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Abstract

Several analyses show that regional capital incentives induce additional investment and growth (Schalk and Untiedt, 2000). The impact of capital subsidies on employment is more doubtful, even if many studies found that the substitution effect outweighs the output effect (Gabe and Kraybill, 2002). However, the spatial effects of capital subsidies on local development are generally neglected. In a recent paper (De Castris and Pellegrini, 2005) we show that several industrial policies have a strong spatial dimension. This study analyzes the presence of spill-overs generated by subsidised firms, disentangling the effects due to the economic links across areas. The identification strategy is based on the introduction of spatial externalities in the spatial autoregressive model (Anselin, 2003). The presence of specific spatial effects of subsidies is tested on the reduced form of the model, evaluating the implicit common factor restriction. The empirical analysis considers subsidies allocated by Law 488/1992, the main regional policy in Italy, in the Southern regions of the country in the period 1996-2001. A difference-in-difference estimator across 365 subsidised and not subsidised local labour systems is applied. The results suggest the presence of a modest spatial crowding out, where incentives attract skills and growth from neighbouring areas.

JEL code: J23, R58, R11
Keywords: spatial spillovers, spatial common factor, industrial policy evaluation

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1. Introduction

State aids to private firms have been a key component of regional policy in European countries. The use of such policy instruments has been aimed at influencing the regional allocation of investments and employment, in order to increase competitiveness, self-sustaining growth, and new employment in low income regions. In Italy several measures for local development are oriented to private capital subsidies. The main policy instrument to boost private investments has been Law 488/1992. From 1996 (the first operative year) to 2007, this law has sustained more than 30,000 investment projects with over 17 billions of Euros of subsidies, whereas investments have added up to over 56 billions of Euros, 70% of which in the South.

The debate over the overall effects of investment subsidies is extensive. Several papers show that capital incentives induce additional investment (Faini and Schiantarelli, 1987; Harris RID, 1991; Daly et al., 1993; Schalk and Untiedt, 2000), even if they can have some unpleasant effects on income inequality across different areas (Dupont and Martin, 2003). Besides, they have some effect in attracting plants to low income areas (Faini and Schiantarelli, 1987; Midelfart-Knarvik, K.H. & Overman H. G., 2002). The theoretical effect of capital subsidies on employment depend on the size of substitution effect, associated to the reduction in the user cost of capital relative to the labour cost, and the size of the output effect, related to the increase in production (and therefore in local labour demand), due to the reduction in total costs and to the attraction of new investment in the area (Schalk and Untiedt, 2000). Several studies found that the substitution effect outweighs the output effect (Driehuis and van den Noord, 1988; Harris RID, 1991; Gabe and Kraybill 2002), others found the opposite (Wren and Waterson, 1991; Daly et al., 1993; Schalk and Untiedt, 2000; Roper and Hewitt-Dundas, 2001). All the studies show that the effects of subsidies on efficiency and productivity are negligible or negative (Lee, 1996; Bergstrom, 1998; Harris and Trainor, 2005).

On the contrary, the literature about the quantitative evaluation of regional effects of industrial aid schemes is not very wide. Some studies, encouraged by data availability, used statistical methods to evaluate the impact of Enterprise Zone Programs, US incentive schemes to firms located in disadvantaged areas (for example Bondonio, 2000; Bondonio, Engberg, 1999; Boarnet, Bogart, 1996; Brintnall, Green, 1988; Dowall, 1996; Erickson, Friedman, 1990a, 1990b, Papke, 1994; Talbot, 1988). Recent papers on regional effects of
subsidies in Italy are Bondonio (2004), that evaluates the regional impact of different incentives in the areas Objective 2 (of EU classification), and De Castris and Pellegrini (2005), that show the regional impact of different policy instruments (Law 488/1992 and “Contratti di programma”). Bondonio (2004) points out the presence of very low regional impacts of subsidies, whereas De Castris and Pellegrini (2005) detect moderate, positive and statistical significant regional effects of incentives. However, the presence of spatial pattern in industrial subsidies has been analyzed only in De Castris and Pellegrini (2005).

