So Close, yet so Far Away?
The Effects of City Size, Density and Growth
On Local Civic Participation

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Abstract
Recent studies in the US context have suggested that political participation is a function of the size and concentration of a city’s population. Most of this research focuses on the idea that there is an optimal size and concentration of population that favours active political participation in terms of a higher propensity to vote in local elections, contact local officials and attend community meetings. The conventional argument suggests a negative relationship between city size and political participation (Oliver, 2001), that is mitigated to some extent by the deeper social interactions generated by increased population density (Stein and Dillingham, 2004). We extend this research by also investigating the influence of population growth on the broader concept of civic participation. Civic participation is a multidimensional concept that requires the use of a broad set of indicators. We expand the number of measures to gauge civic participation at the local level by including data on the formation of volunteer associations, volunteer fire brigades and not-for-profit organizations as well as voter turnout. We test the hypotheses derived from extant research using aggregate data collected from Portuguese cities and discuss the implications of our findings for the literature on local civic participation.
The Effects of City Size, Density and Growth on Civic Participation

In their 1963 seminal study *Civic Culture: Political Attitudes and Democracy in Five Nations*, Gabriel Almond and Sidney Verba explain how civic culture can contribute to democratic stability by fostering political participation. They describe a complex process of socialization involving social institutions (family, peers, school, work, and the political system itself) that contributes to the development and participation in the civic culture. Their conclusion that political and civic participation varies across countries raises questions about the generalization of findings from recent studies examining the American context about the factors affecting civic participation.

Empirical research in the US setting often employs socioeconomic status and metropolitan political structures as explanatory factors of political participation, typically measured as voter turnout in local elections (Oliver, 1999; Kelleher and Lowery, 2004). This research is centered on the role of city population levels and differences in the concentration of population within metropolitan areas as potential constraints or facilitators of political participation. Much of this scholarship, however, reflects the structural setting of the political system in the US and it is not clear that these causal relationships apply to other contexts.

We have three specific objectives for this research. First, we focus on civic participation at the local level by arguing that the presence of voluntary actions and civic and political engagement constitutes an indicator of social capital within local governments. The aggregate measures we employ convey the idea that social capital is a property of communities and groups that can only be observed as a result of human interaction (Costa and Kahn, 2003; Newton, 2001) and the variation across cities can
only be measured and evaluated by looking at aggregate measures that reveal those differences (Rubenson, 2005). Significantly, we argue that political participation is just one part of a broader set of actions described as civic participation. Rather than simply looking at political participation as is the convention in this literature, we also include the following measures of local civic participation: the numbers of volunteer associations, volunteer fire brigades, and non-profit organizations. Finally, whereas prior research has typically focused on social capital as an independent variable (McClurg, 2003; Teorell, 2003), it is a dependent variable in our analysis. We offer an explanation for differences in civic engagement across local governments by focusing on the size, density and growth of city populations in explaining differences in revealed civic participation across local governments.

Second, we seek a better understanding of how the size of cities in terms of population affects the civic engagement of the people who live there. Prior findings regarding the causal effect of city size on civic participation are mixed (Oliver, 2000; Kelleher and Lowery, 2004; Stein and Dillingham, 2004; Carr, 2008), confounding efforts to build theory on this topic. We contend this inconsistency is due, at least in part, from the failure of the works to properly examine the mediating effects of population density and population growth on civic participation. Population density may facilitate the creation of dense social networks that stimulate participation. Neighbours in closer geographical proximity are more prone to come into contact, share concerns on common problems, and organize for civic action (Stein and Dillingham, 2004). In contrast, people living in high growth cities may feel less connection to their neighbours and be less likely to participate in the community. The contingent effects of population density has received
some attention in previous research (Stein and Dillingham, 2004; Carr 2008), but the mediating effects of population growth has been ignored.

Third, our goal is to extend this research beyond the U.S. setting by proposing and testing a general model of civic participation applicable to a wide range of institutional and cultural settings. We use data from Portugal to test the mediating effects of density and city growth upon the relationship between city size and participation, because this country offers a very different setting to examine this topic. In contrast to the highly fragmented system of autonomous governments used by the U.S., local governments in Portugal are more dependent on the national government for funding, have greater levels of economic and racial homogeneity, and lack the regional institutions (e.g., counties, special districts, councils of governments, etc.) common in the U.S.

In the US, local fragmentation and competition leads to the economic segregation in metropolitan areas thought to fuel the participation patterns predicted by Oliver (1999), but what happens in countries where these economic cleavages are less prevalent is not clear. In the case of European countries, local government fragmentation and competition are less frequent and economic segregation is more likely to occur between neighbourhoods within each city rather than between cities. Portuguese local governments are divided in parishes (or freguesias), that have a low number of competences and are heavily financially dependent on the municipal government. This system of parish governments provides an opportunity to examine the role of intra-jurisdictional fragmentation on civic participation and to move past the sole focus on metropolitan fragmentation typical in studies of U.S. cities.
The paper is organized in five sections. First, we define civic participation as comprising a broad set of behaviours usually associated with social capital and criticize the limited use of indicators in the literature addressing the determinants of civic participation. Next, we review the literature on the effects of city size, density and population growth on civic political participation. Section three presents the data and methods employed in our analysis and this is followed by a discussion of the empirical findings in section four. The paper closes with a set of conclusions and a discussion of prospective research.

Social Capital and Civic Participation

Many definitions of social capital have been proposed over the years (Bourdieu, 1983; Coleman, 1988; Putnam, 1993; Cook, Hardin and Levi, 2005). For the purpose of this study, we prefer the definition by Robert Putnam (2000) that places an emphasis on social capital as civic virtue:

Social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them. In that sense social capital is closely related to what some have called “civic virtue.” The difference is that “social capital” calls attention to the fact that civic virtue is most powerful when embedded in a dense network of reciprocal social relations. A society of many virtuous but isolated individuals is not necessarily rich in social capital (Putnam, 2000: 19).

This definition implies that social capital is revealed by voluntary actions of individuals in order to promote a common good or, as Putnam puts it, the resulting benefits of social networks, including problem solving related to mutual interests (Putnam, 2000; see also Cook, Hardin, and Levi, 2005: 87-88). In this sense, social
capital can be measured as the aggregate result of human interaction, both the product of individual characteristics and community attributes (Costa and Kahn, 2003; Newton, 2001).

