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The impacts of spatially targeted programs: evidence from Guangdong

Elisa Barbieri[a*], Chiara Pollio[b], Francesco Prota[c]

ABSTRACT

Spatially targeted policies have been a crucial component of the development strategy pursued by the Chinese government. This paper provides novel empirical evidence in the debate on place-based policy by testing whether the presence of economic development zones is associated with higher values of industrial output and their impact is heterogeneous across territories in the counties/districts in Guangdong during the period 2000-2014. The results show that the level of industrial output is positively correlated with the presence of economic development zones and offer support to the idea that place-based policies have heterogeneous effects across territories.

Keywords: China, economic zones, heterogeneous effects, regional development, industrial output

JEL codes: R11, R12, R38, R58

[a] *elisa.barbieri@unive.it; Department of Economics, University of Venice Ca' Foscari, Fondamenta S. Giobbe, 873, 30100 Cannaregio, Venezia (Italy);*

[b] *chiara.pollio@unife.it; EmiliaLab – The network of the Departments of Economics of Emila-Romagna Region, Department of Economics and Management, University of Ferrara, Via Voltapaletto, 11, 44121 Ferrara (Italy)*

[c] *francesco.prota@uniba.it; Department of Economics and Finance, University of Bari "Aldo Moro" Largo Abbazia Santa Scolastica, 53, 70124, Bari (Italy)*

*Corresponding author

INTRODUCTION

Spatially targeted programs have long been used by both industrialized and industrializing countries. These programs have "the potential to affect the location of economic activity, along with wages, employment, and industry mix of communities and regions" (Kline and Moretti, 2014).

China is probably one of the best-known examples of countries using spatially targeted programs. The first special economic zones (SEZ, hereafter) were introduced in the early 1980s as experiments in market allocation in geographically restricted areas along the coast: Shenzhen, Zhuhai and Shantou in Guangdong Province, and Xiamen in Fujian Province. Then different types of economic development zones (EDZ, hereafter) were extended to other cities along the coast and, starting in the early 1990s, to inland regions. In the last three decades, governments at all levels - the central, the provincial, the prefecture and the county level - have been involved in the establishment of development zones and in the promotion of economic growth.

The benefits and distortions caused by spatially targeted policies have long been debated by economists (Glaeser & Gottlieb, 2008; Kline & Moretti, 2014).[1] The extent to which these incentives can reward in terms of economic performance in a cost-effective way remains an empirical question (Chaurey, 2017). Prior empirical work evaluating place-based policies has mainly focused on developed countries (for example, Ham, Swenson, Imrohoroglu & Song, 2011; Busso, Gregory, & Kline, 2013; Ambroziak & Hartwell, 2018). In the context of developing countries, several papers have studied the effects of China's EDZ on local economies (for example, Wang, 2013; Alder, Shao & Zilibotti, 2016; Zheng, Barbieri, Di Tommaso & Zhang, 2016).

Our paper aims at contributing to a better understanding of the impact of EDZ on local

[1] For an attempt to put special economic zones into a political economy framework, see Moberg (2015) and Hartwell (2018).

economies in China by focusing on sub-national level, the Guangdong Province, and by highlighting the heterogeneous effects that spatially targeted policy tools may have on different local contexts. In particular, we test whether (*i*) the presence of an EDZ in a county or district is associated with a higher value of industrial output compared to counties or districts which have never had an EDZ; (*ii*) the impact of EDZ is heterogeneous across territories and depends on the level of economic development, measured in terms of industrial output; (*iii*) our results are robust to the inclusion of spatial effects.

We use a large number of official sources to construct a novel dataset covering 75 counties and districts of Guangdong Province between 2000 and 2014.[2] The focus on Guangdong is justified by the fact that it is one of the most relevant Chinese provinces in terms of contribution to national wealth and population, and the one with the longest experience in the use of economic zones. In addition, the one-province focus allows us to avoid problems related to the non-homogeneous distribution of spatially targeted programs across Chinese provinces.

Our empirical strategy follows three steps. First, we employ a non-parametric approach in order to examine the distribution of counties industrial output by type (counties/districts with EDZ and counties/districts without EDZ) and verify whether one group 'dominates' the other. Second, we apply quantile regression (QR) techniques to investigate the possible heterogeneity of the effects of a spatially targeted program at different levels of industrial output. In the context of regional analyses, QR has two main advantages: it allows to assess how policy variables affect regions according to their position on the conditional distribution of the outcome variable and to estimate the magnitude of the effects of explanatory variables at the tail of such distribution, which might be more interesting and informative than the conditional mean (McMillen, 2013; Crespo-Cuaresma, Foster & Stehrer, 2011). Third, we assess the validity of our results by testing if they are robust to the inclusion of spatial effects. Indeed, it is widely recognized that data collected from geographically close entities

[2] Counties and districts correspond to the third administrative level in China, below provinces (first level) and cities or prefectures (second level).

can be spatially correlated. In particular, we utilise the spatial Durbin model (SDM) since it contains the most information regarding spatial spillover channels.

In summary, our paper makes the following original contribution to the literature: (*i*) it provides new evidence in the debate about the impact of EDZ in developing countries by focusing on sub-national level and (*ii*) it offers empirical support to the idea that spatially-targeted policies can have heterogeneous effects across territories.

The remainder of the paper is structured as follows. The next section presents the main conclusions from the related literature. The third section discusses the EDZ policy and the fourth section describes the data and our empirical strategy. The fifth section presents the results of the empirical modelling. Finally, the sixth section contains our concluding remarks.

RELATED LITERATURE

Place-based policies have received a lot of scholarly attention (Barca, McCann & Rodríguez-Pose 2012; Kline & Moretti, 2014; Neumark & Simpson, 2015; Bailey, Hilderth & De Propris, 2015). Available studies differ in terms of outcome measurement, spatial unit, modelling approach, and conclusions about the success of these policies.

Looking at the United States, positive effects on local labour markets of various enterprise zone-programs are in Ham, Swenson, İmrohoroğlu & Song (2011) and Busso, Gregory & Kline (2013). Conversely, studies of the French Urban Zones program have found it had at best modest and heterogeneous effects on employment (Gobillon, Magnac & Selod, 2012; Briant, Lafourcade & Schmutz, 2015). In a study on the Polish zones policy, Cizkowicz, Cizkowicz-Pekala, Pekala, & Rzonca (2016) have found a positive spillover effect of the policy on employment at the *poviat* (county) level and a neutral spillover effect on investment in Poland. Moreover, the effect of SEZs on investments is weaker but nonetheless positive, and investments in a given SEZ neither crowd in nor crowd out investments outside the SEZ. Another recent study on the effect of special economic zones in Poland by Ambroziack and Hartwell (2017) finds that SEZ have a heterogeneous impact depending on the development level of recipient areas; in particular, the impact is stronger in least developed regions and weaker or even negative in richer regions.

Our paper contributes to this strand of literature by analysing EDZ in China. The existing empirical studies can be grouped according to the methodological approach they use: descriptive case studies concerning the evolution of particular EDZ (Farole & Akinci, 2011; Zeng, 2015), on one side, and formal econometric analyses, on the other. The majority of the econometric studies make use of difference-in-differences models to evaluate the differences between EDZ hosting and non-hosting regions (Wang, 2013; Alder, Shao & Zilibotti, 2016). Overall, the results show positive effects of EDZ on several outcome variables. For example, Wang (2013) finds positive effects on foreign direct investments, exports, and the output of foreign enterprises. Alder, Shao & Zilibotti (2016) suggest that the establishment of EDZ yields large positive effects on GDP and GDP per capita for the cities in which these were located. Moreover, the EDZ generates positive spillovers to neighbouring areas.

Our study also relates to a recent literature that has documented the heterogeneous effects of spatial agglomeration policies (Faggio, Silva & Strange, 2017). With reference to economic zones, part of the debate on their impact in emerging economies suggests anecdotally that they can be more effective where there is already some degree of industrialization (Farole & Akinci, 2011; Monga, 2013). However, such idea does not seem to be adequately supported by empirical evidence. Only a few authors have focused on the relationship between the effectiveness of economic zones and the characteristics of the recipient territory (Cypher & Dietz, 2009; Schrank, 2008). In this perspective, one might expect that economic zones perform worse in less developed regions, due to greater difficulties in generating spillovers and backward linkages with the local economy (Johansson & Nilsson, 1997). Highly industrialized regions on the contrary would allow economic zones to better exploit specific location advantages such as economies of agglomeration and urbanization (Fujita and Thisse, 2013). On the other hand, however, placing economic zones in less developed areas can offer specific cost advantages of input factors and avoid the typical diseconomies of congested areas (Ago, Isono & Tabuchi, 2006). This would suggest that economic zone might be even more successful in triggering additional economic growth in areas where it is lagging (Ambroziak & Hartwell, 2018). Such debate points to a relationship between economic zones and local economic performances that is most probably non-linear and correspond to different location advantages depending on the local economic conditions.

