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Does distance matter? Geographical Distance and Domestic Support for Mega Sports Events

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Abstract

Residential support is one key multiplier that increases the probability of a positive outcome of mega events. Especially pre-event support seems important since hosting the event often requires public consensus. Within the discussion of determinants of pre-event support, the distance between a resident's home (district) and the event area has been neglected so far. To explore the spatial nature of event support, representative survey data (n=900) from the 2016 Olympic Games is analysed using ordered probit and spatial autoregressive models. Estimates reveal a lower probability of high support for residents living close to the main event area. Moreover, the rate of marginal changes in the probability of support decreases with decreasing distance to other areas.

JEL: C51, D84, L83, R12

Keywords: sports events, spatial economics, residential support, Olympic Games

Introduction

By offering sports activities, a city can increase its attractiveness for potential residents and/or firms in order to increase tax receipts and other income (Faskunger, 2013; Preuss, 2007). One option when providing sports activities is to host mega sports events (MSE), such as world and continental championships, European Capital of Sports or the Olympic Games (Westerbeek & Linley, 2012)**.** Unlike permanent facilities (e.g. fitness centre) and frequent sports events (e.g. annual sports festivals), MSEs are temporary sports events, with changing host cites. They are typically awarded by periodical bidding procedures and, therefore, have to provide adequate mandatory facilities and urban infrastructure[1], which are often inexistent ex-ante and, therefore, require long-term investments (Baade & Matheson, 2016; Preuss & Solberg, 2006; Solberg & Preuss, 2007; Roche 1994). Consequently, initial costs usually exceed event incomes, meaning that event committees often have to request public subsidies (Kang & Perdue, 1994; Preuss & Solberg, 2006).

Local politicians justify such allocations of public money for various reasons: positive macro-economic effects (Allmers & Maennig, 2009; Baade & Matheson, 2004; Bramwell, 1997; Preuss, 2007; Rocha, 2016; Spilling, 1996a), image campaigns for the nation and city (Müller, 2015; Preuss & Alfs, 2011; Rocha & Fink, 2017) and positive effects (e.g. sports participation, living conditions and well-being) at a micro-level (Fredline & Faulkner 1998; Kaplanidou, 2012; Ritchie 2000; Weimar, Wicker & Prinz, 2015). However, MSEs are perceived by residents as being controversial (Boyko, 2007; Kim & Petrick, 2005; Ritchie, Shipway & Cleeve, 2009). On the one hand, locals may benefit from varying positive external or internal effects through improvements to urban infrastructure and psychic income (Preuss & Solberg, 2006; Solberg & Preuss, 2007). On the other hand, they have to face monetary (increased or diversion of taxes) and non-monetary negative external and internal

[1] For instance, sport facilities, transportation, communication, health support, electricity and water supply.

effects such as noise, traffic, pollution, frustration, anger about politics (Müller, 2015; Preuss & Solberg 2006). Referring to social exchange theory (Homans, 1958) and rational behaviour of local residents, the balance of positive and negative effects may determine his/her support for MSEs; such support has been identified as a main factor influencing the benefit/cost ratio and the social impact of these events (Deccio & Baloglu, 2002; Hiller & Wanner 2011; Jeong and Faulkner 1996; Pappas, 2014; Ritchie, Shipway & Cleeve, 2009; Zhou & Ap, 2009). At the pre-event stage especially, it is important to maximize acceptance of the event among local residents, in order to better promote and justify the event to key policy makers, sponsors and the non-city population and to increase the efficiency of event management during the preparation and bidding period (Coates & Wicker, 2015; Ma, Egan, Rotherham & Ma, 2011; Ritchie et al., 2009; Roche, 1994).

While existing studies primarily consider the importance of local pre-event support (Boyko, 2007; Deccio & Baloglu, 2002; Ma, Ma, Wu & Rotherham, 2013; Pappas, 2014; Ritchie et al., 2009), little attention has been paid to the spatial influence on support. If new event infrastructures and facilities are of general utility to residents,[2] then residents living closer to the facilities may be more likely to benefit from the event or the infrastructure remaining afterwards, than those living far away. This might be of key importance if a "local" event is financed by public funds. Previous articles have merely considered factors of demand for the event itself and distance for MSEs (Lee, Mjelde, Kim & Lee, 2014b; Verhoeff, 1992), support-distance of recurring events (Fredline & Faulkner, 1998, 2002), support-distance for tourism landmarks (Jurowski & Gursoy, 2004), demand-distance for permanent cultural facilities (Bajic, 1985), support-distance for stadiums (Ahlfeldt & Maennig, 2011; Coates & Humphreys, 2006; Horn, Cantor & Fort, 2015), or support-distance

[2] E.g. If a resident lives close to a new Olympic swimming facility, but he/she experiences no utility from swimming at all, then the new facility, independent of the distance, is not beneficiary to him. In a similar manner, if a resident does not need a subway because he always walks or rides a bike, then the existence of a new subway entrance might generate more negative (daily noise, pollution) than positive side effects for him.

at a specific outside venue of an MSE (Ritchie et al., 2009). However, no studies of support and distance have yet occurred. A deeper understanding of spatial differences in support would seem important in order to increase the efficiency of the event management in the pre-event period. Hence, this study investigates the external effects on support and especially, the impact of residents' geographical location.

To model a support-distance relationship, we focus on the 2016 Olympic Games. For an empirical investigation, data were obtained by conducting a random and representative survey of residents (*n* = 900) of the 2016 host city of Rio de Janeiro. Ordinal non-linear regression and spatial autoregressive regression models were used to investigate the variance of local stated support and the impact of geographical distance, as well as spatial dependence among residents and spatially affected error terms. The aim of the analysis is to investigate, whether or not there is a spatial dependence in support. Reasons for a spatial dependence are discussed in a theoretical way.

The results of this study are of interest for optimising the work of local organising committees and the support management of local authorities. It has added value for existing spatial economics literature, determinants for sports demand and support, for determinants of residential support for sports events, and for literature on mega sports events.

Theoretical Framework

Social Exchange Theory and Domestic support for mega sports events

Among other factors, support from residents has been identified as being one key factor, which increases the probability of a positive benefit/cost ratio for a mega event and, hence, to indirectly influence the social and tourism impact from the event (Deccio & Baloglu, 2002; Hiller & Wanner 2011; Jeong and Faulkner 1996; Pappas, 2014; Ritchie, Shipway & Cleeve, 2009; Zhou & Ap, 2009). Support for an event can be divided into support before the event (pre-event support) and retrospective support (post-event support).[3] When these are compared (from a host`s point of view), ex-post support seems of secondary importance, with the argument that the necessary investment has been already made (Soutar & McLeod, 1993). Moreover, support usually changes depending on the success of the event.[4] Besides this, local support in the pre-event phase is essential for several reasons. First, the involvement and support of the hosting community is fundamental for enhancing event organization by using existing local structures and networks (Fredline & Faulkner, 2000; Pappas, 2014; Ziakas & Costa, 2011). In this sense, local support positively impacts important recruitment processes for volunteers in the pre-event phase (Lee, Reisinger, Kim & Yoon, 2014a; Pappas, 2014; Ritchie, 2000). Second, the amount of local support influences the probability of a successful bidding process (Preuss & Solberg, 2006). Additionally, event committees might need/want a positive referendum and/or wish to avoid being perceived controversially or demonstrations among the residents, in order to increase the chances of a successful bid (Coates & Wicker, 2015; Hiller, 2000; Horn et al., 2015; Preuss & Solberg, 2006). Third, the degree of local support can be used by event managers as a good "barometer" of an event's social impact (Jeong & Faulkner, 1996). Forth, positive support in the pre-event phase increases the probability of additional monetary help (e.g. donations) and investments (Spilling, 1996b). Fifth, the higher the support for the event, the higher the incentives for local entrepreneurs and non-profit organisations to provide additional satellite events (Roche, 1992).

