hayes 2005; Schwartz 2001; Vangen and Huxham 2005), but most of this work focuses on the costs of collaboration as they impact individual organizations—their management (Selden et al. 2006; Thomson and Perry 2006), their objectives (Eikenberry and Kluver 2004; Schwartz 2001), their viability (Guo and Acar 2005), their culture (Tsasis 2009), and the various characteristics of collaboration across sector lines (Park 2008; Gazley 2008; Guo 2007; Shaw 2003; Gazley and Brudney 2007). In contrast, we question the impact of an increasingly collaborative environment on the broader achievement of social objectives in society. Specifically, when resources are increasingly tied to collaboration, does our social economy shift its focus toward certain types of social objectives and away from others?

This paper contributes to the warning cry against the over-prescription of nonprofit collaboration by examining the possibility that a strong culture of nonprofit collaboration has the potential to create the very market failures that the nonprofit sector has been believed to remedy, causing inefficiencies in the achievement of certain types of social objectives (Hansmann 1980, 1987; Weisbrod 1975, 1977). We do

this by first demonstrating that collaboration—in the absence of transaction costs—would be a near-perfect solution to achieving distributional outcomes (which explains why collaboration is so frequently prescribed), but that when accounting for costs, collaboration is not nearly such a panacea. Second, we demonstrate that while collaboration can improve distributional outcomes in some cases, there are other cases in which a market-type transaction is preferable. In other words, while market failures may exist, outcomes resulting from a resource-sharing environment are sometimes even worse.

We hypothesize that a resource-sharing environment essentially creates inefficiencies that impact the same types of populations, products, and services that are under-served in market settings; namely, smaller and/or less popular (though not necessarily any less pro-social) causes. More formally, our research question is this: does a resource-sharing environment recreate market failure in the nonprofit sector? Our results suggest that when the objective to be fulfilled is of high value to many people, collaboration does in fact outperform a market arrangement, even when resources are rare. In those circumstances, collaboration provides wider access to the resources necessary to achieve the socially beneficial objectives. However, we also find that collaborative institutional arrangements may actually underperform markets when the objectives to be fulfilled are less popular or have less direct impact. In other words, it is possible that nonprofit collaboration may not only recreate market failure, but in some cases may also create failures where they do not naturally exist in markets. We discuss the agent-based models and results of our simulation in the subsequent sections. These are followed by a discussion of the implications of these findings for public administration theory and practice.

Market Failure and the Role of the Nonprofit

Weisbrod (1975, 1977) suggests that nonprofits exist to address several types of market failure, including provision of public goods—production of which is not incentivized in markets. The nonprofit sector provides institutional arrangements designed in part to serve as a remedy to such market failures, particularly when governments also fail to address the issues (Boettke and Prychitko 2004). Salamon's (1987) voluntary failure theory also presumes market failures, but suggests that "the private, nonprofit sector will typically provide the first line of response to perceived 'market failures,' and that government will be called on only as the voluntary response proves insufficient" (p. 39). While other theories of the nonprofit sector exist, (including, for example Hansmann's (1980) "contract failure," and Young's (1983)

"social entrepreneurship"), the predominant approach continues to be centered on theories that include at least some elements of market failure.

There are several commonly identified types or causes of market failure, including information asymmetry, noncompetitive market environments, negative externalities, and the presence of collective consumption ("public") goods. However, the central characteristic of all market failures is that they cause the distribution of goods via the market to be inefficient. We operationalize "efficiency" in terms of the Pareto criterion: a system is efficient when no individual could be made better off without making someone else worse off. Thus, "market failure" occurs when some other means of distribution (e.g., governments or nonprofits) could make more people better off than a market can.

One of the justifications for the very existence of the nonprofit sector is that it provides efficiencies in particular types of goods and services that are often inefficiently delivered in pure markets. In particular, pro-social goods and services that serve specific subsets of the population frequently fail to be provided in the for- profit private market, but are commonly delivered via nonprofit mechanisms (Ben-Ner and Van Hoomissen 1991; Preston 1988). The result is that in the absence of the nonprofit sector, many needs of individual citizens would remain unmet (more people would be worse off). The failure to produce these goods in the market stems from the fact that many of these endeavors are inherently unprofitable—the cost of producing the goods is often larger than the consumers' ability to pay (as in the case of soup kitchens, to use a common example). To support the production and provision of such services requires some form of subsidy—whether through taxes, donations, or grants. Thus, seeking donations (or other forms of redistribution) to finance the endeavor supplants the fee-for-service market model.

But nonprofits are not a pro-social cure-all. Just like in markets, some causes are more resource-friendly than others. Markets favor the production of goods and services that have large numbers of consumers with high ability to pay. The nonprofit sector favors the production of goods and services for which it is easier to secure grants, donations, and other subsidies (Ben-Ner 2002). While payment in the nonprofit sector is redistributive (payers are not consumers) rather than direct (payers are consumers), it is still resource-dependent (Hansmann 1980, 1987). This means that it is more likely that a nonprofit that serves a popular and easily funded cause will be able to subsist than will a nonprofit that serves a rare or less popular cause. While individuals with resources may not themselves want to purchase a particular

socially beneficial product (such as treatment for a rare disease), an appeal to altruism may induce such a potential payer to provide resources through grants and donations. This is how the nonprofit sector can remedy some inefficiencies that would occur in a pure market, providing an opportunity for some goods and services to be produced even if they provide direct benefit to only a few.

Government Funders and Nonprofit Collaboration

The shared social objectives of nonprofit organizations with those of government have made government contracting and other forms of public-nonprofit partnership particularly common (Gazley 2008; Kettl 2006; Gazley and Brudney 2007). Among these inter-sector strategies are government grants and subsidies provided in an effort to encourage nonprofit organizations to work toward specific social objectives. The very presence of these funding streams have caused concern among some scholars, who suggest that this type of funding model may cause resource dependency, mission drift, and even potentially threaten the nature of civil society (Eikenberry and Kluver 2004; Gazley 2010; Guo and Acar 2005). Other scholars have suggested that mandates by funders requiring collaboration among grantees further exacerbates distortions of the nonprofit sector (Jones 2007; Jang and Feiock 2007; Nevile 2010). Despite these concerns, scholars have not addressed the possibility that such distortions—in addition to altering the nature and management of specific firms—may have detrimental effects on the achievement of specific types of social objectives, in essence creating a collaborative correlate of market failure. Nonprofit organizations exist in a limited resource environment in which nonprofit collaboration is frequently endorsed as an approach for making efficient use of limited financial, human capital, and other capacity-related resources (Vangen and Huxham 2005; Mulroy and Shay 1998). Compounding this effect is the additional incentive that many funders place upon collaboration (Suárez and Hwang 2008; La Piana 1998). Believing that collaboration among nonprofit organizations yields greater impact for fewer dollars, many grantmaking agencies— including large government funders—have begun to encourage or even require that nonprofits formally collaborate in order to qualify for grants or donations (Suárez 2011; Jang and Feiock 2007; Sowa 2008). We have every reason to expect this system of incentives for nonprofit collaboration to exacerbate the effects, if any, of inequitable access to resources for those nonprofits that serve smaller and/or less common needs.

