

Giacomo, Giuseppe Di; Mazzola, Fabio

Conference Paper

Fiscal federalism, regional public investment and spatial interaction processes: the case of Italy

50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Giacomo, Giuseppe Di; Mazzola, Fabio (2010) : Fiscal federalism, regional public investment and spatial interaction processes: the case of Italy, 50th Congress of the European Regional Science Association: "Sustainable Regional Growth and Development in the Creative Knowledge Economy", 19-23 August 2010, Jönköping, Sweden, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/119039>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

FISCAL FEDERALISM, DYNAMICS OF CAPITAL PUBLIC EXPENDITURE AND SPATIAL INTERACTION PROCESSES: SOME EMPIRICAL FINDINGS FOR ITALY

Fabio Mazzola¹, Giuseppe Di Giacomo¹

¹ Università degli Studi di Palermo- Dipartimento di Scienze Economiche, Aziendali e Finanziarie (SEAF),
viale delle Scienze, 90128 , Palermo

ABSTRACT

A growing number of countries throughout the world are reconsidering the role and functions of the various levels of government in order to make public policies more effective in meeting the needs of citizens by firmly pursuing administrative devolution.

This paper analyses regional interactions in the dynamics of capital public expenditure based on the estimates of a dynamic gravity model (Dendrinos-Sonis,1990) using a new database on Italian Regional Public Accounts (RPA) for the 1996-2007 period. This empirical model allows to analyse both horizontal (i.e., between regions) and vertical (i.e., between levels of government) dynamic relationships in order to determine whether they are mainly of a competitive or a complementary nature. The implications of these results within the wider debate on fiscal federalism currently under way in Italy are assessed in the analysis together with the evaluation of the sensitivity of the results.

Formatted: Left: 2.5 cm, Right: 2.5 cm, Top: 2.5 cm

1. GAINS AND RISKS OF FISCAL FEDERALISM AND THE ITALIAN RECENT REFORM

Many countries are reconsidering the role and functions of the different levels of government in order to better meet citizens' needs. This trend is also confirmed by the larger financial autonomy granted to local governments in all developed countries. This trend is progressively spreading out to developing countries¹. Within this framework the most common option often considered is fiscal federalism. In Italy, for instance, the debate on federalism started with the reform of a part of Constitution, continued with the draft bill on fiscal federalism (Law no. 42/2009) and is now centered on the assessment of the economic impact of progressive administrative devolution. The reform can yield a profound change in the distribution of power between local and central governments thus favoring the transition towards a less centralized model which can favour a greater participation in policy-making. These changes pertain not only to the territorial dimension but also to the nature of both horizontal and vertical flows between the different levels of government.

According to most economic literature, the potential benefits of a federal reform are not always greater than the possible costs. A recent survey on the main empirical results (Rodriguez-Pose and Gill, 2005) has shown that: a) the debate has progressively moved towards economic themes thus overshadowing historical, ethnolinguistic and sociocultural considerations; b) the "potential economic dividend" that can be gained from a federal reform in terms of greater efficiency, transparency and innovation in providing public services cannot be taken for granted, and is not necessarily distributed throughout the various regions evenly.

The economic literature on federalism is essentially based on the path-breaking contribution by Tiebout (1956) on local public goods² who, in response to Samuelson, pointed out the possibility of finding a market mechanism for efficiently providing public goods and overcoming *free-riding* issues. As known, Tiebout's model proposed a form of competitive federalism based on the perfect mobility of citizens (*foot voting*). Indeed, in choosing to settle in local communities that maximize their preferences over a bundle of services and taxes citizens allow for the improvement of the system efficiency.

The model proposed by Tiebout was later extended by many authors who integrated the mechanism of the perfect mobility of residents with other features such as, for

¹ According to Blochligher (2004), the degree of decentralization in OECD countries has progressively increased in recent years and varies from 6% to 60% for the local government expenditure and from 3% to 50% in terms of incidence on local taxes. In Europe (Briotti, 2008) the situation is diversified since some countries (Belgium, Germany, the Netherlands, Finland and Italy), have government expenditure levels below 30% and some others, such as United Kingdom, Portugal and Greece over 40%.

² By introducing a principle of competition between local governments and the possibility of foot voting for citizens, Tiebout's model proved that it is possible at a local level to achieve an efficient distribution of public goods.

instance, majority voting mechanisms (Gans and Smart, 1996), or funding of public spending by taxing real estate (Nechyba, 1997). Another line of research (Oates, 1972; Oates and Wallis, 1988; Oates, 1999) pointed out the greater ability to represent local interests in a decentralized context and the possibility that more decentralization would favour greater responsibility by local *policy makers* because of the greater *accountability* for their actions (Lockwood, 2005). In addition, Sato (2003) has proven that greater fiscal devolution (both on the revenue and expenditure sides) contributes to reduce the rent-seeking distortions by pressure groups. On the contrary, Tanzi (1995) argues that, especially in developing countries, policy-makers are more vulnerable to *rent-seeking* at a local level, as they are closer to residents' demand.