The lack of an extensive literature on spatial effect of incentives is rather curious, because several industrial policies, especially the industrial policies oriented to the growth of regional underdeveloped regions, have the purpose to generate spatial externalities. Regional industrial policies promote local aggregations of firms, generating positive local agglomeration externalities, spatial externalities or spillovers\(^1\). A summary of the rationale for the supply of localization tax incentives is presented in Glaeser (2001), that lists:

a. Externalities linked to the demand and supply of goods and services;
b. Agglomeration externalities, due to income production generates ex post high regional public income by local taxes;
c. Ex post appropriation. The firm’s fixed resources create an immobility which means that it is easy prey for a taxing authority. Forward-looking firms recognize this fact and demand up-front tax breaks to compensate for ex post appropriation;
d. Tax discrimination for attracting firms in presence of firms with different levels of demand for different locations. Local governments will charge different tax rates (and will give tax incentives) to different firms depending on how much they want to locate in the region;
e. Corruption and influence. Tax incentives reflect the ability of the firm to bribe or coerce the leaders of the local government.

The survey proposed in Glaeser (2001) suggests that tax incentives almost surely improve the efficiency of the locational decisions of firms. The only case where this is not true occurs when tax incentives are driven by corruption and influence. However, the empirical measurement of the spatial effects of the industrial subsidies is not easy task. If incentives are effective in generating spatial externalities and spatial spillovers, they should be empirically

\(^1\) See Rosenthal and Strange (2004) for a recent review on agglomeration economies. See also Garcia-Mila and McGuire (2002).
measured by the presence of a positive spatial correlation in some outcome variables (like regional value added, production, employment) (De Castris and Pellegrini, 2005). Moreover, the localization of the subsidized firms should follow a positive spatial correlation pattern. Nevertheless, the subsidized firms could replace firms and investments project in the neighbouring areas, by a spatial crowding out effect in the input, output and in the labour markets. These effects could decreases the spatial positive correlation. The net effect on spatial correlation is therefore undetermined, even if the empirical spatial distribution of subsidies suggests a overall positive effect.

The presence of such positive effects is basically an empirical matter. Therefore, the aim of this paper is to identify and evaluate the net spatial effects of subsidies considering incentives’ spillovers between areas. The outcome variable is employment, as a measure of economic performance of the area. The estimated effects include both the impact of specific instruments on regional outcome, evaluated here in terms of creation of new jobs, as well as the effect of spatial linkages across neighbouring areas. Our analysis intends to identify and to discriminate the two different effects.

This is the main innovation presented in the paper. The empirical measurement of the spatial effect is affected by a spatial identification problem: the spillover effect generated by the incentives should be disentangled from the spatial attraction across neighbouring areas that cannot be attributed to incentives. For instance, spatial shocks spread across areas with a positive spatial correlation (if income increase in such area then it has also a positive impact on neighbouring areas). We are unaware of any examples of an empirical specification of the spatial identification problem in the literature. Therefore we propose an econometric approach that uses a spatial common factor restriction in order to identify the spatial effects of industrial subsidies.

The analysis is carried out at disaggregated territorial level, using the grid of the local labour system (LLS, territorial unit) in the South of Italy. This allows the spatial analysis of the spillover effects between LLS that are estimated by an econometric model with spatial dependence.

The paper is divided into the following parts: in the second section we illustrate the methodological aspects of our analysis and describe the spatial econometric model we used;
in the third section a brief review of the incentive scheme (Law 488/92) under analysis is presented; in the fourth section the analysis of the spatial distribution of the instruments, evaluating overlapping, concentration and spatial correlation, is described, and data and statistical source are presented. In the following one we show the results of our estimate, explaining the spatial impact of the instrument. The last section is dedicated to the conclusions of our analysis.

2. Methodology for evaluating subsidies spatial effects

The methodology for evaluating spatial effects of subsidies on a region is based on the analysis of the spatial model, following the recent literature on the subject (Anselin, 2003). We meet three main problems that affect the evaluation of the spatial impact of the incentives:

1. identifying the effects of incentives in presence of a selection bias;
2. evaluating the impact of different level of subsidization across LLS;
3. specifying the effect of incentives in presence of spatial interactions across areas.

The first problem is related to the presence of auto-selection: the subsidized firms choose to localize in areas where perspectives are higher; therefore larger growth could be caused not by the incentives but also by the idiosyncratic features of these areas. In this case we can use econometric strategies based on the knowledge of observable and non observable auto-selection variables to remove the selection bias and find the correct impact coefficient. In the case of selection on non observable variables (considered constant in the period) the standard model is the difference-in differences estimator\(^2\): the analysis compares the difference of the outcome variable before and after the intervention (instead that its level), across subsidized and not subsidized areas. In our case the simple differences could be misleading because LLS have different extension (and therefore different employment levels). We use logarithmic differences, i.e. the growth rate of employment. The growth rates differentials are attributed to the features of each LLS, in particular the degree of structural development level and cyclical variables. These features can be approximated by a set of covariates considered in the model.

