RESEARCH NOTE

Do Antipoverty Nonprofits Locate Where People Need Them? Evidence From a Spatial Analysis of Phoenix

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This work explores the spatial connections between nonprofit organizations that have an antipoverty focus and poor residents in the greater Phoenix, Arizona, metropolitan area. Substantial population and service growth occurred in Phoenix between 1990 and 2000, with almost twice the number of organizations and almost three times the amount of expenditures in 2000 than in 1990. Empirical evidence supports that these nonprofits locate in areas of greater need, but evidence that those organizations affect neighborhood poverty is weak, suggesting that the government should not retract services and that further nonprofit organizational growth may be necessary. The comprehensive measure of accessibility and two-way causal analysis are proposed for future replication.

Keywords: *poverty; nonprofit organizations; spatial analysis*

Between 1990 and 2000, the greater Phoenix metropolitan area experienced a very large growth in population. This was coupled with the population becoming slightly more disadvantaged by a variety of measures, although education levels increased. Of particular interest to this research is the extent of poverty, which increased slightly between 1990 and 2000. During the same period, the nonprofit sector grew in terms of both numbers and spending. This work explores specifically those organizations that have some antipoverty function and suggests a fruitful approach to exploring this topic.

   This research article focuses on these questions about the spatial connections between anti-poverty-serving nonprofit organizations and needy residents: To what extent do nonprofit organizations with an antipoverty function locate in areas with high poverty, and given the locations of these organizations, to what extent do they reduce poverty in their vicinities? First,

I highlight relevant findings from prior research on the locations of nonprofit organizations and their connections to target populations. Then, I detail data and methods and discuss the analytic findings, implications, and next steps.

RESEARCH FOUNDATION AND QUESTIONS

A body of research explores the location decisions of nonprofit organizations, and some of that work focuses on anti-poverty-oriented, human service agencies in urban areas. A general tendency of the research is to explore the location decision itself as a function of neighborhood characteristics. The characteristics that are hypothesized to matter regarding nonprofit location include measures of need (such as poverty density), population characteristics (such as education levels, racial distribution, age, families' structure), community characteristics (such as heterogeneity, incorporation date, urbanicity), resources (such as government expenditures, property tax base, housing values), and other organizations' locations (both for-profit and nonprofit organizations) (e.g., Bielefeld & Murdoch, 2004; Bielefeld, Murdoch, & Waddell, 1997; Joassart-Marcelli & Wolch, 2003). For example, work on this topic by Bielefeld et al. (1997) concludes that income, age, and minority racial heterogeneity positively influence whether nonprofits will locate nearby, whereas income heterogeneity and age heterogeneity negatively influence it. Furthermore, they find that populations' characteristics within 1 mile are stronger at explaining nonprofits' locations than are characteristics further away.

A particularly useful model for this work is Joassart-Marcelli and Wolch's (2003) study of Southern California cities. They find that nonprofit spending per poor person declines as poverty rates increase, the number of organizations per poor person decreases as poverty rates increase, but overall poverty is hardly correlated with nonprofit activity. Focusing on the determinants of nonprofit activity, their regression analysis concludes that "nonprofit activity may not necessarily target all poor people in a similar fashion because nonprofit resources are so unevenly distributed across metropolitan communities" (p. 91).

In a three-city study, Allard (2004) also explores the poverty–nonprofit service connection, learning that center-city poor have greater access to services than those in the suburbs and that demographic changes do not necessarily match well to the location of service provision. In addition to the specific focus on nonprofit organizations and poverty, some researchers have begun to focus specifically on welfare populations as a subset of the poor. They explore the extent to which welfare recipients are spatially connected to employment-related support services (Allard & Danziger, 2003; Allard, Tolman, & Rosen, 2003). This is especially important because of the changing nature of welfare programs and the potentially increasing demands placed on government and nonprofit agencies to meet target populations' needs.

In brief, one of the common findings of this research is that nonprofits tend to locate in somewhat more advantaged areas for a variety of reasons. This analysis explores both the characteristics associated with nonprofit organizations' locations as well as the subsequent implications for community well-being. Of course, one would not assume that a neighborhood would become more disadvantaged because of an agency's locating there, but an important unanswered question is the extent to which neighborhoods change as the result of nonprofits' locating and spending. As such, this research explores the two-way causal arrow that exists between nonprofits' locations and the characteristics of neighborhoods in which they locate. Furthermore, few studies have capitalized on data that report changes in neighborhood characteristics and service agencies' locations and spending.