Since local pre-support for MSEs is important for the organisation of the event, the determinants of event support are of special interest. Based on the assumptions of social exchange theory (Homans, 1958), residents are assumed to exchange their good "support" if the individual event-related benefits exceed the individual event-related costs (Deccio &

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[3] There is also support during the event, which will be omitted from this analysis due to the short time span for which it is relevant.

[4] Previous research has revealed unstable support/perceptions before and after the event (Lee, Lee, Kang, Lee & Jeon, 2013; Ma et al. 2013).

Baloglu, 2002; Gursoy & Kendall, 2006; Ritchie et al., 2009). This holds true if both assume the exchange to be advantageous (Blau, 1994). Assuming that a local resident is behaving rationally, the relation between his/her individual positive and negative external effects determine his/her support for the potential MSE.

In this matter, a distinction has to be made between internal and external as well as positive and negative effects for residents. On the one hand, locals might positively benefit (besides entertainment during the event) from various external effects in the post-event phase, such as the improvement of the urban, cultural and tourism infrastructure, improvement of local living conditions such as parks and new student quarters, new cultural and entertainment areas, or new shopping opportunities (Chen & Tian, 2015; Fredline & Faulkner, 1998; Preuss & Solberg, 2006). In the pre-event phase, locals might also gain from temporary jobs (Coates & Wicker, 2015). In addition, positive internal effects might emerge from intangible effects in the pre- and post-period such as pride, anticipation, improved social networks and social capital, cohesion, or cultural heritage (Chen & Tian, 2015, Gibson, 2014; Horne, 2007; Preuss, 2007). These effects are often referred as psychic income (Gibson et al. 2014; Preuss and Solberg, 2006; Szymanski 2002)

On the other hand, they have to face internal and external negative effects (Müller, 2015). Similar to positive effects, negative effects could also arise in both the pre-event and post-event phase. Residents could face external non-monetary negative impacts in the pre-event phase (by construction of new facilities) or in the post-event period (as side-effects of new facilities) such as crowding, garbage, pollution, noise, travel congestion, relocation, increased crime and law enforcement arising from construction of the facilities and the event itself (Chen & Tian, 2015; Fredline & Faulkner 1998; Gursoy & Kendall, 2006; Horn et al., 2015; Prayag, Hosany, Nunkoo & Alders, 2013). Additionally, relocations cause residents to lose connection to their social network, which is linked with a depreciation of social capital

(Hippke & Krieger, 2015; Müller, 2015; Li et al., 2015). Usually these ex-ante negative non-monetary effects occur in tandem with monetary disturbances before and after the event phase, such as increased real estate prices and/or long-term inflation for goods and services (Chen & Tian, 2015; Gursoy & Kendall, 2006; Müller, 2015; Preuss & Solberg, 2006). Long-term substitutions for the subsidies provided are of further critical importance. These involve redirecting public funds from other public projects and services (e.g. community infrastructure and public facilities, educational programmes, medicine services, social projects, and public services) to provide or maintain the new facilities, and/or increases in taxes (Baade & Matheson, 2004; Jackson & Scherer, 2013; Müller, 2015; Preuss, 2007). Besides negative external effects, residents may also experience intangible/internal negative costs. Possible non-external negative effects in the post-event and pre-event phase are general frustration with the legacy or perceptions of legacy of the event, disappointment with non-use of facilities, anger about policy makers, feeling injustice with the relocated residents, cultural conflicts, frustration by corruption or disappointment by missing information by policy makers (Fredline & Falkner, 2002; Gursoy & Kendall, 2006; Kim & Patrick, 2005; Prayag et al. 2013).

Referring to social exchange theory and the aforementioned clusters of positive and negative effects (Deccio & Baloglu, 2002; Gursoy & Kendall 2006; Prayag et al. 2013), we assume a resident to support a MSE in the pre-event phase if the following conditions are met, with y denoting the expected utility from the event:

(1) $$y = f(positive\ external\ effects, positive\ non-external\ effects) - f\ (negative\ external\ effects, negative\ non-external\ effects)$$

$$f(y) = \begin{cases} y > 0\ support \\ y \leq 0\ no\ support \end{cases}$$

Geographical distance and support for mega sports events

A major problem for macro cost-benefit estimates for MSEs is the failure to take the impact on individual citizens sufficiently into account (Jeong & Faulkner, 1996). In other words, it might not be a question of general negative and positive effects, rather than the extent to which they are spatially distributed among residents (Jeong & Faulkner, 1996). Based on the assumption, that urban changes and, thus, the expected utility *y* are not equally distributed within the city (since infrastructural changes are not randomly distributed), the balance of positive and negative influences from the event could impact a resident`s support for the MSE. Thus, residents living closer to the facilities may be more likely to benefit from the event-phase or the remaining infrastructure in the post-event time, than those living further away will. However, closer proximity to the facilities implicates higher negative external effects before and during the event (Fredline & Faulkner, 1998). For instance, while a new plaza is primarily of long-term benefit for residents living closer to the facilities, those residents have to endure negative influences during the construction phase. In the pre-event period, other parts of the city are primarily confronted with external influences in form of changes in taxes or changes in the use of those taxes. To assess his own value and utility from hosting the event in the pre-event phase, a resident has to balance out current/temporary negative effects over long-term benefits and costs, while the costs of distance (monetary and opportunity) tend to increase at a decreasing rate (Verhoeff, 1992).

Consequently, if the individual utility from a MSE is evidently spatial dependent, one may assume the support also to be dependent on the distance of a resident’s home to the event areas. Hence, we adjust our support model as follows, with *X* indicating the distance between a resident’s home and the event areas of a MSE:

(2) $y = f(positive\ external\ effects, positive\ non-external\ effects, X) - f\ (negative\ external\ effects, negative\ non-external\ effects, X)$

$$f(y) = \begin{cases} y > 0\ support \\ y \leq 0\ no\ support \end{cases}$$

Although the argument that spatial differences impact support seems convincing from a theoretical perspective, investigations of spatial effects and the support for mega sports events are rare. Regarding geographical distance and support, existing studies have focused on various dimensions and found partially contrary results. Ritchie et al. (2009) found small evidence for less support for the 2012 Olympics if residents of a non-host city lived closer to an outside Olympic venue. Looking at the support for stadium referendums, Ahlfeldt and Maennig (2011) and Horn et al. (2015) found a positive relation between support and the distance to the main venue. In contrast, Coates and Wicker (2015) found that voters at a referendum for the 2022 Winter Olympics in southern Germany showed a higher probability to vote for the Olympics, when they lived in a potential host district. Fredline and Faulkner (1998) investigated post-support for the Gold Coast Indi Car Race and found no effects of distance on statements regarding community benefits and facilities. They did find that residents living closer to the venue agreed more with short-term negative social and environmental impacts.

