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Spatial spillovers of the cultural employment growth in Brazilian municipalities

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Abstract: The Brazilian cultural sector is rarely explored in the literature, especially considering all municipalities at the same time in an economic and spatial perspective. This paper aims to measure the level of specialization, urbanization and diversification externalities on the cultural employment growth rate in Brazilian municipalities between 2006 and 2016. To do so, spatial econometric models are used. The main results indicate there are no spatial associations regarding cultural employment growth in Brazil. The lack of complementarity of this sector, associate with the lack of incentives for its development, particularly in small municipalities, helps to explain our results.

Keywords: cultural activities; Brazilian municipalities; spatial econometrics; specialization externalities

JEL: R12; Z10

1. Introduction

The creative and cultural industries have been growing faster than traditional industries over the last few decades (Florida, 2014). For instance, in Brazil, reports by the Brazilian Institute of Geography and Statistics (IBGE) shows more than a 30% growth of gross output and value added between 2003-2005 and 2007-2010 periods. In addition, there has been over a 10% increase in the formal¹ workforce in these industries for both periods. However, most of the literature on these industries, especially in Brazil, are still scarce. The expansion of data availability in conjunction with software development contributed to the increase of empirical studies in cultural economics across the globe.

Despite some studies, there has been an increasing effort to evaluate the cultural sector in Brazil. Given the growth trend in output and employment, investigating the spatial spillovers from the cultural employment dynamic in the Brazilian municipalities is of interest. To fill in this gap, this paper aims at measuring the level of specialization, urbanization and diversification externalities on the cultural employment growth rate in Brazilian municipalities between 2006 and 2016. To do so, we use data from the Annual Report of Social Information from the Brazilian Ministry of Labor and Employment (MTE) for the period 2006–2016 and employ Local Indicators of Spatial Association statistics and spatial econometric models.

The focus on specialization, urbanization and diversification stems from the literature of agglomeration and growth. Firms that locate close to each other enjoy specialization or localization spillovers from sharing intermediate inputs, job-market pooling and matching and knowledge spillovers (Marshall, 1920; Glaeser et al., 1992). These, in turn, help the growth and development of said industry. On the other hand, Jacobs (1969) argues that the urban scale and the diversification of industries are

elements that foster innovation and growth. Thus, to properly explain the growth of an industry, it is important to account for all specializations, urbanization and diversifications, as there is no definite answer on which effect is more important (Henderson, 2003, Duranton and Overman, 2005, Groot et al., 2014).

Few studies have assessed the cultural sector in Brazil on different aspects. Some of the topics covered so far are: the production structure (Ferreira Neto et al., 2018); expenditure and consumption of cultural goods and services (Machado et al., 2017; Machado and Paglioto, 2012; Diniz and Machado, 2009; 2011); cultural policy (Souza, 2016); characteristics' identification of the cultural sector among Brazilian municipalities (Ribeiro and Lopes, 2015; Ferreira Neto and Perobelli, 2013) and labor market (Machado et al., 2013; Ferreira Neto et al., 2012).

Expenditures on cultural goods are not only related to available time and income, but the habit of consuming this type of goods is also an important factor, although it is not very common in Brazilian society (Machado et al., 2017). Diniz and Machado (2009) have shown that expenditures on cultural goods/services are very low in Brazilian households, especially in rural areas. As a matter of fact, according to Machado and Paglioto (2012), this expenditure is higher in metropolitan regions - 32.5% of households declared they had incurred this type of expenditure in 2008-09. In terms of interdependence, Ferreira Neto et al. (2018) have shown that Telecommunication, edition and news agencies is the only cultural sector in Brazil with high links to other activities.

Although access to culture is a guaranteed right for all Brazilian citizens, there is an inequality in culture's access. Cultural goods are concentrated in the large Brazilian cities, and the demand for these products is greater for the population that has higher income and higher education (Ribeiro and Lopes, 2015). According to these authors, the

highest average incomes in the cultural sector were in São Paulo and Rio de Janeiro in 2013, which are the two largest Brazilian cities. Therefore, cultural goods' consumption is a small part of most Brazilians' usual consumption basket, which helps to explain the distribution of employment in the industry across the country.