Jurisdictions where individuals choose to join volunteer associations, to form non-profit organizations and/or to participate in electoral and non-electoral political processes are presumed to display larger stocks of social capital. Although these endeavours cannot be entirely regarded as selfless acts, they nevertheless help to generate responsible citizenship, to promote reciprocal behaviours, and to encourage sentiments of trust among community members. In addition, civic participation is also productive as these activities contribute in varying degrees to the common good (Oakerson, 2004).

Despite the recognition that civic participation entails a broader set of behaviours, prior research has placed a disproportionate emphasis on electoral and/or political endeavours as indicators of civic participation (see Hiskey and Bowler, 2005; Kelleher and Lowery, 2004; Oliver, 1999, 2000). The relevance of this body of work to the study of civic participation is somewhat limited by the measures employed in the analyses. For instance, Oliver (1999, 2000) uses four variables – contact local officials, attend organizational meetings, attend community board meetings, and vote in local elections – that are primarily political in nature, since participation in these activities entails at least a moderate degree of conflict over resources.

However, civic participation is not confined to political engagement. Robert Putnam’s index of civic involvement includes a more diverse set of components, namely the incidence of cooperatives per capita, membership in mutual aid societies, and the longevity of local associations (Putnam, 1993). Other work recognizes the multifaceted
nature of civic participation by including volunteering and charitable giving alongside with voter turnout, participation in political meetings, and signing petitions as measures of civic engagement (Aars, Christensen, and Midtbø, 2009; Uslaner and Brown, 2005).

The central argument developed in the next section is that the difference in civic participation across jurisdictions is the consequence of variations in city size, density, population growth, and the way the latter measures mediate the effect of city size. In other words, civic engagement increases because certain demographic features of the community facilitate participation. In order to explore this causal link, we extend the conventional indicators of civic participation employed in the literature and test these hypotheses using a broader set of indicators.

City Size, Density, and Civic Participation

The question of optimal city size for the purposes of civic participation has been an issue of debate since Ancient Greece. In spite of the fact that we cannot know with certainty the actual population size of the typical Greek Polis, it seemed to offer appropriate avenues for political participation by its citizens. Athens, Pericles argued, was a school for the Grecians, meaning that civic education and political socialization were largely induced by the city’s autonomy and self-government (Dahl, 1967).

The discussion of optimal city size in academic debates in political science faded away with the rise of the nation-state (Dahl, 1967). However, this situation has begun to change in recent decades. Over this period, authors have sought to explore the effect of municipal population size on the quality of citizenship (Dagger, 1981), local citizen satisfaction (Cusack, 1997), voter turnout (Kelleher and Lowery, 2004), and political
participation in general (Oliver, 1999, 2000; Carr, 2008). Increased city size is generally thought to impede participation because individuals feel that their ability to make a difference in local politics is significantly diminished in larger jurisdictions. Even if they wish to participate, citizens in large cities have less control over local institutions and are less likely to affect outcomes as a result (Dahl, 1967; Dagger, 1981). Indeed, Oliver concludes that “the variation in political participation between the smallest and largest places are often greater than the differences between high school and college graduates, homeowners and renters, or single and married people” (Oliver, 2000: 371).

Oliver’s findings support the idea that civic participation decreases in more populated jurisdictions. However, the empirical literature on this topic has yet to produce compelling evidence of the complex relationship between population levels and differences in how this population is concentrated in accounting for civic involvement (Carr, 2008). Population concentration may facilitate the creation of dense social networks that stimulate rather than hinder participation. Neighbours in closer geographical proximity are more prone to come into contact, share concerns on common problems, and organize for civic action (Stein and Dillingham, 2004). In addition, proximity also facilitates association and mobilization. Voluntary groups and associations are more successful in captivating the interest of new membership because proximity allows significant savings in communication and information dissemination. In other words, population density may attenuate the negative effect of larger city size on group mobilization and increase the likelihood of civic participation (Carr, 2008).

The contingent effects of variations in population density on the relationship between city size and political participation have been examined in a few studies of
participation in U.S. local governments. Robert Stein and Gavin Dillingham (2004) find no support for the hypothesis that city size hinders participation in an analysis of eight different indicators of political participation. In fact, the only link they find between population size and local participation (i.e., membership in neighbourhood organizations) is positive rather than negative as suggested by previous work. In their study of turnout in city elections, Christine Kelleher and David Lowery (2004) reach a similar conclusion, finding no relationship between city size and voter turnout. Both studies argue that Oliver overlooks the contingent effects of other factors on the relationship between population size and political participation, but these analyses fail to produce empirical support for this proposition. The one study that does provide support for the impact of a contingent factor is Carr’s (2008) analysis of political participation in local governments in Michigan. He finds that increases in population density reduce the depressing effect of increased city size on the probability people vote in city elections. Following these scholars, we expect that:

**H1**: Municipalities with larger populations are likely to display lower rates of civic participation;

**H2**: Municipalities with more dense populations are likely to display higher rates of civic participation; and

**H3**: Population density has a positive contingent effect on the relationship between the size of the local population and levels of civic participation.
Another factor that should affect the levels of civic participation is the rate of population growth. Large, fast growth cities seem to provide the worst setting for civic engagement, since social connections are more difficult to establish and feelings of powerlessness tend to prevail over citizen involvement in collective action (Oliver, 2000). New residents are also less likely to feel a strong psychological attachment to the community, since it takes time to develop social ties and to consider a community as one’s own. Fragile social connections constitute an additional obstacle to mobilization. Thus, cities where the influx of new residents is larger are less likely to be favourable grounds for the expansion of altruistic behaviors and social capital. In fast growing cities, the bystander effect takes hold; given the magnitude of big city problems and the increase in city population, each individual expects that someone else will get involved in civic activities, creating a collective action dilemma for the community as a whole (Oliver, 2001; Olson, 1965). As a result, the negative relationship between city size and civic participation may be further depressed in jurisdictions experiencing significant population growth in the recent past.