Given the few and contradictory findings from recent literature and keeping in mind that support is always a latent, unobserved and intrinsic choice, making a precise assumption on the spatial dependence of support for a MSE at this stage seems not appropriate, considering that there is no general distribution of positive/negative and internal/external effects.[5] Hence, instead of postulating hypotheses, the subsequent analysis should be seen as

[5] Events are different regarding the geographical location, the culture and the economic determinants. Hence, making a theoretical analysis of the cost/benefit balance for resident`s would not lead to any substantial results

an explorative investigation of the link between a resident`s location, the location of MSE's facilities and the support for the event. Instead of investigating why there might be a spatial dependence, the subsequent empirical analysis focuses on the question whether or not support is spatially dependent.

Empirical Analysis

Data collection

To investigate the releation between spatial location of residents and residential support for MSEs, we use primary survey data on the domestic support for the 2016 Olympic Games. The survey was conducted in 2012 with a random and representative sample of Rio de Janeiro's residents, aligned to the 2010 Brazilian census. The sample has a margin of error of 3.3% at a confidence level of 95%. A random sample of 900 residents was drawn from 69 different districts, who were asked to respond to a questionnaire[6]. To select the respondents a multi-stage stratified random sampling strategy was used, according to which a district was randomly selected, then a residence, and finally a respondent. Only one respondent per household was selected to respond to the questionnaire. In order to guarantee representativeness for the population of the city of Rio de Janeiro, four strata were used to randomly select the sample: sex, age, education, and household income. Once selected, the residents were visited in. Residents were replaced only if they were not found at all or did not agree to participate in the study.

Variables and descriptive statistics

The dependent variable in the subsequent analysis is stated Support, which reflects the answer of the respondents to the statement "I support the Olympic Games 2016", which is in

without having precise and observable information about the magnitude of potential external and internal effects.

[6] The survey had 52 questions related to demographics, support for the Olympics, emotions associated with the Olympics, and expected benefits for Brazil.

line with previous research on support for MSE (The variable has ordinal characteristic and ranges from 1 ("*I totally do not support*") to 7 ("*I totally support*"). The distribution of Support indicates a high proportion (54%) of high support for the Olympic Games in the year 2012 (table 1). Only 38 respondents expressed absolutely no support for the Olympic Games.

[Insert table 1 here]

With respect to geographical distance, we use air-line distance (AL) between the centre of a resident's district[7] and the event area (provided by Google maps).[8] To reduce confusions with different spatial terms, in the subsequent analysis we distinguish between *district* (official districts of Rio de Janeiro), *area* (refers exclusively to a cluster of different Olympic facilities at one limited place within the city) and *region* (official clustering of districts within the city of Rio de Janeiro =higher aggregation level).

With respect to geographical dimensions, the 2016 Olympic Games were valuable, since all facilities were located within a radius of 20 km.[9] However, the event was split between four areas within the city, so we gathered data on the distance to every single area (Distance 1 to Distance 4). The main area was situated in the district of Barra da Tijuca, where most of the publically financed infrastructure and buildings[10] were situated, involving extensive urban change and relocation. Thus, we are focusing on the support-distance relationships to this main event area (Distance 1). Besides the distance to the main area, distance-related information has also been generated for Copacabana (Distance 2, mainly temporary facilities at the beach), the Maracana stadium (Distance 3, which was refurbished for the 2014 Soccer World Cup) and the district of Deodoro (Distance 4, mainly smaller

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7 Information on the detailed location has not been surveyed.

8 Since we have no point data (address) of the respondents, all district related information has no variation within a district.

9 For example, in the case of the 1996 Olympic Games, some of the facilities were located outside the city in the region of Georgia – the Stone Mountain Park (24km), the Stegeman Coliseum (96km) or the Georgia International Horse Park (43 km) (Feddersen & Maennig, 2013).

10 Olympic village, practice facilities, hockey facilities, tennis facilities, velodrome, swimming facilities, indoor athletics, golf course and an indoor facility for boxing, badminton, table tennis and weight lifting.

indoor buildings). If the respondents lived within one of the four Olympic districts, the distance was set to 1km. Figure 1 gives a short overview of the spatial distribution of the event areas and the average values per district. Since Rio de Janeiro is characterized by some hills within the city area, air-line distance (mean to Area 1: 16.70km) could be an inefficient measurement. Hence, four additional measurements (provided by Google maps) are used to check the results for robustness: shortest route by feet (mean to Area 1: 21.06km), the shortest route by car (mean to Area 1: 26.67km), the fastest connection by public transport in minutes (mean to Area 1: 80.89 minutes) and a double z-standardization of all four distance measurements.[11] The additional distance measurements are used as a robustness check for the air-line estimations, since we could not collect these measurements at the time the respondents were surveyed. In contrast, air-line distance is independent from time. Since the transport system of Rio de Janeiro has fundamentally changed since 2012, Air-line distance is the preferred distance in the subsequent analysis.

[Insert Figure 1 here]

The first covariate reflects the average social conditions of every district in Rio de Janeiro (Human Development Index (HDI), PNUD 2000), since social and cultural habits of neighbours within a district might influence the residents surveyed (Fredline & Faulkner, 2002). The HDI in our sample ranges from 0.71 (medium human development) to 0.97 (very high human development), which makes Rio de Janeiro one of the most heterogeneous metropoles in the world and, thus, perfect for analysis as variance in HDI is high (Darnell, 2012). We further[12] control for income, education, gender, and age as general variables for

[11] A double z-standardization generates a z-score variable out of variables with different variable natures. This global z-score has a mean of 0 and a standard deviation of 1. For example, the double z-score of the distance to Area 1 is defined as Double Z Distance 1 = SDT(SDT(Distance 1 Air-Line)+SDT(Distance 1 feet)+ SDT(Distance 1 road) + SDT(Distance public transport)) where SDT = $(x - \bar{x})/\sigma_x$. See Bresnahan, Brynjolfsson, and Hitt (2002) or Bloom, Kretschmer, and Van Reenen (2011) for an application of a double z-standardization.

[12] The setting of the covariates is congruent with past CCE support studies (Li et al., 2015; Lee et al., 2013; Ma et al., 2013).

support of mega events (Bajic, 1985; McHone & Rungeling, 1999). In our sample, Education reflects the educational level of the respondents ranging from 1 (elementary school) to 8 (some college degree). By including educational information into the model, we control for educational effects on appreciation of the Olympic Games, since education could be essential for support of sport events (Chen & Tian, 2015; Lera-Lopez & Rapun-Garate, 2007; Li, Hsu & Lawton, 2015).