This research is interested in the extent to which antipoverty nonprofits locate in areas of need and whether that location has positive repercussions for those neighborhoods. The specific research questions posed are as follows:

- To what extent are antipoverty nonprofits located in areas of high poverty density?
- Given Phoenix's geographic distribution, how accessible are these organizations (and their expenditures) to poor residents?
- What neighborhood characteristics, if any, predict nonprofits' and/or their expenditures' locations?
- To what extent is the presence of nonprofits and/or their expenditures associated with a favorable change in neighborhood need over time?

DATA

This research links data from two primary sources: the National Center for Charitable Statistics (NCCS) and the U.S. Census Bureau. In particular, I use the NCCS Core Files from each of the years 1988, 1989, 1990, 1997, 1998, and 1999. These files are based on IRS 990 Form data that nonprofits with gross revenues greater than $25,000 submit triennially. As others have noted, these data have some limitations, but I assert that the benefits far outweigh the drawbacks, which I attempt to minimize, as described below.

I use the National Taxonomy of Exempt Entities to select organizations that provide direct services to the poor in the following broad categories: education, health, mental health, justice, food banks/soup kitchens, shelters, legal services, community development, housing, youth development, residential services, foster care and adoption, and homeless services.[1] If organizations in this categorization do not serve the poor, they are most likely random in their spatial distribution and therefore should not affect or bias the results (Joassart-Marcelli & Wolch, 2003, p. 77).

With these several years of data, I pool 3 years at a time, dropping any resulting duplicate organizations, for each of the years of linked Census

data. I do so because only one-third of organizations submit information per year, which has posed problems in prior research.[2] That is, the 1988, 1989, and 1990 Core Files provide the organizational data that I link to the 1990 Census data on individuals; the 1997, 1998, and 1999 Core Files provide the organizational data linked to the 2000 Census data.[3] Combining the files in this way ensures inclusion of all organizations that are required to file these forms. Organizations' addresses are used to geocode the data set, converting it from an organization-level data set to a census tract–level data set, where each tract's characteristics include the number of organizations located within 1½ miles of the tract's center and the expenditures of those organizations.

Given this project's interest in location, the prevalence of post office box addresses in the NCCS data poses a problem. Although others have dealt with this problem by eliminating these organizations from their analysis data set, I had the luxury of locating by hand organizations' addresses through online yellow page searches. The search yielded street addresses for many organizations. For the remaining organizations, the data set uses the P.O. box location's zip code as the address, which is a reasonable proxy for an organization's location.[4]

An important unresolved problem is that some organizations are not required to file the 990 Form: These are either small organizations or religious organizations, and there is no clear fix to the data's omission. If these organizations are similarly disbursed across the metropolitan area as the organizations contained in the data set, then the data will sufficiently capture the general relationship. In fact, the resulting bias (given the assumption of nonsystematic distribution of small or religious organizations) would suggest that any substantive findings that come from this research would underrepresent the strength of relationships that exist.[5]

In addition to the NCCS data, I use data from the U.S. Census Bureau's decennial census Standard Form 3 (SF-3) for both 1990 and 2000. These are the long-form (detailed) data that are available at the census tract level and describe many characteristics of those neighborhoods.

MEASURES AND METHOD

The general descriptive measures used in this study fall into four main categories: need, demographic characteristics, resources, and organizations. A measure of accessibility assesses the extent of the connection between poor residents and anti-poverty-serving nonprofits. These are all measured at the census tract level and are discussed in more detail below.

Need measures include the proportion of people whose incomes are lower than the federal poverty line, the proportion of households with cash assistance income, the labor force participation rate, and the unemployment

rate. Demographic characteristics used in the analyses include the proportion of the population (older than age 25) that has completed a high school degree or equivalent and the proportion of the population in the following race and ethnicity categories: non-Hispanic White, non-Hispanic Black, Hispanic, American Indian, Asian/Pacific Islander, and other. I use average occupied housing values and the proportion of housing units that are renter occupied to measure the resources a neighborhood has. All of these measures are computed from the U.S. Census Bureau's SF-3 tables. Also aggregated to the census tract level are the variables pertaining to antipoverty nonprofits. These measures are the number of organizations within 1½ miles of the census tract's center and organizational expenditures.