The second problem is related to the choice of the correct parameterization of the intervention variable. The use of a simple flag to single out areas with or without incentive, as often used in the literature, is not adequate, because the high variability across LLS of the amount of subsidies. Moreover, the set of not subsidized LLS by Law 488/92 incentives is very poor (33 over 365, less than 10%).

Given the available data, the dimension of the subsidized investment has be approximated by the number of new workers, a proxy of the amount of the intervention realized, under the hypothesis of a linear relation between the number of new jobs and substitution effects or complementarities on the area\(^3\). The use of logarithmic differences requires that the dimensional effect has to be eliminated. Therefore the units of new created jobs are normalized by total employment in the LLS before intervention. The interpretation of the coefficient of the intervention variable is facilitated: it represents the additional employees units in the LLS succeeding an increase of one unit in the employees pool due to subsidies. In the econometric analysis a LLS is select as “subsidized” only if the share of new employment generated by the subsidized projects is over 5%. Under this condition the subsidized LLS by Law 488/92 are around the 48% of the total.

Probably the most important problem in the specification of the evaluation model is the presence of a high spatial correlation across LLS that could influence the spillover effects’ estimates. This correlation could be representative of a specific territorial development model that has to be included in the analysis. Our approach, based on the suggested econometric spatial externalities specification by Anselin (2003), considers the presence of spatial externalities that are not explicitly modelled, but are, in the Anselin’s jargon “unmodeled”. From the econometric point of view, the approach is to include the externalities in the error spatial term. Therefore any spatial patterns in the dependent variable we consider would be reflected in the error terms. The basic model is therefore the spatial autoregressive model (Anselin, 2003).

The general model, with policy effect, is therefore specified by:

\[ y = \alpha + X\beta + \delta \text{Int} + \varepsilon \]

\(^3\) We test the presence of non linear relation by a COSUM test.
\( e = \lambda W e + u \)

where \( y \) is a \( N \) by 1 vector of observations related to the outcome variable (log of the total employment by LLS), and \( N=365 \), \( X \) is a matrix of \( N \) by \( k \) observations of \( k \) covariates, \( \text{Int} \) (public intervention) is the \( N \) by 1 vector of observations related to new employment created by Law 488/92 intervention (normalized by total employment), \( \alpha \) is a \( N \)x1 vector of LLS specific fixed effect by LLS, \( \beta \) is a \( k \) by 1 vector of parameters and \( \delta \) is a scalar that represents the impact of public intervention on employment, \( u \) is a \( N \)x1 vector of homoscedastic not correlated and normal distributed errors with variance \( \sigma^2 \). \( W \) is the usual \( N \)x\( N \) spatial weights matrix\(^4\) and \( \lambda \) is the spatial autoregressive parameter.

In this model, a random shock in a specific region does not only affect employment of this region, but also has an impact on employment of all other regions through the same inverse spatial multiplier \((I-\lambda W)^{-1}\).

This is the general (global, following Anselin’s taxonomy) spatial spillovers effect across areas that is not directly dependent on subsidies. The reduced form solution is given by:

\[
\begin{align*}
(3) & \quad y = \alpha + X\beta + \delta \text{Int} + (I-\lambda W)^{-1} u \\
(4) & \quad y = (I-\lambda W)\alpha + \lambda W y + X\beta - \lambda W X\beta + \delta \text{Int} - \lambda \delta W \text{Int} + u
\end{align*}
\]

Note that the public intervention variable is inserted in the equation (4) twice: by its level values and also by its spatial lagged values, with different coefficients, as the other covariates. Therefore in the equation (4) a spatially lagged policy intervention variable is specified even if the incentive does not generate a spillover effect.

Let now assume that there is a specific spillover effect \( \tau \text{W Int} \) related to the subsidies to be included in equation (4):

\[
\begin{align*}
(4') & \quad y = (I-\lambda W)\alpha + \lambda W y + X\beta - \lambda W X\beta + \delta \text{Int} + (\tau - \lambda \delta) W \text{Int} + u
\end{align*}
\]

The econometric specification of the model is the following:

\[
\begin{align*}
(5) & \quad y = a_1 W y + X a_2 + W X a_3 + a_4 \text{Int} + a_5 W \text{Int} + u \\
\text{where } & \quad a_1 = \lambda; \quad a_2 = \beta; \quad a_3 = -\lambda \beta; \quad a_4 = \delta; \quad a_5 = (\tau - \lambda \delta)
\end{align*}
\]

