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# **Resilience of Post-disaster Emergency Response Networks: Evacuation Response and Texas School Districts**

**Scott E. Robinson\***

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**Abstract:**

Studies of collaborative public management have relied on a number of concepts that are time-bound. Collaborative networks rely on trust and stable expectations – both elements that have strong temporal elements. Despite this attention, there has been less research into the evolution of collaborative relationships than one would expect – especially using large-N quantitative methodologies. This is due in part to the methodological difficulties of studying relationships across time using survey methodologies. This paper reports results from two surveys of school districts immediately following Hurricane Katrina that asked about their collaborative relationships – including whether they continued collaboration more than a year after the hurricanes. The results suggest that organizational structure plays the largest role in determining whether organizations maintain collaborative relationships.

## I. Introduction

Collaboration has become a major topic of interest in the study of public management. The strongest indication of this new found prominence has been a special issue of *Public Administration Review*, an associated conference, and a couple of prominent volumes devoted to that single conference (Bingham and O'Leary 2008; O'Leary and Bingham 2009). As the special issue of *Public Administration Review* makes clear, research has still only touched the surface of collaborative public management (Bingham and O'Leary 2006). A better understanding of collaborative public management will require further theoretical development related to such subjects as the meaning of collaboration (as distinguished from coordination) and the linkage between collaboration, participation, and conflict resolution process. There will also be a need for better instruments for measuring collaboration and careful collection of data about collaborative public management.

This paper addresses a subject that crosses the boundaries of the needs for theoretical and empirical development of our knowledge of collaborative public management. Some have argued that the age of a relationship is a characteristic that distinguishes collaboration from other less intense relationships. True collaboration, they argue, involves the continued interaction of participants in a relationship in which trust and clear expectations become important guiding principles (Bingham and O'Leary 2006). An empirically driven assessment of network performance also identified the stability of a network across time as a potentially vital component of an effective network of social service providers (Provan and Milward 1995). All this suggests that time is an important aspect of collaboration, but theoretical attention to the role of time has been

limited. Similarly, empirical research into the evolution of collaborative relationships across time has been limited. There have been some notable case studies that have looked at the evolution of networks over time (for a review, see Robinson 2006). However, these case studies have not lead to large N quantitative assessment due in part to the difficulty of collecting comparable data on collaborations (Meier and O'Toole 2005). This problem is even more acute in the case of studying the temporal dimension of collaborative relationships. Studying the temporal dimensions of collaboration calls not only for a set of comparable units for study, but measurement across time. For this reason, the few surveys of collaborative public management that exist are predominantly cross-sectional (e.g. Meier and O'Toole 2001). This limitation has recently been overcome. Recent surveys have provided some measures of collaboration that allow for time-serial analysis (O'Toole et al. 2006).

This paper presents results from a recent survey of public management that provides some insight into the temporal dimension of collaboration. Specifically, the paper assesses the factors more significantly related to sustained collaborations. The next section reviews the literature on collaborative public management with special attention to the literature suggesting that time is an important dimension in collaborations. The third section will review the data and methods used to assess the relative importance of various factors related to resilient collaborative relationships. The fourth section reviews the results of the analysis while the fifth section places these results in the context of the existing literature and suggests how the literature can benefit from further inclusion of time-based elements in the study of collaborative public management.

## II. Collaborative Public Management

### a. The Importance of the Age of Collaborative Relationships

To some eyes the study of collaborative public management is nothing new. Scholars have long discussed inter-organizational relationships involved in policymaking. One of the most famous studies of implementation (Pressman and Wildavsky 1984) took as its theme the important effect that the number of parties involved in a policy had on the likelihood of successful implementation. This study established as conventional wisdom the proposition that increasing the number of parties involved in policy implementation increased the probability of policy failure.

Despite Pressman and Wildavsky's warning that increased participation brought dangerous complications, it became obvious that policy implementation commonly employed networks of actors rather than a simple hierarchy (O'Toole 1997; O'Toole and Hall 2000). Provan and Milward provided some of the hallmark studies describing common networks arrangements and arguing that the US was moving towards a "hollow state" (Milward and Provan 2000; 2004). Their studies stand today as some of the best accounts of how collaborative public management works in social service delivery.