An extensive literature has also analyzed the interactions between the degree of administrative decentralization and economic growth (Thiessen, 2001; Davoodi and Zou, 1998; Iimi, 2005). Empirical results on this issue, however, are rather mixed and heavily affected by the variables used to "measure" the degree of administrative decentralization³ (Thornton, 2007), the dataset used and the level of territorial aggregation (cross-country or regional).

At the same time, various authors (Treisman, 1999, 2002, Prud'homme, 1995; Tanzi, 1995, 2008) showed that a federal reform carries risks in terms of efficiency and can contrast with cautious fiscal policies. Other authors (Shah, 2005) reached, instead, opposite conclusions empirically demonstrating that greater devolution can yield a greater attention to budget balancing at all levels of government.

In the field of urban economics, empirical approaches have described alternative forms of competition between local jurisdictions in various fields such as taxation, welfare policies, environmental policies, etc (*yardstick competition*).. In particular, two different models (the *spillover*⁴ and the *resource-flow*⁵ models) have empirically measured the effect of strategic interaction between the various levels of territorial government. These approaches estimate a reaction function which represents the best response of a local jurisdiction to the policy chosen by other jurisdictions. In Italy, these models have shown that municipalities, under certain conditions, showing that (re-election of the mayor), are affected by the same fiscal decisions made by neighboring jurisdictions in defining the levels of local taxation (Bordignon et al., 2003). Further insight has been found on the interaction between the

³ In this regard, Thornton (2007) showed that empirical estimates on the interaction between growth and the degree of fiscal decentralization are heavily affected by the choice of the variables used to measure the degree of financial autonomy of local administrations. In particular, using a sample of nineteen OECD countries and considering only the revenues resulting from actual fiscal autonomy, the author showed that the positive interaction between economic growth and decentralization is no longer statistically significant.

⁴ See Murdoch, Sandler and Sargent (1997) and Fredriksson and Millimet (2002)

⁵ See Wildasin (1986), and Brueckner (2000)

efficiency in the provision of public services and the degree of decentralization. The empirical contributions on this issue (Balaguer-Coll, Priore et al., 2009; Revelli, 2008) tend to stress the positive correlation between the degree of administrative decentralization and the efficiency/quality in providing public services.

Of course, coordination between different levels of government can become more complex in a federal system and in the case of imperfect local governance there can be a loss in efficiency in the transition from the central to the regional level.

Therefore, in order to maximize the *economic dividends* from a federal reform, a thorough preliminary analysis needs to be carried out on the main economic and institutional characteristics, which play a central role in the reform process.

For instance, in Italy, the recent reform on fiscal federalism has focused on what the draft bill calls the “*determination of the standard costs and needs*” which represents the yardstick for comparing and assessing public policy. Based on this criterion, the basic levels of services relating to civil and social rights and the basic functions of local authorities are defined. Regional and local administrations are not only compared each other on a single assessment criterion basis (standard cost and need), but they are judged or can be judged by citizens on the basis of the correlation between the fiscal burden and the benefits from services offered in order to favour the correspondence between financial and administration accountability.

In particular, the central and the regional governments must define together the basic levels of assistance (LEA), the basic levels of services (LEP) and the standard costs for each basic public service.

At a first view, the federal reform allows for a comparison between regions based not only on tax liability, but also on the minimum level of basic public services offered thus comparing the efficiency of each region in providing these services. However, there is still no mutual definition of the set of indicators applied in defining the standard costs. According to the draft bill, the expenditures which cover the standard costs must be funded by regional tax revenues and by a centralized “equity” fund. The concept of equity should take into account not only income gaps but also other regional gaps (i.e., infrastructure). The measure of such gaps, however, is not always straightforward. The infrastructure gap, for instance, cannot be limited to a mere analyses of different endowments. With regard to transportation, this gap should include both external and internal accessibility. Depending on which indicator is applied, the financial value of the amounts transferred to less efficient regions to cover

essential services can differ. Also, the very concept of “essential service” has generated major disputes. The draft bill has identified healthcare and welfare among the basic services. But this force to assess the link between environmental damage and the collection of excise duties. This issue was raised by some autonomous regions with regard to the industrial complexes located in their territory.