[Insert Table 2 here]

Since every resident usually possesses some consumption capital (Stigler & Becker, 1977) for at least one sport provided by the event, we assume the effect of education to be marginal for the Olympic Games. In keeping with previous research (Bajic, 1985; McHone & Rungeling, 1999), household income is assumed to affect cultural demand and support in a significant, positive way. Both education and income are included as linear trends. Finally, different professions are included as fixed effects.[13] Table 2 shows a summary of the descriptive statistics. As depicted by table 3, there are no problematic (r>0.8) correlations among the covariates and the main variable of interest, Distance 1.

[Insert Table 3 here]

Empirical model

Support, a latent variable with ordinal characteristics, was set as the dependent variable. Due to the ordinal characteristic, linear estimates would be biased (Long & Freese, 2006). Instead, an ordered probit approach is applied, using average marginal effect (AME) for interpretation purposes. For a better understanding of the non-linear relationships, graphical interpretations are also provided. As event managers and policy makers should be interested in highly supportive residents (e.g. only highly supportive residents are likely to participate in

[13] Employee private firm (N=268), Civil Servant (N=43), Self-Employed (N=226), Freelancer (N=6), Student (University) (N=20), Unemployed (N=48), Student (Non-University) (N=17), Pensioner (N=147), Housewife (N=115), Military (N=6), Dealer (N=3), Miscellaneous (N=1).

volunteering and referendums (Lee et al., 2014a), we focus on the impact of Distance 1 on the probability of Support at the highest level of support (*Support* = 7).[14] Assuming a standard normal distribution of ε_i, the probability function of the subsequent models is specified as follows (Long & Freese, 2006):

$$(3) \qquad Pr\ (Support=7)= \Phi(\tau_7 - x\beta) - \Phi(\tau_6 - x\beta)$$

where x is the vector of our explanatory variables; β a vector of estimable parameters, Φ(.) is the normal distribution function for ε and τ are the cut-off points. The average marginal effects are denoted as:

$$(4) \qquad \delta Pr\ (Support=7)/\delta x= -[\varphi(\tau_7 - x\beta) - \varphi(\tau_6 - x\beta)]\ \beta`$$

where φ(.) is the probability mass function of the standard normal distribution and β` the remaining parameters. In contrast to a simple probit model (using 1 for Support=7 and 0 if otherwise), the ordered probit model takes the whole distribution of Support into account when estimating the coefficients of the independent variables for Support=7.

As proposed by studies concerning proximity effects of voting behaviour (Coates & Humphreys, 2006; Horn et al., 2015), we use a non-linear model with distance measurements as independent variables in a first step. To differentiate the effect of Distance 1, we start with a reduced model (Model 1) including the distance from a resident's district centre to the main Olympic area. However, the existence of different event areas within the city complicates the

[14] Another reason to focus on the most important manifestation on ordinal variable is that we cannot analyze every manifestation with the same accuracy within one paper. All results of the AME of the other manifestations are available on request. With regard to Distance 1 in model 3, the marginal effects are positive for high support and negative significant for other manifestations, which is obvious, since marginal effects in ordered probit models are always estimated in reference to the other manifestations.

investigation of support-distance effects between a local's district centre and the main area at Barra da Tijuca (Distance 1). It has to be taken into consideration that a resident lives far away from the Olympic Village, but close to the area of the Maracana stadium, this might mean that a support-distance effect is a function of dependences between Distances 1-4. To test for such mutual dependencies, Model 2 includes Distance 2-4, while Model 3a contains an additional interaction between Distance 1-4**.** Hence, Model 3a additionally includes a fourth-order interaction effect of Distance 1-4 (Chen & Thomas, 2010; Cornell & Montgomery, 1996). In contrast to interaction terms in linear regression models and to unconditional variables in non-linear models, the reported coefficients and standard errors of the interactions terms in non-linear models are misleading and not straightforward (Hoetker, 2007; Norton, Wang & Ai, 2004). Therefore, the interaction effect of Model 3a is analysed using a graphical interpretation of the marginal effect of Distance 1, depending on a change in Distance 2-4. Additionally, Model 3b has a squared term of Distance 1 incorporated, to test for a potential non-linear relation between distance and support.

As discussed by Horn et al. (2015) and Ahlfeldt and Maennig (2011), local support for stadiums or events may not be spatially independent. Neighbours could affect each other with their perceptions and opinions, which would lead to biased results. Moreover, unobserved disturbance factors (e.g. omitted variables such as external effects like weather or landscape) might be also spatially dependent. To control for so-called spatial lag effects and spatially affected error terms, spatial autoregressive regression models (SARM) are employed for robustness issues (Anselin 1988, 2003). Two SARM models with maximum-likelihood estimates (Ahlfeldt & Maennig, 2011) are presented. SARM 1 contains spatially corrected error terms and spatial lags. SARM 2 is a pure spatial lag model without error term adjustments.[15] Since there is no point information on a respondent`s location we used polygon data of the city of Rio de Janeiro retrieved from the online available data to generate a contiguity matrix indicating whether districts are neighbours or not. [16] Support was then converted into mean values per district. [17] Subsequently, average values of the independent variables on a region (official cluster of districts) level were generated in order to adapt the survey data to the spatial model. Hence, the spatial weight matrix indicates one if two districts are neighbours. As we use mean values[18] of Support per district, we preferred a standard SARM over a specific spatial probit model, since ordered spatial probit models are designed for "modeling situations where the alternatives exhibit a natural or logical ordering" (Lesage & Pace, 2009, p. 297).

Results

Departing from the reduced ordered probit Model 1, estimates (Table 4) show significant impact of the distance from a respondent's district centre to the main event area at Barra da Tijuca, at the one percent confidence interval. More precisely, every additional km away from the event area increased the probability of high support by one percent. At the maximum distance of 31.34 km, the overall probability of maximum support increases to 68 percent, while it decreases to 40 percent at the minimum of Distance 1. Besides the highly

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15 The general form of a spatial model is precisely descripted by Elhost (2010, p. 11): "The Manski model takes the form: $Y=\rho WY+\alpha+X\beta+WX\theta+u$; $u=\lambda Wu+\varepsilon$ where the variable WY denotes the endogenous interaction effects among the dependent variables, WX the exogenous interaction effects among the independent variables, and Wu the interaction effects among the disturbance terms of the different spatial units. ρ is called the spatial autoregressive coefficient, λ the spatial autocorrelation coefficient, while θ, just as for β, represents a Kx1 vector of fixed but unknown parameters. W is an NxN matrix describing the spatial arrangement of the spatial units in the sample."

16 Prefeitura da Cidade do Rio de Janeiro: http://portalgeo.pcrj.opendata.arcgis.com/datasets/8454eb0454b7424d89c61b67742286a1_15

17 Four districts out of 161 (Lapa, Centro, Jacarezinho and Paqueta) were dropped from the spatial data due to missing information (no surveyed residents). To impute other missing information of districts within the same region (in total 33 regions), average values per region were generated and subsequently assigned to the subordinated districts.