HISTORICAL AND INSTITUTIONAL BACKGROUND

The role of economic zones in China has been crucial for the Chinese economic transition. The 'open-door' policy process started within the early SEZ in Guangdong and Fujian. The growth in the number of EDZ has followed different temporal waves, corresponding to a differentiated geographical expansion of the zone policy across China, as described by Figure 1. The first zones were founded before 1990 and were concentrated in the coastal area. Through the 1990s, new zones were founded both in the inner prefectures of coastal provinces and in the inner provinces. The beginning of the 21st century witnessed a growth in the intensity of the use of zones, that is an increase in the number of zones in areas already hosting zones. This trend continued up to 2008, after which the establishment of new zones tended to stagnate.

One of the most distinctive features of EDZ in China is their heterogeneity: in addition to the original SEZ, there are other types of zones such as the economic and technological development zones (ETDZ), the high tech development zones (HTDZ), the free trade zones (FTZ) and the export processing zones (EPZ). These zones differ in their stated mission, origins and types of incentives provided to attract firms and motivate them to invest. ETDZs, established soon after the launch of SEZs, offer favourable fiscal treatment on foreign investment to attract foreign firms and promote their collaboration with local firms. These zones are organized into functional areas according to the types of activities carried out within the zone. HTDZs specifically aim at increasing the value added of products by supporting the adoption of new technologies and processes. They originated in the late

1980s within the Torch Program, whose main objective was to use the technological capacity of research institutes, universities and large- and medium-sized firms to develop new and high-tech products and to accelerate the technology transfer processes.[3] FTZs and EPZs, both directed by the Duty Office, have been promoted with a different rationale. FTZs were introduced to experiment with free trade before China's inclusion into the WTO and to offer to firms a wide range of benefits related to import, export and value added taxes, while EPZs were created specifically to develop export-oriented production (Zeng, 2015; Zheng, Barbieri, Di Tommaso & Zhang, 2016).

Another peculiarity of Chinese spatially targeted programs is that these economic enclaves can be created and administered directly by the national government or by provincial or even local (county or town level zones) government. Consequently, local officials are found to have a strong incentive to compete among them by soliciting or campaigning for new investments to locate in their regions and experimenting with different preferential policies to investors and entrepreneurs.

The final element worthy of being stressed is the tendency of Chinese authorities to adapt the use of economic zones to the changing long-term goals of the country economic policy. At the beginning, they were the laboratories for market economy. Soon they became tools to rationalize the location of different types of national and foreign investment (Wei & Leung, 2005). More recently, they were used to further experiment with the liberalization of capital flows, economic upgrading and territorial rebalancing (Bräutigam & Tang, 2014; Yao & Whalley, 2015).

[Here Figure 1]

Special Economic Zones in Guangdong Province

Half as large as Germany but with 20 million more people, Guangdong is the first Chinese province

[3] On the relation between innovation strategies and "open door policy" in China see, among others, Petti, Prota & Rubini (2016).

in terms of contribution to national GDP (10.8 percent) and export (nearly 30 percent) and the second for FDI attraction (about 15 percent) (NBS, 2017). Nowadays its economic performance is comparable to those of some important OECD countries: its export value is not far from that of Japan and the GDP figures are comparable to those of Poland or Australia.

Its position as an international important player is due among other things to its early experience with EDZ. Guangdong is the Chinese province with the longest involvement in the use of economic zones. The very first special economic zones were set in Shenzhen, Zhuhai and Shantou, which were very close to potential sources of foreign capital (such as Hong Kong, Macau and Taiwan) and, at the same time, in a lagging region, far from the influence of central Beijing power (Ge, 1999). These territories had heterogeneous economic conditions. Shenzhen was a poor city, depending on subsistence farming and suffering from large flows of illegal emigration towards the richer industrial neighbouring region of Hong Kong. Zhuhai had an ideal geographical position for trade (right in front of Macao), but the scattered nature of its territory (divided among many small islands within the delta of the Pearl River) prevented it from becoming a commercial hub. Finally, Shantou, once a rich commercial port, had seen slowing its economic dynamism in the post-revolutionary era because of its military strategic position (Tao & Zhinguo, 2012).

The location choice of the successive zones was mainly guided by geographical considerations. In particular, the Pearl River Delta area in Guangdong has been the preferred destination for EDZ, because of its accessibility to FDIs and its potential for commercial transports given the presence of the river.

Nowadays, in Guangdong the zone policy is used with different goals, reflected in the distribution of the economic zones by type (ETDZ, EPZ, FTZ, and HTDZ). Figure 2 shows the spatial distribution of EDZ across Guangdong counties and districts in 2000 and in 2014.[4] As a whole, up to 2014 there were 87 EDZ in Guangdong province. The distribution of EDZ across Guangdong

[4] Table A1 in the Appendix shows the zone distribution for 2000 and 2014.

territories is uneven both at the beginning and at the end of the period. The number of zones is particularly high in the prefecture-level cities of Shenzhen, Foshan and in few counties of the capital city Guangzhou and of Shantou.

[Here Figure 2]

DATA AND EMPIRICAL STRATEGY

In order to evaluate the impact of EDZ, we constructed an original database on 75 counties and districts of Guangdong Province. It contains information on several economic and geographical variables for the period 2000-2014. Specifically, for each county/district we have collected information on the industrial output, the amount of investments in fixed assets, the number of large enterprises, the number of fully employed workers. Additionally, we have recorded how many specialized towns there are in each county/district and whether the county/district is included in the Pearl River Delta area or not.[5] The dataset comprises the following information on the EDZ: the location at the county/district level, the year of foundation and the type of zone.[6]

We follow three different empirical approaches in order to investigate the relationship between the presence of EDZ and the industrial production in Guangdong Province.

First, we employ a non-parametric approach that consists of comparing the distributions of

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[5] The specialized towns program is a provincial cluster-based policy aimed at promoting township-level industrial specialisation (Barbieri, Di Tommaso, Pollio and Rubini, 2019; Di Tommaso, Pollio, Barbieri and Rubini, 2019). Due to their economic relevance for the province, it is important to take their presence into account when studying provincial economic performances.

[6] The data were collected by merging different official data sources: NBS (various years), Ministry of Commerce, Hong Kong Trade Development Council, Guangdong Government prefectures' documents and websites, specific economic zones official websites.

counties/districts industrial output corresponding to counties/districts with EDZ and counties/districts that never had EDZ. This strategy, defined as stochastic dominance, allows us to robustly compare industrial output performance differences across the two counties/districts types at all moments of their output distributions, rather than at a single moment (typically the mean).

The hypothesis that the industrial output distribution of one group of counties/districts stochastically dominates the industrial output distribution of another group can be tested by the Kolmogorov–Smirnov (K-S, henceforth) test. In particular, following Delgado, Farinas & Ruano (2002) we perform tests of stochastic dominance of a given cumulative distribution function *F(z)* (in our case, the industrial output of counties and districts hosting EDZ) with respect to another cumulative distribution function *G(z)* (in our case, the industrial output of counties and districts that never hosted EDZ) by testing two hypotheses:

$F(z) - G(z) = 0$ uniformly in z

with strictly inequality for some z (1)

$F(z) - G(z) \leq 0$ uniformly in z

with strictly inequality for some z (2)

The first hypothesis is tested through the so-called two-sided K-S test whereas the second hypothesis is tested through the so-called one-sided K-S test. We can conclude that *F(z)*, the industrial output distribution of counties and districts hosting EDZ, stochastically dominates *G(z)*, the industrial output distribution of counties and districts that never hosted EDZ, if we reject the null hypothesis in the first test and fail to reject the null in the second test.

Second, we investigate the impact of EDZ at different quantiles of the distribution of the log industrial output instead than at the average. This allows us to capture the heterogeneity of the possible effects of EDZ according to the counties/districts industrial performance. Formally, we estimate the following equation:

$$lnY_{i,t} = \beta_0 + \beta_1*DUMMYZONES_{i,t} + \beta_2*NUMBERZONES_{i,t} + \beta_3*lnINVESTMENTS_{i,t} + \beta_4*lnENTERPRISES_{i,t} + \beta_5*SPTOWNS_{i,t} + \beta_6*PRD + \beta_7*T + e_{i,t} \quad (3)$$

where $lnY_{i,t}$ is the natural logarithm of the industrial output in county/district i at time t. The regressors of interest are two. The first is $DUMMYZONES_{i,t}$, a dummy variable that takes value 1 if location i hosts an EDZ at time t and 0 otherwise; it is used to signal the presence of the policy initiative in the location.[7] The second is $NUMBERZONES_{i,t}$, i.e. the number of economic zones in county/district i at time t; this variable is a proxy for the treatment intensity on local economic outcomes.[8]

The set of controls is related to the economic environment: $lnINVESTMENTS_{i,t}$ and $lnENTERPRISES_{i,t}$, respectively, the amount of fixed assets in the manufacturing sector and the number of large firms. $SPTOWNS_{i,t}$ accounts for the number of specialized towns in county i at time t; $PRD_{i,t}$ is a dummy taking value 1 when the county/district is inside the Pearl River Delta and 0 otherwise; T controls for time effects and $e_{i,t}$ is the error term.

Another possible proxy for the treatment intensity is the size of the economic zones. For this reason, we run further regressions in which we include alternately $NR\_SMALL_{i,t}$ (the number of zones whose area ranges from 0 to 10 sq kms) and $NR\_MEDIUM\_LARGE_{i,t}$ (the number of zones whose area is over 10 sq kms).