As for investment expenditures, the draft bill does not explicitly mention any mechanism for repartition of EU and national development funds and omits to consider the distribution of ordinary public expenditures across regions.

The focus of this paper is to add another puzzle to the definition of a correct fiscal federal reform, by accounting for interactions in the transmission of capital public expenditures across regions. Within this framework, the rest of the paper is divided into two parts. The first part (sections 2 and 3) describe the main features of the database and the dynamic gravity model used in the empirical analysis. The second part (sections 4 and 5) shows the main results from the econometric analysis and offer the main *policy* implications.

2. TRENDS IN CAPITAL PUBLIC EXPENDITURE BETWEEN 1996 AND 2007

The previous section showed that the analysis of the dividends from a federal reform needs to take into account not only regional revenues, but also public spending and particularly capital expenditure, as it expresses a region's ability to implement policies capable of supporting its medium- and long-term growth.

Capital public expenditure is especially important as it includes all public investments, ranging from ordinary investments as in the case of expenditure on education and defence to more long run regional investments such as private enterprise support and tangible or intangible infrastructures. Moreover, capital public expenditure can be further divided by level of government and by economic sectors and macro-categories⁶.

In Italy, a recent database on Territorial Public Accounts (CPT) by the Ministry of Economic Development (MISE) allows for a reconstruction of the major trends in regional spending and revenues in the 1996-2007 period. The degree of territorial and sectoral disaggregation in the *database* enables to conduct analyses of all revenues and expenditure of local and regional public authorities not only with regard to Public Administration, but also

⁶ The empirical analysis has taken into consideration capital public expenditure instead of investment spending because this aggregate appeared to better overlap with the sectoral set of intervention by EU and national cohesion and development policies.

the Wider Public Sector taken as a whole⁷. In addition, it is possible to break down capital public expenditure by sectors and categories. This information is extremely valuable in determining the quality and quantity of public investments in each region. One important use of the new database is the assessment of the additionality of European regional policy in order to avoid that the considerable amount of resources made available through Structural Funds is used for more “traditional” and ordinary interventions.

The data base is developed starting from the balance sheets of each institution or from public sources having the same nature. Each institution is then considered as a source of final spending by eliminating the flows to other units belonging to the same group of reference.

The database is especially useful from a federal perspective to determine the behavior of the main variables in public spending at a regional level. In the period 1996-2007⁸ Italy moved towards a more federalist economic system after the reform of Chapter V of the Constitution (Barca, Volpe, Ravoni, 2003).

As for capital expenditure, however, other major trends have occurred. First of all, there has been a reduction in capital public expenditure in absolute terms. A comparison of the second five-year period (2002 – 2007) with the previous one (1996 – 2001) (table.1) shows a substantial reduction in capital public expenditure in almost all Italian regions. Looking at the data by sector, it can be shown that many sectors registered even a reduction in nominal terms. The reduction in capital public expenditure in the regions of southern Italy was greater compared to the other regions as confirmed by a recent report on Italian local public finance⁹ (Isae, Irpet and Ires, 2009). Another interesting phenomenon is the increase in regional and local expenditure, which is consistent with the federal reform processes under way (tab.2). The highest growth rates in regional and local spending are found for central and northern regions. In southern regions and especially in the autonomous ones (Sicily and Sardinia), there has been a reduction in the *regional* share of capital public expenditure even though, in some of these regions this reduction was slightly offset, especially for some sectors, by a slight increase in the share of *local* administrations. A third phenomenon to be

⁷ The Wider Public Sector extends the definition of Public Administration to include, both at a central and local level, institutions that: a) produce public utility services; b) are directly or indirectly controlled by public institutions either in management or in financing

⁸ The data are updated on an annual basis with a delay of about 12-18 months with respect to the period to which they refer.

⁹ Indeed, the most recent available data on credit granted to local bodies have registered a sharp reduction in all Italian regions. Starting from 2007 the situation has also worsened due to a substantial reduction in the funding of local authorities investments of that continued in the following two-year period.

considered is the greater relative importance of not ordinary (Community and national) investment expenditure at the expense of the “ordinary” one (Mazzola,2009).

An interesting question is whether the trend in the reduction in capital and investment public expenditure can be slowed down or further accelerated by a federal fiscal reform. It is reasonable to believe that the use of investment funds for ordinary spending will increase with a move towards a federal system but more intensive fiscal federalism could also slow down the shift of resources from investments to current spending. In this respect, the federal reform can offer a great opportunity. A consolidation in investment spending could also be favored by introducing tax benefit mechanisms, which could be linked to the effective gaps of the various regions in order to avoid triggering processes of fiscal competition, which could prove to be detrimental to the overall balance of public finance. By a different token, an indiscriminate reduction in regions with less tax liability that would heavily hit spending in investments should be absolutely discouraged, if it could be proven that investment spending triggers a multiplicative process in other regions favoring the growth of the federal system as a whole. It is hence necessary to study the spatial interaction of regions in the propagation of spending in investments in order to highlight the bonds of positive and negative interactions existing among the various areas of the federal system.