The hypothesis that city growth deepens the negative effect of city size on civic participation is clear and intuitive. However, political participation may respond to city growth in quite a different manner. City growth increases the potential for conflict among individuals and interest groups with divergent preferences regarding local policies such as taxation, public education, affordable housing, and growth management. This clash of interests is likely to result in increased political involvement. We expect that:
**H4:** Higher growth jurisdictions are likely to display lower rates of civic engagement, but higher rates of political participation;

**H5:** Population growth has a negative contingent effect on the relationship between city size and civic engagement, but a positive contingent effect on the relationship between city size and political participation.

**Local Government Institutional Context**

Empirical work in the US context also emphasizes the role of local political institutions and the configuration of local governments within metropolitan areas as determinants of participation. Kelleher and Lowery (2004) argue that the way population is distributed across the municipal governments in a metropolitan area influences the degree of political participation in the region’s local governments and they provide empirical evidence to support this proposition.¹ The Portuguese context provides an opportunity to examine the effects of local government institutions on civic participation in a different way. Portuguese local governments are divided in parishes (or *freguesias*), that have a low number of competences and are heavily financially dependent on the municipal government.² Parishes are the smallest unit of local government in Portugal and their boundaries are completely contained within a single municipality. The number of parishes in each municipality varies significantly, ranging from one, where the boundary of the parish coincides with the boundary of the municipality, to 89, where each parish is essentially equivalent to a neighbourhood (Silva, 2004). The level of intrajurisdictional fragmentation within Portuguese municipalities affects civic
participation because each parish represents a distinct set of democratic elections and institutions.

The number of parishes may also be a proxy for preference heterogeneity at the local level because each parish operates as an interest group, lobbying the municipal government for more and better services for the residents of the parish. Oliver’s (2000) work suggests that heterogeneity of community preferences stimulates participation because it gives people a motivation to become involved in the community. In a context of increased competition for scarce resources, an adversarial pattern of civic participation develops as a means to either capture larger budgets from municipal authorities or to increase service supply through voluntary service provision (Oliver, 2000). Hence, municipalities with a higher number of parishes should exhibit higher rates of civic participation.

Although Portugal is not divided into autonomous regional governments with democratic institutions like the U.S., the territory is geographically divided in districts (or distritos). Formally established in 1835, the 18 districts in Continental Portugal cannot be considered a regional level of government since they are decentralized agents of the central state. The district governor acts as the representative of the national government in the regional district. Historically, the district capital has been the most important and populated city in the district. Currently, this is still the case in the large majority of the 18 districts.

The district capitals have been more populated, socially dynamic, and true engines of regional economic development in the district. Due to these historic, geographic, and economic reasons, district capitals should constitute exceptions to the
city size hypothesis. A higher degree of civic participation can be expected in these communities, as they display higher rates of change in production technologies and consumer preferences capable of attracting entrepreneurial and civic activism (Schneider, Teske, and Mintrom, 1995). This is partly the argument used by Oliver (2001) concerning the visibility of large cities in metropolitan areas. Even though these are not, for the most part, the most populated cities in Portugal, they are nevertheless the most visible and dynamic in each district and should display higher rates of civic engagement.

**Data and Methods**

This research investigates these questions through an analysis of civic participation activities in the 278 municipalities of Continental Portugal during the years of 2009 and 2010. The analysis uses data aggregated at the municipal level because social capital is a property of communities and groups that can only be observed as a result of human interaction (Costa and Kahn, 2003; Newton, 2001). Each of our civic participation measures is an indicator of social capital activity at the local level and taken together they illustrate the variation of social capital resources across cities (Rubenson, 2005) that can only be explained at the aggregate level. Table 1 provides descriptive statistics for each of the measures used in the analysis.

[Insert table 1 about here]

**Dependent Variables**

The study uses four dependent variables to capture different types of civic participation. Political participation is measured by voter turnout in city elections.
Although this is a coarser measure of active participation than attendance at political meetings, political party membership or contacting public officials, it is by far the most widely employed indicator of political participation for studies where participation is aggregated to the city level (see Wood, 2002; Kelleher and Lowery, 2004). The voter turnout data are from the local elections held simultaneously in all municipalities in 2009.

Civic participation in these cities is measured by three count variables: the number of non-profit organizations, the number of local voluntary associations, and the number of volunteer fire brigades. Non-profit organizations are registered in the national Social Security Institute and include all organizations that provide human and social services such as childcare, nursing homes, home care assistance, youth leisure activities, and care for the homeless. The number of local voluntary associations is available from the Forum for Local Development and Association (http://www.forumlocal.org/). Most of these organizations are primarily concerned with the integration of minorities and immigrant workers into the Portuguese society and way-of-life. The number of volunteer fire brigades was obtained from the Administração Local em Números, a statistical handbook of local administration published by the Direcção-Geral das Autarquias Locais. The data for the three civic participation measures are from 2010.

**Theoretical Variables**

In order to investigate the role of the size, growth, and concentration of city population in stimulating civic participation, we include population size, population density in square kilometres, and the rate of population growth over the previous five years in the models. Population size and density are in log form to fulfil the normality
assumption. The expected signs of the coefficients for the population size and population growth variables are negative, whereas density should be positively related with participation.

Control Variables

The models also include two groups of variables to control for differences in participation due to the effect of variations in the institutional arrangements of the cities and their regions, and differences in the economic and demographic composition of the residents in these cities. The number of parishes in each municipality is expected to be positively associated with civic participation. Parishes operate as breeding grounds of political and civic skills and act as channels that allow citizens to express their views, consult with officials and achieve full participatory status, even more so than in the case of municipal government. Dummy variables are also used to indicate the 18 cities that are district capitals and for the cities belonging to the two metropolitan areas of Lisbon and Porto. Both coefficients are expected to be positive.

We also include several measures of the economic and demographic composition of these cities. The role of economic affluence on political and civic participation at the level of the individual is generally regarded as positive (Almond and Verba, 1963; Huckfeldt, 1979). Empirical work shows that individuals with less access to resources (money, time, and civic skills) are also less likely to participate, both in the US context and elsewhere (Brady, Verba, and Schlozman, 1995; Magalhães, 2001). Other studies have examined the effect on participation from variations in resources at the level of the city and find this relationship resembles an inverted U-shape curve, with the upper and
lower levels of the income scale displaying significantly less participation in local civic activities (Oliver, 1999). The rationale for this explanation is that residents in communities lacking resources have fewer incentives to participate in local politics (Solt, 2008); conversely, wealthier communities display the economic homogeneity and shared interests that lead to political apathy as the need for action is absent. As a result, Oliver (1999) argues, middle-income jurisdictions are more likely to witness higher rates of involvement in local affairs as these communities are characterized by economic heterogeneity and diverse interests, which generates group conflicts leading to individual involvement and action. We control for the effect of economic prosperity by employing the log of per capita personal income in the municipality.