18 Due to the generation of means, we dropped profession from the SARM models, because profession is a strictly nominal variable and means of "profession" would lead to non-interpretable estimations.

significant effect of Distance 1, HDI also indicates a positive effect statistically different from zero, meaning that residents in better-off district tend to support the Olympic Games more than those in poorer districts. Further, we found a positive marginal effect of Income, which is significant at the five percent level. In contrast, the linear effect of Education reveals a negative impact at the 10 percent level.

[Insert Table 4 here]

[Insert Table 5 here]

As stated above, a single consideration of Distance 1 seems insufficient since the Olympic Games will take place in four different areas. Assuming an independent relation of Distance 1-4, Model 2 indicated lower marginal effects (0.8 percent increase in Support for every additional km) for Distance 1, whereby the effect remained significant and positive. In this way, the overall probability of high support for the Olympic Games rose to 67 percent at the maximum distance to the main area (31 km) and fell to 42 percent at the minimum distance. The estimates for the marginal effects of Distance 2-4 were heterogeneous. While the distance to the Maracana stadium (Distance 3) also had a positive significance, the impact of localisation to the Copacabana area (Distance 2) was negative and significant at the one percent confidence level. No significant effect was detected for Distance 4. The significant effects of HDI and education vanished. The impact of income on support for the sports event remained significant at the five percent threshold. For the best approximation of mutual spatial dependences among the residents' location to the four Olympic areas, a higher-order interaction term[19] was included in the full model (Model 3). Regarding the main variable Distance 1, the model revealed almost congruent results compared to Model 2. The effect of Distance 1 remained at 0.8 percentage point for an additional kilometre, which was different

[19] We also tried a non-linear effect for area 1 (Horn et al., 2015), incorporating a squared term of Distance 1 into the model. The interaction effect was insignificant and other coefficients were concurrent.

from zero at the one percent level. Looking at the overall probability of high support among residents, Figure 2 shows a maximum of 66 percent at the maximum distance from the main area and a minimum probability of 40 percent when Distance 1 is minimised. Hence, residents at a maximum distance had a 25 percent higher probability of highly supporting the Olympic Games, than those living in the district of Barra da Tijuca. Estimates for other distances also revealed only slightly different marginal effects, while the inference statistics remained constant. For interpreting purposes of non-linear effects of the independent variables (Model 3b) graphical interpretation is useful. Looking at Figure 3 indicates no significant effect of the included Distance^2 Term as the curve is only slightly concave. Including a squared term into Model 1 and Model 2 lead to a slightly more concave output, but the overall impact remained insignificant.

[Insert Figure 2 here]

[Insert Figure 3 here]

Graphical analysis is necessary to interpret the interaction effect. Therefore, Figure 4 provides graphical insights on the change in the marginal effect of Distance 1 depending on the other distances, which were held constant at the same level of distance. Based on Figure 3, a positive impact from the other distances on Distance 1 was confirmed. According to Figure 4, the effect of every additional kilometre between a resident's district centre and the main area increased support with increasing distance to the other three areas. In the case of a resident living 10 kilometres from areas 2-4, every extra kilometre closer to the main facilities decreases his/her support by 0.65 percent. In the case of another resident living 30 kilometres from areas 2-4, every extra kilometre to the main facilities decreases his/her support by 1.1 percent. In summary, the effect of living closer to potential negative external factors caused by the construction of the main facilities on support for the Olympic Games is higher if residents are not negatively affected by other negative external factors related with the construction of Deodoro or Maracana. Conversely, if a local is closely situated to other areas, then being close to the main area has a smaller effect on his/her support.[20] In model 1 – model 3a we additionally detected a significant ($p<0.05$) effect of Students. According to the estimations, the probability of high support by students is on average 20% lower than for employees, which is in line with recent findings from Rocha and Barbanti (2015).

As depicted by table 4, the differences between the air-line distance estimations and the alternative distance estimations are only marginal with respect to the main variable (Distance 1). Based on the higher mean distances by feet or by car, the coefficients of the feet and road estimations are smaller. Even the double z-score confirms the findings from the air-line distance estimations with a very similar estimation, since one standard deviation change in double z-score leads to an 5.4% increase of high support. With regard to air-line distance, a 1 one standard deviation increase leads to a 5.7% increase (6.38*0.009).

[Insert Figure 4 here]

Looking at the spatial autoregressive model (SARM 1) presented in table 6, there does not seem to be any spatial dependences in the error terms, since Lambda turned out to be insignificant. However, the coefficient for the special lag (rho) is highly significant, indicating that respondents of neighbour districts are related to each other in terms of their support for the Olympic Games. Hence, SARM 2 is the preferred model. Both SARM models reveal results which are in line with the ordered probit estimations. With every additional kilometre closer to the main event area support decreases by 0.024 points (SARM 2). Similar to the results from the ordered probit models, the SARM 2 estimations with different distance

[20] An additional model, only including the minimum of distance to one of the facilities revealed no significant effect of distance.

proxies are very similar to the air-line results, confirming a positive effect of distance to the main area on the support for the event (table 7).

[Insert Table 6 here]

[Insert Table 7 here]

Discussion

To sum up the results on Distance 1, the closer a resident lived to the main event area, the lower was his/her support for the event. These results are in line with the findings of referendums for sports stadiums (Ahlfeldt & Maennig, 2011; Horn et al., 2015). Furthermore, support decreased if a resident already lived close to other event-related areas. Concerning Distances 2-4, the results showed heterogeneous findings. While the external effects of the Maracana Stadium (Distance 3) seemed to decrease support with decreasing distance, no such effect was determined for the area of Deodoro (Distance 4). Moreover, the effect of Copacabana area (Distance 2) on support was increased with decreasing distance.. One possible reason for these heterogeneous findings may be the status of construction and the type of urban change. At the time the residents were surveyed, the areas of Barra da Tijuca and Maracana were under construction. In contrast, construction in Copacabana had not started. As a result, residents experienced different levels of external effects depending on the Olympic areas. Another reason could be related to the kind of construction work. Unlike permanent changes at Barra da Tijuca, Maracana and Deodoro, the Olympic area at Copacabana mostly provided temporary facilities (e.g., beach volleyball arenas). Therefore, residents living in or close to Copacabana appear to be less affected by construction and thus show higher support for the event. However, the findings might also be related to the high correlation among Distance 2 and Distance 3 (table 3), for which reason an interpretation of these to two coefficients have to be done with caution.

Besides the distance effects, some covariates also affected the intention to support the 2016 Games. While the living conditions (HDI) had significant impact based on model 1, the effect disappeared in model 2 and 3. This important change might be a result of an “omitting variable bias”, as the distances to area 2-4 are strongly related to districts and, therefore, to social conditions. Also, the effects of Education on Support changed, which might also be related to the omission of Distance 2-4. The insignificance of education is also in line with the literature, which suggests that sport-related events are not strongly related with education, since spectator sport events have a “low educational requirement”. Income, on the other hand, seems to be a driver of support for the Olympic Games. Residents with higher household income support the games at a 10 percent significance level. Poorer locals might see less utility from the Games, since they are more often affected from relocations (Hall & Hodges, 1996) and from long-term reductions in public services in order to finance subsidies. No effects for age and gender were detected on support for the Olympic Games.