In this regard the debate on the benefits from a fiscal federalism reform should increasingly shift from the strictly accounting aspects associated with the advantages and disadvantages resulting from the change in the allocation of tax revenues to more typically broader economic impacts which fully consider both the indirect and the induced effects.

<<insert tables 1,2 here>>

3. THE DENDRINOS-SONIS MODEL AND ITS APPLICABILITY TO POLICY VARIABLES

In order to shed light into the spatial interaction process in capital public expenditure dynamics, we built an interaction model of this variable by following the Dendrinos-Sonis approach. This dynamic gravity model was introduced to study the dynamics of urban population changes (Dendrinos and Sonis, 1988). The model was then applied to economic variables by, among others, Hewings et al. (1996) to study the trend in per-capita GDP growth rates at a regional level. The central idea is that of considering regional/urban growth in terms of the interaction among different regions/cities. In particular, the model allows for a dynamic analysis of the vertical and horizontal interactions among territorial aggregates of differing

sizes (NUTS1-NUTS2-NUTS3). The observed interactions can identify possible forms of competition or cooperation between territorial areas if the growth in GDP in an area has a positive or negative effect on the growth in GDP in other areas. Unlike spatial econometrics models, the Dendrinos-Sonis model allows for the endogenous modeling of the geographical effects without imposing *a priori* a spatial contiguity matrix¹⁰.

One of the main shortcomings of this model is, however, the choice of the area serving as a numeraire, i.e. the region used as a *benchmark* for all the other areas. The problem of choosing the numeraire, though addressed by several authors (Kamarianakis and Kaslis 2005; Postiglione and Hewings, 2008) does not have a general solution and must be addressed on a case-by-case basis depending on the purpose of the analysis.

The model is formalized as follows. Assume that $x_i(t)$ is the public capital expenditure variable expressed in relative terms, namely in terms of the regional total share of expenditure out of the national total share at time t . In the n -region case, the model can be written as follows:

$$x_i(t) = [x_1(t), x_2(t), \dots, x_n(t)] \quad i=1,2,\dots,n; t=1,2,\dots,T \quad (1)$$

Therefore, the relative dynamics of the model in each period t can be re-written as follows

$$x_i(t+1) = \frac{F_i[x_i(t)]}{\sum_{j=1}^n F_j[x_j(t)]} \quad i=1,2,\dots,n \quad (2)$$

where $0 \leq x_i(t) \leq 1$, $F_i[x_i] \geq 0$ and $\sum_{i=1}^n x_i(0) = 1$.

By choosing the numeraire region (region 1) and comparing the various regional shares to this region we obtain:

$$y_j[t+1] = \frac{F_j[x_j(t)]}{F_1[x_1(t)]} \quad \forall j = 2, \dots, n \quad (3)$$

¹⁰ The spatial contiguity matrix allows for the conversion of the initial data based on their geographical “vicinity”. In particular, contiguity matrices can be built based on the proximity of spatial units or with methods based on distances. The spatial dependence is anyhow modeled by defining *ex ante* the weights of the contiguity matrix.

The system of equations (2) can then be re-written as follows:

$$x_j(t+1) = x_j(t) \prod_{k=1}^n G_j(x(t)) \quad (4)$$

where $j=2, \dots, n$ which yields:

$$x_j(t+1) = x_j(t) G_j[x(t)] \quad (5)$$

Assuming that:

$$G_j[x(t)] = A_j \prod_{k=1}^n [x_k(t)]^{a_{jk}} \quad (6)$$

with:

$$a_{jk} = \frac{\partial \ln G_j[x_t]}{\partial \ln x_{kt}} \quad (7)$$

while A_j is a constant representing the locational advantage of region j compared to the numeraire region determined by factors *other than* the public capital expenditure:

We can express equation (6) in log-linear form, i.e.:

$$\ln x_{j,t+1} - \ln x_{j,t} = \ln A_j + \sum_{k=1}^n a_{jk} \ln x_{k,t} \quad (8)$$

In this form, the model captures the interactions among the different regions of the system considered, which are, to a certain extent, competing to increase their own share of public capital expenditure ($x_{i,t}$).