To understand the determinants of the employment growth in the cultural industries in Brazil and its spatial spillover we rely on municipal level data from the Annual Report of Social Information (RAIS) from the Brazilian Ministry of Labor and Employment (MTE) for the period 2006–2016. RAIS is a mandatory annual administrative survey used to monitor the labor market and can be considered a census of formal employment in the country. Following Combes (2000), Lazaretti and Capone (2009) and Ribeiro et al. (2018), we also differentiate the determinants of employment growth in three components: specialization, measured by locational quotient and the number of cultural establishments per 100,000 inhabitants; urbanization, measured by the inverse of the Hirschman-Herfindahl index and the percentage of formal employees with higher education; and, diversification, proxied by employment shares of agriculture, industry and commerce. To properly capture the spillover effects, we make use of spatial econometric models that allow us to estimate the impact of either/both spatially lagged dependent and explanatory variables on the 10-year employment growth.

Our results show that there are no spatial associations regarding cultural employment growth in Brazilian municipalities between 2006 and 2016 in any of the spatial econometrics models used. These results are important because, although there is evidence in the international literature that artists agglomerate in space and this is in their benefit (Borowiecki, 2013, 2015; Hellmanzik, 2010; O'Hagan and Hellmanzik,

2008; O'Hagan and Borowiecki, 2010), this was not the case for the cultural sector in Brazil between 2006 and 2016.

2. Data

In order to classify the cultural activities, we used the 4-digit level of the Brazilian Code of Economic Activities (CNAE) provided by IBGE. This classification was first proposed by Ribeiro and Lopes (2015), in which the authors based their definitions on the classifications by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Brazilian Ministry of Culture. Table 1 shows the 23 activities that constitute the cultural sector in Brazil.

<Insert table 1>

Table 2 shows the variables used in the econometric models. All variables were obtained from the RAIS from the Brazilian Ministry of Labor and Employment (MTE). The main limitation of this dataset is that it only accounts for formal jobs. This can be an issue for cultural and creative activities since they are usually associated with informal or part-time activities (Throsby, 1992; Benhamou, 2007). However, according to IBGE (2013), the number of artists in formal jobs has increased between 2007 and 2012 and is about 50% in each sector. On the other hand, this is the most recent database available at the local (municipality) level and sectoral details. In addition, RAIS data have been widely used in the recent literature (Ribeiro et al., 2018; Garsou et al., 2017; Ribeiro and Andrade, 2015; Ribeiro and Lopes, 2015).

With the exception of the variable “municipal expenditures in culture” and “average income per municipality,” all other variables were selected following Lazaretti and Capone (2009) and Ribeiro et al. (2018). In general, these authors explain the growth on employment rate in the tourism sector from three dimensions, namely:

specialization, urbanization and diversification. In general, as previously discussed, the spatial agglomeration of industries contributes to its growth through different types of spillovers (Marshall, 1920; Glaeser et al., 1992) measured here by these three dimensions.

<Insert table 2>

The Locational Quotient (LQ) and the number of cultural establishments per 100,000 inhabitants seek to capture specialization effects. LQ is one of the variables most often used in the literature to capture the level of sectoral specialization of a given region. According to Isard (1971), it can be specified as:

$$LQ_{ij} = \frac{E_{ij}/E_i}{E_{.j}/E_{..}} \quad (1)$$

In which: E_{ij} is the cultural employment in municipality j ; E_i is the total employment in municipality j ; $E_{.j}$ is the cultural employment in Brazil (region of reference); and $E_{..}$ is the total employment in Brazil. If $LQ > 1$, this municipality is specialized in the cultural sector in relation to the region of reference (Brazil). Authors such as Glaeser et al. (1992), Combes (2000) and Ribeiro et al. (2018) have used LQ as proxy of specialization externalities.

Population density, the inverse of the Hirschman-Herfindahl index (HH) and the percentage of formal employees with higher education seek to capture urbanization effects. The inverse of the HH index can be specified as:

$$HH = \frac{1}{\sum_1^k (p_i^2)} \quad (2)$$

In which: p_i is the share of each sector in the total employment of each municipality.