Conclusion

Although the literature is rich on determinants of local support in the pre-event phase of mega sports events, the spatial location of citizens has been neglected so far, for which reason we investigated the impact of the spatial distribution of residents on the probability of support for mega sports events.

Survey data on the 2016 Olympic Games was used for the empirical investigation. Representative and random survey data on 900 residents of Rio de Janeiro were analysed using ordered probit and autoregressive regression models with interaction effects. Results indicated a significant impact of (air-line) distance on high-level support for the Olympic Games. The closer residents live to the main area, the less they support the event. This effect decreased with decreasing distance to other event areas. Residents may have short-term preferences as they possibly over-evaluate short-term effects (e.g., pollution, noise, etc.) in the pre-event phase over long-term effects (e.g., facilities and infrastructure). The results were also robust when using other distance measures (feet, road, public transport). Besides this, income was identified to slightly influence popular support, with poorer residents being less supportive of the event. Spatial autoregressive specifications revealed that respondents of neighbour districts are related to each other with respect to the stated support for the event.

Economically, the results are important in several ways. First, local authorities could invest more in convincing residents living close to the event areas (e.g. to obtain a positive referendum or more volunteers) by offering benefits (e.g. free admission to special events), visits and talks with media, policy makers and/or popular athletes/artists, free use of public transportation, or even financial compensation (Hiller, 2000; Karadakis, Kaplanidou & Karlis, 2010; Lee at al. 2014; Ritchie et al., 2009; Ritchie et al., 2010). They also might inform closer residents more about the short and long-term positive external effects, intensify the involvement of nearby locals in the planning process, finance simultaneous construction of non-event related facilities, or promise public post-event access to the event facilities (Karadakis et al., 2010; Gursoy & Kendall, 2006; Pappas, 2014; Ritchie et al., 2010). In a similar vein, public committees may subsidise tickets prices for locals rather than subsidising the whole event (Hiller, 2000; Ritchie et al., 2009). In summary, the management of sports events might adjust the strategic planning by anticipating spatial differences in local support (Solberg & Preuss, 2007; Ritchie, 2000; Ritchie at al., 2009).

Second, organisers and policy makers should involve nearby populations to a greater extent in planning for the event and for urban change (Boyko, 2007; Ritchie at al., 2009). Third, organising committees could expand their voluntary programs or campaigns for funding and donations to residents in suburban areas. Fourth, improved understanding of local support and location of the residents is a further step towards maximising the benefits of hosting major sports events.

Considering that every major sports event is somehow unique and that we use stated preferences instead of revealed preferences, some drawbacks have to be taken into account. In contrast to recurring events, where panel studies are desirable, such data structure is not straightforward for MSEs, as they mainly take place only once in a city (or at least with intervals of many years). Furthermore, the results may vary with the mega event under observation. Moreover, the level of support might be dependent on general nation specific happiness and life satisfaction (Gundelach & Kreiner, 2004). In addition, the dimensions of urban change certainly vary with the event, which also may affect the probability of support. Finally, as with any economic and social pattern, the results are a one-off snapshot and may vary over time (Lucas, 1976).

Future research on the topic of spatial distribution of support for mega sports events may repeat the analysis for other mega events. New studies should also try to test the support-distance effects with longitudinal data and to add information on the precise location of the residents to investigate how the level of support from one resident is affected by his neighbours. Since we only could control whether or not support is spatially dependent, future studies might explicitly focus on an empirical investigations of the precise reasons for this findings, by specifically looking at differences in the spatial dependence between tangible and intangible benefits and costs. Instead of using a simple question to proxy support, future research could use a contingent valuation method approach to more precisely assess the “hidden” value of mega sport events to residents and the spatial location of it (Walton, Longo & Dawson, 2008; Wicker, Kiefer & Dilger; Wicker, Prinz, von Hanau, 2012). Finally, it could be important to evaluate spatial support effects between low and high-income hosting nations (Preuss & Solberg, 2006).

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Table 1
Overview on the dependent variable Support (n=900)

Variables	Description	N	%	Mean	SD
	"I support the Olympic Games 2016"				
Support = 1	I totally do not support	38	4.22		
Support = 2		26	2.89		
Support = 3		31	3.44		
Support = 4		51	5.67		
Support = 5		91	10.11		
Support = 6		176	19.56		
Support = 7	"I totally support"	487	54.11		
Sum		**900**	**100**	**5.90**	**1.64**

Table 2
Overview on the independent variables (n=900)

Variables	Description	Mean	SD	Min	Max
AL Distance 1	Air-line (AL) Distance of a respondent's district (center) to facilities at Barra da Tijuca (km)	16.70	6.38	1.00	31.34
AL Distance 2	Air-line (AL) Distance of a respondent's district (center) to facilities at Copacabana (km)	21.80	12.75	1.00	53.23
AL Distance 3	Air-line (AL) Distance of a respondent's district (center) to facilities at Maracana (km)	16.72	12.09	1.46	48.89
AL Distance 4	Air-line (AL) Distance of a respondent's district (center) to facilities at Deodoro (km)	14.11	7.50	2.21	34.64
HDI	Human Development Index of a respondent`s district	0.83	0.07	0.71	0.97
Female	Sex of the respondent (1=female, 0=male)	0.54	0.50	0.00	1.00
Age	Age of the respondent (years)	42.90	16.03	18.00	85.00
Income	Income of the respondent`s household (1 = low; 8 = high)	3.68	1.94	1.00	8.00
Education	Level of the respondent`s highest education (1= low; 8=high)	5.07	1.97	1.00	8.00
Profession	Dummy variables for different professions of the respondent	-	-	-	-

Table 3
Correlation table (n=900)

Variables	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**
[1] Support	1.00									
[2] AL Distance 1	0.07*	1.00								
[3] AL Distance 2	-0.10**	0.22**	1.00							
[4] AL Distance 3	-0.07	0.25**	0.97**	1.00						
[5] AL Distance 4	0.12**	0.62**	0.20**	0.36**	1.00					
[6] HDI	0.08*	-0.18**	-0.63**	-0.54**	0.08*	1.00				
[7] Female	-0.07*	0.03	0.05	0.04	0.01	0.00	1.00			
[8] Age	0.04	0.05	0.01	0.01	0.02	-0.01	-0.03	1.00		
[9] Income	0.11**	-0.06	-0.28**	-0.23**	0.07*	0.39**	-0.11**	0.06	1.00	
[10] Education	0.00	-0.04	-0.10**	-0.09**	-0.04	0.21**	-0.01	-0.23**	0.47**	1.00

Note: *p<.05; **p<.01;

Table 4

Average marginal effect of an ordered probit estimation on Support = 7 (n=900)