Funder pressure has led to collaboration for grant-seeking purposes, not for the inherent or

intrinsic value of collaboration itself. As the nonprofit sector continues to grow, organizations have to compete with similar organizations for limited dollars, creating another incentive for inter-organizational collaboration (Babiak and Thibault 2009; La Piana and Hayes 2005; Vangen and Huxham 2005). The line between market-like competition and cooperative collaboration can be thin and ambiguous in the nonprofit sector. According to Oster, "[For] most nonprofits competition and cooperation co-exist… Partnerships grow up, dissolve, and are later reformed. In some situations, competition among nonprofits increases efficiency and responsiveness, while at other times society is better served by cooperation" (1995). When organizations interact with external sources of services and funding, dependence can be created that can threaten the stability of the organization (Kotter 1979). Among the commonly cited reasons for nonprofit collaboration are securing and leveraging resources and meeting institutional pressures—including pressure from government funders—to collaborate (Sowa 2008; Guo and Acar 2005).

The survival strategies used by nonprofits to seek and maintain such grants and contracts have been criticized as threatening the traditional role of nonprofits in civil society (Alexander et al. 1999; Eikenberry and Kluver 2004). Among the most commonly cited pitfalls of collaboration is the tendency to drop social objectives in favor of those more conducive to collaboration or to alter the mission of the organization for the same purpose ("mission drift") (Vahon 2012; Nevile 2010; Jones 2007). Brinkerhoff and Brinkerhoff (2002) suggest that nonprofits should be wary of some particular tendencies in forming and maintaining collaboration that undermine the sector's ability to accomplish social objectives. Galaskiewicz and Colman (2006) suggest that collaboration can push nonprofits into mission drift, particularly as a result of pressures to adopt a traditional business model under pressure from the New Public Management movement (Eikenberry and Kluver 2004; Gazley 2008; Alexander 2000). Market failures may go unaddressed because they lack a potential monetary pay-off. The same risk may apply to other sources of monetary income: nonprofits may focus on those objectives that give them the best access to grant or donor monies, partnerships with other organizations, or contract-based funding streams (Babiak and Thibault 2009; Jones 2007).

Research demonstrates that collaboration with government can have specific effects on the pursuit of social objectives by nonprofits (Suárez 2011; Gazley 2010; Gazley and Brudney 2007). Government grants and contracts can be restrictive and limit the flexibility of nonprofits, requiring

compliance with strict reporting requirements that may shift organizational objectives, and professionalizing nonprofit boards and staff in a manner that may push out community representation and knowledge of local needs. This, in turn, can mean that some community social objectives are not met because nonprofits do not know about them. Considine (2003) suggests that collaborative arrangements can replicate market failures by failing to provide solutions to the most disadvantaged beneficiary groups and compromising objectives that cannot be provided in markets. Because firms have more bargaining power, for-profit partners may also be able to push nonprofits into less profitable areas of the market, making nonprofits' financial and strategic positions less stable.

The Costs of Collaboration

Collaboration has potential downsides beyond resource-seeking behaviors that lead to failure to meet social objectives. Specifically, it is important to recognize that collaboration comes at a cost. Collaboration costs include financial instability, cooptation of actors and goals, loss of managerial autonomy, difficulty in evaluating results, and opportunity costs of time and resources spent on collaboration efforts and collaborative activities (Jang and Feiock 2007). Huxham and Vangen (2005) caution that "seeking collaborative advantage is a seriously resource-consuming activity so is only to be considered when the stakes are really worth pursuing. Our message to practitioners and policy makers alike is don't do it unless you have to" (p. 13).

Maintaining good collaborations requires investments of time and energy. Even 'pseudo-collaboration'—participating in multiple collaborations that do not function as real partnerships—is a serious drain on nonprofit resources (Vangen and Huxham 2005). When members of a collaboration are a poor fit, the numerous challenges that arise can weaken the community's overall response to a social problem, potentially leaving the most serious, unaddressed needs unmet and the most disadvantaged beneficiary groups under-served (La Piana and Hayes 2005). Poor collaboration can slow provision, waste resources, and undermine overall success. Galaskiewicz and Colman (2006) also suggest that collaboration can increase environmental uncertainty and disrupt nonprofits' legitimacy, undermining their perceived trustworthiness and integrity.

The various costs of collaboration—including drains on time, human resources, social capital, and autonomy—may result in reduced organizational capacity. According to Jang and Feiock (2007),

collaboration costs tend to be borne by individual organizations. Thus, organizations that are overstretched by the need to manage collaborative relationships that involve "formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together" (Thomson and Perry 2006) may drop pursuit of some social objectives simply because they no longer have the resources available to pursue them.

Hypotheses

As identified in the introduction of this paper, our research question is this: does a resource-sharing environment recreate market failure in the nonprofit sector? Specifically, when resources are increasingly tied to collaboration, does our social economy shift its focus toward certain types of social objectives and away from others? Of utmost interest to nonprofit management scholars should be the study of those conditions that significantly alter the resource environment associated with the pursuit of pro-social goods. In other words, what makes resources for particular activities more or less scarce, and what impact does this have on the goods and services provided in the economy as a whole? Our interest in connecting the theory of market failure with the practice of nonprofit collaboration is in identifying whether, and under what circumstances, the practice of nonprofit collaboration improves economic efficiency (making more people better off) or reduces efficiency.

In order to examine the potential for a resource-sharing environment to recreate market failures, we use agent-based modeling to study different economic outcomes that might be expected to result from different institutional arrangements. In particular, we consider the comparative impact of market-based and collaborative environments on the distribution of social objectives that vary on the following characteristics: (1) the prevalence of the social objective within society, (2) the value of the social objective, and (3) the availability of the specific resources necessary to accomplish the objective. We would expect markets to under-produce objectives that are rare, of lower value, and that are associated with more rare resources. By varying the conditions in which organizations in our simulation interact, we can predict ways in which nonprofit and market institutions may incentivize or de-incentivize the accomplishment of specific types of social objectives. Specifically, we vary whether interactions are based on (1) trading resources (market) or sharing resources (collaboration), (2) whether agents in the model are maximizing their own individual value (individualistic) or trying to achieve the "greater good"

(social value maximizing), and (3) whether or not a cost is incurred for collaborating.