The notion of accessibility has posed challenges to other analysts, and I have attempted to build on prior research in developing a useful measure for this project. My measure is based on the observation that individuals who live in a particular census tract access services and amenities not only in their own census tract but also in neighboring tracts and distant tracts, as do others across the metropolitan area. To measure service accessibility, I use the general model that Wang and Minor (2002) use in their examination of connections between employment, jobs access, and crime. Theirs is a common gravity-based accessibility index that combines information about individuals, competition, and distance that I adapt to measure service accessibility (A) in each census tract as follows:

$$A_i = \sum_{j=1}^{n} \frac{J_j d_{ij}^{-\beta}}{V_j},$$

where

A_i is the service provider accessibility at location i,

J_j is the number of organizations (or service dollars) in location j,

d_{ij} is the distance (as a linear measure) between residential and service locations,

β is the distance friction (an empirically determined constant),[6] and

n is the total number of service provider locations;

and where

$$V_j = \sum_{k=1}^{m} W_k d_{kj}^{-\beta},$$

where

V_j is the service competition intensity at location j, and

W_k is the service provider's proximity to each poor person.

This computation creates two measures, one for access to the number of organizations and one for access to organizations' expenditures. These measures account for the distance decay of organizations (and their spending) over space as well as the competition that exists among target populations for services and service dollars.
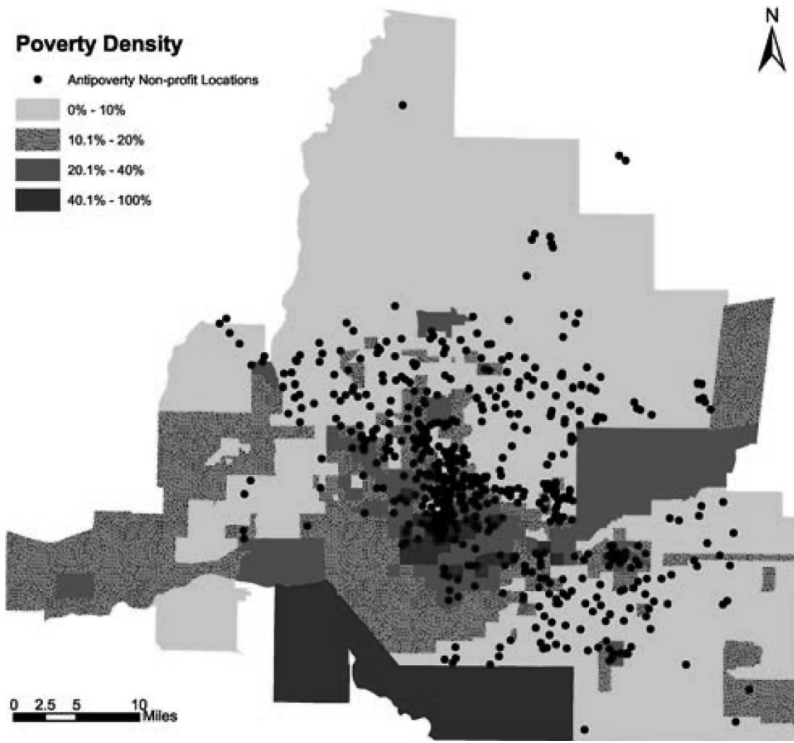
Figure 1. Location of Nonprofit Organizations Relative to Poverty Density in Greater Phoenix, 2000

Source: Author's computation from the U.S. Census, 2000, Summary File 3, and from the National Center for Charitable Statistics IRS 990 Form data, 1997 to 1999.

The geographic information system analysis and other descriptive analyses are used to describe the state of the urban area and the change that it experienced between 1990 and 2000. The crux of the analysis relies on an ordinary least squares (OLS) regression, where the unit of observation is the census tract. These regressions explore the relationships between organizations (the number of them and their expenditures) and other neighborhood characteristics. I use both level and change measures to help identify not only the factors associated with nonprofits' service provision but also the implications of that provision for neighborhood poverty rates.

FINDINGS

Consider the general relationship between poverty and nonprofit location in Phoenix, as depicted in Figure 1: A greater density of organizations exists

in the central part of the metropolitan area, with dispersion occurring primarily in the east and north-easterly directions. This leaves a notable void of organizations on the west side as well as in the south, where there is an Indian reservation that demonstrates high poverty. Descriptive analysis (see the appendix) shows that the average census tract in moderately high and very high poverty density areas, respectively, had 14.3 and 18.2 organizations within a 1½ mile buffer, compared to 4.7 organizations in low poverty density areas and 9.4 organizations in areas of average poverty density. This bivariate relationship does not account for the whole set of neighborhood characteristics that might matter, in addition to poverty, in an organization's location.