\(^4\) In our case \( w_{ij} \) is equal to 1 if the distance between two centroids of LLS is less than 39 km, the average distance between the centroids, 0 otherwise.
If there is not a specific subsidies spillover effect \((\tau = 0)\), the spatial spillover effects of the intervention variables are equal to the spatial spillover effects of all the covariates, and the spatial common factor restriction must hold:

\[
(6) \quad a_5 = - a_1 \cdot a_4
\]

In this case, the policy spillover effects have to be attributed entirely to the general pattern of spatial autocorrelation across areas and not to specific policy effects. If instead \(\tau\) is different from 0, it can be estimated by (7):

\[
(7) \quad \tau^* = a_5 - (- a_1 \cdot a_4)
\]

In this case the common factor restriction does not hold, and we measure a specific spillover effect that can be attributed to the policy intervention. Note that in this case the subsidy specific spillover impact \((\tau)\) is different from the subsidy total spillover impact \((a_5)\).

The empirical specification of the model has to take into account the presence of regional fixed effects. The solution is given by differencing the outcome variable (log of employment by LLS). Therefore the outcome variable is the employment growth rate (period 1996-2001), and it is conditioned to the policy variable (share of new employment created by Law 488/92 to total employment), controlling for a set of covariates, related to the initial condition of each LLS and to territorial cyclical dynamics, with a spatial error. The empirically specification basically uses a parametrically conditioned difference-in-difference estimator, controlling for observed differences in initial conditions\(^5\). The model is estimated considering time \(t\) (after the policy intervention,) and time \(t-1\) (before the policy intervention):

\[
(8) \quad \Delta(ln y)_t = a_1 W \Delta(ln y)_{t-1} + a_{21} \Delta(ln y)_{t-1} + a_{22} X_{t-1} + a_3 W X_{t-1} + a_4 \text{Int}_t + a_5 W \text{Int}_t + u_t
\]

where \(W \Delta(ln y)_t\) is the endogenous spatially lagged variable (the log of the LLS employment change), calculated as the matrix product of \(W\) and the employment growth rate for each LLS. \(a_1\) is the autoregressive spatial parameter that includes spatial independent effects. The model

---

\(^5\) In cases where data on observable pre-intervention variables that are differently distributed between treated and non-treated units are available, a more common estimator is the conditional difference-in-difference estimator with propensity score matching (CDD-PSM). The confounding factors are controlled for by a PSM design, which surpasses the difficulties of choosing the proper functional forms of the observable control variables (Bondonio, 2008). However, the CDD-PSM approach does not deal with spatial spillover, and it cannot be used in our estimate. The presence of confounding factor is controlled parametrically, specifying and testing an appropriate functional form of the covariates.
controls for the exogenous temporally lagged employment growth rate $\Delta (\ln y)_{t-1}$ (period 1991-1996).

The OLS estimator in the case of the spatial autoregressive model, where the dependent variable and other covariates are spatially lagged, is biased, even it is robust. A unbiased estimator is the instrumental variables estimator (2SLS), that is very sensitive to the model specification and to the instrument chosen. Both are member of the k-class family of estimators. This family was introduced by Theil and it includes the OLS estimator ($k = 0$) and the 2SLS estimator ($k = 1$) as specific cases. The $k$-class family includes the LIML estimator. The LIML estimator is obtained by setting $k = \lambda^*$, where $\lambda^*$ is the smallest root of the determinant equation $|V_1 - \lambda V| = 0$. In the determinant equation, $V_1$ is the cross-product matrix of residuals from the OLS regression of the included endogenous variables on the included exogenous variable, and $V$ is the cross-product matrix of the residuals from the OLS regression of the included endogenous on all the exogenous variables. The model (8) is estimated by 2SLS, and we use the OLS and the LIML estimators for a robustness test.

3. **An industrial aid scheme: the Law 488/92**

The empirical analysis in the paper is based on the subsidies allocated by Law 488/1992, a policy instrument oriented to sustain the accumulation of private capital and to support employment growth in the South of Italy. In 1992, the Law 488/92 introduced a new way to allocate subsidies through a “rationing” system based on an auction mechanism which guarantees compatibility of demand and supply of incentives. Subsidies are granted on the basis of the amount of the funding available. Interventions to be subsidised are selected on the basis of 3 indicators, in accordance with the policy targets. The indicators are the following: 1) share of owner capital invested in the project; 2) number of new employees per unit of investment; 3) ratio between the maximum subsidy which can be allocated and the amount of subsidies requested by the firm. In order to draw up rankings to grant subsidies, each application receives a score obtained by adding up the values of the single standardised and normalised indicators. The rankings are drawn up through the decreasing order of the score awarded to each project and the subsidies are allocated to projects until funding granted to

---

6 The selection process was based on three indicators in the period the empirical analysis refers to. After, two more indicators were added to them: an indicator linked to specific regional, sectorial or territorial priorities, and an indicator linked to the level of awareness of environmental issues.
each region is exhausted. These rankings are constructed at a regional level. There are also special rankings for large projects and reserved lists for small and medium-sized firms.