The relative performance of each region compared to the *benchmark* depends on two factors: (i) the comparative advantage of each region, (ii) the interactions among the different regions as captured by coefficients $a_{j,k}$ which account for the pseudo-elasticities, namely the percentage change in public capital expenditure in a j -th region compared to region 1, vis-à-vis a 1% variation of expenditure in the k -th region,

As reaffirmed by Hewings et al. (1996), it is assumed that the interaction is the substitute of a whole set of mainly non-measurable flows whose macro-effects can be approximated by a spatial interaction model,

The main question in our analysis is whether the Dendrinos-Sonis model, usually centered on the spatial-temporal dynamics of socio-economic flows (population, per-capita GDP), can also be applied to policy variables and in particular to public expenditure by the different regions. For instance, it is evident that public capital expenditure can vary in absolute terms without particular constraints while the regional share of public capital expenditure must be considered, after a first rough estimate, within a zero-sum game in which some regions gain and others lose from a different distribution. The point is, however, that in a federal perspective the ideal distribution should not be considered in a static context in which taxation or investment decisions of each region are taken as exogenous, but rather in a dynamic one in which the potential interactions among the regions in the system are taken into account in order to identify whether the positive variations in a region's share in one year can have, over the following year, a positive or negative effect on the relative distance between the regional share and that of the benchmark region.

The applicability of the model to public expenditure variables implicitly assumes that decisions have a spatial-temporal effect that goes beyond the initial moment in which the policy is implemented. From a chronological point of view the expenditure decisions have bigger impacts since they usually concern long-term investment projects that refer to multi-year plans and are often determined by institutional decisions that do not change in the short run. From a spatial perspective, taking the region with the highest expenditure as the benchmark, an increase in the share in regional public expenditure in year t could favor, due to the persistence effects, a reduction in year $t+1$ of the relative distance of this share from that of the numeraire region. The gap could also grow due to the dispersion effects on expenditure if the increase in the share of public expenditure has a very positive impact on the numeraire region. In terms of the interactions with regions other than the numeraire, in case of positive interdependencies between the i -th region and j -th region (complementary relations) an increase in the expenditure share of the i -th region can favor processes that narrow the gap of the share of the j -th region from that of the numeraire region. Alternatively, the gap may increase in case of negative interdependencies between the two regions (competitive relations). This means that the decision to increase or decrease the expenditure shares of some regions must be analyzed from a more comprehensive perspective rather than from a merely accounting one by considering the dynamic impacts of an allocation decision that are implicitly associated with the multiplicative forces of the investment decisions.

More specifically, there could be an interaction effect that decrease with distance with a sign that that can take different values depending on the region considered. As for vertical relations, we might expect a predominance of competitive relations particularly for the interactions between the regional and the central levels.

In our empirical analysis, the use of the new database allows for an assessment of the decisions relating to public expenditure in Italy covering a time-frame characterized by some reforms that go in a federalist direction. In particular, the analysis will also involve the dynamic interactions between the three levels of government considered by the database (central administration, regional administrations, local administrations). Based on a Dendrinis-Sonis (1988,1990) approach, evidence of possible forms of vertical and horizontal competition or cooperation interactions will be offered for the capital expenditure pertaining to different sectors in the database. The empirical approach makes it possible to distinguish the cases in which interdependency in public capital expenditure decisions can be approximated by a zero-sum game with some institutional levels managing to gain financial resources at the expenses of other institutions from other cases in which the interdependence has beneficial effects on the whole system because it allows for a long-term rebalancing of the expenditure shares.

4. EMPIRICAL ANALYSIS

4.1 Model specification

In our analysis we estimated a multivariate SUR (*Seemingly Unrelated Regression*) model built on a system of seemingly unrelated linear equations (Zellner, 1962). In our case, Zellner's method can take the initial form of a system of equations (one for each region¹¹ and/or group) in which the variables of each equation are represented by a series of length T . In order to increase the sample size we then considered as different observations those provided by different sectors¹². As for simultaneity, the error terms in the equations related to each must be considered as correlated, since they are affected by (possible common) factors

¹¹ The regions considered were sixteen since smaller regions were grouped together on the basis of their territorial proximity.

¹² Due to sectoral interdependence, this procedure can introduce autocorrelation errors in each equation. A partial solution to this problem has been given by grouping together some of the sectors in the database. The results of the estimates showed substantial negative autocorrelations (with rho greater than 0.10) only in the 18% of the estimated equations.

left out from the list of independent variables of the single equations. Due to the potential correlation between the errors across regional equations, it seemed appropriated to adopt a SUR approach. In estimating our model Lombardy was chosen as the numeraire region because of its highest level of public capital expenditure throughout Italy.