As noted earlier, people are not restricted to accessing organizations within their tract of residence or even to accessing organizations within 1½ miles of that location. In response to this observation, I use a measure of accessibility that accounts for access to organizations over space (not restricting people to access only those organizations that are in or near their tract proper) and also for the competition between poor people for services. Figure 2 shows the spatial distribution of this measure of accessibility to organizations, revealing that, in 2000, access to organizations was much greater in the areas extending from the central part of the metropolitan, where poverty density tends to be somewhat greater, to the northeast valley, where poverty density is very low. Particularly along the Mesa corridor (extending east), there are pockets of very low accessibility where there are areas of moderate and high poverty density.

The comparison shows greater numbers of organizations located in places where there is greater poverty, but when competition for services is accounted for (in the accessibility measure), organizations that serve the poor appear not to be ideally situated. The next section reports the results of a series of multivariate regression analyses that intend to tease out both some of the factors that affect these nonprofits' location decisions and the resulting implications for neighborhoods.

The first set of regressions analyzes the level of organizations and expenditures as a function of the level of neighborhood characteristics, and the next set analyzes change over time in organizations and expenditures as a function of change in neighborhood characteristics. I then report the results of analyses in which the causal arrow is pointed the other way, that is, exploring measures of poverty as a function not only of other neighborhood characteristics (those that matter for determining the level of poverty) but also of organizations and expenditures. Results follow.

Table 1 reports the results of four models of the determinants of the number of nonprofits (within the 1½ mile buffer) and the amount of organizational expenditures (also within the 1½ mile buffer). As a function of the needs, demographics, and resources within the census tracts, organizations tend to be influenced by poverty, ethnicity, and rates of renter occupancy. More specifically, holding other characteristics constant, a 10% increase in the poverty rate within
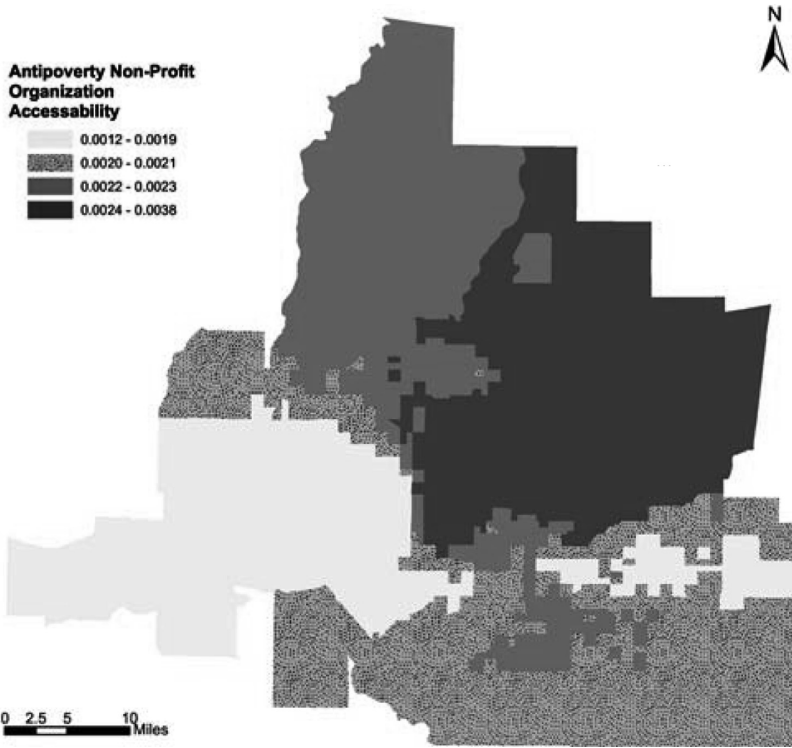
Figure 2.   Organizational Accessibility, 2000
Source: Author's computation from the U.S. Census, 2000, Summary File 3, and from the National Center for Charitable Statistics IRS 990 Form data, 1997 to 1999.

a tract is associated with having about 0.13 more organizations locating within 1½ miles. Although this finding is statistically significant, it is not large in magnitude, considering the average number of organizations by tract across the metropolitan area (7.8 in the year 2000). In other words, a 10% increase in the tract's poverty rate compels about a 1.7% increase in the number of anti-poverty-serving organizations locating there. Nevertheless, at least in 1990, these larger numbers of organizations did not correspond to more spending due to poverty; a 10% increase in the tract's poverty rate is associated with $233,000 less in expenditures (the corresponding finding for 2000 is not statistically significant).