Moreover, our dataset allows us to disentangle the impact of different types of zones and, therefore, to overcome the limitation of using a dummy variable, which captures the average effect

[7] The choice of using a dummy variable indicating zone existence in a particular region and period is in line with the majority of the literature (Wang, 2013; Alder, Shao & Zilibotti, 2016; Jensen, 2018).

[8] The decision to establish several zones in a county can be interpreted as a signal of the political commitment for this policy instrument.

of EDZ on the economic outcomes of a hosting county. We, therefore, estimate a specification of Eq. (3) in which we use alternately three variables: $NR\_ETDZ_{i,t}$ (the number of economic and technological development zones), $NR\_HTDZ_{i,t}$ (the number of high tech development zones) and $NR\_OTHERS_{i,t}$ (the number of export processing zones, free trade zones and other industrial zones).

We use quantile regression to estimate Eq. (3).[9] While the OLS estimator is obtained by minimizing the sum of squares of the residuals, the QR estimator for the τ^{th} quantile comes from:

$$\hat{\beta}_\tau = argmin \sum_{i=1}^{n} \rho_\tau (y_i - \boldsymbol{x}_i \beta_\tau) \quad (4)$$

where ρ_τ is a 'check' function that, following the LAD-estimator principle (Koenker & Hallock, 2001), weights positive and negative residuals asymmetrically:

$$\rho_\tau(u) = 1(u > 0) \cdot \tau|u| + 1(u \leq 0) \cdot (1 - \tau)|u| \quad (5)$$

The QR estimator, therefore, estimates the τ^{th} conditional quantile of Y given x:

$$Q_\tau(Y|\boldsymbol{x}) = \boldsymbol{x}\beta_\tau \quad (6)$$

Third, we introduce a spatial dimension into econometric analysis. It is widely recognized that data collected from geographically close entities can be spatially correlated. In our case, spatially targeted policies such as EDZ can have an impact not only on the economy of the target region, but also on the economies of neighbouring regions. Ignoring the potential spatial dependence either in observable or unobservable variables may bias the estimates of the coefficients of interest (LeSage &

[9] In such technique, the quantiles of the conditional distribution of the outcome of interest are expressed as a function of the independent variables (Koenker & Hallock, 2001; Koenker, 2005).

Pace, 2009). In order to capture spatial dependence and to avoid biased and inefficient estimates, we transform Eq. (3) into a spatial panel model. The spatial Durbin model adaptation of Eq. (3) takes the form:[10]

$$lnY_{i,t} = \alpha_r + \rho \sum_{j=1}^{75} W_{i,j} \, lnY_{i,t} + \beta Z_{i,t} + \theta \sum_{j=1}^{75} W_{i,j} S_{i,t} + \varepsilon_{r,t} \quad (7)$$

where $W_{i,j}$ denotes the spatial weights matrix; ρ is the coefficient of the spatially lagged dependent variable; $Z_{i,t}$ is a vector of exogenous explanatory variables; θ captures the impact of a vector of explanatory variables ($S_{i,t}$) in the adjacent counties on industrial output in county i.[11]

Table A2 in the Appendix shows the descriptive statistics and sources of the variables used in the econometric analysis.

RESULTS

The results of the non-parametric estimation indicate a significant "between-group" heterogeneity for the comparison group, with counties/districts in which EDZ are localised showing a higher value of industrial output than counties without EDZ. Indeed, inspection of Table 1 reveals that we strongly reject the null hypothesis of equality of the cumulative distribution for all years. As we do not reject the null in the one-sided test, we can conclude that cumulative distribution of counties/districts in which EDZ are localised stochastically dominates that of counties/districts without EDZ. These results are in line with previous studies, which have found a positive impact of special economic

[10] The SDM is a generalization of the spatial autoregressive model, which also includes spatially weighted independent variables as explanatory variables. For estimation purposes, we use the SPMLREG Stata command by Jeanty (2013).

[11] The spatial weights matrix W is specified as a row-normalized binary contiguity matrix, with elements $w_{ij} = 1$ if two spatial neighbourhoods share a common border, and zero otherwise.

zones on local economies (Wang, 2013; Alder, Shao & Zilibotti, 2016).

[Here Table 1]

In addition, we analyse graphically whether the industrial output shows differentiated trends between the group of counties/districts without EDZ and the group hosting the economic zone before and after the introduction of the EDZ. We run this check on a sub-sample of counties (42) that did not have any development zone before the beginning of the period under analysis: 6 changed their status starting to hosts an EDZ between 2000 and 2014, while 36 did not change their status. The graphical inspection of pre- and post- treatment trends of industrial output is reported in Figure A1 in the Appendix. While for the time span before the establishment of the zones, the trend is very similar among counties in which EDZ are localised ("treated units") and counties without zones ("control units"), in the post-treatment period the treated counties' average industrial output is higher, and increasingly larger, than the controls counties' average industrial output. This evidence seems to suggest a causal interpretation of the relation between establishing the zones and the economic performances.

Table 2 shows the results of the quantile regressions. In the first two specifications we include either $DUMMYZONES_{i,t}$ or $NUMBERZONES_{i,t}$. The third specification considers the two variables together; since $NUMBERZONES_{i,t}$ is different from zero only when $DUMMYZONES_{i,t}$ is equal to one, the effect of the two variables has to be analysed jointly. We report the results at each decile of the distribution of the outcome of interest, together with the coefficient for the quartiles (25th, 50th and 75th quantile, bold in the table).

In the first specification of the model, $DUMMYZONES_{i,t}$ displays a positive and strongly significant coefficient in the lowest part of the distribution (10th to 25th quantile) and in the highest one (70th to 90th quantile), though with a weaker significance. In terms of magnitude, the coefficients are similar. There seems to be, therefore, a positive and significant correlation between the presence of the policy and the industrial output at the extremes of the distribution.

In the second specification, the variable *NUMBERZONES*$_{i,t}$ is strongly significant across the whole distribution of the industrial output. The sign is positive and the magnitude increases as we move from lower to higher quantiles. This result suggests that, for higher values of the industrial output, it is the intensity of the policy (approximated by the number of the zones) that matters rather than the mere presence. Figure A2 in the Appendix shows the trend of *DUMMYZONES*$_{i,t}$ (panel a) and *NUMBERZONES*$_{i,t}$ (panel b) for the two specifications of the model.

Figure 3 shows the combined effect of *DUMMYZONES*$_{i,t}$ and *NUMBERZONES*$_{i,t}$ across all the quantiles and for various number of zones. A positive and significant relationship between the two policy variables and output is confirmed for all numbers of zones and for all quantiles (expect for hypothetical case of one zone on the 90th quantile). More in detail, for small numbers of zones (1 to 3) the effect on lower quantiles is larger than on higher quantiles of output; on the contrary, a number of zones above 5 displays a greater effect on richer areas.

[Here Figure 3]

In the light of these results, the current factual economic zones distribution across quantiles in Guangdong raises some concerns on the possible further polarization of economic performances in the Province (Figure A3 in the Appendix). While at the beginning of the period under analysis the distribution of zones seemed roughly balanced across quantiles, in 2014 more than one half of the total number of zones (49 out of 87) is located in the counties at the highest decile of the distribution, and the percentage increases to 87 percent in the highest three deciles.

The sign and the statistical significance of most of the other control variables are stable across the whole distribution: the amount of fixed assets in the manufacturing sector and the number of large firms show a positive and significant coefficient, while the number of specialized towns is negatively correlated with the industrial performance of the areas.[12] This can be explained by the fact that, particularly from 2008 onwards, specialized towns were used as a promotion tool of the more rural and peripheral counties of the province, which were characterised by low levels of industrialization. The localisation of a county/district inside the Pearl River Delta area (*PRD*) is positively associated with output for the lower and median values of the distribution, while it loses its significance for high performing counties.

[Here Table 2]

To verify that the coefficients of both $DUMMYZONES_{i,t}$ and $NUMBERZONES_{i,t}$ change significantly along the distribution, we use the Interquantile Regression (Kang & Liu, 2014). We measure the differences in the effects of both variables between selected quantiles (corresponding to the maximum and minimum effect, i.e. 10^{th} and 90^{th} quantile). In addition, we measure the difference in a narrower range of the values of output, between the values at the third and the first quartile (75^{th} and 25^{th} quartile). The results are in Table A3 in the Appendix. They confirm that establishing a development economic zone in lagging areas can be beneficial in terms of output. The establishment of zones can be beneficial also in richer areas, but in this case a higher investment in terms of number of economic zones is needed.

Heterogeneous EDZ effects

The impacts of development economic zones may be heterogeneous across different treatment intensities (approximated by the size of the economic zones) and according to the type (Wang,

[12] In order to exclude possible reverse causality issues, we also run the model by lagging the variable *INVESTMENT* at t-3. The results, available upon request, do not change.