The literature on nonprofit collaboration suggests that it is overprescribed and the costs of collaboration are frequently underestimated (Babiak and Thibault 2009; Vangen and Huxam 2005; Schwartz 2001). This suggests a tendency in the nonprofit world to idealize collaboration, maximizing the perceived benefits, and minimizing the potential costs of engaging in resource-sharing activities. To demonstrate the distributional outcomes that might result from making assumptions based on a no-cost collaboration model and a counterpart in which we account for the cost of collaboration, we create both scenarios and hypothesize that there will be a significant difference in outcomes between costless collaboration and collaboration with costs. Specifically, we hypothesize that

H1: The outcomes of costless collaboration will exceed the outcomes of collaboration with costs for all simulation models.

While this is a straightforward hypothesis, it nonetheless suggests an important observation about the prescription for collaboration in the nonprofit sphere: recommending collaboration without identifying and accounting for the costs of collaboration can result in the systematic overestimation of the social and individual benefits associated with collaboration. It can also lead to a failure to understand the circumstances in which collaboration may be beneficial to the achievement of organizational objectives and circumstances in which it can be detrimental.

One of the key differences between traditional markets and the third sector is the social value-maximizing paradigm of the latter. While traditional markets function based on the assumption of self-interested parties that seek their own best interests, the third sector functions largely on donations and grants that seek to maximize the interest of people other than the donor/payers. One important assumption of the nonprofit sector is that the "market" for donations, grants, gifts in-kind, and other resources are traded or proffered with the social benefit in mind, rather than the maximization of mere self-interest. Emerging models under the social enterprise movement suggests that altruism and traditional markets may be able to coexist, or to exist in hybridity (Ben-Ner 2002; Kettl 2006). Examining the impact of motivations (i.e., pro-social motivations or individualistic motivations) on the actual distribution and fulfillment of organizational objectives is important for selecting optimal institutional arrangements. The

rise of alternative institutional arrangements that mix social sector and market characteristics—including social business, nonprofit enterprise, and the like—suggests the need to examine the fundamental assumptions underlying the achievement of social objectives (Lohmann 2007). We therefore hypothesize that

H2: The outcomes of social gain scenarios will exceed the outcomes of individual gain scenarios for all objectives.

Several important factors help to determine whether a good is produced or not in the economy (regardless of sector). The relative availability of resources—whether through customers, donors or grantors—has a clear impact on the ability of an individual or firm to produce and provide a good or service. Likewise, the preferences in society for fulfillment of social objectives are not equally distributed. Some social objectives are widely pursued, and some serve narrower interests. Finally, it can be observed that the fulfillment of different social objectives may be valued at different rates by members of society. For example, finding a cure for cancer may be of interest to most members in society, but it is of higher value to those whose lives have been directly affected by the disease. Following these observations, we hypothesize that

H3: Common objectives (objectives with high prevalence) will achieve higher rates of fulfillment than less commonly held objectives.

H4: Objectives associated with highly available resources will achieve greater rates of fulfillment than objectives associated with rare resources.

H5: Objectives with higher value will achieve greater rates of fulfillment than objectives with lower value.

An Agent-Based Model of the Nonprofit Sector

Agent-Based Modeling Generally

This study employs an agent-based Monte Carlo simulation to examine the effects of collaboration on the distribution of social objectives. While agent-based modeling does not use actual

respondents or organizational data to answer a research question, it provides a means for examining what could occur if particular characteristics of the macro-environment were altered. This alteration of the environment cannot be manipulated through experiments, surveys, observational studies, or other approaches and necessitates an approach more aligned with economic analysis. Agent-based simulation provides an ideal methodology for manipulating assumptions about the institutional environment in ways that would be difficult to effectively control in observational studies. Simulation is especially useful for the study of public administration, as researchers can use a simplified virtual world to build a social system from the "bottom-up," generating "insights into the elements of bureaucratic rules, cultures and environments that make [institutions] a complex phenomenon" (Kiel 2005, pp. 270–271), and usefully identifying variables, relationships, and context dependencies that can inform both practice and future research. That said, simulation methodologies remain rare in public sector research, and are virtually nonexistent in nonprofit management. Because nonprofit management maintains a dedication to practitioner-friendly research, methods that do not employ actual people or firms have been less favored. However, there are specific cases in which simulation-based research is particularly relevant and useful, even for highly applied fields. In particular, simulations that examine the effects of changes in exogenous, institutional factors can help us to describe and predict the effect of those changes before actually implementing them. Simulations allow us to isolate and vary specific institutional characteristics in a sterile environment—thus allowing us to create settings and scenarios that correspond both to the real world and to a precisely comparable counterfactual. By using simulation-based studies in conjunction with studies more frequently observed in the nonprofit literature (e.g., surveys and qualitative research), we can develop a richer understanding of the mechanisms and incentives that operate in the real world.

In this study, we are interested in varying some very specific characteristics of the institutional environment in which decisions are made about which social objectives get funded, and which do not. Namely, we want to know if collaboration (vs. market exchange) changes the rate at which objectives with different characteristics are met in society. We are also interested in whether an individual actor's preference for individual welfare versus collective social welfare alters these outcomes. Finally, we are interested in whether or not an understanding of the costs of collaboration might impact overall outcomes.

Human Pre-study

Before we programmed a computerized agent-based model, we ran several simulations with real

people to identify the patterns and questions we modeled using a Monte Carlo methodology. We also sought to ensure that we had at least minimal anecdotal evidence to support any findings that may result from an agent-based modeling approach. In these human simulations, we used a convenience sample of individuals (simulations included 15–20 individuals per run) and gave each the name of a nonprofit organization drawn at random from a list of actual entities registered as 501.c.3 entities with the IRS. Each individual then identified five objectives that might be pursued by this organization. The intent of this activity was to identify those objectives that undergirded the particular mix of nonprofit entities. We then discarded the names of the original nonprofit organizations, randomized the individual objectives, and redistributed the objectives among the participants. Each participant received five objectives. Using a variety of institutional rules, participants were instructed to trade and/or partner with other individuals to create new nonprofit organizations with cohesive missions. The intent of this phase of the activity was to simulate the creation of organizations out of disparate individual preferences. During some iterations of the simulation, a cost was imposed for collaboration. Namely, individuals were required to give up pursuit of one of their objectives if they wanted to achieve other objectives by collaborating with others.

Although the simulations were too expensive to replicate enough times to achieve statistical power, we found that on the whole, common objectives (such as education and health) were readily assimilated into formal organizations, whereas less common objectives (such as promotion of a particular activity like playing chess or skiing) were frequently dropped from play as a cost of collaboration. Due to the prohibitive cost of replicating these human simulations, we sought to examine these patterns through agent-based modeling. However, we used our qualitative assessments of the dynamics of the human simulation to help us form the characteristics and assumptions that undergirded the computerized simulation that followed. Assuming that people behave approximately rationally according to identified decision rules, we expect the results of the agent-based model to provide a much more complete picture of how different decision heuristics—including the role of collaboration—on distributional outcomes.