In addition to poverty, the ethnicity of a tract's residents seems to influence whether anti-poverty-serving nonprofit organizations locate there, and in 2000 the magnitude of the effect is larger than the influence of poverty. Specifically,

Table 1.   **Organizations and Expenditures as a Function of
Neighborhood Characteristics**

	Dependent Variables			
	Number of Organizations Within 1½ miles		*Expenditures by Organizations Within 1½ miles*	
Independent Variables (level)	*1990*	*2000*	*1990*	*2000*
Needs				
People under the federal poverty line	12.96*	13.94*	–23,303,374**	10,530,422
Unemployment rate	–1.50	17.86	8,269,917	26,679,564
Demographic characteristics				
Non-Hispanic White	5.64	26.18***	5,735,912	27,596,919+
Hispanic	9.08+	40.06***	15,017,315*	74,520,363**
Older than 25 years with high school completion	4.34	3.08	15,359,310*	9,966,989
Resources				
Average occupied housing value (000s)	0.01*	0.01	8,067+	43,361**
Renter-occupied housing	16.43***	21.67***	19,191,072***	42,026,432***
Intercept	–12.25+	–29.85***	–24,481,107**	–48,123,854*
Adjusted R^2	.201	.200	.178	.120

Note: Except for average housing value (which is measured in thousands of dollars), the level of the independent variables is a percentage, where 10% is 0.10 in the data set. A plus sign indicates $p < .20$ (marginally statistically significant).
*$p < .10$. **$p < .05$. ***$p < .01$.

a 10% increase in the rate of the population that is Hispanic increases the number of organizations within the 1½ mile buffer by four, which (at the mean) represents more than a 5% boost in the year 2000. Furthermore, the same 10% increase in the proportion of tract residents who are Hispanic is associated with an increase in nearby spending by a statistically significant $150,000 in 1990 and $745,000 in 2000. Tracts with higher rates of renter occupancy also see greater numbers of organizations (0.22 more in 2000) and greater organizational expenditures ($420,000 more) within 1½ miles. These findings suggest that the Phoenix-area nonprofit organizations that target poverty locate in areas with somewhat greater need.

Taking advantage of having 1990 and 2000 data, I next explore whether changes in neighborhood characteristics are associated with changes in nonprofits and their expenditures. Although a couple of statistically significant coefficients exist—related to the number of organizations—the explanatory power of these models is very low (adjusted R^2 statistics were .055 and .009 in the two models). The large growth in the number of organizations and in organizational expenditure that is observed across the metropolitan area is

Table 2. Poverty as a Function of Organizations and Expenditures

	Dependent Variables		
	Poverty 2000	*Poverty 2000*	*Change in Poverty*
Independent variables (measure)	*f* (1990 level)	*f* (change)	*f* (change)
Needs			
Unemployment rate	1.47***	0.01	0.11
Demographic characteristics			
Non-Hispanic White	–0.15***	–0.35***	0.35
Hispanic	–0.06+	–0.02***	0.05
Older than 25 years with high school completion	–0.04	0.21***	–1.34**
Resources			
Average occupied housing value	0.00*	–0.09***	0.25
Renter-occupied housing	0.14***	–0.01+	0.14*
Nonprofit organizations[a]			
Number of organizations	0.001	–0.004	0.085
Expenditures (000s)	0.000	–0.004	0.040
Intercept	0.16***	0.02***	0.38**
Adjusted R^2	.589	.465	.005

Note: Below the column headings that identify the dependent variables in each of the four models appears the measure that the independent variables assume. For instance, the third column explains the 2000 poverty level as a function of the 1990-2000 change in tract characteristics. A plus sign indicates $p < .20$ (marginally statistically significant).

a. The number of organizations and expenditures are those measured within 1½ miles of the census tract's center.

*$p < .10$. **$p < .05$. ***$p < .01$.

not related in any systematic way to the changes that neighborhoods experienced between 1990 and 2000.