2013).[13]

For what concerns the size, smaller economic zones seem to be associated to smaller effects, as measured by the magnitude of the coefficients, than large-sized zones across the whole distribution (Figure 4). Small zones show a positive effect across all the quantiles: it grows between the 40th and the 70th quantile and then stabilises, while the effect of large zones is stronger on lower quantiles, then it tends to decrease and exhibits a second (even if smaller) peak on the rich quantiles.[14]

[Figure 4 here]

We find heterogeneous effects when distinguishing by type of economic zone (Figure 5). ETDZs seem to have a stronger effect on the medium-to-high values of the distribution compared to poorer areas, while HTDZs' effect is generally decreasing across the distribution, although it is stronger in absolute terms compared to that of ETDZs. We may advance two tentative interpretations of this result. First, HTDZs tend to be larger than other zones and may be affected by negative scale effects. Second, higher value-added productions such as those promoted in HTDZs may yield weaker marginal effects on richer areas, which presumably already host these kinds of activities.[15]

[Figure 5 here]

[13] The results of the estimations in which we include the number of zones by size and type are, respectively, in Table A4 and Table A5 in the Appendix.

[14] The results from the Interquantile regression measuring the differences between the maximum and the minimum values of the coefficients, confirm the heterogeneity of effects across the distribution (Table A6 in the Appendix).

[15] Although positive, the effects across the distribution of the other types of zones do not show statistically significant differences across the quantiles (see Tables A3 and A4 in the Appendix).

Spatial EDZ effects[16]

In order to test for spatial autocorrelation, we apply the Moran's I test on the dependent variable (Moran, 1950).[17] The Moran's I statistics indicate the existence of positive spatial dependence for the industrial output over the period analysed, therefore, suggesting a spatial econometric model (Table A7 in the Appendix).

Table 3 reports the estimation results with spatial effects. They confirm a positive and highly significant correlation between the presence of EDZ in counties of Guangdong Province and the level of industrial output.[18] Interestingly, the spatial lag of the dummy variable for the existence of an economic zone is negative and statistically significant meaning that the presence of an EDZ in a county is associated to a lower industrial output in the neighbouring counties (Table 3, column 1).[19]

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[16] Policies oriented to the growth of regions can generate spatial externalities. The analysis of place-based policies should recognize the existence of spillover effects in neighbouring areas. Recent studies have tried to deal with the impact evaluation in presence of spillovers, but the most up-to-date researches on this topic have not come to a satisfactory solution yet (Cerqua & Pellegrini, 2017; 2018). In our study, however, this is not a relevant issue since our aim is not to evaluate the Chinese spatially targeted policy and, therefore, we are not interested in the interpretation of average differences in outcomes between treatment and control groups. Notwithstanding, as robustness test, we have adopted a strategy which tries to minimise the spillovers effects. We compared counties/districts with EDZ (treated areas) and counties/districts without EDZ (untreated areas) which are distant in terms of level of development (as proxied by the industrial output). The results, available upon request, give support to our analysis.

[17] Moran's I index ranges from negative one to positive one, where a larger absolute value denotes a greater degree of spatial association. $I > 0$ identifies a positive correlation among spatial units, while $I < 0$ indicates a negative correlation among spatial units.

[18] While spatial autocorrelation does not imply the existence of spillovers between counties, the existence of spatial autocorrelation would have important implications for the analysis of the policy.

[19] It is interesting to note the this result is partly in contrast with what Alder, Shao & Zilibotti (2016) find in their study on the establishment of special economic zones in China, that is positive and often significant spillover effects of SEZ on neighbouring regions.

The spatial correlation coefficients, ρ, is statistically significant which indicates that the industrial output in county/district *i* depends on the industrial output in the neighbouring county/district.

We find similar results when considering different sizes and different types of economic zones. Both the presence of small and medium-large economic zones is positively associated to the level of industrial output of the counties in which they are localised (Table 5, columns 3 and 4). Similarly, all the different types of economic zone show a positive and highly significant correlation with the level of industrial output (Table 5, columns 5, 6 and 7). The magnitude of the coefficient is higher in the case of high tech development zones.

[Here Table 3]

DISCUSSION AND CONCLUSIONS

This paper analyses one of the most popular spatially targeted program among policy-makers: the economic development zones. Our focus is on the use of this policy instrument in the Chinese province of Guangdong, which is the province that experimented earlier with zone incentives. Through a mix of techniques, we test whether (*i*) the presence of an EDZ is associated with a higher value of industrial output at the level of single county/district and (*ii*) there is a heterogeneous effect of the presence of EDZ according to the local industrial development. We also assess the validity of our results by testing if they are robust to the inclusion of spatial effects.

Our results clearly indicate that counties and districts that host an EDZ have better industrial performances than territories that never had EDZ. Indeed, the cumulative distribution of counties/districts in which economic zones are localised stochastically dominates that of counties/districts without economic zones. Our findings are in line with earlier literature on the impact of spatially targeted incentives on economic development in China.

In addition, we document the heterogeneous effects of EDZ. In more detail, we find a positive and significant correlation between the (mere) presence of the policy and the industrial output at the extremes of the distribution. The joint analysis of the presence and the intensity of the policy (as measured by the number of zones) shows larger effects on richer areas as the number of zones increases. Given the factual distribution of zones across quantiles in Guangdong Province, our results warn against possible polarization effects.

When measuring the policy effects by taking into account other sources of heterogeneity: the sizes and the types, our results suggest that there might be major gains by investing more in high-scale and high-tech zone incentives in poorer areas. This may also be a way to address spatial economic disparities across the Province.

The findings of this paper provide support to the choice of spatially target programs and seem to suggest that the use of these programs can be a catalyst of the development process. It is important to underline that in China the use of EDZ incorporated both efficiency and equity motivations together with the additional target of experimenting with market reforms.

Finally, our analysis is of important policy relevancy as the results suggest that the extent to which spatially target programs affect the local economy depends on local economic characteristics.

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Table 1. Kolmogorov-Smirnov tests for first order stochastic dominance - industrial output

Counties with SEZ vs counties without SEZ		
Year	Two sided	One sided
2000	0.424	0.000
	(0.003)	(1.000)
2001	0.429	0.000
	(0.002)	(1.000)
2002	0.429	0.000
	(0.002)	(1.000)
2003	0.384	0.000
	(0.008)	(1.000)
2004	0.384	0.000
	(0.008)	(1.000)
2005	0.382	0.000
	(0.009)	(1.000)
2006	0.366	0.000
	(0.013)	(1.000)
2007	0.341	0.000
	(0.025)	(1.000)
2008	0.340	0.000
	(0.027)	(1.000)
2009	0.340	0.000
	(0.026)	(1.000)
2010	0.337	0.000
	(0.028)	(1.000)
2011	0.338	0.000
	(0.028)	(1.000)
2012	0.392	0.000
	(0.006)	(1.000)
2013	0.388	0.000
	(0.007)	(1.000)
2014	0.387	0.000
	(0.007)	(1.000)

Table 2. Quantile regressions (Dependent variable: logarithm of the industrial output)

	Quantiles										
	q10	q20	**q25**	q30	q40	**q50**	q60	q70	**q75**	q80	q90
Only $DUMMYZONES_{i,t}$											
$DUMMYZONES_{i,t}$	0.154	0.151	**0.123**	0.0938	0.0198	**0.0528**	0.0645	0.121	**0.0988**	0.102	0.128
	(0.048)***	(0.045)***	**(0.047)****	(0.050)*	(0.047)	**(0.049)**	(0.050)	(0.052)**	**(.051)****	(0.059)*	(0.076)*
$lnINVESTMENTS_{i,t}$	0.234	0.293	**0.287**	0.314	0.322	**0.342**	0.369	0.406	**0.429**	0.445	0.341
	(0.036)***	(0. 033)***	**(0.034)*****	(0.036)***	(0.029)***	**(0.031)*****	(0.034)***	(0.037)***	**(0.037)*****	(0.042)***	(0.069)***
$lnENTERPRISES_{i,t}$	1.011	0.922	**0.938**	0.917	0.904	**0.855**	0.812	0.758	**0.754**	0.757	0.800
	(0.042)***	(0.037)***	**(0.036)*****	(0.038)***	(0.034)***	**(0.034)*****	(0.036)***	(0.039)***	**(0.042)*****	(0.052)***	(0.076)***
$SPTOWNS_{i,t}$	-0.0153	-0.0111	**-0.0158**	-0.0162	-0.0157	**-0.0127**	-0.0111	-0.0135	**-0.0131**	-0.0147	-0.0123
	(0.005)***	(0.004)**	**(0.005)*****	(0.004)***	(0.004)***	**(0.004)*****	(0.003)***	(0.003)***	**(0.004)*****	(0.004)***	(0.004)***
$PRD_{i,t}$	0.218	0.216	**0.200**	0.182	0.181	**0.161**	0.156	0.121	**0.0537**	-0.0236	-0.0316
	(0.070)***	(0.054)***	**(0.053)*****	(0.057)**	(0.060)**	**(0.056)****	(0.059)**	(0.073)	**(0.081)**	(0.094)	(0.119)
Const	13.13	12.37	**12.50**	12.05	12.10	**11.96**	11.67	11.26	**10.90**	10.57	12.89
	(0.673)***	(0.612)***	**(0.647)*****	(0.661)***	(0.550)***	**(0.585)*****	(0.658)***	(0.716)***	**(0.722)*****	(0.801)***	(1.325)***
Year dummies	Yes	Yes	**Yes**	Yes	Yes	**Yes**	Yes	Yes	**Yes**	Yes	Yes
N	1125	1125	**1125**	1125	1125	**1125**	1125	1125	**1125**	1125	1125
pseudo R2	0.704	0.711	0.712	0.713	0.715	0.718	0.724	0.730	0.736	0.739	0.737
Only $NUMBERZONES_{i,t}$											