The average income per municipality seeks to capture the local purchasing power. Following Ribeiro et al. (2018), the variables “employment share of the agriculture” (AGR), “employment share of the industry” (IND) and “employment share of the commerce” (COM) are used to control effects outside the cultural sector. To

some extent, these variables indicate the economy's diversification degree of each municipality. Moreover, all explanatory variables, as in Lazzaretti and Capone (2009) and Ribeiro et al. (2018) were collected for the base year, i.e., 2006. Table 3 presents the descriptive statistics of the variables used.

<Insert Table 3>

The average employment growth in this period was 0.57%, and the average cultural employment was 42 people. In general, it is also possible to see that there is a strong heterogeneity in several variables given their high standard deviation, such as employment growth rate (Y), Locational Quotient (LQ), number of cultural establishments per 100,000 inhabitants (EST), population density (DEN) and average income per municipality (INC). Furthermore, the cultural employment is very concentrated in Brazil.

The fifteen Brazilian municipalities with the most workers in the cultural sector in 2016 were, respectively: São Paulo (SP), Rio de Janeiro (RJ), Curitiba (PR), Belo Horizonte (MG), Brasilia (DF), Porto Alegre (RS), Fortaleza (CE), Salvador (BA), Recife (PE), Goiania (GO), Belém (PA), Manaus (AM), Osasco (SP), Vitória (ES) and Campinas (SP). Together, these municipalities have accounted for 53.5% of the total cultural employment in Brazil. However, in only three of them, employment in the culture sector exceeds 1% of total jobs: Osasco (1.82%), Rio de Janeiro (1.18%) and Vitória (1.15%). Among these fifteen municipalities, Osasco (SP) had the highest employment growth rate in the cultural sector during the analyzed period (49%), followed by Belém (26%) and Manaus (18%), while five municipalities presented the highest negative growth rate: Porto Alegre (-30%), Belo Horizonte (-11%), Goiania (-7%), Salvador (-3%) and Rio de Janeiro (-1%).

3. Method

Spatial econometrics allows the investigation of agent behaviour, considering its interaction with other agents in a heterogeneous space. The use of spatial econometrics' techniques in this case stems from the nature of cultural and creative jobs as well as characteristics of workers in these sectors. Firstly, artists and creative workers tend to cluster (Borowiecki, 2015; Florida, 2014; Hellmanzik, 2010). In addition, firms and workers may not locate in the same area. On the one hand, creative and cultural firms may want to locate in areas in which they enjoy agglomeration economies, but also have enough density that creates market demand (Cooke and Lazzeretti, 2008). On the other hand, artists are usually poorer, and need to find affordable living spaces that may not coincide with the location of firms (Mangset et al., 2018; Benhamou, 2007). Therefore, one must account for these possible interactions across space when estimating the location decision of cultural and creative firms and workers.

The general formulation for spatial econometric models is:

$$y_t = \rho W_1 y_t + X_t \beta + W_1 X_t \gamma + \xi_t \quad (3)$$

and

$$\xi_t = \lambda W_2 \xi_t + \varepsilon_t \quad (4)$$

where, W is a spatial weight matrix used to spatially lag the variable of interest. This general formulation can be broken into five models: Autoregressive Spatial Model (SAR), Spatial Error Model (SEM), Spatial Autoregressive Error (SAC), Spatial Durbin Model (SDM) and Spatial Durbin Error Model (SDEM). The difference between them is the spatial terms that are included.

LeSage and Pace (2014) argue that there are only two models applied work should focus on: the SDM and SDEM models. The SDM model includes both the spatially lagged dependent variable and the spatially lagged independent variables, i.e., parameters ρ and γ . The SDEM model, in turn, includes both the spatially lagged

independent variables and the spatially lagged error term, thus, parameters λ and γ . The main difference between these models is that the former is a global spillover model in that it captures higher-order neighboring spillovers, which are a less common phenomenon. The latter is a local spillover model.

In addition, the estimated coefficients for the SDM model are not immediately interpretable as in a classical linear regression model. This is because a global shock propagates throughout space, such that indirect effects, via spatial spillovers, need to be considered. Therefore, the direct and indirect effects of the explanatory variables need to be calculated. For the SDEM models, in turn, the spatially lagged independent variables can be interpreted as indirect effects, while the non-spatially lagged are the direct effect.