The descriptive accounts of collaborative networks were followed by a series of quantitative studies of collaborative managerial behavior. The most prominent of these studies were the studies of Texas school districts (e.g. Meier and O'Toole 2001; 2005). In these studies, Meier and O'Toole found that school superintendents adopted a range of collaborative approaches to such external organizations as business groups, other school

districts, and government officials. Reports of collaborative relationships scaled onto a single measure of increased collaborative management (Meier and O'Toole 2005). This scale then became a singular measure of collaborative public management. Meier and O'Toole found that internal networking (collaborative relationships with subordinates at various campuses) was related to external networking (collaborative relationships with people outside of the district) and that external networking was related to district performance (Meier and O'Toole 2003).

Within this growing volume of studies, there was very little attention to changes in collaborative relationships across time. Provan and Milward's study of network effectiveness, itself an understudied area of collaborative public management, led them to speculate about the role of time in the effectiveness of networks (Provan and Milward 1995). They argued that stability across time was a potentially important component of network effectiveness. They observed that some of the poor performing networks had recently experienced disruption. These networks had not had the time to develop trust between network actors and stable expectations to guide coordinated behavior. As a result, they argued, it was more difficult for these networks to be effective. They hypothesized that as networks aged they would have the opportunity to be more effective.

Provan and Milward's suggestion that age and stability are keys to successful collaborative networks contrasts with the account of many who research emergency management networks. The research in to disaster response networks, often involving extensive collaboration across traditional sectors, has suggested that these networks emerge spontaneously following a disaster (Comfort 1993). In her research, the disaster recovery process was largely ad hoc. Actors not previously identified as being part of the

network stepped up to provide assistance. Actors took on new and unexpected roles. These unplanned networks still proved to be effective in some circumstances – despite the burden of youth that Provan and Milward suggested would plague these networks.

Evidence in the wake Hurricane Katrina suggests that one should not take the spontaneous emergence argument too far (Robinson, Berrett, and Stone 2007). Pre-existing relationships between actors, often having little to do with disaster recovery, aided in the building of ad hoc disaster networks in the wake of Hurricane Katrina. In some cases, what might look like a new collaboration (in the sense of being activated following an emergency) may actually have built on a long-standing relationship with the qualities Provan and Milward expect to serve to stabilize the network.

This brief review of the literature relevant to the age of collaborative networks suggests that relationship age may have a significant impact on the quality of collaborations (with older relationships being more stable and the source of clearer expectations on the part of actors). What is not clear is why some collaborative relationships survive while others fail.

#### b. Factors Affecting the Resilience of Relationships

It is worth beginning any theorizing about factors related to the resilience of collaborative relationships by thinking about why collaborations begin in the first place. There is still very little known about what predisposes some organizations to create collaborative relationships with other organizations. To some, the decision to collaborate is the product of a personal managerial style (Miles and Snow 1978). Managers have



styles that predispose them to delegate authority, tolerate uncertainty, or see the environment as a threat. I will refer to this collection of attitudes as strategies and thus summarize this tradition as hypothesizing that collaborations are the product of individual managerial strategy.

In terms of the maintenance of existing collaborations, the managerial styles conducive to create these relationships should also support those collaborations once the relationship exists. If managerial strategies are relatively long standing elements of a leader's decision process, one would expect those same attitudes to support the continuation of a collaboration.

Recent work on the decision to embark on post-disaster collaborations (Robinson 2008) has suggested that these strategy characteristics play only a minor role in the decision to create post-disaster collaborations. This recent research has suggested that two other categories of factors have been primary. First and foremost, structural characteristics may determine the level of an organization's collaborative activities. Most famously, Thompson argued that inter-organizational connections are the product of the slack resources available to large organization that the organization can invest in specialized boundary spanning activities (2003 [1967]). Again, the structural characteristics that are conducive the creation of the relationships should also be conducive to the resilience of this relationship.