The amount of aids requested by the firm (with respect to threshold established by the European Union) affects the possibility of obtaining the incentive: lower the requested share of aid, higher the likelihood of receiving it. The mechanism allows firms to affect the probability of obtaining the subsidy and the State to reduce the “rent” granted to the firm. By ranking and selecting projects and subsidies, the government can stimulate projects with different earning capacities in different ways and maximize the number of subsidised investments given the available resources.

There are few studies concerning ex-post evaluation of the impact of Law 488/92. A positive effect of Law 488/92 on investment is found in Ministero dell’Industria (2000) and in Bronzini and de Blasio (2005). Pellegrini and Carlucci (2003) and Carlucci and Pellegrini (2005) show empirical evidence on a positive employment effect. Bronzini and de Blasio (2006) indicate the presence of intertemporal substitution: financed firms slowdown significantly their investment activity in the years following the program. All the previous studies do not consider the spatial impact of the policy intervention.

4. Territorial diffusion and concentration of the subsidies by Law 488/92

The choice of Italian policy makers, to implement regional growth policies using the same map designed for the allowance of EU structural financial founds, has clearly affected the spatial distribution of incentives. The Law 488/92 has financed firms in both Northern and Southern regions of the country; however, the subsidy intensity was by far higher in the latter, following the map of aid delineated by the UE Commission. In our paper, we consider only incentives to the Southern regions, where the number of subsidised LLS is very high, and the capture of the spatial patterns is easier. In the nineties, we observe 784 LLS in Italy, 365 of which are in the Southern regions (Table 1).

The spatial distribution of incentives by Law 488/92 was extensive: 332 (91%) of the 365 LLS localized in the South received incentives by Law 488/92, i.e., they include at least one municipality where subsidized firms by Law 488/92 are located. On the contrary, only the 55% of LLS in the Centre and North regions was subsidized. The process of firm
subsidization was very intensive in the southern regions: *ex post*, in the nineties, any action of territorial concentration of the policy intervention in the South did not have any relevant effect.

The process of concentration can be analyzed also by the exam of new job creation by subsidized firms. On the whole, the policy instrument created 145,000 new jobs, more than 2% of total industrial employment in 2001 of the whole country. However, the employment generated by Law 488/92 in the North-Centre (36,500 employees) represents only the 0.7% of industrial employment, while in the South (86,200 employees) the share is strongly higher (7.5%).

Table 1- Local labour systems by the presence/absence of subsidized firms (by Law 488/92) by region (period 1996-2001).

<table>
<thead>
<tr>
<th>Local Labour Systems</th>
<th>Number of LLS by region</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>South</td>
</tr>
<tr>
<td>No subsidy by Law 488/92</td>
<td>33</td>
</tr>
<tr>
<td>Subsidized by Law 488/92</td>
<td>332</td>
</tr>
<tr>
<td>Total</td>
<td>365</td>
</tr>
</tbody>
</table>

The presence of a spatial pattern in the subsidies distribution can be detected by the analysis of spatial correlation, a standard statistical measure of spatial interactions. The indexes of spatial autocorrelation measure the influences of economic and social phenomena in the space. In other word, the objective is to evaluate if an economic variable (X), observed in two (geographically) neighbouring areas, assumes on average similar or dissimilar values. The most used index $I_m$ of spatial correlation, defined by Moran, has the following expression:

$$I_m = \frac{n \sum_i \sum_j w_{ij} (x_i - \bar{x}) \cdot (x_j - \bar{x})}{\left( \sum_i \sum_j w_{ij} \right) \sum_i (x_i - \bar{x})^2}$$

Where $n$ is the number of observations; $w_{ij}$ (*binary weight*) is one element of the contiguity symmetric matrix $[w_{ij}]$ with null diagonal ($w_{ii} = 0$) and its value is equal to one if the area $i$ and area $j$ are contiguous, zero otherwise; $x_i$ are the values of the variables X for the $i^{th}$ unit.
The correlation analysis by Moran’s $I_m$ index in the regions of Southern Italy is presented in table 5. In general, the distribution of employment across LLS is clearly positively spatial correlated. We find also a positive and statistically significance spatial correlation of new employees created by Law 488/92. The spatial correlation of new employees by subsidized firms is larger than the spatial correlation of employment. Therefore the degree of spatial agglomeration of Law 488/92 is higher than the average. These effects of agglomeration are a specific characteristic of the instrument and they individuate spillover effects between contiguous areas.