The Agent-Based Model

Our computerized simulation is an agent-based model, which means that the data are generated by using simulated “agents” or “players” which represent individual economic actors. Each “player” represents an individual or organization in the economy. These players are given certain rules by which they will make their decisions within the simulation. Although in reality there are myriad possible

conflicting motivations for the actions of individuals and organizations, we are interested in isolating just a few of these to examine their effects on outcomes. We thus simplify the decision heuristics of players to just those dimensions that we want to research.

In order to examine the hypotheses proposed above, we create models that vary on five characteristics we believe to reflect the key characteristics we want to observe about the nonprofit sector. In order to assist the reader in identifying the characteristics of the model and how we view these characteristics as reflecting pertinent realities of the nonprofit sector, we present a table with the model components and definitions as well as real-world examples in Tables 4 and 5 in Appendix 1.

Objectives

In our simulation, each player is assigned an arbitrary number of objectives. These represent the things that organizations want to achieve in the world. Real-world examples might be alleviating poverty, improving education, promoting health, curing disease, preserving art, or any number of other objectives. The achievement of these objectives in the simulation gives the player (and/or the society at-large) a benefit, which we measure using points.

Objective Value

In the real world, not all objectives are alike. Some objectives are what we call "high value" objectives, and produce a significant and large positive impact. These might be such things as saving lives, significantly improving the quality of life, producing and disseminating clean water (which both saves life and improves its quality), or literacy programs that teach people to read. In contrast, our social economy is also filled with objectives that might be of lesser value, particularly when being compared with the "high value" objectives. These objectives, while of value, might produce less good relatively speaking. Examples might be cosmetic changes to buildings (which improve quality of life but not as much as access to clean water does) or book clubs (which improve quality of life but not as much as teaching people how to read in the first place) or the production and dissemination of exercise guidelines (which improve health and prolong life but not as dramatically as curing life-threatening disease). In reality, the relative value of various objectives can be subjective and disputed, so though we offer these potential examples, we do not claim to identify specific "high value" objectives or "low value" objectives—merely that such subjective judgments exist. Instead, in our simulation, we give each objective a value in terms of points, allowing us to gauge the relative value of specific objectives. In an

economic sense, these "points" might be considered units of utility, or "utils." Objectives in our Objectives with a subscripted 1 (i.e., a1) are classified as high value, while objectives with a subscripted 2 are classified as low value. In the set of simulations reported here, high-value objectives have been set to a value of 20 points, while low-value objectives are worth 10 points.

Objective Prevalence

Just as objectives vary in relative value, they also vary in relative prevalence. Regardless of the potential value of a particular social objective, some objectives are more common than others. For example, due simply to the relative prevalence of the diseases in society, more people are interested in finding a cure for cancer than are those who are interested in finding a cure for Creutzfeldt-Jakob disease, a rare fatal degenerative disease of the central nervous system. In either case, a cure would be of very high value (saving lives) but fewer people are actively pursuing the latter cure. We therefore include both "high prevalence" objectives and "low prevalence" objectives in our simulation. Being a "high prevalence" objective simply means that there are more of those objectives than there are of "low prevalence" objectives. The prevalence of an objective varies independently from its value and from the prevalence of the resources associated with the objective.

Resource

In the real world, resources are generally needed to help organizations to achieve their objectives. In our simulation, players are assigned one resource, which corresponds to a real-world set of assets such as money, human resources, skills, natural resources, social capital, or any number of other means that are necessary to carry out social objectives. A resource is unique to each player and essentially represents that player's competitive advantage or supply in the market.

These resources necessary to carry out an objective are often dependent on the nature of the objective itself. Therefore, in our simulation, we have created a "match" between specific objectives and their corresponding resources. Thus, to achieve objective "a," you need to also be in possession of resource "A." Resources are represented with uppercase Latin letters (i.e., A, B, C) and objectives with lowercase Latin letters and numerals (i.e., a1, a2, b1, c2).

In our simulation, the points associated with an objective can only be realized by a player (or society at-large) if each objective is associated with a resource of the matching letter. This is intended to represent the ability of an organization to achieve its objectives by deploying core competencies that

allow it to meet those objectives.

Resource Prevalence

Sometimes, the available resources for pursuing an objective are not proportional to the demand for that objective. Particularly in the philanthropic nonprofit sector, it is not uncommon for wealthy philanthropists to fund objectives that are of interest to themselves, but are not necessarily commonly held objectives in the broader society. Sometimes, grantmakers intentionally incentivize achievement of specific objectives by making resources available for their pursuit. And sometimes, effective cause marketing changes the distribution of available resources by expanding the potential donor base. To represent this set of phenomena in our simulation, we vary the quantity of resources that may be associated with a particular objective.

Interactions: Collaboration Versus Market

Unmet objectives represent inefficiencies in the distribution of objectives and resources, since more efficient allocations of resources and objectives would make more people better off without harming anyone. Again, objectives only benefit players when they match a player's assigned resource. For example, a player assigned resource A and objectives a1, a2, b2, c1, and c2 would have 30 points, as a1 (20 points) and a2 (10 points) match the player's resource. The remaining three objectives (b2, c1, and c2) represent unmet demand. This unmet demand provides the incentive for players to trade (as in a market) or to collaborate with other players that have different resources (specifically B and C) in order to mobilize those partner organizations' resources in meeting the player's own objectives.

We are interested in whether a market-based system will provide more or less efficiency than a collaboration-based system, so we create different sets of simulation scenarios, each representing one institutional form or the other. Altogether, we have four sets of institutional rules that we test:

- *Baseline*: In the baseline variation, no interactions take place; for an objective to be fulfilled, the initial (random) allocation to a player must include both the objective and the associated resource. This is what the world would look like if people could only pursue those objectives for which they themselves naturally have the necessary resources.
- *Market*: No collaboration occurs. The two players attempt to make a mutually beneficial trade. This represents individual pursuit of objectives, but provides institutional arrangements in which players may enhance their (or society's) overall utility by deciding

to switch objectives. Objectives in this arrangement can only be traded if the trade results in a net increase according to the incentive structure in the model. In other words, trades only occur if they improve Pareto efficiency—we want these simulated markets to reduce market failure as much as possible.

- *Costless collaboration*: To collaborate with another player, both players must agree to network. Collaboration suggests sharing of resources to pursue shared objectives. In this model, there is no need to trade or give up unfulfilled objectives in order to collaborate; players may continue to hold all objectives in hopes of attaining access to additional resources later in the simulation. This is similar to the market condition, except that no trade takes place. Instead, the players simply share resources. As before, such sharing only occurs if it is Pareto-improving.
- *Collaboration with cost*: In this scenario, we wanted to mirror the real-life opportunity costs that are associated with collaboration. The "cost" of collaboration in this case was the need to drop one objective (of the player's choice) and leave it unfulfilled as the transaction cost for engaging in collaboration with another player. This model simulates the need to focus on joint objectives within collaboration, with individual social objective preferences generally receiving less attention, fewer resources, and possibly being dropped altogether. A player in this scenario begins with a particular set of objectives, but in order to participate in collaborative arrangements that improve overall individual (or social) benefit, the player must "give up" on an objective and leave it unfulfilled.