Prior studies of voting behaviour in Portugal at the national level reveal that participation levels are lower among the younger and urban population and higher among those engaging in religious practices (predominantly Catholic) (Magalhães, 2001; Freire and Magalhães, 2002). The findings concerning age and religion in Portugal are also consistent with research from other European countries such as Germany, Hungary, and Poland (Viegas and Faria, 2004). We account for these factors by including the number of Catholic marriages to control for the effect of religious practices and the proportion of the elderly population in the municipality. Positive coefficients are expected for both variables.

The models do not include a measure capturing differences in the racial composition of these cities, since Portugal is essentially a racially homogenous country. However, the size of foreign-born populations is not equally distributed throughout the Portuguese territory and these individuals are likely to have fewer resources available to
engage in civic and political participation. Foreign born population living in each municipality is included in natural log form and a negative coefficient is expected.

Finally, we also include a few control variables that are specific to each model. The equation predicting voter turnout includes a measure of margin of victory to control for contested elections. This measure is the difference in percentage points between the winner and the runner up in each city election of 2009. A dummy variable accounting for the presence of a professional fire brigade is included in the equation that predicts the formation of volunteer fire brigades. The variable measuring the proportion of elderly population is omitted from the equations predicting the number of local development associations and the number of volunteer fire brigades, since there is no theoretically compelling argument to include this variable in these models.

Findings

Tables 2 and 3 present the findings of the regression models. Ordinary least squares (OLS) regression is employed in the models estimating voter turnout and the number of non-profit organizations. Although the number of non-profit organizations is a count variable, inspection of its distribution indicated an approximation to the normal distribution. Poisson regression is used to estimate the models examining the number of voluntary associations and volunteer fire brigades. These variables are both counts that are not normally distributed, and thus violate the assumptions of the OLS model.4

We use two sets of models to assess the strength of the modifying effects of population density and city growth on the relationship between the size of the city’s population and the level of civic participation by its residents. The baseline models
estimate the marginal effects of changes in the size of city population, population density, and city growth on the four measures of civic participation. We do this by estimating each model without the two interaction terms. Excluding the interaction terms from the four models enables us to assess the nature of the relationship between city size and civic participation, population density and civic participation, and city growth and civic participation without having to make restrictive assumptions about the level of the other measure(s) (Brambor et al., 2006).  

Next, we analyze the findings of the contingent effects models presented in tables 2 and 3 through a discussion of the plots in figures 1-8 presenting the marginal effects of changes in the population measures. Our approach follows the technique developed by Brambor, Clark, and Golder (2006). The plots illustrate how the marginal effects from changes in the city population vary over a substantively meaningful range of city population density and population growth. The plots are produced using the GRINTER routine created for Stata by Frederick Boehmke. The plots illustrate the marginal effect of a one-unit increase in X (city population) on Y (measure of civic participation) as Z (population density or population growth) is increased from its minimum to maximum value. All other continuous variables in the model are held constant at their mean value and dichotomous variables are set at one. The dotted lines in the figures indicate the range of values within a 95 percent confidence level.

Baseline Models

The findings for the four baseline models provide mixed support for the hypotheses outlined in the previous section. City population is negatively related to voter turnout as predicted, but it is positively related to the other three measures of
participation. Similarly, the coefficients for population density do not indicate the predicted effects in any of the four baseline models. The coefficient for this variable is negative and significant in two of the models (local development organizations and volunteer fire brigades) and positive and statistically insignificant in the other two models. The findings are more consistent in the case of population growth. The coefficient indicates a negative relationship in all four modes of participation, but the coefficient does not reach statistical significance in two of the four models (voter turnout and local development associations).

[Insert table 2 about here]

The measures controlling for the differences in local and regional institutions show findings largely consistent with our predictions. The number of parishes in the city is positively and significantly related to three of the four modes of civic participation. The one exception is voluntary fire brigades; this measure is positive, but statistically insignificant. The evidence for the other two elements of local government structure is more mixed. The measure indicating that the city is a district capital is significant only in the model examining the number of nonprofit organizations in the city. The fact that the city is in a metropolitan area matters in only two of the models. Cities in metropolitan areas have more nonprofit organizations and are more likely to have greater numbers of volunteer fire brigades than the cities outside of the two metropolitan areas.

[Insert table 3 about here]

The demographic control variables display results consistent with the rationale for their inclusion in the equations. Margin of victory is negatively related with voter turnout, indicating that participation is higher in more competitive local elections. The results
concerning religious practices in the jurisdiction also confirm prior findings for the Portuguese setting (Magalhães, 2001; Freire and Magalhães, 2002). Per capita personal income is positively related with the civic participation measures, but no discernible effect is found in terms of political participation. As expected, the presence of a professional fire brigade is detrimental to the formation of volunteer fire brigades.

*Contingent Effects Models*

Next, we turn to the models examining the contingent effects of population density on the relationship between city size and these four measures of civic participation. Figures 1-4 depict the relationship between population and the four participation measures at different levels of population density. Figure 1 shows the analysis for voter turnout. This plot confirms that the relationship between city population and voter turnout is dependent upon the level of population density. As predicted, the depressing effect of an increase in city population on voter turnout lessens as population density increases. This is indicated by the upwardly sloping marginal effects curve. The contingent effect is statistically significant up to a density level of about 3,000 people per square kilometre, which is well above the mean density of 81.3 people per square kilometre.

Figure 2 shows the same analysis for the model examining nonprofit organizations. This plot differs in a couple of ways from the analysis of voter turnout. First, the contingent effect of population density is to amplify the positive relationship between city population and the number of nonprofit organizations in the city. Second, this plot shows a contingent effect of density that occurs over a smaller range of
population density than was the case in the turnout model. The contingent effect of population density is statistically significant only at levels of density exceeding approximately 300 people per square kilometre. Once again, this range is far above the mean density in Portuguese cities.