Finally, this particular analysis will focus on collaboration within the area of emergency management. It would not be surprising to find that policy domain specific factors were powerful explanatory factors in the resilience of collaboration. Some factors specific to mental health policy could, for example, explain a portion of the collaborative

behaviors within such a network. Some portion of the variation in each policy area, then, may be a product of factors specific to that policy domain. The literature on emergency management suggests some factors that are specific to the disaster context. While organizational structure and managerial strategy are thought to support the emergence and maintenance of collaborations of all types, the specific policy domain of emergency management may engage factors specific to issues related to disasters and emergencies. The extensive literature on individual and organizational preparedness suggests that perceptions of disaster vulnerability and the likelihood of disasters are the most important motivations for individual and organizational preparedness (See Lindell and Perry 2000 for a review of this extensive literature). Previous research into the initial decision to collaborate supports these literatures in finding that organizational structure and perceptions of an organization's disaster situation are significant factors in supporting collaborations. As a result, this paper will test compare the influence of managerial style, organizational structure, and disaster situation in explaining whether post-disaster collaboration are resilient.

### III. Measurement and Methods

This section describes a quantitative method for identifying factors related to the resilience of collaborative relationships. It first describes a survey; the results of which are presented here. Second, it describes measures used to test the hypotheses described in the previous section. Finally, the section includes a brief description of the statistical model needed to test the hypotheses.

The findings reported here are from two surveys of Texas public school districts following Hurricane Katrina. Soon after Hurricane Katrina (and Hurricane Rita) we sent a survey to each public school district superintendent in the state of Texas. This survey followed the methods employed in several previous surveys of this population (Meier and O'Toole 2005). Following three waves of the survey, approximately 60% of the school districts had responded to the first survey. The responding districts come disproportionately from larger districts that were more likely to be affected by the hurricanes or people displaced by the hurricanes – though these differences between the size of respondent and non-respondents were small. The survey asked a battery of questions about the experiences of the district in the aftermath of the hurricanes and the collaborative partners with whom they had worked since the hurricanes themselves.

Approximately 16 months after the initial survey, we conducted a follow-up survey (in the Spring of 2007) asking with whom the districts were currently collaborating. This survey again proceeded in three ways, this time resulting in a response rate of almost 50%. The combination of these two surveys, then, allows me to test propositions related as to whether collaborations reported to exist in the immediate aftermath of the hurricanes persisted a year and a half later. To do this, I select two different measures of collaboration with two different types of organizations. The first model uses a strict definition of collaboration, the conduct of regularly scheduled meetings. Both surveys asked whether the district conducted regularly scheduled meetings with key partners. Specifically, I employ the responses to whether the district conducts regularly scheduled meetings with police, fire, and first responder (PFF) organizations. I limit the analysis to those organizations that reported having regularly

scheduled meetings with police, fire and first responder organizations in the aftermath of the hurricanes. The districts are said to have a resilient relationship with these partners if they again reported having regularly scheduled meetings with police, fire, and first responder groups in the second survey. If the district reported regularly scheduled meetings immediately following the hurricane but did not report these meetings in the second survey, the collaboration is considered to have lapsed.

I conducted a second test with a different potential partner group and with a more permissive definition of collaboration to assess the robustness of the findings. In the second model, I instead use questions as to whether the school districts collaborate (however the respondent defines collaboration) with nonprofit or relief organizations. This permissive definition of collaboration, in which the respondent defines for him or herself what qualifies as collaboration, has previously proven to be a moderate definition of collaboration between the relatively rare regularly scheduled meeting collaborations and the potentially trivial information sharing relationships (Robinson and Gaddis 2007). Again, the collaboration is said to have been resilient if the respondent reported collaboration in both the 2005 and 2007 surveys. If the district reported collaborating following the hurricanes but not in 2007, the collaboration is said to have lapsed. Any district that did not respond to both surveys or that did not report collaboration in 2005 is excluded from this analysis.

To test the three propositions related to managerial strategy, organizational structure, and disaster situation I have included a series of independent variables drawn from previous work on the initial collaboration decision. The choice of samples limits the structural variables that one needs to include in the model. School districts perform

similar functions in roughly similar ways. They differ mainly in respect to size. To assess the effect of district size I include a variable representing the log of the total number of full-time equivalent employees in the district (the log transformation because of the significant skew in the population with a small number of extremely large districts like Dallas and Houston ISDs). This measure of size is highly correlated with other potential measures of size including budget size and student population (at above 98% correlation).