Player Motives

In the nonprofit world—which we are simulating here—there is a great deal of discussion about whether the motives of nonprofit actors are self-interested or focused instead on improving society as a whole (see, e.g., Rose-Ackerman 1996; Harbaugh 1998; Holmes et al. 2002). This is an important question because it impacts the way in which a player would act in any given scenario. What is rational if a player is trying to improve its own point total may be irrational if the player is instead trying to make society better off (and vice versa). Because this decision heuristic has huge implications for the equilibrium of objectives and resources reached at the end of the scenario (which corresponds to the expected mix of social programs and goods in the real world), we developed heuristics for both types of

utility maximization (individual and societal).

The simulation is thus run using two different types of decision heuristics: Individual benefit and social benefit. In the individual benefit motivation scenario, players seek to maximize their own personal scores through collaboration. When making decisions about whether to join a different team (using the rules for the given variation), players look at the change in their own personal score that would result from the switch. When the simulation is run using the social benefit motivation scenario, players look at the change in the total social benefit (the sum of all players' point totals) that would result from the networking decision rather than their own personal scores. In the social benefit scenario, a networking decision can be made even if one player gains zero (or even negative) personal benefit, as long as society as a whole is made better off because of the collaboration. This accounts for the possibility of altruism.

Running the Simulation

Prior to running the simulation, we determine the scenario characteristics, including whether we are running a baseline, market, collaboration, or collaboration with cost scenario. Then, we determine whether players in the scenario are to be individual benefit-maximizing or social benefit-maximizing. Once these settings are identified, the simulation builds a pool of resources, objectives, and players. Each player is then randomly assigned one resource and a given number of objectives.

Once this pool of players, resources, and objectives is built, players meet randomly in pairs and attempt to create exchanges in order to fulfill the unmet resource their objectives demand. Player pairings are randomly assigned and reassigned until 25 sequential rounds result in no new player trades or networking, essentially resulting in a Pareto-efficient equilibrium. (In other words, players have stopped networking or trading because there is no more benefit to be gained without making someone worse off). Note again that in the baseline models, no trading or networking occurs.

Players are aware of the resources others have to offer, but not the objectives of others. Trading and collaborating decisions are made simply by looking at the number of points a player or the society as a whole would gain (or lose) by creating a network or making a trade. We are assuming rational actors who are either trying to make themselves better off (the individual benefit-maximizing scenarios) or by making society better off (the social benefit-maximizing scenarios). We do not allow trades that decrease Pareto efficiency.

When two players meet, one player is given precedence in decision making. A player can only be in one collaboration network at a time. When deciding to collaborate, the requesting player can either (1) choose to stay in their existing network and request that the responding player join or (2) attempt to leave their existing network and request to join the network of the responding player. A network or exchange will only be created when the decision making player benefits (when players are individually motivated) or society benefits (when players are socially motivated).

Results

In this section of the paper, we present the simulation results from a simulation using 16 players, four resources, and five objectives per player, with each variation having been repeated 500 times for each motivation, for a total of 4000 observations (four scenario variations 9 two utility maximizing functions 9 500 replications). Tables 6, 7, and 8 in Appendix 2 provide more detail about the specific allocations in this set of simulations.

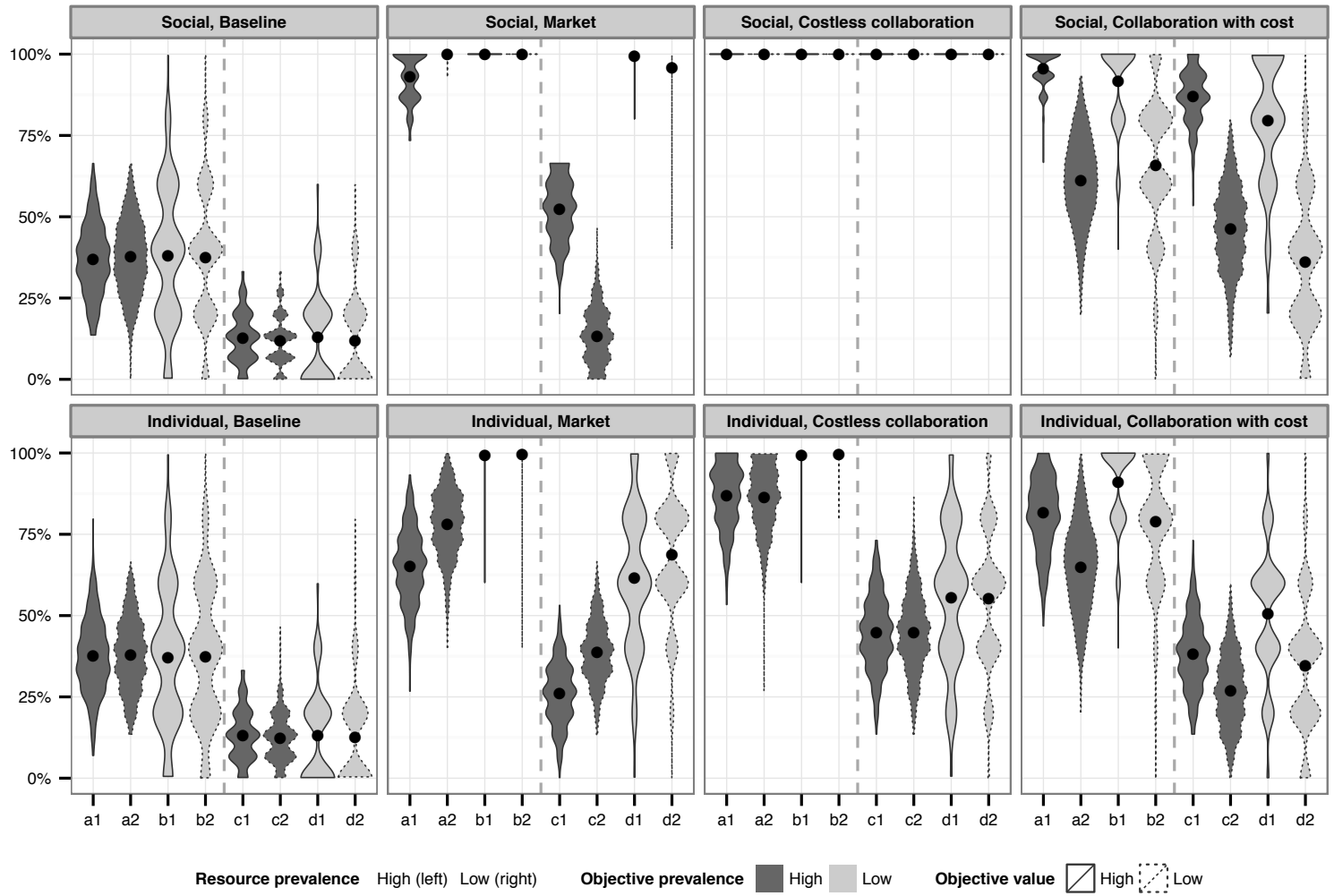
We were particularly interested in the factors influencing the fulfillment of objectives overall based on the institutional arrangements and incentive structures described. The higher a fulfillment level for an objective—that is, the proportion of each objective (e.g., a1) that is associated with a matching resources (e.g., A)—the better the institutional arrangement for distributing that type of objective. Table 1 reports result the mean objective fulfillment under each of the variations in institutional arrangement—specifically, variations socially or individualistically motivated institutions, and the presence or absence of costs for trading objectives. Figure 1 presents these results visually using violin plots (Hintze and Nelson 1998). It is clear from a comparison of the baseline scenarios (in which no trading or collaboration occurred) with any of the market or collaboration scenarios that encouraging interaction and exchange between social actors yield net benefit. The question remains, however, as to what type of interaction should be encouraged (collaboration vs. market) and to what extent these prescriptions are altered by the motivations (individual vs. social) of the individual players.