[Insert figures 1 and 2 about here]

The plots produced for the two count models are shown in figures 3 and 4. Figure 3 shows the analysis for civic participation measured through the number of local development organizations in the city. Once again, this plot illustrates that the relationship between city population and the number of development organizations is contingent on the level of population density in the city. Increased density amplifies the positive relationship between city population and the number of development organizations in the city. The contingent relationship is statistically significant across the entire range of population density.

Figure 4 shows the analysis for civic participation measured through the number of volunteer fire brigades in the city. This plot illustrates that the relationship between city population and the number of volunteer fire brigades is contingent on the level of population density in the city. Once again, increased density amplifies the positive relationship between city population and the number of volunteer fire brigades in the city. This contingent relationship is statistically significant across the entire range of population density.

[Insert figures 3 and 4 about here]

Figures 5-8 depict the relationship between population and the four participation measures at different rates of population growth. These plots confirm the proposed
differential contingent effects of population growth on the measures of political and civic participation. Figure 5 reveals that population growth reduces the negative effect of city size on voter turnout. In other words, the depressing effect of a larger population on voter turnout becomes less pronounced in fast growing cities. This result confirms our prior expectation that city growth affects the relationship between city size and political participation in a different manner than it influences the relationship between city size and civic engagement.

[Insert figures 5 and 6 about here]

The analysis of figure 6 suggests that city growth has a depressing effect on the relationship between population size and the presence of nonprofit organizations. Cities with positive growth rates seem less favourable grounds for the expansion of nonprofit organizations, even though this is result is not statistically significant for most of the levels of population growth seen in these cities. These findings are consistent with the place attachment difficulties typically associated with fast growing jurisdictions. Higher levels of population growth reduce the positive relationship between city size and the number of nonprofits, but over a narrow range of negative population growth. The plot displays a similar reductive effect as growth turns positive, but it is not statistically significant.

[Insert figures 7 and 8 about here]

The plot in figure 7 displays the relationship between city size and the number of local development associations mediated by the rate of city growth. The results confirm the proposition that city growth has a depressive effect on the relationship between city
size and the presence of these organizations. Local development associations are more prevalent in larger cities, but this effect is mitigated by the rate of city growth.

Finally, figure 8 shows the effect of population size upon the number of volunteer fire brigades is contingent on the level of population growth in the city. Contrary to our findings regarding nonprofit organizations and local development associations, this graph shows that population growth exerts a positive contingent relationship between population size and the formation of volunteer fire brigades.

Conclusions and Future Research

A decade ago, the publication of Eric Oliver’s work *Democracy in Suburbia* ignited tremendous interest about the effects of city size on civic participation. Since the publication of that groundbreaking work, other scholars have suggested that the influence of city size on participation is more complex than Oliver’s description and is mediated by factors such as population density (Stein and Dillingham, 2004) and the concentration of population metropolitan areas (Kelleher and Lowery, 2004). These scholars provided a compelling logic for how these factors mediate the relationship between the size of a city’s population and the extent to which its residents engage in local politics, but they were unable to muster strong empirical support for their propositions. Our research improves upon their efforts in several ways, including the addition of population growth as a mediating variable, examination of a broader set of participation measures, and the use of local governments in Portugal as a context for this analysis.

Our findings advance our understanding of this topic in several important ways. First, our findings provide strong support for the proposition that the contingent effects of
population density and population growth are part of the explanation of local civic participation. We find that when city population and population density are modeled as exerting direct effects on these four measures of civic participation, neither measure is shown to be consistently statistically related to the level of civic engagement in the city. It is not until the model is estimated with population density and population growth as mediating the effects of city size on participation that the importance of these three factors is revealed. Our findings confirm Stein and Dillingham’s (2004) basic contention about the need to examine the contingent effects of population density on city spending. Our finding that density has a positive impact upon the relationship between city size and all our measures of civic participation also suggests that Oliver’s conclusions may be incomplete, since he fails to account for the mitigation effect of density upon the relationship between city size and participation.

Second, our findings contribute to this literature by showing that city growth has both direct and indirect effects upon civic participation. We find that city growth is detrimental to civic engagement, possibly due to reduced psychological attachment and less effective mobilization in fast growing communities (Oliver, 2001). In addition, we also find evidence of a positive indirect effect of city growth, since the negative relationship between city size and voting in local elections is attenuated in fast growing jurisdictions. Again, our work underlines the differences between political and nonpolitical participation. Whereas civic participation is negatively affected by growth because it requires deeper social interactions to take hold, voting is much less dependent on these close ties among residents. In fact, voting may be the first civic activity that a
newcomer can engage in, even before he or she develops social networks in the community.

Third, we make substantial progress with this analysis toward the objective of examining measures of civic participation other than political participation. It is clear from this analysis that our political and nonpolitical measures of civic participation respond differently to the same set of predictors. Our findings are still preliminary, but they suggest a need for further research to better specify the factors that explain levels of nonpolitical civic participation. Civic participation is a multidimensional concept that requires the use of a broad set of indicators. We think these efforts to develop more general models of civic participation are important advances in reframing how scholars conceive of this issue.

Finally, this analysis shows the importance of considering the degree of intra-jurisdictional fragmentation instead of focusing only on how metropolitan fragmentation affects incentives for civic participation. Our focus is on the contingent effects of the density and growth of the city’s population on civic participation, but our findings suggest an interesting role for subcity fragmentation in this topic. Our findings confirm that larger numbers of parish governments in the city are associated with higher levels (or greater probabilities) of the participation measures we examined. Authors such as Kelleher and Lowery convincingly describe the disincentives for participation created by patterns of highly fragmented populations within regions, yet the potential benefits for civic participation from fragmentation at the municipal level have not been considered in previous research. There is reason to believe that municipalities that have subcity institutions empowered to make decisions for the residents living in these districts will
have more citizens engaged in civic and political action. We think this is a very interesting direction for future work examining the determinants of civic participation in local government.
Notes

1 They cite four reasons why residents in less fragmented metropolitan areas are expected to exhibit increased participation (Kelleher and Lowery, 2004: 725-728): first, larger municipalities provide adequate political settings where regional issues that matter to voters can be addressed more successfully (Dahl, 1967; Orfield, 1997; Drier, Mollenkopf, and Swanstrom, 2001); second, more consolidated metro areas tend to be demographically diverse, which entails conflicting goals among residents and stimulates political participation (Oliver, 1999); third, more fragmented metro areas are associated with smaller jurisdictions that typically adopt more reformed, less “political,” institutions that promote homogeneity rather than confrontation over issues, which in turn reduces voter turnout (Lineberry and Fowler, 1967; Alford and Lee, 1968; Wood, 2002); and finally, in consolidated areas, the psychological attachment to place is higher than in more fragmented metro areas (Lowery, Lyons, and DeHoog, 1992), which contributes to increased civic engagement and participation in local politics (Kelleher and Lowery, 2004).