There are very few variables available to measure managerial strategy. To stand for the superintendent's attitude towards delegation, I include a measure of their stated attitude towards delegating emergency planning to campuses as opposed to retaining that authority at the central office. Increasing values of this variable indicate an increasing opposition to delegation in emergency planning operations. This is an area where superintendents can impose his or her managerial style on district operations and structure – as opposed to district size that is determined exogenously.

I then include two variables to assess the impact of disaster domain relevant difference among school districts. Based on the previously reviewed literature, the key factors predisposing districts towards preparedness and continued dedication to collaborations in emergency preparedness should be the degree to which the district has been affected by recent emergencies and whether the superintendent anticipate a emergency in the near future. The model includes variables where increasing values indicate increased reported impact of recent disasters and increased reported likelihood of future disasters.

The four variables described above leave many unmeasured factors out and risk omitted variable bias is assessed without additional control variables. Given the limitations of available survey data on school districts, I have instead adopted a control variable strategy similar to the use of a lagged dependent variable in a time series model. I include a control variable that measures the general collaborative tendency of the school district as the number of “other” collaborations (the total of all collaborations other than the one measured in the model – so all non-nonprofit organization collaborations in the nonprofit model). This variable should help mitigate omitted variable bias by controlling for unmeasured factors that are correlated with general collaborative tendency. This also affects the interpretation of the results. The effect of each variable is then the independent effect of the variable on the resilience of the studied relationship in addition to the effect general collaborative tendencies. The model represents a “hard” test of these hypotheses when including the control variable.

The models then consists of:

$P$  (Sustained Collaboration) =  $f$  (Organization Size, Emergency Management Centralization, Impact of Recent Emergencies, Likelihood of Emergencies, General Collaboration Tendency).

Because the dependent variable only takes on values of zero and one (representing lapsed and sustained collaboration), a traditional linear regression is not appropriate. Instead, I employ a logit regression model with robust standard errors. This model accounts for the dichotomous nature of the dependent variable but still allows for the test of multiple independent variables. The coefficients and standard errors produced by this

estimator are difficult to interpret directly, so I will provide not only these values but also figures illustrates the simulated probabilities of sustained collaborations at various theoretically interesting values.

#### IV. Results

The results of the regular meetings with PFF organizations model are reported in Table 1. The overall model fit is difficult to assess on such a discrete choice model. The model correctly predicts the observed value of collaboration resilience almost 70% of the time. However, since almost two-thirds of all collaborations in the sample were sustained, this is only a 4% improvement over the naïve guess of all collaborations being resilient.

The individual coefficient tests are more informative. While all of these variables had been significant in previous assessments of the initial decision to collaborate (Robinson 2008), only organizational size and the control variable for general collaborative tendency are individually significant. The coefficients reveal that larger organizations and those that display a larger general collaborative tendency are more likely to sustain regular meetings with PFF organizations. To see the size of these effects, I ran 1000 simulations of the outcome variables based on all other variables in the model being held at their average value (the mean for continuous variables and median for categorical variables) to assess the estimated probability of sustained collaboration at different levels of the significant variables. The results of these simulations are presented in figures 1 and 2. One can see that small districts (districts for which only 20% of observed districts

were smaller) are expected to sustain their collaborations just over 50% of the time. Large districts (districts for which only 20% of observed districts were larger) are expected to sustain their collaboration about 75% of the time.

Figure 2 represents the impact of the control variable for general collaborative tendency. Again, the districts with the lowest general collaborative tendency (those reporting no other partners) are expected to collaborate around 55% of the time. Districts with who collaborate with all of the potential other partner types are expected to collaborate over 75% of the time. It is interesting to note how similar an effect moving from small to large district size is to the effect of moving from having no other partners to collaborating with the full slate of other partners.