Table 1: Simulation results

Resource prevalence	Objective prevalence	Objective value	Objective	Baseline (social)	Market (social)	Costless (social)	With cost (social)	Baseline (individual)	Market (individual)	Costless (individual)	With cost (individual)
High	High	High	a1	0.369 (0.11)	0.93 (0.072)	1 (0)	0.957 (0.054)	0.375 (0.113)	0.651 (0.114)	0.868 (0.1)	0.815 (0.112)
High	High	Low	a2	0.376 (0.115)	0.999 (0.006)	1 (0)	0.611 (0.133)	0.38 (0.111)	0.782 (0.106)	0.864 (0.107)	0.65 (0.139)
High	Low	High	b1	0.379 (0.209)	1 (0)	1 (0)	0.916 (0.129)	0.371 (0.217)	0.994 (0.04)	0.993 (0.039)	0.91 (0.128)
High	Low	Low	b2	0.376 (0.205)	1 (0)	1 (0)	0.658 (0.213)	0.374 (0.213)	0.996 (0.039)	0.995 (0.031)	0.789 (0.187)
Low	High	High	c1	0.127 (0.076)	0.523 (0.096)	1 (0)	0.869 (0.084)	0.132 (0.08)	0.261 (0.094)	0.447 (0.113)	0.382 (0.11)
Low	High	Low	c2	0.12 (0.078)	0.131 (0.088)	1 (0)	0.461 (0.136)	0.123 (0.077)	0.388 (0.096)	0.448 (0.121)	0.27 (0.114)
Low	Low	High	d1	0.128 (0.142)	0.994 (0.034)	1 (0)	0.797 (0.194)	0.132 (0.147)	0.616 (0.21)	0.555 (0.216)	0.506 (0.203)
Low	Low	Low	d2	0.118 (0.14)	0.959 (0.116)	1 (0)	0.36 (0.214)	0.124 (0.148)	0.686 (0.202)	0.552 (0.215)	0.346 (0.211)

N=4000; 500 runs per variation and motivation; standard deviation in parentheses.

Figure 1: Simulation results



The baseline model demonstrates the expected outcomes for the achievement of each type of objective in the absence of any trades or collaboration. The costless collaboration model is an idealized scenario suggesting the upper limit of what might be possible. These two scenarios—both baseline and costless collaboration— are intended as extreme models that represent the outer limits of the range of possible outcomes, merely providing scenarios that are useful in comparison. Some types of objectives are simply more subject to institutional failures than others. For rare but highly valued objectives with prevalent resources, even the worst-case institutional scenario fulfills such objectives about 90 % of the time. On the other hand, common but low-value objectives that are associated with rare resources are the least likely to be fulfilled, with a best-case scenario fulfilling these objectives only about half the time (46 %). We will proceed by examining the hypotheses outlined at the beginning of this paper. Table 2 describes each hypothesis and its results in parallel with the written results presented here.

Table 2: Hypotheses, findings, and implications

Hypothesis	**Findings**	**Implications**
H1: The outcomes of costless collaboration will exceed the outcomes of collaboration with costs for all simulation models	Confirmed	Prescribing collaboration without considering transaction costs will result in much lower achievement of objectives than expected. Collaboration should only be prescribed after the costs associated with collaboration have been considered
H2: The outcomes of social gain scenarios will exceed the outcomes of individual gain scenarios for all objectives	Confirmed but with some exceptions	In general, an altruistic orientation is superior to an individualistic orientation for achieving social objectives, in both markets and collaborations. The following are exceptions: Objectives that help many people but with lower impact and for which resources are rare are more likely to be fulfilled in individualistic markets than altruistic markets When resources are highly available for providing small-value benefits, individualistic collaboration is more likely to achieve these objectives for more people than is altruistic collaboration
H3: Common objectives (objectives with high prevalence) will achieve higher rates of fulfillment than less commonly held objectives	Not confirmed	Holding resource supply and value prevalence constant, rare social objectives are most likely to be fulfilled (probably because they experience less competition for resources)
H4: Objectives associated with highly available resources will achieve greater rates of fulfillment	Confirmed	Resource prevalence is a strong driver of objective fulfillment, though other characteristics of institutional environments can significantly alter the overall

than objectives associated with rare resources		likelihood of social objectives being fulfilled. All other factors being equal, however, the more available resources available, the more likely a social objective is to be fulfilled
H5: Objectives with higher value will achieve greater rates of fulfillment than objectives with lower value	Confirmed for collaboration with cost; mixed for markets	When objectives must be sacrificed in order to collaborate, lower value objectives are less likely to be fulfilled overall. In markets, value helps to determine whether a trade is made, but overall fulfillment of low-value objectives depends on resource and objective prevalence, and whether the market is individualistic or altruistic

Our first hypothesis suggested that we should expect a drop in the fulfillment of objectives when we impose a cost for collaboration (as opposed to allowing costless collaborations to occur). We found that this is, indeed, the case. Adding cost to the institutional arrangements reduces the gains seen in the costless collaboration scenarios significantly. While this was a clearly expected result, the simulation underscores the need for organizations to consider the costs associated with collaboration. Nonprofit managers and funders who do not consider the reality of the impact of collaboration costs on their ability to achieve organizational objectives may expect one outcome (modeled here as costless collaboration) and then wonder when the actual outcomes are significantly lower.