Our estimates are based on annual observations of the territorial public account (TPA) database from 1996 to 2007. The estimated log-linear model derives from the one in equation (8), such as:

$$\ln y_j(t+1) - \ln y_1(t+1) = \ln(A_j) + \sum_{k=1}^4 a_{jk} \ln y_k(t) \quad j=2, \dots, 16 \quad (9)$$

in which: $y_j(t)$ is the share of public capital expenditure of the j -th region at time t ; “1” is considered the benchmark region (or numeraire); a_{jk} is the pseudoelasticity, and A_j captures the specific characteristics of the region with respect to public capital expenditure. Therefore, j and k are geographical units of the same (regional) level. The rise in public capital expenditure is considered in relative terms, i.e., vis-à-vis the one in the region taken as a benchmark. Therefore, the choice of the numeraire region is crucial for a proper model specification.

A positive value of coefficient a_{jk} expresses a complementary relation between the two regions (j,k), while a negative value expresses a competitive relation between the same regions.

Initially, we considered only the horizontal relations between the various regions. In order to consider different levels of territorial aggregation, we extended the model according to the literature (Postiglione, Hewings, 2008) including spatial effects at different geographic levels. In this regard, the equation becomes:

$$\ln y_j(t+1) - \ln y_1(t+1) = \ln(A_j) + \sum_{k=1}^4 a_{jk} \ln y_k(t) + \sum_{l=1}^3 a_{jl} \ln y_l(t) \quad \text{with } j=1, \dots, 16 \quad (10)$$

in which the last term takes into account the higher level interaction (e.g., group) compared to the k regions.

Specification (9) also allows for the analysis of various levels of government making it possible to distinguish between the public capital expenditure of central, regional and local administrations.

In order to assess the sensitivity of the results, consistently with the existing literature, we estimated models with different numeraires.

4.2 Results

The estimates from the empirical analysis are shown in table 3 while table 4 offers a summary overview of the results which highlights only the (positive or negative) sign of the impacts.

As for the general effects, it should be noted that the impact with the greatest intensity in terms of the magnitude of the coefficients occurs for the shares of public capital expenditure referring to the same region (direct effects). The coefficients for these shares are positive and significant with only one exception. This rather self-evident result confirms that the growth in public capital expenditure mainly depends on what happens within the region, though not exclusively. Complementary effects normally do exist between regions belonging to the same geographical group or linked by production interdependency relations. Moreover, the effects of an increase in regional spending are not always bidirectional: a relative variation (compared to the numeraire region) in the public capital expenditure share of a small region is positively correlated with the variation in the public capital expenditure share of a neighboring larger region, while the opposite is not true (tab.3)

<<insert table 3 here>>

As for the effects between territorial groups, the results show that the regions of northwestern Italy develop complementary relations with the northeastern group, while the effects of other groups are positive but not significant (tab.4). The northeastern regions, in turn, are positively affected by the variation in the share of the northwestern regions but they also develop complementary relations with other groups, even though only in two cases (southern Italy with Emilia and central Italy with Veneto) the coefficients are significant. The regions of central Italy seem to develop competitive relations (with significant coefficients) with northwestern Italy, while they have no significant relation with the other two groups with the exception of Lazio whose relative distance from the benchmark region is positively correlated with the share of public capital expenditure in southern Italy. Finally, the southern regions develop very significant competitive relations with the three external geographical groups. These results seem to point out that the allocation of public capital expenditure between southern Italy and the rest of the country can lead to some sort of asymmetry in the effects. Namely, an increase in the share in the South might elicit positive effects in the regions of central and northern Italy though in limited cases, while the growth in the share of the central and northern groups has diverging effects on southern regions with respect to their distance from the benchmark region.

<<insert table 4 here>>

By analyzing the interaction between regions in the same geographical group, it must be noted that the northwestern and the northeastern regions have usually bidirectional complementary relations. On the contrary, the central regions have either extremely competitive interactions or are generally unaffected by the expenditure in the other regions in the same group, while the southern regions are characterized by extremely diversified internal dynamics with a general predominance of competitive or insignificant relations. Complementary relations are frequent only in Apulia and in smaller regions (i.e., Basilicata).

Our analysis confirms that the northern regions show greater interdependence vis-à-vis southern regions. The model also provides useful hints with respect to the current debate on development policy in Italy. Indeed, an increase in public capital expenditure for the larger southern regions (Apulia, Sicilia and Campania) seems to have on average a positive impact on the spending in most of the remaining southern regions.

The effects among regions seem to be positive and significant if the shares of public capital expenditure of the other groups are excluded from the set of explanatory variables and if we limit our observation to the interactions inside the same group.