The estimated model has the following specification, with the spatially lagged terms added accordinglyⁱⁱ:

$$\ln \frac{E_{16}}{E_{06}} = \beta_1 + \beta_2 \ln E_{06} + \beta_3 LQ_{ij} + B_4 \ln EST + B_5 \ln DEN + B_6 HH + B_7 EDU + B_8 AGR + B_9 IND + B_{10} COM + B_{11} EXP + B_{12} INC + \varepsilon \quad (11)$$

The description of the model's variables can be found in Table 2. These models will be estimated by Maximum Likelihood and by the GMM. This will be particularly necessary when including the spatially lagged dependent variable, since this is equivalent to introducing an endogenous variable (Anselin, 1992). The instruments for the endogenous variable are the explanatory variables spatially lagged.

It should be emphasized, as commented earlier, that all explanatory variables refer to the base year (2006). The objective, therefore, is to verify the effects of the variables that refer to specialization, urbanization and diversification on the employment growth rates in the cultural sector for the Brazilian municipalities. In addition, it is sought to investigate eventual effects of spatial spillovers.

4. Results and Discussion

In 2006 and 2016, formal employment in the cultural sector in Brazil accounted for 0.67% and 0.53%, respectively, of total employment in the Brazilian economy. This low share could be associated with the high level of informal jobs in the sector (IBGE, 2013). Further, this decrease in the share of employment can be associated with the Brazilian economic crisis between 2014 and 2016.

A first step into understanding the cultural employment dynamic in Brazil is to look at its spatial distribution. Figure 1 shows the LQ result for the cultural sector's specialization degree in Brazilian municipalities in 2006 and 2016. It is possible to see that the specialization pattern remains similar among the Brazilian municipalities in the analyzed period. The most specialized cities regarding the cultural sector are located in the South and Southeast regions, which are the richest in the country. This result is in accordance with Ribeiro and Lopes (2015), who argue that cultural goods and services in Brazil are more demanded by middle-class and high-class households.

<Insert Figure 1>

The first step in estimating spatial models is to determine the weight matrix that will be used. The procedure for choosing the weight matrix followed Almeida (2012). First, the general model was estimated using Ordinary Least Squares. The residuals were then extracted from the regression and Moran's I was calculated for several weight matrices, including upper orders ones. The weight matrix with higher significant Moran's I was used in spatial models. Weight matrices based on contiguity and distance were used in this step, and the selected one was the weight matrix of 1 nearest neighbor. For a summary of the tested weight matrices, refer to Appendix 1.

The results are presented in Tables 4 and 5. Table 4 contains the SDM results, while Table 5 contains the SDEM results. As previously discussed, the estimated

parameters in the SDM are not interpretable as direct and indirect impacts, as changes in the explanatory variable in each region j affects not only the region itself via the direct effect, but also the value of the dependent variable in all other regions, via indirect effect (LeSage and Pace, 2009). Thus, to properly account for direct and indirect impacts on the SDM, one must calculate their marginal effects. In the SDEM model, in turn, the non-spatially lagged variables can be interpreted as direct effect, while those spatially lagged are the indirect effects.

<Insert Table 4 & 5>

The results show that the higher the level of employment in the cultural sector in each municipality, the lower its growth rate is. This implies that there is a convergence effect. The same is true for the locational quotient. That is, municipalities where the cultural sector is more specialized are associated with lower employment growth.

The diversification index (HH) and the percentage of formal employees with higher education (EDU) were not significant in any model. From our results, therefore, the degree of economic diversification does not explain the cultural employment growth. Employment shares of Commerce (COM) and industry (IND) sectors are positively associated with culture, with COM being more relevant to explain cultural employment growth. Thus, in municipalities with greater relative importance of those two sectors, the cultural activities present more dynamism.

Additionally, the higher population density (DEN) encourages the expansion of the cultural sector in terms of employment, since the parameter associated with density was positive and statistically significant in all models. As pointed out by Glaeser et al. (2001), cities are becoming the center of consumption instead of production. The cultural and creative goods can be seen as amenities provided to local consumers, and some are not possible to export, such as theater plays, museums, and exhibitions, among

others. Further, cultural and creative firms' output, hence employment, depend on the local demand and density (Jacobs, 1969).