Interestingly, the social costless collaboration model achieves perfect fulfillment of all objectives. This suggests that the "perfect" world for the achievement of objectives would be a resource-sharing environment in which everyone is altruistic and there are no transaction costs for working together. This panacea may be what prescribers of nonprofit collaboration envision when they encourage resource sharing. However, the model for costless collaboration with individualistic (rather than altruistic) motivations suggests that even in the absence of transaction costs, the realities of collaboration prohibit this perfect scenario from being achieved. If collaboration was truly costless, under individualistic conditions, resource prevalence appears to be the primary driver of objective realization—those objectives associated with prevalent resources are almost twice as likely to be achieved as those with low resource prevalence. Less common objectives also appear to be slightly more likely to be achieved in such a scenario, regardless of objective value or resource prevalence, though this difference is much less pronounced.

Our second hypothesis was that those scenarios that focused on social gain rather than individual gain would be more likely to achieve social objectives. We found that this was more nuanced than

expected. Under market conditions, it was true that socially motivated decision processes outperformed the achievement of social objectives for all types of objectives but one. When resource prevalence was low, objective prevalence high, and objective value low, the social market underperformed all other scenarios, essentially recreating the baseline fulfillment level. This suggests that social goods that help many people but with lower impact, for which resources are rare, are not ideally suited to a social market. Real-world examples of such goods might include information or tips about how to perform common functions better (such as managing gasoline costs or water usage) or things that provide small improvements in the quality of life (such as uplifting billboards that encourage optimism and development of positive character traits). Such goods appear to be better suited to individualistic market conditions or collaborations (either social or individualistic).

Social collaboration with cost underperformed the individual collaboration with cost for objectives associated with high resource prevalence, high objective prevalence, and low objective value. This suggests that when resources are highly available for providing small-value benefits for many people, individualistic motivations are more likely to help a greater proportion of those objectives to be fulfilled in society.

It is also notable that the benefit of a social-maximizing decision heuristic for collaboration with cost occurred when there was low resource prevalence and high objective value. In other words, altruistic collaboration (with cost) is better than individualistic collaboration when resources are rare but impact is high.

Our third hypothesis was that common (highly prevalent) objectives would achieve higher rates of fulfillment than less common objectives. This was not the case. In our model, the prevalence of resources, not objectives, determined the baseline likelihood that an objective would be fulfilled. In many cases, objective prevalence appeared to have a negative relationship with that objective's fulfillment. This suggests that competition for resources favors environments in which objectives are not commonly held. This is true whether the resources themselves are common or scarce.

Our fourth hypothesis was that objectives with common resources would be more commonly fulfilled than those objectives associated with rare resources. In even the baseline scenario, this appeared to be the case. Resource prevalence was a strong driver of objective fulfillment in almost all models. In models with high objective value, however, this effect appeared to be ameliorated somewhat in social

collaborative settings. In individualistic markets, the resource prevalence also appeared to be mediated by objective prevalence—with more rare objectives being more likely to be fulfilled in the presence of low resource prevalence, and more common objectives being more likely to be fulfilled in the presence of high resource prevalence. This suggests that institutional environments can significantly alter the likelihood of social objectives being fulfilled, and that the various characteristics of goods and institutions may interact to produce better or worse outcomes overall.

Our fifth hypothesis was that objectives associated with higher value would be more likely to be fulfilled. Again, we found that the effect of institutional characteristics made the answer to this question much more nuanced than expected. In collaborations with cost (both individualistic and social), higher value objectives were always more likely to be fulfilled than their similarly prevalent and resourced counterparts. This suggests that when individuals have multiple objectives and must sacrifice one or more objectives in order to collaborate (as in the collaboration with cost scenarios), lower value objectives will be systematically dropped, resulting in those objectives being less likely to be fulfilled in society. Such would not be the case in a costless collaboration scenario, as demonstrated by individualistic costless collaboration, in which the only real driver of objective fulfillment is the prevalence of resources.

Markets, on the other hand, behave differently. In social markets, objective value appeared only to have an impact when resources were low and objective prevalence was high, making high-value objectives more likely to be fulfilled. In individualistic markets, high-value objectives were slightly *less* likely to be fulfilled when resources and objectives were prevalent, and when resources were low.

Conclusion

The results of this study suggest that the enthusiasm for promoting collaboration in the nonprofit sector may be based on a faulty model that systematically underestimates the costs associated with collaboration. When costs associated with collaboration are considered, there are circumstances in which collaboration—even in a social utility maximizing setting—is not the ideal approach for achieving the fulfillment of most social objectives. Thus, government funders should carefully consider additional factors before encouraging potential grantees to engage in collaborative efforts.

Specifically, our results suggest that the prevalence and value of objectives and the prevalence of resources have important implications for the institutions that will best support fulfillment of social

objectives. We are able to identify specific market failures—circumstances in which individualistic markets do not achieve Pareto optimal results as compared with other types of institutional arrangements. However, the results also suggest that neither an exclusively altruistic social orientation nor a collaborative environment results in Pareto optimality for all cases. In actuality, certain combinations of objective characteristics and institutional characteristics are toxic, producing suboptimal results, while others help to achieve nearly perfect objective fulfillment.

Table 3 identifies the best institutional arrangement (excluding costless collaborations) and the worst institutional arrangement (excluding the baseline scenarios) for various combinations of objective characteristics. This suggests specific circumstances in which markets and collaborations ought to be prescribed or proscribed, and the cases in which individual or altruistic orientations influence the outcomes.

Table 3: Best and worst institutional arrangements for distributing objectives

Resource prevalence	**Objective prevalence**	**Objective value**	**Best arrangement[a]**	**Worst arrangement[b]**
High	High	High	Social collaboration (0.957)	Individual market (0.651)
High	High	Low	Social market (0.999)	Collaboration (0.611 (S), 0.650 (I))[c]
High	Low	High	Market (1.00 (S), 0.994 (I))	Collaboration (0.916 (S), 0.901 (I))
High	Low	Low	Market (1.00 (S), 0.996 (I))	Social collaboration (0.658)
Low	High	High	Social collaboration (0.869)	Individual market (0.261)
Low	High	Low	Social collaboration (0.461)	Social market (0.131)
Low	Low	High	Social market (0.994)	Individual collaboration (0.506)
Low	Low	Low	Social market (0.959)	Collaboration (0.360 (S), 0.346 (I))

[a] Best arrangement scenarios do not include costless collaboration
[b] Worst arrangement scenarios do not include baseline
[c] Where no significant difference exists between two arrangements, both are reported. The annotation (S) indicates level of objective fulfillment for socially motivated scenarios, and (I) indicates level of objective fulfillment for individually motivated scenarios.

Markets (either social or individualistic) are the ideal institutional arrangement for high resource environments when objectives are rare. In such settings, social collaborations are the worst possible arrangement for low-value objectives, and collaborations in general are the worst type of arrangement for high-value objectives. Social markets—markets in which the social good is more important than individual gain—are the ideal institutional setting when both resources and objective prevalence are high but impact is low, or when both resources and objective prevalence are low. In these circumstances, collaborations are the worst type of arrangements, with individualistic collaboration being particularly

bad for high-value objectives that are rare and associated with rare resources.