The final part of our empirical analysis dealt with two remaining issues. Firstly, the issue of sensitivity of the estimates to the change in the numeraire was addressed. We therefore estimated the model of tab.1 by taking the Lazio region instead of Lombardy as the numeraire. The results of the estimates in tab.5 show only the qualitative aspects and prove an adequate overall stability of the coefficients confirming most of the signs of the previous analysis and a substantial invariance of the average degree of significance across coefficients. In any case, the positive effect of the increase in the public capital expenditure share of the southern group on central and northern regions appeared to be amplified.

<<insert table 5 here>>

Finally, tab. 6 shows an analysis of the spatial-temporal dynamics of the share of public capital expenditure in the various geographical groups at different levels of government. In this case the numeraire was the public capital expenditure of the Central Administration in the northwestern group. The table clearly shows that almost all the direct impacts are positive and significant.

<<insert table 6 here>>

As regards the central level, there are differences between the various geographical groups concerns the effects of a variation in the public capital expenditure in the other groups. For instance, the southern group shows complementary relations with all the other groups, while the northeastern group shows a prevalence of competitive relations and the central Italy group shows complementary relations with the northeastern group and competitive relations with the southern and northwestern groups. The groups also show marked differences in the interactions between the regional share and the Central Administration share. For instance, the central Italy group shows complementary relations while the northeastern group shows competitive interactions between the regional and the Central Administration shares.

As for the regional government level, the gap between the shares of the various groups and the benchmark shows that the northwestern and northeastern groups have a complementary interaction with all the geographical groups except for the central Italian one. In the South there is no clear evidence on the direction of the impact with the exception of the relationship with the northeastern group which appears to be negative. In the different groups, the impact of the variation in the share of the Central Administration on the variation in the gap of the regional share compared to the benchmark is negative, thus demonstrating that administrative devolution does not have positive interactions among all levels of government.

At the local level, the share of public capital expenditure is not affected much by the variation in other shares apart from the Southern case where there is a complementary interaction between the regional and local levels and from the the northwestern group where there is competitive interaction between these shares.

5. CONCLUSIONS

The analysis of the spatial-temporal dynamics of public capital expenditure has implicitly shown the need for greater insight into the possible consequences of federalism which has already extensively studied in the literature. The “economic dividend” from a fiscal federalism reform, indeed, cannot be taken for granted and the overall impact is affected by the institutional and economic conditions characterizing the country. The challenges posed by the new federal reform in Italy must necessarily consider the potential dynamics that may be triggered at a regional level in terms of the main variables involved in the reform.

The results have shown a composite framework of interactions among the various regions and groups, which, on the one hand, confirms the concerns for a worsening in the competition between northern and southern regions in Italy but, on the other, envisage forms of complementarity, which should be taken into due account in implementing federalism. Therefore, a federal system should be designed on the basis of the overall effects generated in

the whole regional system and a deviation in the expenditure levels compared to the benchmark could actually hide in some cases positive spillover phenomena towards other regions. Another interesting aspect arising from the analysis of the empirical model concerns the national debate on the development of southern Italy. In this regard, the estimated model suggests that the possible diffusion effects should be included, as these may arise from an increase in the public capital expenditure shares of the larger southern regions.

References

- Balaguer-Coll M. T., Prior D., Tortosa-Ausina E. (2009), "Decentralization and efficiency of local government", *Annals of Regional Science*, online: DOI 10.1007/s00168-009-0286-7
- Barca, Cappiello, Ravoni, Volpe (Eds) (2006), *Federalismo, equità, sviluppo. I risultati delle politiche pubbliche analizzati e misurati dai Conti Pubblici Territoriali*, Bologna, Il Mulino
- Bergstrom, T.C., and R.P. Goodman (1973), "Private demands for public goods," *American Economic Review* 63, 280-296.
- Black, D. (1948), "On the rationale of group decision making", *Journal of Political Economy* 56, 23-34.
- Bordignon M., Cerniglia F., Revelli F. (2003), "In search of yardstick competition: a spatial analysis of Italian municipality property tax setting", *Journal of Urban Economics* 54, 199–217
- Bowen, H. (1943), "The interpretation of voting in the allocation of economic resources," in *Quarterly Journal of Economics* 58, 27-48.
- Briotti M.G. (2008), "Assetti di bilancio e indebitamento pubblico nella finanza decentrata in alcuni paesi europei", *La Finanza Locale in Italia* (ISAE-IRES-IRPET-IRER and SRM), Milano, Angeli.
- Brueckner J.K. (1998), "Testing for Strategic Interaction Among Local Governments: The Case of Growth Controls", *Journal of Urban Economics* 44, 438–467
- Brueckner, J.K. (2000), "A Tiebout/tax-competition model", *Journal of Public Economics* 77, 285-306
- Brueckner, Jan K. (2003). "Strategic interaction among governments: an overview of empirical studies", *International Regional Science Review* 26, 175-88.
- Davoodi H., Zou H. (1998), "Fiscal decentralization and economic growth: a cross-country study," *Journal of Urban Economics* 43, 244–257.