The employment share of agriculture (AGR) and the cultural expenditure in proportion to GDP (EXP) were not significant in any estimated model. That is, the increase in expenditures on culture has not been able to expand formal jobs in that sector. Perhaps the inefficiency of spending and/or informality is relevant in understanding this fact. On the other hand, the number of cultural establishments per 100,000 inhabitants (EST) was positive and significant in the SDEM but not SDM model, similar to the average income per municipality (INC). To some extent, this corroborates the idea that the cultural sector should be relatively more dynamic in richer regions, as pointed out by Machado and Paglioto (2012) and Ribeiro and Lopes (2015).

The SDM estimates show that there is no global spillover effect, as no indirect effect is statistically significant. However, the SDEM model shows a negative and statistically significant local spillover from the average income per municipality (W_INC). That is, the richer the neighboring municipalities are, the lower is the employment growth rate in the culture sector in the municipality j . This, reinforces the idea of cultural employment as input to local amenities (Glaeser et al., 2001). Cultural workers, thus, sort themselves into municipalities in which they have demand for their services. This is accordance with the literature in Brazil that shows that cultural goods are in general consumed by richer and more educated people.

Using a similar methodology, Ribeiro et al. (2018) have analyzed the tourism sector in Brazil. The authors found, contrary to what was observed in our results, that the more diversified the local economy, the greater the stimulus to employment growth in the tourism sector. In addition, although negative, the spatial effects were statistically significant. According to these authors, this may be interpreted as a competitive effect

that may prevail among municipalities in relation to employment growth in the tourism sector. The results pointed out by Ribeiro et al. (2018) differ significantly from those presented in Table 4 regarding spatial spillovers.

5. Conclusions

This paper investigates the determinants of the cultural employment growth in Brazil from 2006 to 2016. Building from agglomeration and growth literature (Glaeser et al., 1992) three mechanisms – specialization, urbanization and diversification – are tested using data from the Brazilian Ministry of Labor and Employment. To account for heterogeneous spatial pattern, spatial econometric techniques were employed. In particular, the Spatial Durbin Model and the Spatial Durbin Error Model were estimated to capture the global and local spillovers, respectively.

The results show that specialization is not important to explain the growth of cultural employment in Brazil. However, having both manufacturing and service industries, as well as density and income are helpful in explaining this growth. These results corroborate the idea that cultural goods are amenities demanded by richer and more educated people in Brazil. Other results may have been affected by the fact that our data considers only formal employment.

The policy implication of this paper is two-fold. On the one hand, in Brazil the results suggest that agglomeration economies do not explain growth in cultural employment, which is contrary to the current literature (Borowiecki, 2013; Hellmanzik, 2010). Place-based policies involving cultural and creative industries, which focus on these agglomeration economies, are increasing in both the US and Europe (Cooke and Lazzaretti, 2008). On the other hand, the results suggest that average income per capita and density are important to explain cultural economic growth. Therefore, if policy-

makers want to boost local cultural activities, in Brazil, it is important to attract more people as well as expand its manufacturing and service industries generating extra income to be spent on cultural goods.

As discussed by Ferreira Neto et al. (2018), in the last two decades Brazil is increasing its average income per capita as well as education level, which should positively impact the demand for cultural goods and services. However, these services are still secondary items in the mix of the average Brazilian household (Diniz and Machado, 2009; 2011), especially in light of the challenges the country still faces in terms of development. As a step further, it would be interesting to investigate these effects (specialization, urbanization and diversification) on the Brazilian cultural sector year by year in a panel data framework in order to provide new results to the discussion.

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Table 1: Cultural activities in Brazil

Class CNAE 2.0 Classification
Book publishing
Publishing of newspapers
Publishing of magazines
Editing of registrations, lists and other graphic products
Edition integrated with book printing
Integrated edition of newspaper printing
Integrated editing for magazine printing
Integrated edition for the printing of catalogs, lists and other graphic products
Motion picture, video and television program activities
Post-production activities, film, videos and television programs
Cinematographic, video and television programs distribution
Cinematographic exhibition activities
Sound recording and music publishing activities
Radio activities
Open television activities
Programmers and activities related to pay-TV
Teaching of art and culture
Performing arts, shows and complementary activities
Artistic creation
Management of spaces for performing arts, shows and other artistic activities
Library and File Activities
Activities of museums and exploration, artistic restoration, and conservation of historic places and buildings and similar attractions
Activities of associative organizations linked to culture and art

Note: RAIS: Annual Report on Social Information; CNAE 2.0: National Code of Economic Activities 2.0. Prepared by the author using RAIS data.