$NUMBERZONES_{i,t}$	0.0518	0.0584	**0.0587**	0.0524	0.0579	**0.0705**	0.0755	0.0786	**0.0825**	0.0915	0.100***
	(0.014)***	(0.013)***	**(0.013)*****	(0.014)***	(0.016)***	**(0.014)*****	(0.0142)***	(0.0153)***	**(0.016)*****	(0.018)***	(0.022)***
$lnINVESTMENTS_{i,t}$	0.218	0.255	**0.249**	0.276	0.301	**0.303**	0.333	0.361	**0.381**	0.384	0.305
	(0.032)***	(0.034)***	**(0.034)*****	(0.037)***	(0.034)***	**(0.034)*****	(0.033)***	(0.039)***	**(0.045)*****	(0.048)***	(0.070)***
$lnENTERPRISES_{i,t}$	1.006	0.930***	**0.923**	0.901	0.867	**0.838**	0.785	0.756	**0.737**	0.718	0.736
	(0.035)***	(0.034)***	**(0.034)*****	(0.038)***	(0.034)***	**(0.036)*****	(0.036)***	(0.038)***	**(0.041)*****	(0.049)***	(0.071)***
$SPTOWNS_{i,t}$	-0.0161	-0.0115	**-0.0126**	-0.0130***	-0.0159	**-0.0153**	-0.0153	-0.0161	**-0.0172**	-0.0153	-0.0155
	(0.004)***	(0.004)***	**(0.004)*****	(0.003)***	(0.003)***	**(0.003)*****	(0.003)***	(0.003)***	**(0.004)*****	(0.004)***	(0.005)***
$PRD_{i,t}$	0.199	0.232	**0.265**	0.226	0.231	**0.201**	0.188	0.125	**0.104**	0.0263	-0.0214
	(0.075)***	(0.070)***	**(0.068)*****	(0.063)***	(0.056)***	**(0.057)*****	(0.062)***	(0.060)**	**'(0.064)**	'(0.079)	'(0.101)
Const	13.50***	13.19	**13.45**	13.02	12.72	**12.91**	12.59	12.34	**12.03**	12.09	14.04
	(0.612)***	(0.668)***	**(0.659)*****	(0.697)***	(0.648)***	**(0.654)*****	(0.646)***	(0.753)***	**(0.870)*****	(0.947)***	(1.407)***
Year dummies	Yes	Yes	**Yes**	Yes	Yes	**Yes**	Yes	Yes	**Yes**	Yes	Yes
N	1125	1125	**1125**	1125	1125	**1125**	1125	1125	**1125**	1125	1125
pseudo R2	0.704	0.713	**0.714**	0.715	0.719	**0.722**	0.729	0.736	**0.742**	0.745	0.744

Table 2. Quantile regressions (Dependent variable: logarithm of the industrial output) (cont.d)

	Quantiles										
	q10	q20	**q25**	q30	q40	**q50**	q60	q70	**q75**	q80	q90
Joint effect											
$DUMMYZONES_{i,t}$	0.123	0.097	**0.084**	0.043	-0.049	**-0.027**	-0.035	-0.088	**-0.049**	-0.093	-0.132

	(0.037)***	(0.022)***	**(0.033)****	(0.040)	(0.040)	**(0.055)**	(0.046)	(0.046)*	**(0.044)**	(0.050)*	(0.065)**
$NUMBERZONES_{i,t}$	0.03	0.05	**0.053**	0.048	0.066	**0.072**	0.079	0.094	**0.093**	0.103	0.12
	(0.016)*	(0.011)***	**(0.012)*****	(0.013)***	(0.013)***	**(0.011)*****	(0.016)***	(0.019)***	**(0.020)*****	(0.025)***	(0.020)***
$lnINVESTMENTS_{i,t}$	0.208	0.252	**0.253**	0.275	0.281	**0.302**	0.333	0.373	**0.383**	0.378	0.299
	(0.035)***	(0.027)***	**(0.027)*****	(0.032)***	(0.022)***	**(0.031)*****	(0.032)***	(0.039)***	**(0.045)*****	(0.054)***	(0.072)***
$lnENTERPRISES_{i,t}$	1.011	0.922	**0.918**	0.898	0.885	**0.841**	0.789	0.746	**0.732**	0.728	0.745
	(0.03)***	(0.025)***	**(0.026)*****	(0.031)***	(0.003)***	**(0.034)*****	(0.032)***	(0.038)***	**(0.047)*****	(0.056)***	(0.064)***
$SPTOWNS_{i,t}$	-0.016	-0.013	**-0.014**	-0.014	-0.016	**-0.015**	-0.015	-0.017	**-0.018**	-0.015	-0.014
	(0.004)***	(0.004)***	**(0.004)*****	(0.003)***	(0.003)***	**(0.003)*****	(0.003)***	(0.004)***	**(0.004)*****	(0.005)***	(0.006)***
$PRD_{i,t}$	0.249	0.248	**0.262**	0.23	0.23	**0.201**	0.185	0.124	**0.095**	0.023	-0.045
	(0.060)***	(0.050)***	**(0.047)*****	(0.047)***	(0.060)***	**(0.057)*****	(0.053)***	(0.056)**	**(0.082)***	(0.090)	(0.077)
Const	13.691	13.3	**13.34**	13.01	13.116	**12.914**	12.612	12.137	**12.017**	12.215	14.146
	(0.686)***	(0.541)***	**(0.544)*****	(0.619)***	(0.419)***	**(0.606)*****	(0.653)***	(0.756)***	**(0.876)*****	(1.022)***	(1.396)***
Year dummies	Yes	Yes	**Yes**	Yes	Yes	**Yes**	Yes	Yes	**Yes**	Yes	Yes
N	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
pseudo R2	0.705	0.714	**0.715**	0.715	0.719	**0.722**	0.729	0.737	**0.742**	0.746	0.745

Notes: Bootstrapped standard errors in brackets, 500 replications. Significance: * 10%, ** 5%, *** 1%. Year dummies 2000 to 2014.

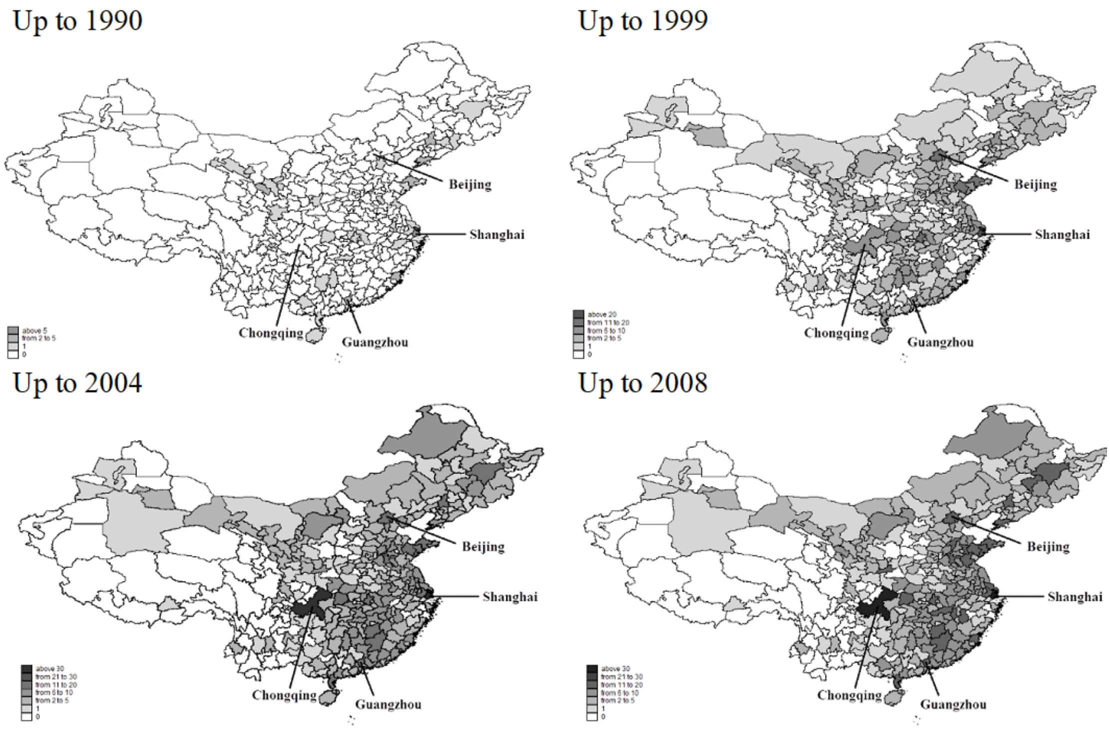
Table 3. Regression results of the spatial Durbin model (Dependent variable: logarithm of the industrial output)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$DUMMYZONES_{i,t}$	0.200***	0.097					
	(0.053)	(0.063)					
W x $DUMMYZONES_{i,t}$	-0.158**	-0.064					
	(0.068)	(0.080)					
$NUMBERZONES_{i,t}$		0.068***					
		(0.023)					
W x $NUMBERZONES_{i,t}$		-0.061**					
		(0.029)					
$SIZE\_SMALL_{i,t}$			0.093***				
			(0.027)				
W x $SIZE\_SMALL_{i,t}$			-0.077**				
			(0.035)				
$\text{SIZE\_MEDIUM\_LARGE}_{i,t}$				0.154***			
				(0.045)			
W x $\text{SIZE\_MEDIUM\_LARGE}_{i,t}$				-0.139**			
				(0.059)			
$\text{ETDZ}_{i,t}$					0.112***		
					(0.029)		
W x $\text{ETDZ}_{i,t}$					-0.091**		
					(0.036)		
$\text{HTDZ}_{i,t}$						0.265***	
						(0.072)	
W x $\text{HTDZ}_{i,t}$						-0.211**	
						(0.090)	
$\text{NR\_OTHERS}_{i,t}$							0.179***
							(0.061)
W x $\text{NR\_OTHERS}_{i,t}$							-0.173**
							(0.077)
P	0.380***	0.382***	0.380***	0.381***	0.379***	0.382***	0.380***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Σ	0.571***	0.568***	0.571***	0.571***	0.571***	0.571***	0.572***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Observations	1,125	1,125	1,125	1,125	1,125	1,125	1,125
Log-likelihood	-989.70297	-985.48104	-991.03625	-991.04527	-989.69874	-990.05295	-992.59218