2 The freguesia is reminiscent of the Catholic parishes. The parish executive is elected by the deliberative body – the parish assembly (assembleia de freguesia) with the exception of the president of the executive, elected directly as the head of the winning list for the parish assembly. Nonpartisan lists are possible for both elections of the municipal executive and deliberative bodies and the parish assembly.

3 Prior work suggests that education is positively associated with the degree of civic and political participation (Aars and Strømsnes, 2011; Brady et al., 1995; Oliver, 2000; Uslaner and Brown, 2005). Unfortunately, 34 municipalities do not have usable data for this variable, so this is not included in the analyses that follow. However, models including a measure of the residents’ educational level (i.e., percent holding a high school degree) were estimated for each of the dependent variables. In each case, the findings for the key variables were unchanged.

4 The models were estimated using STATA 11.0. In general, Poisson regression is the appropriate estimation technique to treat event counts when the conditional mean of the distribution equals the conditional variance (equidispersion). When this assumption is not met, negative binomial regression is appropriate. Tests of overdispersion were conducted for both variables. For both measures, the goodness-of-fit $\chi^2$ test does not allow us to reject the null hypothesis that the data are Poisson distributed, so Poisson regression is used in the estimation. See Long and Freese (2006) for an excellent discussion of the range of the issues encountered in analyses of count data.

5 For example, in the following model, the effect of the independent variable $X$ on the dependent variable $Y$ depends on the value of a third variable $Z$: $Y = B_0 + B_1X_1 + B_2Z_1 + B_3X_1Z_1 + \ldots + \varepsilon$. Brambor, Clark, and Golder (2006: 73) warn: “As a consequence, the coefficient on the constitutive term $X$ must not be interpreted as the average effect of a change in $X$ on $Y$ as it can be in a linear-additive regression model. …[T]he coefficient on $X$ only captures the effect on $Y$ when $Z$ is zero. Similarly, it should be obvious that the coefficient on $Z$ captures the effect of $Z$ on $Y$ when $X$ is zero.”

6 Grinter is available at http://www.fredboehmke.net.

7 Kelleher and Lowery (2004) emphasize the importance of differences in the concentration of population across the local governments of the metropolitan area in mediating the effects of city size on voter turnout. They argue that in those regions where residents are concentrated into a few city governments, political participation is higher because these city governments are able to resolve “regional” problems. In regions where the population is dispersed across many local governments, these individual governments are not able to effectively confront the problems people care about and, consequently, people are less likely to participate in local politics. Kelleher and Lowery examine their concentration hypothesis using urban counties as the basic measure of the relevant region. There is no analog to the urban county in the
Portuguese system of local government, so we do not include a measure of population concentration in our analysis.
References


Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable Measures</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
<th>No Obs</th>
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<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voter Turnout in City Elections (Percentage) (2009)</td>
<td>65.903</td>
<td>7.523</td>
<td>46.301</td>
<td>82.35</td>
<td>278</td>
</tr>
<tr>
<td>Number of Nonprofit Organizations in City (2010)</td>
<td>18.098</td>
<td>33.424</td>
<td>1</td>
<td>472</td>
<td>278</td>
</tr>
<tr>
<td>Number of Local Development Associations in City (2010)</td>
<td>.612</td>
<td>.966</td>
<td>0</td>
<td>9</td>
<td>278</td>
</tr>
<tr>
<td>Number of Volunteer Fire Brigades in City (2010)</td>
<td>1.464</td>
<td>1.161</td>
<td>0</td>
<td>9</td>
<td>278</td>
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<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
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<tr>
<td>City Population in 2006 (Log)</td>
<td>9.828</td>
<td>1.096</td>
<td>7.477</td>
<td>13.142</td>
<td>278</td>
</tr>
<tr>
<td>City Population Density in 2006 [Sq Kils] (Log)</td>
<td>4.398</td>
<td>1.478</td>
<td>1.738</td>
<td>8.901</td>
<td>278</td>
</tr>
<tr>
<td>City Population (Log) * City Population Density (Log)</td>
<td>44.543</td>
<td>19.665</td>
<td>14.067</td>
<td>114.360</td>
<td>278</td>
</tr>
<tr>
<td>City Population Growth from 2001-2006 (Percentage)</td>
<td>-.116</td>
<td>1.111</td>
<td>-2.534</td>
<td>4.271</td>
<td>278</td>
</tr>
<tr>
<td>City Population (Log) * City Population Growth</td>
<td>-.575</td>
<td>10.981</td>
<td>-30.355</td>
<td>46.051</td>
<td>278</td>
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<tr>
<td><strong>Control Variables</strong></td>
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<tr>
<td>Number of Parish Governments in City</td>
<td>14.522</td>
<td>12.772</td>
<td>1</td>
<td>89</td>
<td>278</td>
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<tr>
<td>City is a District Capital</td>
<td>.0647</td>
<td>.247</td>
<td>0</td>
<td>1</td>
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<tr>
<td>City is in Metropolitan Area</td>
<td>.115</td>
<td>.320</td>
<td>0</td>
<td>1</td>
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</tr>
<tr>
<td>Personal Income Per Capita in City (Log)</td>
<td>9.048</td>
<td>.163</td>
<td>8.752</td>
<td>9.813</td>
<td>278</td>
</tr>
<tr>
<td>Elderly (over 65 years) Population in City (Percentage)</td>
<td>21.752</td>
<td>6.206</td>
<td>9.791</td>
<td>41.72</td>
<td>278</td>
</tr>
<tr>
<td>Catholic Weddings in City (Percentage of Total Weddings)</td>
<td>46.308</td>
<td>16.309</td>
<td>0</td>
<td>84</td>
<td>278</td>
</tr>
<tr>
<td>Margin of Victory (Percentage points) (2009)</td>
<td>19.561</td>
<td>13.541</td>
<td>.1</td>
<td>58.5</td>
<td>278</td>
</tr>
<tr>
<td>Foreign-Born Population in City (Log)</td>
<td>5.680</td>
<td>1.728</td>
<td>1.386</td>
<td>10.681</td>
<td>278</td>
</tr>
<tr>
<td>City has a Professional Fire Brigade</td>
<td>.086</td>
<td>.281</td>
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<td>1</td>
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</table>