Table 2: Dependent variable and explanatory variables

Dependent variable		Cultural employment growth rate between 2006 and 2016
Component	Symbol	Exploratory variables
Specialization	E ₀₆	Number of employees in the cultural sector
	LQ	Locational Quotient of the cultural employment
	EST	Number of cultural establishments per 100,000 inhabitants
Urbanization	DEN	Population Density
	HH	Inverse of Hirschman-Herfindahl Index
	EDU	Percentage of formal employees with higher education
Diversification	AGR	Employment share of the agriculture
	IND	Employment share of the industry
	COM	Employment share of the commerce
Cultural expenditure	EXP	Cultural expenditure in proportion to GDP
Income	INC	Average income per municipality

Source: Prepared by the authors. Note: LQ: locational quotient.

Table 3: Descriptive statistics

Variables	Average	Standard Deviation	Minimum	Maximum
Y	0.57	5.33	-99	332
E06	42	10	0	44,077
LQ	0.3	1.1	0.0	51.4
EST	7	108	0	7,814
DEN	110	597	0	13,267
HH	0.5	0.2	0.0	1.3
EDU	0.1	0.1	0.0	0.8
AGRO	0.1	0.1	0.0	0.9
IND	0.2	0.2	0.0	0.9
COM	0.1	0.1	0.0	1.0
EXP	0.0	0.0	0.0	0.1
INC	659.3	210.8	161.2	2,839.9

Source: Prepared by the authors.

Table 4: SDM Results

Dependent variable: Cultural employment growth rate between 2006 and 2016

Variable	Effect		
	Direct	Indirect	Total
LN_E ₀₆	-0.10*** (0.01)	-0.00 (0.00)	-0.10*** (0.01)
LQ	-0.16*** (0.01)	-0.00 (0.00)	-0.16*** (0.01)
HH	0.05 (0.05)	0.00 (0.00)	0.05 (0.05)
EDU	0.10 (0.14)	0.00 (0.00)	0.10 (0.15)
DEN	0.70*** (0.16)	0.00 (0.02)	0.70*** (0.16)
IND	0.33*** (0.06)	0.00 (0.01)	0.33*** (0.06)
COM	1.38*** (0.12)	0.01 (0.04)	1.39*** (0.13)
AGR	-0.11 (0.07)	-0.00 (0.00)	-0.11 (0.07)
LN_INC	0.36 (0.04)	0.00 (0.00)	0.36 (0.04)
EXP	-1.82 (2.80)	-0.01 (0.05)	-1.82 (2.81)
EST	1.14 (0.81)	0.01 (0.03)	1.14 (0.81)

Source: Prepared by the authors. Note: Note: *p<0.1; **p<0.05; ***p<0.01. N = 5,537. We use 5,537 of 5,570 Brazilian municipalities because we have missing data regarding to cultural expenditure.

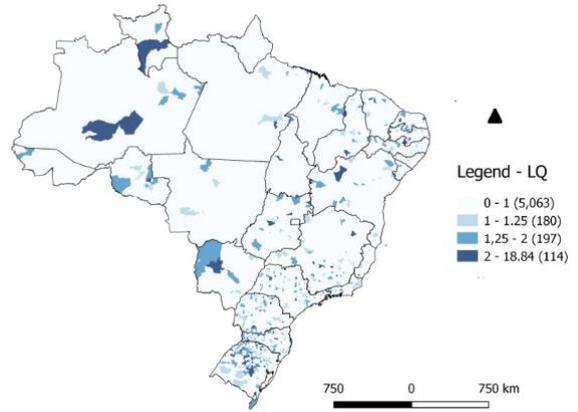
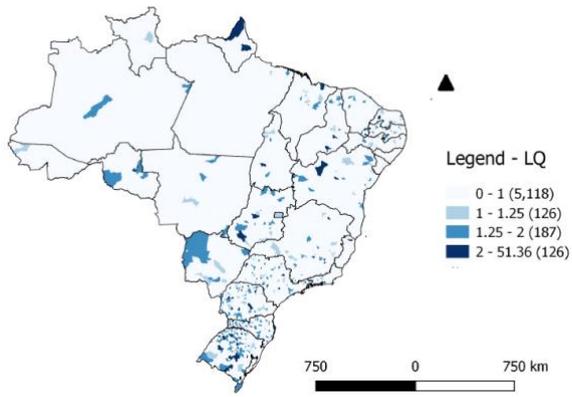
Table 5: SDEM Results