Notes: For the sake of clarity and in order to keep the table manageable, we do not report control variables.

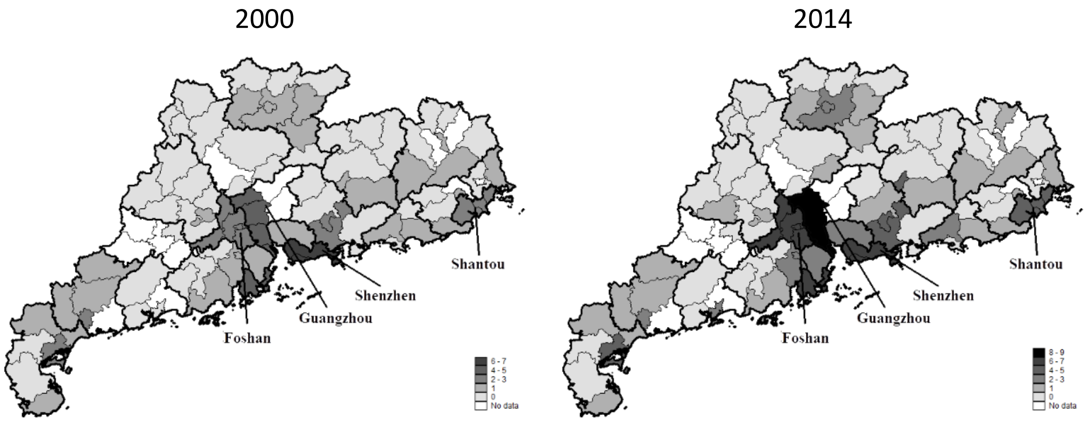
* significant at 10%, ** significant at 5% and *** significant at 1%. Standard errors in parentheses.

Figure 1. Geographical distribution of number of zones by waves.



Source: authors' elaboration upon data from various sources.

Figure 2. Economic zones by counties in Guangdong.



Notes: the districts of Foshan, Guangzhou, Shantou, Shaoguan, Shenzhen and Zhuhai are computed as unique administrative areas.

Source: author’s elaboration upon data from various sources.

Figure 3. Net effect of the zone-policy across quantiles for various number of zones

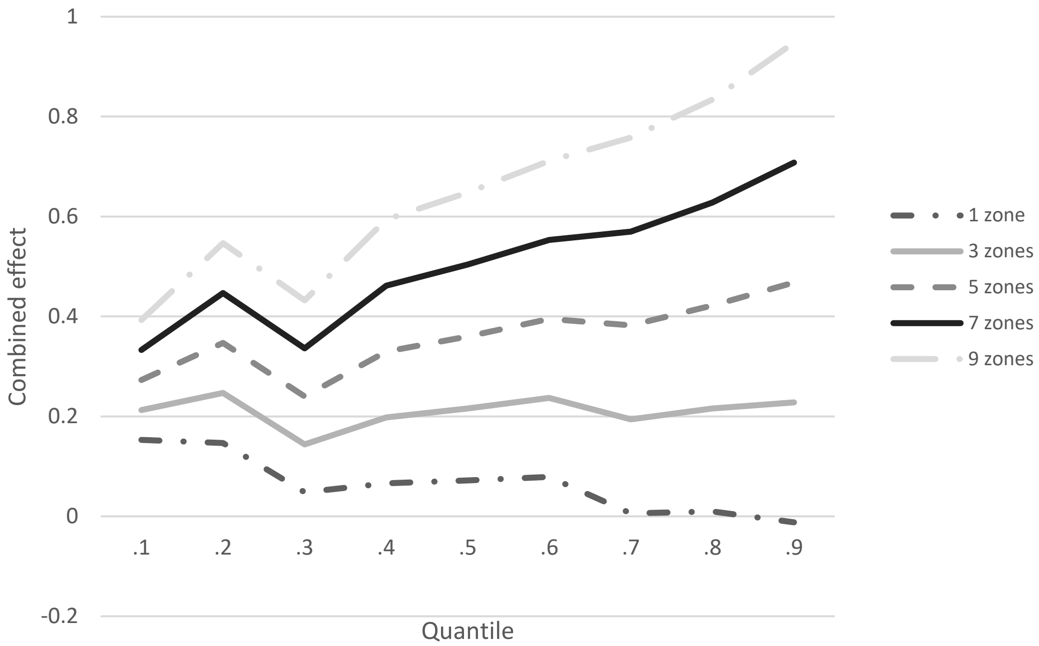


Figure 4. Effect of small and medium-large zones across the distribution of industrial output

$NR\_SMALL_{i,t}$ *$NR\_MEDIUM\_LARGE_{i,t}$*

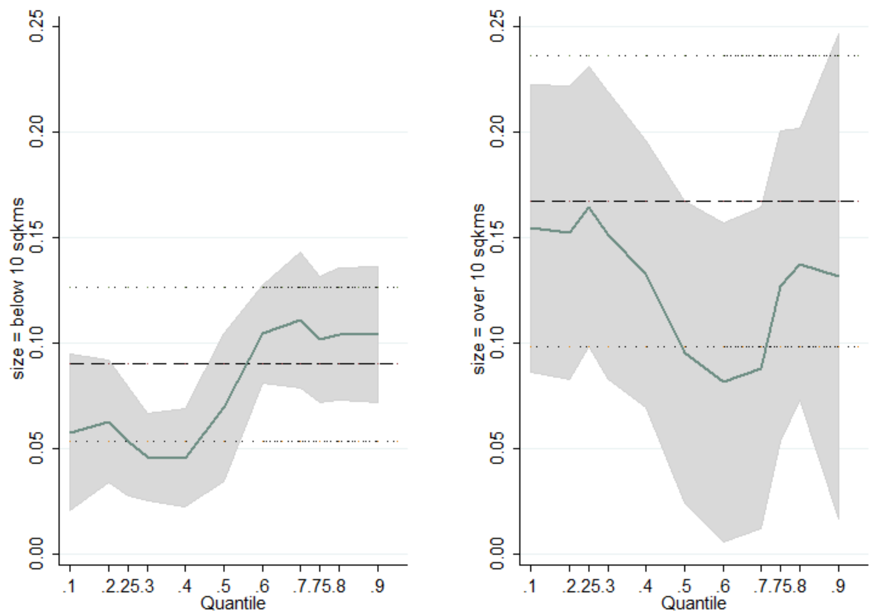
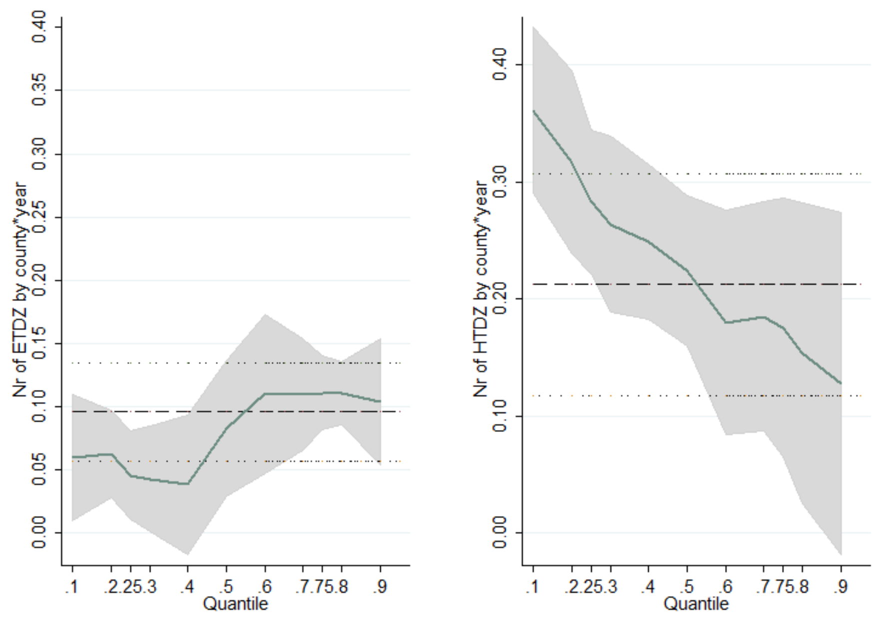