The data for the variable measures are from 2008 unless otherwise indicated.
Table 2: Determinants of Voter Turnout in City Elections and Number of Nonprofit Organizations in City

<table>
<thead>
<tr>
<th></th>
<th>Voter Turnout Base Model</th>
<th>Voter Turnout Full Model (w/PopSize*Density)</th>
<th>Voter Turnout Full Model (w/PopSize*PopGrowth)</th>
<th>Nonprofit Orgs Base Model</th>
<th>Nonprofit Orgs Full Model (w/PopSize*Density)</th>
<th>Nonprofit Orgs Full Model (w/PopSize*PopGrowth)</th>
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</thead>
<tbody>
<tr>
<td><strong>Theoretical Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density (Log)</td>
<td>.485 (.444)</td>
<td>-9.323 (2.057)***</td>
<td>.613 (.449)</td>
<td>8.531 (5.692)</td>
<td>-53.993 (18.291)***</td>
<td>6.734 (4.043)</td>
</tr>
<tr>
<td>Population (Log) * Density (Log)</td>
<td>-----------</td>
<td>.936 (.197)***</td>
<td>---</td>
<td>5.973 (2.224)***</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Population Growth Rate</td>
<td>-.437 (.347)</td>
<td>.044 (.346)</td>
<td>-4.755 (2.165)**</td>
<td>-5.485 (2.341)**</td>
<td>-2.285 (1.368)*</td>
<td>54.918 (38.117)</td>
</tr>
<tr>
<td>Population (Log) * Pop. Growth</td>
<td>------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
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</tr>
<tr>
<td><strong>Control Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parishes</td>
<td>.171 (.033)***</td>
<td>.155 (.032)***</td>
<td>.175 (.032)***</td>
<td>.893 (.415)**</td>
<td>.796 (.351)**</td>
<td>.828 (.337)**</td>
</tr>
<tr>
<td>District Capital</td>
<td>-.298 (1.064)</td>
<td>-.399 (1.039)</td>
<td>.024 (1.078)</td>
<td>34.751 (10.948)**</td>
<td>34.060 (9.700)***</td>
<td>30.249 (8.258)**</td>
</tr>
<tr>
<td>Metropolitan Area</td>
<td>.910 (1.368)</td>
<td>-1.947 (1.569)</td>
<td>.332 (1.437)</td>
<td>8.362 (5.097)*</td>
<td>-10.121 (5.429)*</td>
<td>16.485 (9.238)**</td>
</tr>
<tr>
<td>Per Capita Income (Log)</td>
<td>-2.444 (2.530)</td>
<td>-3.648 (2.453)</td>
<td>-1.896 (2.508)</td>
<td>42.660 (24.826)**</td>
<td>34.995 (21.253)*</td>
<td>34.990 (17.610)**</td>
</tr>
<tr>
<td>Percent Elderly</td>
<td>-.136 (.101)</td>
<td>-.248 (.100)**</td>
<td>-.146 (.100)</td>
<td>1.668 (.900)*</td>
<td>.984 (.591)*</td>
<td>1.798 (.885)**</td>
</tr>
<tr>
<td>Foreign Born Population (Log)</td>
<td>-.704 (.399)*</td>
<td>-.768 (.384)**</td>
<td>-.692 (.402)*</td>
<td>1.621 (1.455)</td>
<td>1.139 (1.258)</td>
<td>1.458 (1.393)</td>
</tr>
<tr>
<td>Margin of Victory</td>
<td>-.103 (.022)***</td>
<td>-.095 (.021)***</td>
<td>-.103 (.022)***</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Percent Weddings Catholic</td>
<td>.113 (.021)***</td>
<td>.124 (.020)***</td>
<td>.112 (.021)***</td>
<td>-.041 (.084)</td>
<td>.031 (.0677)</td>
<td>-.036 (.073)</td>
</tr>
<tr>
<td>Constant</td>
<td>133.732 (22.087)***</td>
<td>188.905 (23.604)***</td>
<td>129.072 (21.876)***</td>
<td>-485.107 (226.227)**</td>
<td>-133.344 (122.423)</td>
<td>-419.835 (165.01)</td>
</tr>
<tr>
<td><strong>Model</strong></td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
</tr>
<tr>
<td>R²</td>
<td>.63</td>
<td>.66</td>
<td>.64</td>
<td>.57</td>
<td>.63</td>
<td>.62</td>
</tr>
<tr>
<td>F Test</td>
<td>43.42***</td>
<td>42.75***</td>
<td>39.10***</td>
<td>17.56***</td>
<td>21.03***</td>
<td>13.89***</td>
</tr>
<tr>
<td>N (Observations)</td>
<td>278</td>
<td>278</td>
<td>278</td>
<td>278</td>
<td>278</td>
<td>278</td>
</tr>
</tbody>
</table>

NOTES: Robust standard errors are in parentheses. ***p < .01; **p < .05; *p < .10 for two-tailed significance tests.
Table 3: Determinants of Number of Local Development Organizations and Volunteer Fire Brigades in City