Anselin (1995) demonstrate that the Moran index of global autocorrelation could be decomposed into the sum of local Moran indexes. The analytical expression of local Moran index for a fixed space point is (Anselin, 1995):

\[
I_i = \frac{(x_i - \bar{x})}{S^2} \sum_{j=1}^{N} w_{ij} (d)(x_j - \bar{x}), \quad j \neq i
\]

where $x_i$ is the value of the variable $X$ at $i$, $\bar{x}$ is the average of all observations of $X$, $n$ is the number of the observations and $N$ is the number of the contiguities of $I$; $w_{ij}$ is the element of contiguity symmetric matrix $[w_{ij}]$, the values of $w_{ij}$ are non zero when two locations are within a given distance of each other. The distance has been measured as the average of the distances between gravity centres of the LLS. All other values are zero included also those of each location distance with itself. The elements of the spatial weights matrix are row-standardized, such that for each $i$, $\sum_{j=1}^{N} w_{ij} = 1$, and $S^2$ can be formally expressed by:

\[
S^2 = \frac{\sum_{j=1}^{N} x_j^2}{N - 1} - \bar{x}^2
\]

Each index $I_i$ for each location $i$ represents only association between the value of $x$ in location $i$ and the values in the contiguous locations. The sum of $I_i$ net of a proportional constant gives the global index of Moran. We can decompose it into two components, the first one related to the presence of local autocorrelation in the LLS where are localized subsidized firms, the second one for not subsidized:
\( I = I_{i,ea} + I_{i,ena} \)

with

\[
I_{i,ea} = \left( \frac{x_{i,ea} - \bar{x}}{S_{i,ea}} \right) \sum_{j=1}^{N} W_{i,ea,j}(d)(x_j - \bar{x})
\]

where \( a \) is the set of subsidized LLS. The same chain rule for \( I_{i,ena} \).

In the last rows of the table 2 there are the estimated values of \( I_{i,ea} \) for employment and their variation. We observe a spatial correlation higher than the average. The empirical evidence shows that the spatial distribution of subsidies is clearly spatially correlated: the subsidized firms tend to create a spatial agglomeration of employment, and therefore to generate positive externalities. Moreover, if we decompose the Moran \( I \), the share of the index attributed to subsidized LLS is always higher than the share of the not subsidized LLS.

**Table 2 - Spatial correlation of employment (Moran’s \( I \) index by LLS)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Moran’s ( I )</th>
<th>Test ( z ) (normal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment 1991</td>
<td>0.065</td>
<td>2.46</td>
</tr>
<tr>
<td>Employment 1996</td>
<td>0.071</td>
<td>2.65</td>
</tr>
<tr>
<td>Employment 2001</td>
<td>0.074</td>
<td>2.75</td>
</tr>
<tr>
<td>Employment Change 1996-01</td>
<td>0.082</td>
<td>3.05</td>
</tr>
<tr>
<td>Employment Change 1991-96</td>
<td>0.002</td>
<td>0.18</td>
</tr>
<tr>
<td>Subsidized LLS (flag)</td>
<td>0.10</td>
<td>3.78</td>
</tr>
<tr>
<td>New employment generated by Law 488/92</td>
<td>0.09</td>
<td>3.41</td>
</tr>
<tr>
<td>Share of new employment Law 488/92 on total employment 1996</td>
<td>0.42</td>
<td>15.3</td>
</tr>
<tr>
<td>Employment 1996: only subsidized LLS (decomposition)</td>
<td>0.073</td>
<td>-</td>
</tr>
<tr>
<td>Employment 2001: only subsidized LLS (decomposition)</td>
<td>0.076</td>
<td>-</td>
</tr>
<tr>
<td>Employment Change 1996-01: only subsidized LLS (decomposition)</td>
<td>0.17</td>
<td>-</td>
</tr>
</tbody>
</table>

5. Results

We estimated the regression model (8) on the 365 LLS in the South of Italy. The dependent variable is total employment growth rate by LLS for the period (pre-post) 1996-2001.