To test how robust these findings are, I conducted a parallel test of collaboration with nonprofit and relief organizations. As discussed in the previous section, this is a lower threshold definition in that every respondent can define for him or herself what constitutes collaboration. The model, using the same independent variables, assess the effect, if any, of the independent variables on the probability of a reported sustained collaboration with nonprofit or relief organizations.

Table 2 reports the results of the analysis of sustained collaboration with nonprofit and relief organizations. The overall fit of the model is similar to model 1. The model correctly predicts sustained collaboration 73.9% of the time – representing a 4.5% percent increase in accuracy over the naïve model. In this model, organization size is again a significant factor – this time, the only significant factor. The general collaborative tendency variable falls to non-significance. The coefficient is in the same direction but since it is not a significant variable, I will discuss it no further. Figure 3



presents the simulated probabilities of sustained collaboration for organizations of different sizes. The expected probability of sustained collaboration with nonprofit and relief organizations for small districts is above 60% while the probability for large districts is just above 80%. These effect sizes are not as large as those in the model for sustained regular meeting with PFF organizations, but are encouragingly similar.

## V. Conclusions

The results for this preliminary study are not entirely surprising. Previous work on the initial collaboration decision has made clear that organizational structure is a primary driver of organizational collaborations in matters of emergency preparedness and response (Robinson 2008). This study only considered the decision to sustain collaboration, including only those organizations that had previously collaborated following the hurricanes. The results suggest that the forces that are related to the initial collaboration decision are generally unrelated to the decision to sustain those collaborations. The only force that consistently matters in the models of sustained collaboration is organizational size. Large districts are more likely to sustain collaborations. The literature in structural organization theory suggests that large organizations are capable to investing resources in specialized boundary spanning units – thus encouraging sustained collaborations. There are other possible interpretations of this variable that cannot be addressed with the available data. It could be that larger districts are different less in their internal structure than in the nature of the potential partners that surround them. Previous research has found that, controlling for size, districts in more

affluent districts are no more likely to initially collaborate (Robinson 2008), but it could be that large districts simply have more available partners. Without any data on partner density within the reach of districts, it is not possible to control for this possible factor likely related to size.

It is also possible that larger school districts have different inducements to offer potential partners, and that it is not size – per se – that is important. Corroborating interviews with school district officials have not turned up any indication that districts differ widely in what they offer partners. For the most part, the districts see their collaborations as involving partners helping them – rather than an exchange of services. This suggestion, however, does warrant further consideration. In all, these possibilities suggest that more data on the supply side of collaborative partners would be helpful.

In conclusion, organization size and little else seems to support sustained collaborative partnerships. The implication of this admittedly initial finding may be troubling to some. If sustained collaboration is a product of factors outside the control of managers, it may be that sustained collaboration is more a matter of luck than strategic choice on the part of trained managers. We can hardly train managers to be in large organizations. At most we can recommend the legislature that draw jurisdictional maps to design larger jurisdictions for larger organizations if they want to increase the probability that these organizations will sustain collaborations. This contrasts rather sharply with the many case study accounts of collaboration that focus on the role of entrepreneurial leaders in creating and sustaining collaborations. It could be that these studies are subject to fundamental attribution bias in which people tend to attribute all events to human agents even when these events are the product of chance or structures

outside of the control of human agents. It could also be that the coarseness of the measures of managerial attitudes towards delegation and disaster situation are masking what would otherwise be significant relationships (though test of the initial collaboration decision that included a more diverse set of attitude questions similarly found small or insignificant relationships). This problem may be easier to solve. There is a room for improvement in the measurement of managerial attitudes. In the mean time, the results do suggest that to be taken seriously, studies of managerial attitudes need to compare the effect of these variables to the already proven structural variables.