<table>
<thead>
<tr>
<th>Theoretical Variables</th>
<th>Development Orgs Base Model</th>
<th>Development Orgs Full Model (w/PopSize*Density)</th>
<th>Development Orgs Full Model (w/PopSize*PopGrowth)</th>
<th>Fire Brigades Base Model</th>
<th>Fire Brigades Full Model (w/PopSize*Density)</th>
<th>Fire Brigades Full Model (w/PopSize*PopGrowth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (Log)</td>
<td>.851 (.237)***</td>
<td>.586 (.311)*</td>
<td>.931 (.222)***</td>
<td>.514 (.106)***</td>
<td>.234 (.116)**</td>
<td>.490 (.099)***</td>
</tr>
<tr>
<td>Density (Log)</td>
<td>-.442 (.104)***</td>
<td>-1.284 (.582)**</td>
<td>-.517 (.099)***</td>
<td>-.092 (.043)**</td>
<td>-.794 (.215)***</td>
<td>-.070 (.040)*</td>
</tr>
<tr>
<td>Population Growth Rate</td>
<td>-.134 (.120)</td>
<td>-.054 (.128)</td>
<td>1.286 (.757)*</td>
<td>-.074 (.037)**</td>
<td>-.013 (.045)</td>
<td>-.468 (.286)*</td>
</tr>
<tr>
<td>Population (Log) * Pop. Growth</td>
<td>-----</td>
<td>-----</td>
<td>-.133 (.068) *</td>
<td>-----</td>
<td>-----</td>
<td>.038 (.029)</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parishes</td>
<td>.016 (.009)*</td>
<td>.013 (.008)</td>
<td>.014 (.008)*</td>
<td>.003 (.003)</td>
<td>.001 (.003)</td>
<td>.004 (.003)</td>
</tr>
<tr>
<td>District Capital</td>
<td>.071 (.262)</td>
<td>.098 (.263)</td>
<td>-.003 (.273)</td>
<td>-.125 (.166)</td>
<td>-.065 (.160)</td>
<td>-.083 (.164)</td>
</tr>
<tr>
<td>Metropolitan Area</td>
<td>-.124 (.272)</td>
<td>-.406 (.333)</td>
<td>.019 (.270)</td>
<td>.312 (.123)**</td>
<td>.113 (.140)</td>
<td>.263 (.129)**</td>
</tr>
<tr>
<td>Per Capita Income (Log)</td>
<td>.5111 (.717)</td>
<td>.352 (.667)</td>
<td>.151 (.695)</td>
<td>.726 (.246)**</td>
<td>.574 (.236)**</td>
<td>.772 (.242)**</td>
</tr>
<tr>
<td>Foreign Born Population (Log)</td>
<td>.007 (.124)</td>
<td>-.025 (.122)</td>
<td>-.016 (.121)</td>
<td>-.093 (.050)*</td>
<td>-.108 (.049)***</td>
<td>-.088 (.050)*</td>
</tr>
<tr>
<td>City has Fire Department</td>
<td>-----</td>
<td>-----</td>
<td>-.557 (.222)**</td>
<td>-----</td>
<td>-.625 (.209)**</td>
<td>-.542 (.216)**</td>
</tr>
<tr>
<td>Percent Weddings Catholic</td>
<td>-.006 (.006)</td>
<td>-.005 (.006)</td>
<td>-.006 (.007)</td>
<td>-.001 (.002)</td>
<td>.000 (.002)</td>
<td>.001 (.002)</td>
</tr>
</tbody>
</table>

Model | POISSON | POISSON | POISSON | POISSON | POISSON | POISSON |
Pseudo R² | .16 | .16 | .16 | .12 | .12 | .12 |
Wald Chi-Square (df) | 79.60 (9)*** | 86.33 (10)*** | 84.72 (10)*** | 193.11 (10)*** | 279.21 (11)*** | 212.90 (11)*** |
N (Observations) | 278 | 278 | 278 | 278 | 278 | 278 |

NOTES: Robust standard errors are in parentheses. ***p < .01; **p < .05; *p < .10 for two-tailed significance tests.
Figure 1: Contingent Effects of Different Levels of Population Density on the Relationship between Population Size and Voter Turnout in City Elections

Marginal Effects of Population (ln) on Voter Turnout (%)

Dashed lines indicate 95% confidence interval

Mean Population Density

5.7 813 7338

Population Density *

5.7 813 7338

Marginal Effects of Population (ln) on Voter Turnout (%)

Model estimated using the natural log of population density. The x-axis is labeled with the unlogged values.

Figure 2: Contingent Effects of Different Levels of Population Density on the Relationship between Population Size and the Number of Nonprofit Organizations in the City

Marginal Effects of Population (ln) on the Number of Nonprofit Organizations

Dashed lines indicate a 95% confidence interval

Mean Population Density

5.7 813 7338

Population Density *

5.7 813 7338

Marginal Effects of Population (ln) on the Number of Nonprofit Organizations

Model estimated using the natural log of population density. The x-axis is labeled with the unlogged values.

Figure 3: Contingent Effects of Different Levels of Population Density on the Relationship between City Population and Number of Local Development Organizations in the City

Marginal Effects of Population (ln) on the Number of Local Development Associations

Dashed lines indicate a 95% confidence interval

Mean of Population Density

0 0.5 1 1.5 2

Population Density *

0 0.5 1 1.5 2

Marginal Effects of Population (ln) on the Number of Local Development Associations

Model estimated using the natural log of population density. The x-axis is labeled with the unlogged values.

Figure 4: Contingent Effects of Different Levels of Population Density on the Relationship between City Population and Volunteer Fire Brigades in the City

Marginal Effects of Population (ln) on the Number of Volunteer Fire Brigades

Dashed lines indicate a 95% confidence interval

Mean of Population Density

0.2 0.4 0.6 0.8 1 1.2

Population Density *

0.2 0.4 0.6 0.8 1 1.2

Marginal Effects of Population (ln) on the Number of Volunteer Fire Brigades

Model estimated using the natural log of population density. The x-axis is labeled with the unlogged values.
Figure 5: Contingent Effects of Different Levels of Population Growth on the Relationship between Population and Voter Turnout

Figure 6: Contingent Effects of Different Levels of Population Growth on the Relationship between Population and the Number of Nonprofit Organizations

Figure 7: Contingent Effects of Different Levels of Population Growth on the Relationship between Population and the Number of Local Development Associations

Figure 8: Contingent Effects of Different Levels of Population Growth on the Relationship between Population and the Number of Volunteer Fire Brigades

NOTES: All other continuous variables in the models are held at their mean; dichotomous variables are set to one. All plots produced using GRINTER (Boehmke, 2008), a Stata utility for graphing the marginal effect of an interacted variable in regression models