The preliminary results of the OLS estimate indicates a significant effect of the policy intervention (Table 3). The variable related to the new jobs created by Law 488/92
normalized by employment in 1996, has a positive and significant coefficient, equal to 0.48. Therefore the model suggests that subsidies increase the total employment of about a half worker for each new job created. The transfer is not complete because the presence of a "substitution effect": the increase of employment in the subsidized firms partially "substitutes" job that could be created also in absence of incentives. The net impact of subsidization on job creation is equal to half of the gross impact. Moreover, the dependent variable present a clear spatial dependence that it is not captured by the other covariates and should properly specified (Table 4). The testing procedure cannot discriminate between the spatial error and the spatial lag specification; however, the introduction of the spatial lagged dependent variable eliminates the spatial dependence in the model.

In Table 5 we present the full estimation of the model, considering the spatial lag of the dependent variables and the covariates and using OLS, 2SLS e LIML estimators. For each model we test the spatial common factor restriction, i.e. the statistical significance of the difference between the coefficient of the spatial lag of the variable representing the level of subsidies and the coefficient related to the common spatial spillover effects.

For the 2SLS and the LIML specification we instrumented the spatial lag of the dependent variables using as instrument: the lagged dependent variables, the share of agricultural value added and its spatial lag, the growth rate in service value added and its spatial lag, the spatial lag of the new employment of Law 488/92. In both cases the model satisfies the Sargan’s statistic (Anderson-Rubin statistic in the case of LIML) on over identifying restrictions and the Anderson canonical correlations likelihood-ratio test of equation identification, i.e. that the excluded instruments are relevant.

The spatial common factor restriction is rejected in all the three estimated models. Therefore we observed significant spillover effects uniquely related to the subsidies. A simple evaluation of the subsidy specific spatial spillover effect shows that it is negative, quite small, included in the interval between -0.1 and -0.05. The results suggest the presence of a modest spatial crowding out effects of the subsidies: the increase in the subsidized employment (and investments) in a specific area reduces employment (and investments) in the neighbouring areas. The reason is that the subsidy reduces the cost of localization in the subsidized areas: if the cost of changing location is sufficiently low, the firms have the incentive to move (or to create new establishments) to the subsidized areas.
Table 3 – Preliminary OLS estimate of model (8) (dependent variable: employment growth rate in the period 1996-2001; t-statistics in parentheses)

<table>
<thead>
<tr>
<th>Variables</th>
<th>MOD. 1</th>
<th>MOD. 2</th>
<th>MOD. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged employment growth rate (1991-96)</td>
<td>-0.09</td>
<td>-0.09</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td>(-2.02)</td>
<td>(-2.18)</td>
<td>(-2.18)</td>
</tr>
<tr>
<td>Share of agricultural value added (1996)</td>
<td>0.13</td>
<td>0.19</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>(-2.49)</td>
<td>(-3.45)</td>
<td>(-3.33)</td>
</tr>
<tr>
<td>Growth rate of value added in service sector (1996-01)</td>
<td>0.16</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(5.02)</td>
<td>(4.14)</td>
<td>(4.00)</td>
</tr>
<tr>
<td>Unemployment rate (1996)</td>
<td>-0.29</td>
<td>-0.28</td>
<td>-0.21</td>
</tr>
<tr>
<td></td>
<td>(-4.15)</td>
<td>(-4.05)</td>
<td>(-2.79)</td>
</tr>
<tr>
<td>Dummy LLS n. 616</td>
<td>0.73</td>
<td>0.69</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>(6.42)</td>
<td>(6.20)</td>
<td>(6.20)</td>
</tr>
<tr>
<td>Share of new employment by 488/92 (on total employment 1996)</td>
<td>-</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.90)</td>
<td>(3.96)</td>
</tr>
<tr>
<td>Spatial lag of employment growth rate</td>
<td>-</td>
<td>-</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.86)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.21</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.19</td>
<td>0.22</td>
<td>0.20</td>
</tr>
<tr>
<td>Number of observations</td>
<td>365</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

Table 4 - Test of spatial dependence for model (8)

<table>
<thead>
<tr>
<th>Test of spatial dependence</th>
<th>MOD. 1</th>
<th>MOD. 2</th>
<th>MOD. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial Error</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagrange multiplier*</td>
<td>24.19</td>
<td>20.62</td>
<td>0.16</td>
</tr>
<tr>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.69)</td>
<td></td>
</tr>
<tr>
<td>Spatial lag</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagrange multiplier*</td>
<td>12.10</td>
<td>5.65</td>
<td>0.24</td>
</tr>
<tr>
<td>(0.00)</td>
<td>(0.01)</td>
<td>(0.62)</td>
<td></td>
</tr>
</tbody>
</table>

*p-value* between parentheses.
Table 5 – Full model estimation (dependent variable: employment growth rate in the period 1996-2001; t-statistics in parentheses)