Figure 5. Effects of $ETDZ_{i,t}$ and $HTDZ_{i,t}$ across the distribution of industrial output

$ETDZ_{i,t}$ *$HTDZ_{i,t}$*



APPENDIX

TABLES

Table A1. Percent distribution by type of zone, 2000 and 2014

Type	Year	
	2000	2014
Total	51	87
ETDZ	58.82	48.28
EPZ	1.96	3.45
FTZ	9.80	8.05
HTDZ	19.61	18.39
Others	7.84	14.94

Table A2. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Source
lnY	1125	22.924	1.920	17.232	28.538	NBS, various years
DUMMYZONES	1125	0.483	0.500	0	1	
NUMBERZONES	1125	1.067	1.744	0	9	
NR_SMALL	1125	0.499	1.126	0	6	Hong Kong Trade Development Council, Guangdong Government prefectures' websites, specific economic zones official websites, Rightsite Asia
NR_MEDIUM_LARGE	1125	0.380	0.631	0	3	
NR_ETDZ	1125	0.537	0.952	0	5	
NR_HTDZ	1125	0.192	0.424	0	2	
NR_OTHER	1125	0.276	0.789	0	4	
lnINVESTMENTS	1125	21.378	1.798	11.002	26.451	NBS, various years
lnENTERPRISES	1125	4.678	1.462	1.099	9.097	
SPTOWNS	1125	2.371	4.707	0	41	Association of Specialized Towns of Guangdong
PRD	1125	0.227	0.419	0	1	Di Tommaso *et al.*, 2013

Table A3. Interquantile regression

	Quantiles	
	Q10 Q90	Q25 Q75
$DUMMYZONES_{i,t}$	-0.256	-0.132
	(0.108)**	(0.059)**
$NUMBERZONES_{i,t}$	0.09	0.039
	(0.031)***	(0.14)***
$lnINVESTMENTS_{i,t}$	0.091	0.13
	(0.079)	(0.025)***
$lnENTERPRISES_{i,t}$	-0.295	-0.185
	(0.121)**	(0.043)***
$SPTOWNS_{i,t}$	0.002	-0.004
	(0.006)	(0.004)
$PRD_{i,t}$	-0.295	-0.167
	(0.121)**	(0.077)**
Year dummies	Yes	Yes
N	1125	1125
Q10 pseudo-R2	0.705	
Q90 pseudo-R2	0.744	
Q25 pseudo-R2		0.715
Q75 pseudo-R2		0.742

Notes: Bootstrapped standard errors in brackets, 500 replications. Significance: * 10%, ** 5%, *** 1%. Year dummies 2000 to 2014. First column reports the difference between 10^{th} and 90^{th} quantiles, second column reports the difference 25^{th} and the 75^{th}.

Table A4. Quantile Regression – Effect of number of zones by size

Variables	*Quantiles*										
	10	20	25	30	40	50	60	70	75	80	90
Small zones											
$lnINVESTMENTS_{i,t}$	0.214***	0.265***	0.283***	0.304***	0.302***	0.314***	0.342***	0.366***	0.389***	0.399***	0.311***
	(0.032)	(0.034)	(0.036)	(0.036)	(0.029)	(0.034)	(0.035)	(0.037)	(0.042)	(0.053)	(0.067)
$lnENTERPRISES_{i,t}$	1.032***	0.938***	0.911***	0.896***	0.880***	0.844***	0.808***	0.757***	0.749***	0.736***	0.755***
	(0.039)	(0.035)	(0.037)	(0.037)	(0.030)	(0.034)	(0.034)	(0.037)	(0.043)	(0.052)	(0.068)
$SPTOWNS_{i,t}$	-0.013***	-0.008**	-0.0081**	-0.009***	-0.011***	-0.010***	-0.013***	-0.010***	-0.012***	-0.012***	-0.007
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
PRD_{i}	0.182**	0.251***	0.260***	0.212***	0.247***	0.203***	0.141***	0.106*	0.039	0.001	-0.076
	(0.073)	(0.065)	(0.066)	(0.059)	(0.053)	(0.055)	(0.054)	(0.057)	(0.058)	(0.068)	(0.097)
$SIZE\_SMALL_{i,t}$	0.057***	0.063***	0.053***	0.046***	0.046***	0.069***	0.104***	0.111***	0.102***	0.104***	0.104***
	(0.018)	(0.015)	(0.014)	(0.014)	(0.016)	(0.020)	(0.019)	(0.016)	(0.016)	(0.017)	(0.020)
Const	13.47***	12.95***	12.71***	12.41***	12.64***	12.65***	12.33***	12.19***	11.81***	11.68***	13.83***
	'(0.616)	'(0.662)	'(0.679)	'(0.691)	'(0.573)	'(0.664)	'(0.678)	'(0.719)	'(0.818)	'(1.026)	'(1.309)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
Pseudo-R2	0.702	0.711	0.713	0.714	0.717	0.721	0.728	0.737	0.742	0.745	0.743
Medium and large zones											
$lnINVESTMENTS_{i,t}$	0.202***	0.246***	0.252***	0.278***	0.304***	0.331	0.353***	0.408***	0.435***	0.439***	0.370***
	(0.036)	(0.037)	(0.037)	(0.037)	(0.032)	(0.565)	(0.036)	(0.040)	(0.034)	(0.040)	(0.073)
$lnENTERPRISES_{i,t}$	1.037***	0.959***	0.945***	0.919***	0.894***	0.855***	0.830***	0.767***	0.734***	0.751***	0.752***
	(0.040)	(0.034)	(0.033)	(0.037)	(0.033)	(0.207)	(0.034)	(0.039)	(0.043)	(0.047)	(0.082)
$SPTOWNS_{i,t}$	-0.014**	-0.014**	-0.016***	-0.017***	-0.0179***	-0.016	-0.017***	-0.017***	-0.019***	-0.021***	-0.016***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.013)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)
PRD_{i}	0.128**	0.121**	0.127**	0.125**	0.09	0.128*	0.112*	0.065	0.026	-0.080	-0.059
	(0.081)	(0.059)	(0.056)	(0.063)	(0.071)	(0.065)	(0.060)	(0.067)	(0.069)	(0.077)	(0.115)
$SIZE\_MEDIUM\_LARGE_{i,t}$	0.155***	0.152***	0.165***	0.151***	0.133***	0.095	0.081**	0.088**	0.127***	0.137***	0.132**
	(0.045)	(0.038)	(0.039)	(0.040)	(0.038)	(0.303)	(0.037)	(0.038)	(0.038)	(0.036)	(0.056)
Const	13.73***	13.34***	13.31***	13.31***	12.04***	12.23***	12.03***	11.23***	10.86***	10.77***	12.48***
	(0.671)	(0.724)	(0.724)	(0.724)	'(0.578)	(4.54e+14)	(0.702)	'(0.633)	(0.742)	(0.759)	(1.391)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
Pseudo-R2	0.704	0.713	0.714	0.715	0.718	0.721	0.726	0.733	0.74	0.745	0.737

Notes: Bootstrapped standard errors in brackets, 500 replications. Significance: * 10%, ** 5%, *** 1%. Year dummies 2000 to 2014.