Next, the question that I am more interested in is whether the presence of anti-poverty-serving nonprofit organizations improves conditions within the neighborhoods where they locate. Table 2 reports the results of three regressions that are intended to help address this issue. I expect that it is somewhat unlikely that organizations will have an immediate (same year) effect on outcomes, which is why I present three change, or time-lagged, models. The table shows the 2000 poverty rate as a function of 1990 characteristics, the 2000 poverty rate as a function of the 1990-2000 change in characteristics, and the 1990-2000 change in poverty as a function of the 1990-2000 change in characteristics. These models attempt to get at the various possibilities of effects that might exist. If organizations are going to affect poverty outcomes where they are located, this effect is most likely to occur as a function of the characteristics at a prior time point, while controlling for other important neighborhood characteristics. As shown in

Table 2, the organizational variables in these three specifications are indistinguishable from zero, whereas other neighborhood traits—including unemployment, demographics, and housing—are substantially important in explaining the poverty rate.

DISCUSSION AND CONCLUSION

In brief, the research presented here suggests that other factors in the world—the economy and other neighborhood conditions—have far greater traction in explaining poverty, whereas the influence of anti-poverty-serving nonprofit organizations is essentially nonexistent. Of course, these nonprofits are not the only efforts in place to improve conditions for poor people. Churches and government agencies (neither of which is included in this data set) also assist, and perhaps these efforts taken together might reflect a greater influence, if there is one. Follow-up research might expand the service data set to include these institutions. On the issue of whether nonprofits locate in areas of need, both descriptive and multivariate analyses show that anti-poverty-serving nonprofit organizations locate in areas with greater poverty, even controlling for other contextual factors. So, organizations are located in a manner to be able to affect neighborhood conditions, although little evidence of effect exists so far.

This work is important for several reasons. First, in the greater Phoenix metropolitan area alone, the subset of nonprofits that have an antipoverty focus spent roughly $1.4 billion in the year 2000. It is worth assessing the extent to which these funds are being productively spent. Next, spatial analysis of the connections between disadvantaged residents and social services may offer insights regarding service effectiveness. Finally, as welfare caseloads have eliminated nearly all but those with the most complex employment barriers, both government and community agencies are faced with serving this more challenging population. The role of nonprofit organizations in meeting these needs is important, and this work begins to quantify the extent to which nonprofit service agencies are poised to help.

Clearly, there is need for additional analysis on this topic. In particular, the observation that poverty influences organizations that intend to influence poverty creates a specification problem that should be addressed. Future research should also continue to focus on diverse city types and not only explore what is unique to each specific urban area but also what is common across certain city types that vary by factors such as age, region, growth trends, and other factors. This article has presented an approach to using existing data and considering accessibility that might be replicated to increase scholarly and practical knowledge on the topic of the location of antipoverty nonprofits and its implications.

Appendix
Poverty and Organizational Presence in
Phoenix Census Tracts

	Less Than 10%	10% to 20%	20% to 40%	More Than 40%
	Low	*Average*	*Moderately High*	*Very High*
Number of tracts	388	136	106	26
Selected needs				
People under the federal poverty line				
1990 (%)	5.8	13.0	25.3	49.6
2000 (%)	5.5	14.2	27.9	53.7
Change, difference of averages (%)	–4.9	9.8	10.6	8.3
Change, average of differences (%)	27.0	37.8	24.1	10.9
Change, median of differences (%)	–6.8	19.3	14.1	5.1
Nonprofit organizations				
Number of organizations within 1½ miles				
1990	2.6	6.6	10.0	13.6
2000	4.7	9.4	14.3	18.2
Change[a] (%)	83.7	42.6	43.4	34.0
Expenditures within 1½ miles				
1990	$2,727,623	$7,097,815	$11,940,484	$18,483,070
2000	$6,089,779	$17,588,058	$28,646,616	$29,293,980
Change (%)	123.3	147.8	139.9	58.5

Note: Three measures of change are reported for poverty. The difference of averages is computed as the difference between the tract-average 2000 measure and the tract-average 1990 measure, divided by the tract-average 1990 measure. In contrast, the average (or median) of the differences first creates a measure of difference (2000-1990) at the tract level and then averages that change measure (or takes the median) across the tracts. As noted, the difference of the averages is negative (poverty declined overall), but the average of differences is positive (the average difference in 1990-2000 poverty rates increased, although the median tract experienced a decline). Difference-of-averages figures may compute differently when computed at one decimal place (due to rounding); the figures in the table are computed at many places and then rounded for presentation.

a. As shown, the number of organizations increased in all neighborhoods, with the highest poverty density tracts having the largest numbers but also the smallest increase. The median tract in this category saw a 6.7% increase in the number of organizations located within 1½ miles, whereas the median tract in the lowest poverty density areas saw a 35.7% increase. This may be attributable in part to the different bases from which they were starting.