Individualistic collaboration is never the ideal institutional arrangement, but socially minded (altruistic) collaboration is the preferred mechanism for objective fulfillment particularly when resource prevalence is low, objectives are common, and organizations are motivated by social welfare. In such cases, collaboration achieves significant substantive gains over market-based alternatives.

While the method applied here allows us to alter the assumptions on which our social institutions operate—allowing us to glimpse alternate realities in which the parameters of social interactions are altered—there are some clear limitations to this study based on the methodology applied. The primary difficulty is not that the present study is a simulation, but rather that the simulation is fairly simple in its structure and parameters. There are a variety of factors we know to be important in collaboration and market interactions which have been held constant in this study when, in fact, they are important variables in the real world. These include such dynamics as trust and reciprocity, which we know to affect collaborative efforts. They also include the presence or absence of information asymmetries, interpersonal dynamics such as principal-agent problems, leadership, and other network management dilemmas. We have also not accounted for the probabilities of success or failure at achieving social objectives, or changes in supply of resources that may result from different demand curves for prevalent objectives. We encourage future research to explore more sophisticated models and evaluations of the conclusions drawn here.

These limitations notwithstanding, our simplified model has allowed us to isolate key variables of interest to determine how they potentially affect the ways in which our society—under various incentive and distributional constraints—impacts which social objectives are most likely to be achieved and under what circumstances.

Software

All the graphs, tables, and simulation results can be replicated using code available at https://github.com/andrewheiss/np-collaboration and the following open source software:

R Development Core Team. 2013. R: A language and environment for statistical computing. Vienna, Austria. http://www.R-project.org. Version 3.0.2.

Rossum, G. van, et al. 2013. Python programming language. Python Software Foundation. http://www.python.org. Version 2.7.6.

Wickham, H. 2009. ggplot2: Elegant graphics for data analysis. Springer New York. http://had.co.nz/ggplot2/book. Version 0.9.3.1.

Appendix 1: Model Constructs and Definitions

Table 4: Construct definitions (basic simulation elements)

Construct	What it means in the simulation	What it represents in the real world
Objective	What the player must find resources for in order to get points	What an individual or organization wants to accomplish in order to make them happy (or to make society better off)
Resources	The units needed for a player to be able to realize the potential point value associated with their objectives	Money or other resources such as social or human capital, skills and competencies, etc. that are needed to achieve goals
Player	Decision making unit within the simulation	Individual or organization in society
Objective value	The number of points realized if there is a match between resources and objectives	The amount of social and/or individual benefit or impact gained if a goal or objective can be achieved
Objective frequency	How common a particular objective is in the simulation	How many people or organizations share the same goal
Social benefit-maximizing scenarios	Players make decisions based on whether or not the entire society would be better off	Altruistic motivations to pursue social objectives
Individual benefit-maximizing scenarios	Players make decisions based on whether or not they themselves would be better off	Personal utility maximizing reasons to pursue social objectives
Market scenario	Players only get access to resources by trading with other players	What the world might look like if there were no collaboration but people were encouraged to trade resources in order to help make sure that objectives could be accomplished
Costless collaboration scenario	Players get access to resources by sharing resources with other players	What the world might look like if collaboration were free
Collaboration with cost scenario	Players get access to resources by sharing resources with other players but must drop objectives in order to do so	What the world might look like if people shared resources but at the cost of having to focus their efforts on shared objectives
Baseline scenario	No trading or sharing occurs; players can only get points if they received resources that matched their objectives due to the random distribution at the beginning of the scenario	What the world might look like if people did not interact at all and could only pursue goals for which they themselves had the resources

Table 5: Construct definitions with examples (objective value and prevalence, resource prevalence)

Construct	What it means in the simulation	What it represents in the real world	Real-world examples
High objective value	The objective is worth more points than other objectives in the simulation model	Goods or services that produce great value, benefit, or impact for those who enjoy them	Life-saving medical equipment or knowledge; literacy programs that teach people how to read; the production and dissemination of clean water
Low objective value	The objective is worth fewer points than other objectives in the simulation model	Goods or services that produce value or benefit for those who enjoy them, but which produce less discernible impact than other objectives	Cosmetic medical procedures; book clubs; the production and dissemination of exercise guidelines
High resource prevalence	The resources needed to get points for the objective are common	The resources needed to produce a particular good or service are readily available to those who want them	The presence of large grantmaking institutions that favor this specific objective, and/or the presence of a wide base of donors who are willing to donate to the cause (e.g., resources available to fund cancer research)
Low resource prevalence	The resources needed to get points for the objective are rare	The resources needed to produce a particular good or service are not readily available to those who want them	The absence of donors and grantmaking institutions that favor this specific cause (e.g., resources available to fund peptic ulcer research)
High objective prevalence	Many players in the model share this objective	Goods and services that are valued by many individuals in society	Cures or support groups for very common ailments or diseases; promotion of popular art forms such as movies and books; dissemination of information that is of interest to the majority of people
Low objective prevalence	Few players in the model share this objective	Goods and services that are valued by few individuals in society	Cures or support groups for very rare diseases; support for the production of rare or archaic art forms; dissemination of information that is of interest to only a few people

Appendix 2: Reported Simulation Characteristics and Allocations

Table 6: Resource quantities

Resource	Quantity
A	6
B	6
C	2
D	2

Table 7: Objective quantity, frequency, and value

Objective	Quantity	Frequency	Value
a1	15	High	High
a2	15	High	Low
b1	5	Low	High
b2	5	Low	Low
c1	5	Low	High
c2	5	Low	Low
d1	15	High	High
d2	15	High	Low

Table 8: Sample initial player allocations

Player	Resource	Objectives	Value
Player 00	C	a2, d2, b2, c2, d2	10
Player 01	B	d1, d2, d2, a1, a2	0
Player 02	D	d2, d2, d2, d1, a1	50
Player 03	B	d1, d1, a1, d1, c1	0
Player 04	A	a1, d2, a1, d1, c2	40
Player 05	D	a1, c1, a2, d1, b2	20
Player 06	C	b1, d1, a2, d1, d2	0
Player 07	B	c2, d1, c2, b1, d2	20
Player 08	B	a2, a2, a2, a1, d1	0
Player 09	A	a1, d2, a1, a2, a2	60
Player 10	B	a2, d2, a1, a1, d1	0
Player 11	B	b1, a1, d1, a1, b1	40
Player 12	A	a2, d1, b2, a2, c1	20
Player 13	A	c2, a2, a1, d2, a1	50
Player 14	A	d1, c1, a2, b2, b1	10
Player 15	A	a2, c1, b2, d2, d2	10

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