Table 1. Factors Influencing the Likelihood of a Sustained Collaboration with Police, Fire, and First-responder Organizations

<b>Independent Variable</b>	<b>Coefficient</b>	<b>Z-score</b>
Organizational Size	.458	3.95
Emergency Planning Centralization	-.151	-.82
Recent Disaster Impact	-.249	-1.26
Likelihood of Disaster	.018	.10
General Collaborative Tendency	.207	2.25

N: 295

Proportion Correctly Predicted: 69.5%

Improvement in Prediction: 4.3%

Table 2. Factors Influencing the Likelihood of a Sustained Collaboration with Nonprofit Relief Organizations

<b>Independent Variable</b>	<b>Coefficient</b>	<b>Z-score</b>
Organizational Size	.354	2.26
Emergency Planning Centralization	-.075	-.24
Recent Disaster Impact	-.397	-1.38
Likelihood of Disaster	.037	.272
General Collaborative Tendency	.238	1.52

N: 161

Proportion Correctly Predicted: 73.9%

Improvement in Prediction: 4.5%

Figure 1. District Size and Sustained Regular Meetings

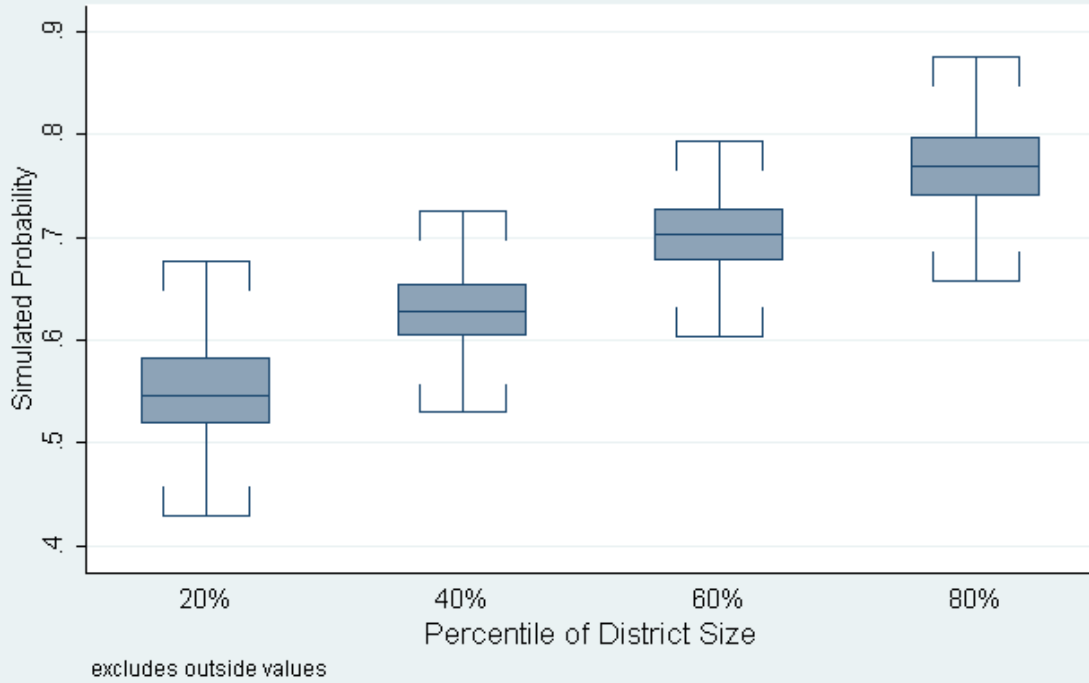


Figure 2. Collaborations and Sustained Regular Meetings

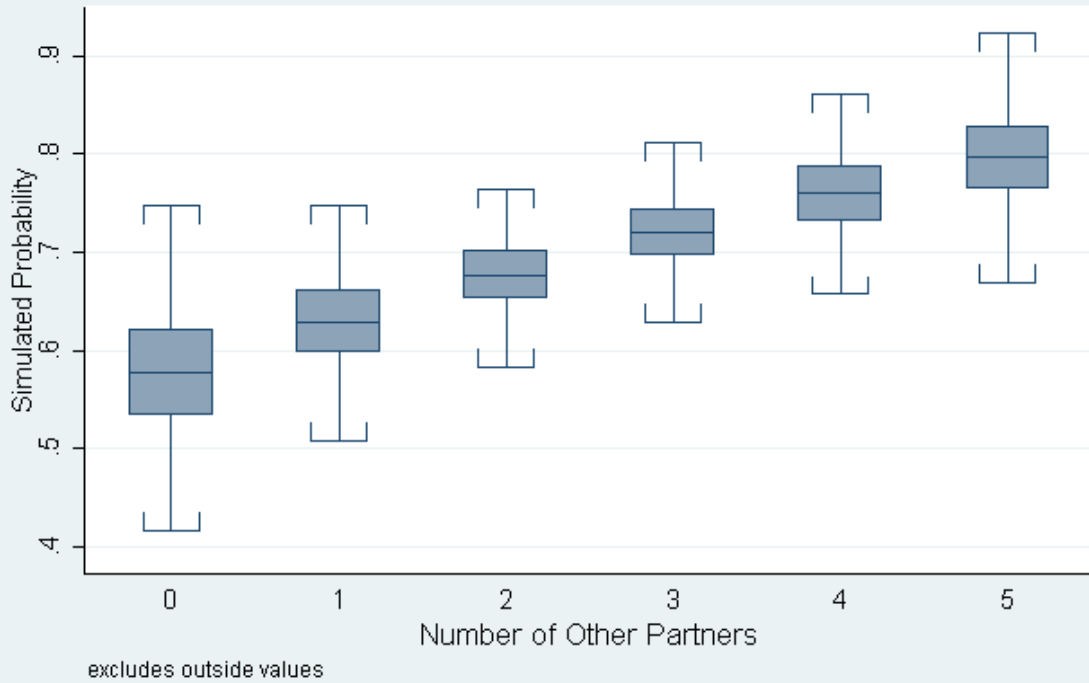
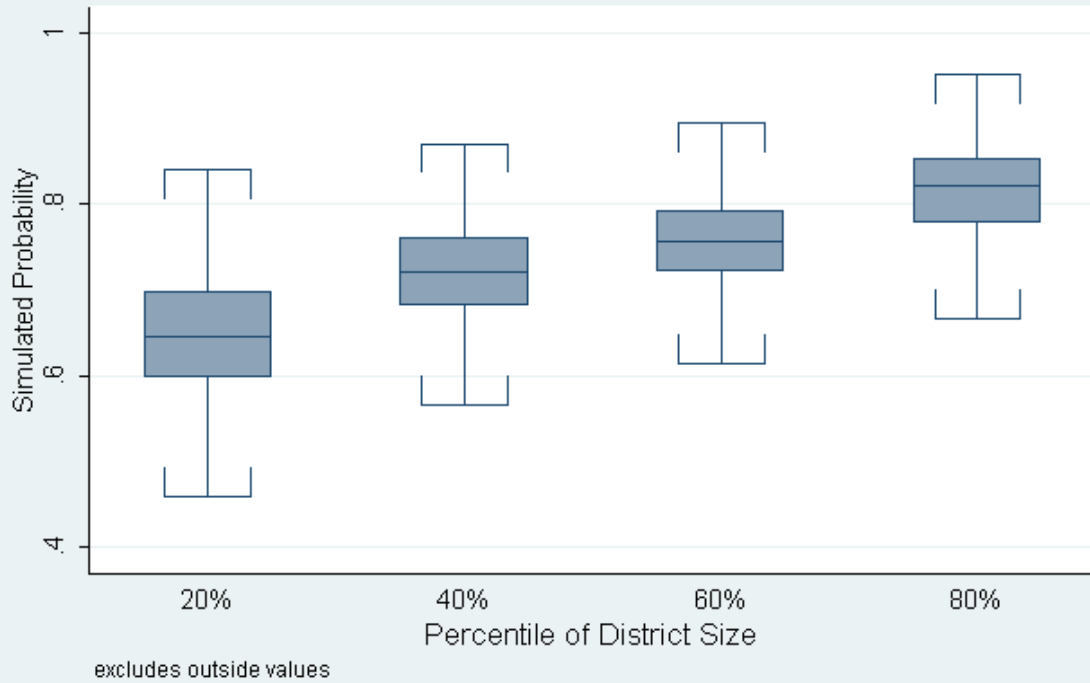


Figure 3. District Size and Nonprofit Collaboration



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