Table A5. Quantile Regression – Effect of number of zones by type

Variables	*Quantiles*										
	10	*20*	*25*	*30*	*40*	*50*	*60*	*70*	*75*	*80*	*90*
	ETDZ										
lnINVESTMENTS$_{i,t}$	0.214***	0.277***	0.291***	0.289***	0.312***	0.333***	0.340***	0.377***	0.401***	0.408***	0.312***
	(0.032)	(0.036)	(0.037)	(0.036)	(0.031)	(0.032)	(0.034)	(0.040)	(0.042)	(0.049)	(0.070)
lnENTERPRISES$_{i,t}$	1.030***	0.944***	0.941***	0.928***	0.913***	0.880***	0.853***	0.801***	0.783***	0.778***	0.794***
	(0.034)	(0.036)	(0.035)	(0.037)	(0.035)	(0.032)	(0.035)	(0.039)	(0.040)	(0.047)	(0.068)
SPTOWNS$_{i,t}$	-0.008**	-0.011***	-0.012***	-0.013***	-0.015***	-0.019***	-0.021***	-0.021***	-0.020***	-0.020***	-0.019***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
PRD$_i$	0.200***	0.219***	0.194***	0.201***	0.164***	0.147***	0.113**	0.076	0.032	-0.022	0.013
	(0.068)	(0.065)	(0.063)	(0.058)	(0.060)	(0.052)	(0.051)	(0.050)	(0.053)	(0.065)	'(0.105)
NR_ETDZ$_{i,t}$	0.059***	0.063***	0.046**	0.043**	0.038	0.083***	0.110***	0.109***	0.111***	0.110***	0.104***
	(0.019)	(0.018)	(0.018)	(0.019)	(0.025)	(0.026)	(0.023)	(0.019)	(0.018)	(0.018)	(0.025)
Const	13.47***	12.67***	12.44***	12.60***	12.30***	12.26***	12.18***	11.78***	11.44***	11.33***	13.64***
	'(0.609)	'(0.698)	'(0.722)	'(0.684)	'(0.593)	'(0.620)	'(0.642)	'(0.749)	'(0.788)	'(0.939)	'(1.359)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
	HTDZ										
lnINVESTMENTS$_{i,t}$	0.204***	0.242***	0.262***	0.289***	0.303***	0.329***	0.360***	0.403***	0.430***	0.426***	0.352***
	(0.034)	(0.038)	(0.038)	(0.039)	(0.031)	(0.031)	(0.035)	(0.038)	(0.039)	(0.043)	(0.070)
lnENTERPRISES$_{i,t}$	1.016***	0.965***	0.945***	0.905***	0.877***	0.820***	0.789***	0.737***	0.735***	0.758***	0.794***
	(0.038)	(0.038)	(0.037)	(0.039)	(0.036)	(0.031)	(0.034)	(0.038)	(0.042)	(0.052)	(0.083)
SPTOWNS$_{i,t}$	-0.026***	-0.025***	-0.022***	-0.020***	-0.020***	-0.014***	-0.012***	-0.010***	-0.012***	-0.014***	-0.011***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
PRD$_i$	0.151*	0.129*	0.153**	0.174***	0.175***	0.236***	0.196***	0.117	0.042	-0.053	-0.124
	(0.080)	(0.075)	(0.069)	(0.063)	(0.050)	(0.050)	(0.059)	(0.072)	(0.079)	(0.091)	'(0.122)
NR_HTDZ$_{i,t}$	0.361***	0.316***	0.283***	0.264***	0.249***	0.224***	0.180***	0.185***	0.176***	0.154**	0.128
	(0.059)	'(0.0509)	(0.049)	(0.048)	(0.043)	(0.047)	(0.055)	(0.062)	(0.066)	(0.067)	(0.085)
Const	13.82***	13.41***	13.09***	12.75***	12.69***	12.41***	12.01***	11.46***	10.96***	11.00***	12.69***
	'(0.653)	'(0.737)	'(0.731)	'(0.744)	'(0.590)	'(0.600)	'(0.692)	'(0.761)	'(0.781)	'(0.831)	'(1.329)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125

Table A5. Quantile Regression – Effect of number of zones by type (Dependent variable: logarithm of the industrial output) (cont.d)

Other zones											
lnINVESTMENTS$_{i,t}$	0.222***	0.262***	0.278***	0.309***	0.301***	0.333***	0.369***	0.404***	0.426***	0.429***	0.351***
	(0.034)	(0.0347)	(0.037)	(0.038)	(0.032)	(0.033)	(0.037)	(0.037)	(0.041)	(0.046)	(0.070)
lnENTERPRISES$_{i,t}$	1.012***	0.956***	0.932***	0.908***	0.895***	0.850***	0.795***	0.743***	0.749***	0.771***	0.791***
	(0.041)	(0.037)	(0.039)	(0.039)	(0.033)	(0.034)	(0.035)	(0.044)	(0.047)	(0.054)	(0.086)
SPTOWNS$_{i,t}$	-0.018***	-0.015***	-0.016***	-0.016***	-0.015***	-0.011***	-0.011***	-0.010***	- 0.012***	-0.014***	-0.012***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)
PRD$_i$	0.190*	0.154**	0.198*	0.146**	0.225***	0.163**	0.144***	0.091	0.002	-0.092	-0.099
	(0.078)	(0.069)	(0.066)	(0.063)	(0.060)	(0.057)	(0.056)	(0.066)	(0.078)	(0.087)	(0.137)
NR_OTHERS$_{i,t}$	0.095***	0.079***	0.068**	0.071***	0.050**	0.053***	0.075***	0.077***	0.062***	0.045***	0.041
	(0.030)	(0.028)	(0.027)	(0.025)	(0.024)	(0.024)	(0.023)	(0.019)	(0.020)	(0.022)	(0.043)
Const	13.40***	12.60***	12.79***	12.29***	12.62***	12.22***	11.78***	11.39***	10.98***	10.86***	12.83***
	'(0.661)	'(0.659)	(0.709)	(0.721)	(0.610)	(0.631)	(0.712)	(0.722)	(0.791)	(0.849)	(1.339)
Year dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125

Notes: Bootstrapped standard errors in brackets, 500 replications. Significance: * 10%, ** 5%, *** 1%. Year dummies 2000 to 2014.

Table A6. Interquantile Regression – Number of zones by size and type

Variables	Quantiles	Pseudo-R2	Difference	Standard Error
Size				
$NR\_SMALL_{i,t}$	Q70	0.737	0.065***	(0.016)
	Q30	0.714		
$NR\_MEDIUM\_LARGE_{i,t}$	Q60	0.724	-0.083**	(0.038)
	Q25	0.714		
Type				
$NR\_ETDZ_{i,t}$	Q60	0.727	0.072***	(0.021)
	Q40	0.716		
$NR\_HTDZ_{i,t}$	Q90	0.737	-0.234**	(0.094)
	Q10	0.707		
$NR\_OTHERS_{i,t}$	Q90	0.736	-0.054	(0.056)
	Q10	0.702		

Notes: Bootstrapped standard errors in brackets, 500 replications. Significance: * 10%, ** 5%, *** 1%. Year dummies 2000 to 2014.

Table A7. Measuring spatial autocorrelation: Moran's I 2000-2014

Year	Logarithm of the industrial output
2000	0.283***
2001	0.280***
2002	0.276***
2003	0.148**
2004	0.126**
2005	0.118**
2006	0.115*
2007	0.123**
2008	0.137**
2009	0.162**
2010	0.170**
2011	0.181***
2012	0.156**
2013	0.142**
2014	0.146**

Notes: * significant at 10%, ** significant at 5% and *** significant at 1%.

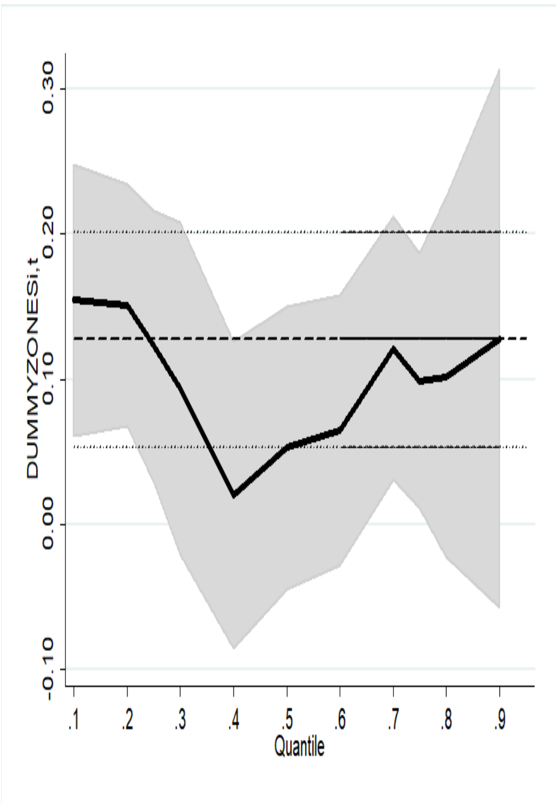
FIGURES

Figure A1. Pre- and post-treatment trends of industrial output for a sub-sample of counties and districts (million yuan)

Figure A2. Effect of $DUMMYZONES_{i,t}$ and $NUMBERZONES_{i,t}$ across the distribution of industrial output

DUMMYZONES$_{i,t}$

(panel a)



NUMBERZONES$_{i,t}$

(panel b)

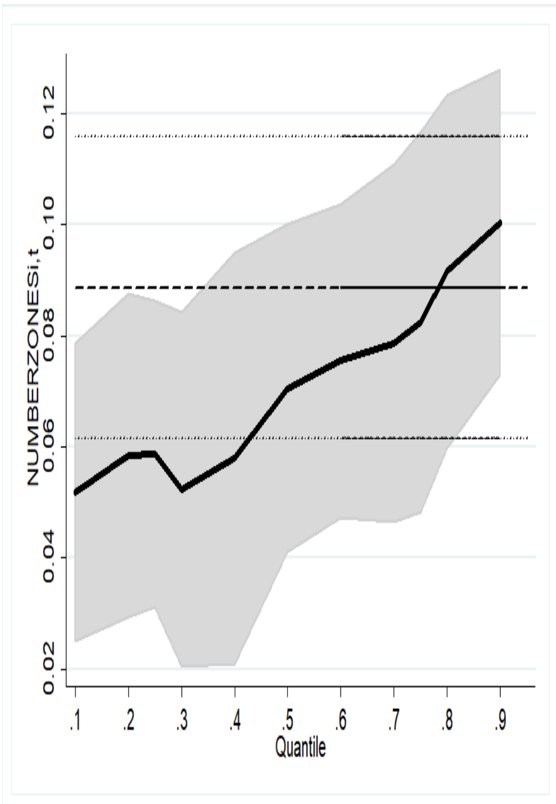


Figure A3. Number of zones in counties by quantile in 2000 and in 2014 (source: authors' elaboration).