Support	**Model 1**	**Model 2**	**Model 3a**	**Model 3b**
AL Distance 1	0.010 (0.00)***	0.009 (0.00)***	0.008 (0.00)***	0.009 (0.00)**
AL Distance 1^2	/	/	/	Incl.
AL Distance 2	/	-0.022 (0.01)***	-0.026 (0.01)***	-0.026 (0.01)***
AL Distance 3	/	0.018 (0.01)**	0.021 (0.01)**	0.021 (0.01)**
AL Distance 4	/	0.002 (0.00)	-0.002 (0.00)	-0.002 (0.00)
AL Distance Interact.	/	/	Incl.	Incl.
HDI	0.810 (0.23)***	-0.03 (0.29)	-0.034 (0.29)	-0.042 (0.29)
Female	-0.039 (0.03)	-0.034 (0.03)	-0.036 (0.03)	-0.036 (0.03)
Age	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)
Income	0.023 (0.01)**	0.018 (0.01)**	0.017 (0.01)*	0.017 (0.01)*
Education	-0.015 (0.01)*	-0.01 (0.01)	-0.009 (0.01)	-0.01 (0.01)
FE Profession	Incl.	Incl.	Incl.	Incl.
Log-Lik	-1232.925	-1223.510	-1221.417	-1221.338
Wald	449.870***	480.047***	472.378***	472.586***
McFadden's R2	0.020	0.027	0.029	0.029
AIC/N	2.791	2.777	2.774	2.776
BIC	2.622	2.623	2.626	2.633

Note: **p*<.1; ***p*<.05; ****p*<.01; robust (White, 1980) standard errors in parentheses.

Table 5

Average marginal effect of an orders probit estimation on support = 7 (n=900)

	Model 3a	**Model 3a**	**Model 3a**	**Model 3a**	**Model 3a**
Distance Measure	**Air-Line**	**Feet Distance**	**Road Distance**	**Public Transport**	**Double Z-Score**
Distance 1	0.009 (0.00)***	0.005 (0.00)**	0.004 (0.00)**	0.002 (0.00)***	0.054 (0.02)***
Distance 2	-0.022 (0.01)***	-0.006 (0.00)	0.001 (0.00)	-0.003 (0.00)***	-0.106 (0.06)*
Distance 3	0.018 (0.01)**	0.001 (0.01)	-0.005 (0.00)	0.001 (0.00)	0.04 (0.07)
Distance 4	0.002 (0.00)	0.005 (0.00)	0.007 (0.00)**	0.002 (0.00)**	0.031 (0.03)
HDI	-0.03 (0.29)	0.111 (0.28)	0.225 (0.27)	0.281 (0.28)	0.163 (0.28)
Female	-0.034 (0.03)	-0.034 (0.03)	-0.034 (0.03)	-0.035 (0.03)	-0.034 (0.03)
Age	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0)
Income	0.018 (0.01)**	0.018 (0.01)**	0.019 (0.01)**	0.017 (0.01)*	0.018 (0.01)**
Education	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
FE Profession	Incl.	Incl.	Incl.	Incl.	Incl.
r=Airline 1	1.00				
r=Feet Distance 1	0.95	1.00			
r=Road Distance 1	0.94	0.97	1.00		
r=Public Transport 1	0.86	0.90	0.87	1.00	
r=Double Z-Score 1	0.97	0.99	0.98	0.94	1.00

Note: *p<.1; **p<.05; ***p<.01; robust (White, 1980) standard errors in parentheses. Correlation coefficients reflect the relation between the different distance predictors of Distance 1 (Main Area).

Table 6

Spatial autoregressive regressions (n=157)

Support	**SARM 1**	**SARM 2**
AL Distance 1	0.021 (0.01)***	0.024 (0.01)***
AL Distance 2	-0.073 (0.01)***	-0.067 (0.02)***
AL Distance 3	0.07 (0.02)***	0.064 (0.02)***
AL Distance 4	-0.014 (0.01)	-0.015 (0.01)
AL Distance Interact.	Incl.	Incl.
HDI	-0.112 (0.64)	-0.003 (0.67)
Female	-0.019 (0.25)	-0.085 (0.26)
Age	0.006 (0.01)	0.004 (0.01)
Income	0.287 (0.05)***	0.273 (0.05)***
Education	-0.244 (0.06)***	-0.244 (0.07)***
Const.	6.147 (0.63)***	6.166 (0.67)***
Lambda	0.00004	/
Rho	0.19895***	0.15433***

Note: **p*<.1; ***p*<.05; ****p*<.01; robust (White, 1980) standard errors in parentheses.

Table 7

Average marginal effect of an orders probit estimation on support = 7 (n=900)

	SARM 2	**SARM 2**	**SARM 2**	**SARM 2**	**SARM 2**
Distance Measure	**Air-Line Distance**	**Feet Distance**	**Road Distance**	**Public Transport**	**Double Z-Score**
Distance 1	0.024 (0.01)***	0.014 (0.01)**	0.013 (0.01)**	0.005 (0.00)***	0.136 (0.04)***
Distance 2	-0.067 (0.02)***	-0.021 (0.01)**	-0.000 (0.01)	-0.01 (0.00)***	-0.442 (0.11)***
Distance 3	0.064 (0.02)***	0.016 (0.01)	0.006 (0.01)	0.009 (0.00)***	0.361 (0.11)***
Distance 4	-0.015 (0.01)	-0.003 (0.01)	0.005 (0.01)	-0.003 (0.00)	-0.138 (0.07)*
Distance Interact.	Incl.	Incl.	Incl.	Incl.	Incl.
HDI	-0.003 (0.67)	0.516 (0.69)	0.888 (0.73)	0.969 (0.61)	0.393 (0.66)
Female	-0.085 (0.26)	-0.212 (0.28)	-0.302 (0.29)	-0.063 (0.23)	-0.163 (0.26)
Age	0.004 (0.01)	0.007 (0.01)	0.01 (0.01)	0.004 (0.01)	0.003 (0.01)
Income	0.273 (0.05)***	0.278 (0.05)***	0.269 (0.06)***	0.27 (0.04)***	0.291 (0.05)***
Education	-0.244 (0.07)***	-0.258 (0.07)***	-0.264 (0.07)***	-0.295 (0.06)***	-0.271 (0.07)***
Const.	6.166 (0.67)***	5.523 (0.72)***	4.908 (0.76)***	5.299 (0.61)***	5.78 (0.61)***
Rho	0.154***	0.154***	0.136***	0.199***	0.154***

Note: **p*<.1; ***p*<.05; ****p*<.01; robust (White, 1980) standard errors in parentheses.