<table>
<thead>
<tr>
<th>Variables</th>
<th>OLS</th>
<th>IV</th>
<th>LIML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged employment growth rate (1991-96)</td>
<td>0.56</td>
<td>0.93</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.34)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Share of agricultural value added (1996)</td>
<td>-0.15</td>
<td>-0.15</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.04)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Growth rate of value added in service sector (1996-01)</td>
<td>0.15</td>
<td>0.15</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>(0.4)</td>
<td>(0.04)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Unemployment rate (1996)</td>
<td>0.71</td>
<td>0.71</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>(0.1)</td>
<td>(0.11)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Dummy LLS n. 616</td>
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<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Share of new employment by 488/92 (on total employment 1996)</td>
<td>0.56</td>
<td>0.93</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.34)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Spatial lag of the hare of new employment by 488/92</td>
<td>-0.22</td>
<td>-0.26</td>
<td>-0.26</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.14)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>Common factor restriction</td>
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<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(0.42)</td>
<td>(0.62)</td>
<td>(0.64)</td>
</tr>
<tr>
<td>$\tau$</td>
<td>-0.09</td>
<td>-0.06</td>
<td>-0.06</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.26</td>
<td>0.26</td>
<td>0.24</td>
</tr>
<tr>
<td>Number of observations</td>
<td>365</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

6. Conclusion

In this paper we have focused on the evaluation of spatial effects of Law 488/92, the main policy instruments devoted to private capital accumulation in the South of Italy. The analysis is based on a non experimental statistical methods applied to a very disaggregated territorial grid. A spatial difference-in-difference model is estimated using different econometric methods, taking into account the diffusion of territorial spillovers across neighbouring areas. The identification strategy of the subsidies territorial effects is based on the introduction of spatial externalities in the spatial autoregressive model (Anselin, 2003). The presence of specific spatial effects of subsidies is tested on the reduced form of the model, evaluating the implicit common factor restriction.
Restricting the impact analysis of public subsidies to regional employment, we argued that the effect of the policy intervention is twofold: on one side, there is a direct effect on subsidized firms. The sign of the impact is generally positive, the output effect outweighing the substitution effect; on the other side, there is a crowding out effect across firms in the same area and across neighbouring areas. We proposed a new methodological approach to the evaluation of the spatial crowding out. The identification of the net crowding out spatial effect is based on the spatial common factor restriction applied to the subsidies spillover effects. The methodology allows disentangling the spatial spillovers generated by the subsidies to the spillovers attributed to the generic attraction effect between neighbouring areas.

The empirical application to subsidies financed by Law 488/92 shows the presence of a significant, even if modest, crowding out effect. Therefore, the policy intervention affects the location of the new investments, increasing the share of new employment localized in subsidized areas. The attraction of new investments from richest regions to the poorest ones is exactly the effect pursued by the policy maker. The question is if the subsidies lead to an efficient location of the firms or to spatial distortions, where the subsidies distort the decisions of firms. Glaeser (2001) argues that an efficient location means that firms choose location in such a way that maximizes total social surplus: “the benefits of a firm moving to a particular location should include the profits that the firm earns from the location, any external effects, and the consumer and/or producer surplus created by the location choice” (Glaeser, p.11). Therefore, if there are agglomeration externalities or externalities linked to the demand and supply of goods and services, both being the rationale for regional policies, subsidies are an important policy instruments to get the efficient location of firms. Glaeser (2001, p.12) also notes that “more generally, tax incentives will lead to efficient, not inefficient, location of firms if there are heterogeneous agglomeration effects across space”.

Our empirical application indicates the presence of subsidy specific spillover effects across areas. Therefore the results suggest that the evaluation of the spatial effect of the policy intervention should be based on the spatial net effect that considers the (generally) positive effects on the subsidized areas but also the crowding out effect in the neighbouring areas. The analysis shows that incentives attract skills and growth from nearest areas. The policy maker should consider if it is a suitable effect and should consequently adapt the policy intervention (for instance, increasing the spatial concentration of the subsidies).
Using a spatial approach, our study confirms that subsidies by Law 488/92 have a positive employment impact. The results are robust to different estimation methods and to the presence of spatial effects. Subsidies by Law 488/92 have effectively led to an increase in the number of employees in the subsidized LLS more than in the others. This is one of the expected effects of the incentive scheme (additional employment per unit of investment is one of the determining indicators for selecting projects). The analysis suggests that selective incentive policies like Law 488/92 appear to be useful and effective for regional development.
References