Dependent variable: Cultural employment growth rate between 2006 and 2016

Variable	Estimate	Variable	Estimate
Constant	-0.14 (0.33)	W_LN_E06	0.001 (0.01)
LN_E06	-0.09*** (0.01)	W_LQ	-0.005 (0.003)
LQ	-0.16*** (0.04)	W_HH	0.07 (0.06)
HH	0.01 (0.06)	W_EDU	0.19 (0.13)
EDU	-0.05 (0.10)	W_DEN	0.21 (0.23)
DEN	0.58** (0.25)	W_IND	-0.04 (0.06)
IND	0.36*** (0.07)	W_COM	0.05 (0.12)
COM	1.40*** (0.15)	W_AGR	-0.005 (0.07)
AGR	-0.06 (0.08)	W_LN_INC	-0.08* (0.04)
LN_INC	0.09** (0.04)	W_EXP	0.77 (2.19)
EXP	-2.08 (1.90)	W_EST	2.19 (3.84)
EST	0.91*** (0.29)	Lambda	0.0005 (0.01)

Source: Prepared by the authors. Note: *p<0.1; **p<0.05; ***p<0.01. N = 5,537, R-squared = 0.13. We use 5,537 of 5,570 Brazilian municipalities because we have missing data regarding to cultural expenditure.

Figure 1: LQ of the cultural sector in Brazilian municipalities – 2006 and 2016



Source: Prepared by the authors.

Appendix 1: Spatial weights matrices' tests

Type	Moran's I	p-Value
Queen	0.36	0.17
Rook	0.35	0.72
KNN 1	-1.72*	0.08
KNN 2	-0.4	0.68
KNN 3	0.57	0.56
KNN 4	1.15	0.24
KNN 5	1.06	0.28

Source: Prepared by the authors. Note: KNN: K nearest neighbors based on distance.

Appendix 2: SAR, SEM and SAC Results.

Dependent variable: Cultural employment growth rate between 2006 and 2016			
	SAR	SEM	SAC
LN_E06	-0.09*** (0.01)	-0.09*** (0.01)	-0.09*** (0.01)
LQ	-0.16*** (0.04)	-0.16*** (0.04)	-0.16*** (0.03)
HH	0.05 (0.06)	0.05 (0.06)	0.05 (0.06)
EDU	0.07 (0.11)	0.009 (0.11)	0.01 (0.11)
DEN	0.70*** (0.27)	0.70** (0.27)	0.70** (0.27)
IND	0.33*** (0.06)	0.33*** (0.06)	0.33*** (0.06)
COM	1.38*** (0.15)	1.38*** (0.15)	1.38*** (0.15)
AGR	-0.10 (0.07)	-0.10 (0.07)	-0.10 (0.07)
LN_INC	0.03 (0.04)	0.03 (0.04)	0.03 (0.04)
EXP	-1.80 (1.82)	-1.81 (1.82)	-1.81 (1.82)
EST	1.14*** (0.22)	1.14*** (0.23)	1.14*** (0.22)
ρ	0.009 (0.02)		0.01 (0.02)
λ		0.0009 (0.01)	-0.009 (0.03)
R ²	0.13	0.13	0.13

Source: Prepared by the authors. Note: *p<0.1; **p<0.05; ***p<0.01. N = 5,537. Marginal impacts available from authors upon request

ⁱ Formal workers in Brazil are defined as those with a formal labor contract. Informal workers are defined as those unregistered and self-employed.

ⁱⁱ The SAR, SEM and SAC models have also been estimated and their results are presented on Appendix