Notes

1. For additional information on which types of organizations were selected and why, see Joassart-Marcelli and Wolch (2003), whose decisions serve as a model for this work.

2. Other scholars using these data have identified that the fact that organizations cease to exist is a problem because these organizations may remain in the data set. What is a drawback to them is an advantage for this project because over-time variation in the number, location, and spending of organizations enhances the amount of available data. Newly formed and recently expired organizations are captured by the use of several years of the National Center for Charitable Statistics data, with attention to the data filing year (as opposed to the data submission year) and subsequent purging of duplicate observations (that others note remain in the data by virtue of not having multiple years of observations).

3. For the 1990 comparison, about 82% of the data reported are from the most recent year (1990, as opposed to 1988 or 1989). For the 2000 comparison, 36% of the organizational data reported is from 1999, and 55% is from 1998. This is likely the case because our most recent data collection year was 2000, meaning that many organizations may not yet have had the opportunity to report their 1999 financial data. To the extent that this introduces bias, it may underestimate the accessibility of nonprofits because the general trend has been toward expansion, and I have not yet captured the full expansion to 2000 that has occurred in reality in my data set. This means that any estimated positive impacts are smaller than they would be, introducing a conservative (favorable) bias.

4. A related problem, unresolved, pertains to headquarter locations and satellites and organizations with privacy concerns. For tax-filing purposes, some organizations use a central address, although they may provide services in multiple locations. A common such organization might be a food bank that distributes food from a warehouse to many partner agencies that then deliver food to clients. Similarly, some organizations do not provide a street address for confidentiality reasons; domestic violence shelters have good reason for not making their locations public. But, as Joassart-Marcelli and Wolch (2003) note, the headquarters-satellite problem is a bigger issue for larger organizations such as public charities, which are not included in their analysis or in this one. In particular, the data set used here excludes "mutual-benefit public charities (which distribute funds to operating public charities and might lead to double counting)" (Joassart-Marcelli & Wolch, 2003, pp. 76-77) in order to be comparable to prior research. Even for those organizations with privacy concerns, not having their street addresses may not pose a large problem for at least two reasons. First, people are probably willing to travel longer distances to access these services; they are perhaps more likely to use a shelter that is not in their neighborhood of residence than one that is, for perceived safety reasons. Second, for these organizations, I likely have their post office box addresses. If that address is not too distant from the location of service delivery, then I will capture roughly the location of their services. These two factors combined suggest that the problem of service confidentiality precluding specific location data is not a severe problem.

5. Joassart-Marcelli and Wolch (2003) conclude that they are satisfied with the data and that any lingering problems are not systematic. I have used their data structuring as a model but have taken some additional steps to massage the data (by pooling several years for instance). I likewise believe that it is unlikely that any major biases exist by virtue of what is included or excluded from this particular data set.

6. The β used here is computed using ordinary least squares regression, estimating the number of commuters (C) as a function of the number of working-aged people (W), the number of jobs (J), and the distance (d) between them. Specifically, I log-transform the original model, $C_{ij} = aW_jJ_jd_{ij}^{-\beta}$, into the following for ease of estimation: $\ln[C_{ij}/(W_jJ_j)] = \ln(a) - \ln(\beta)$. Phoenix's resulting β is 1.12, which, when used in the computation of the access measure (raising distance to the negative β), suggests the extent of the stickiness, or friction, associated with travel in Phoenix. For instance, if the sum of the distance from one census tract's center to all other tracts' centers were 40 kilometers, its $d_{ij}^{-\beta}$ value would be 0.016; whereas the tract situated 80 kilometers from other tracts would have a $d_{ij}^{-\beta}$ value of 0.007. Whereas the ratio of the raw distance is 2 (80:40), the ratio of their friction-adjusted distances is 0.460. The value of β likely has a relatively minor effect on the access measure (Wang & Minor, 2002), but it more accurately reflects the effects of varying distance over space. I believe that it is appropriate to use commuters and

jobs, rather than poor residents and organizations, because prior work has suggested that distance friction is a function of more common intrametropolitan travel than the unique application here to antipoverty nonprofits.

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