Figure 1
Spatial distribution of the event areas within the city of Rio de Janeiro (MRJ 2005)

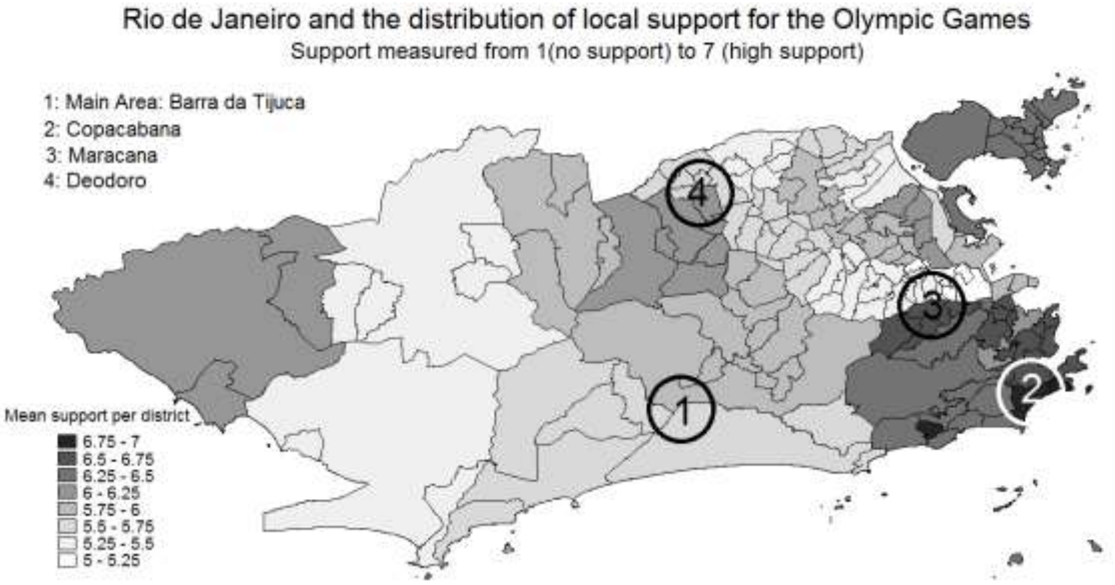

Figure 2

Predictive margins of support (Model 3a)

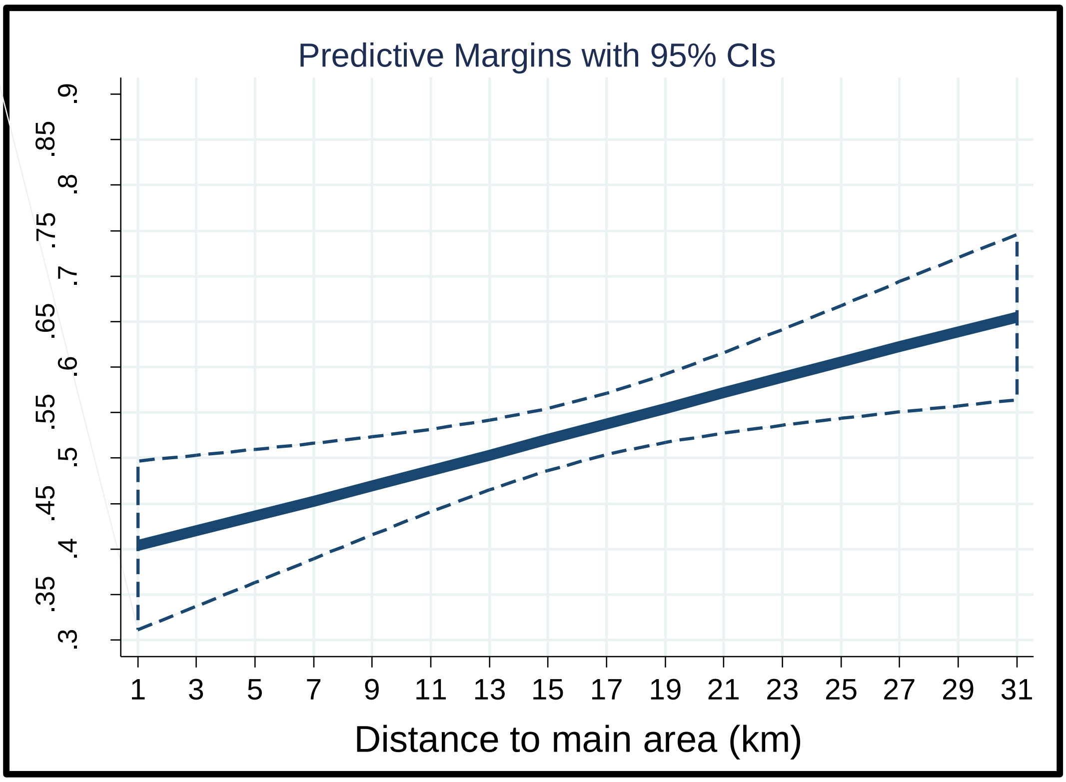

Figure 3

Predictive margins of support (Model 3b) with non-linear assumption of Distance 1

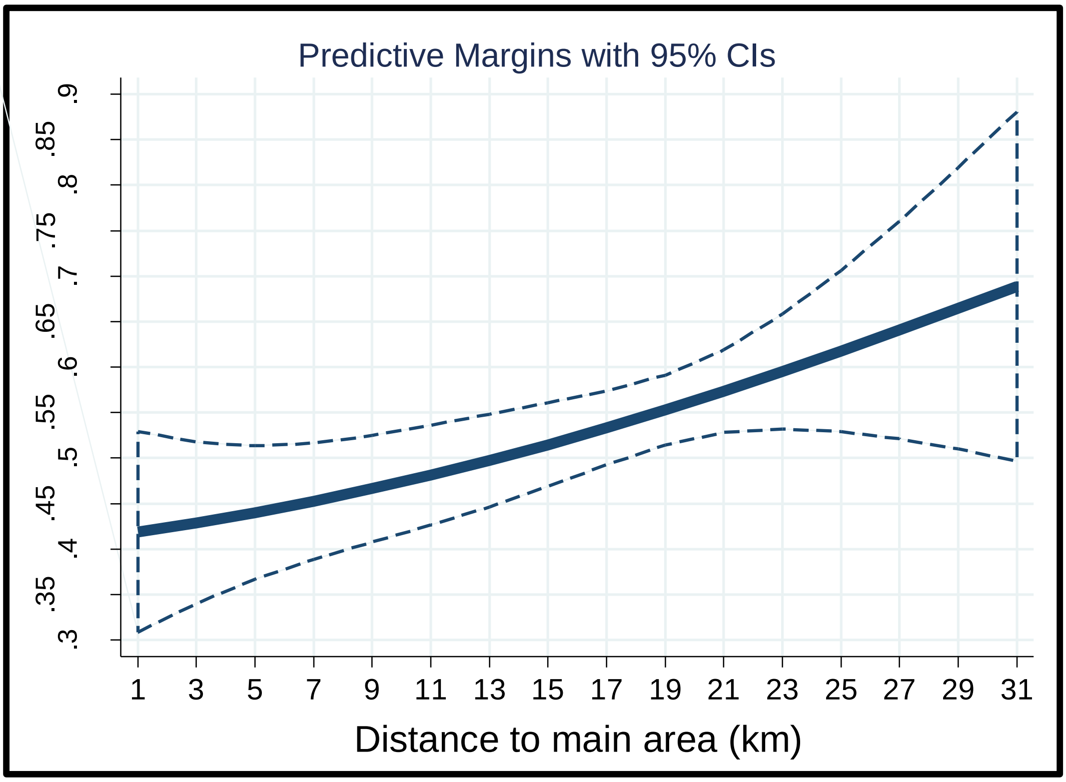

Figure 4

Interaction effect: Average marginal effects of Distance 1 on Support=7 with 95% CIs