Dall'erba S, Percoco M (2003) "North-South disparities, complementarity and competition within Italy", *Scienze Regionali - Italian Journal of Regional Science*, (2), 29-49

Dendrinos, D. S. and Sonis, M. (1988), "Nonlinear relative discrete population dynamics of the US regions", *Journal of Applied Mathematics and Computation*, 23, 265-285.

Dendrinos DS, Sonis M (1990), *Chaos and socio-spatial dynamics*. Springer, Berlin

Fredriksson P.G, Millimet D.L.(2002),"Strategic Interaction and the Determination of Environmental Policy across U.S. States," *Journal of Urban Economics* 51(1), 101-122

Gans, J.S. and M. Smart (1996), "Majority voting with single-crossing preferences" , *Journal of Public Economics* 59, 219-237

Hewings, G. J. D., Sonis, M., Cuello, F. A. and Mansouri, F.(1996), "The Role of regional interaction in regional growth: competition and complementarity in the US regional system", *Australian Journal of Regional Studies*, 2, 133-49.

Isae-Irpet-Ires (2009), *Rapporto 2009 sulla finanza locale*, Roma.

Kamarianakis Y, Kaslis V (2005) "Competition-complementarity relationship between Greek regional economies", Working paper, ERSA, Free University of Amsterdam.

Iimi A. (2005), "Decentralization and economic growth revisited: an empirical note", *Journal of Urban Economics* 57, 449-461

Lockwood B. (2005), *Fiscal federalism and electoral accountability*, working paper, University of Warwick

Mazzola F. (2009), *I Fondi Strutturali e le politiche di sviluppo*, in Busetta P. (Eds), *Sicilia 2015*, Liguori Editore, Napoli

Ministero dello sviluppo economico,. *Guida ai conti pubblici territoriali (CPT), Aspetti metodologici e operativi per la costruzione di conti consolidati di finanza pubblica a livello regionale*

Murdoch J.C. Sandler T. e Sargent K., , (1997) "A Tale of Two Collectives: Sulfur versus Nitrogen Oxides Emission Reduction in Europe", *Economica*, Vol. 64, 1997, 281-301

Nechyba, T.J. (1997), "Existence of equilibrium and stratification in local and hierarchical Tiebout economies with property taxes and voting," *Economic Theory* 10, 277-304.

Oates, W.E. (1972), *Fiscal Federalism*, Harcourt Brace Jovanovich, New York.

Oates,W.E.(1999),. "An essay on fiscal federalism", *Journal of Economic Literature* 37, 1120-1149.

Oates, W.E. , Wallis W.(1988), *Decentralization in the Public Sector: An Empirical Study of State and Local Government* , in Harvey Rosen (ed.). *Fiscal Federalism*, NBER, University of Chicago Press, 1988

Postiglione P., Hewings (2008), Hierarchical spatial interaction among the Italian regions: a nonlinear relative dynamics approach, *Journal of Geographical Systems* 10, 369–382

Prud'homme, R. (1995) “ On the dangers of Decentralization.”, *World Bank Economic Review* 9

Revelli F. (2008), Spend more, get more? An enquiry into English local government performance, working paper n.4, Dipartimento di Economia “S.Cognetti de Martiis” Università di Torino.

Rodríguez-Pose e Gill (2004), “Is there a global link between regional disparities and devolution?” in *Environment and Planning* N.36, 2097 –2117

Rodríguez-Pose e Gill (2005), On the “economic dividend” of devolution, *Regional Studies*, 39 , 405–420

Sato M. (2003), “Tax-competition, rent-seeking and fiscal decentralization”, in *European Economic Review* 47, 19–40

Shah, Anwar, 2005. "Fiscal decentralization and fiscal performance," in *Policy Research Working Paper Series 3786*, The World Bank, 1-55

Tanzi V (1995) Fiscal federalism and decentralization: A review of some efficiency and macroeconomic aspects. In: Bruno M and Pleskovic B (eds.) *Annual World Bank Conference on development economics*. World Bank, Washington, DC, 295–316

Tanzi V. (2008), “The future of fiscal federalism”, *European Journal of Political Economy* 24, 705–712

Thiessen U. (2001), *Fiscal Decentralisation and Economic Growth in High Income OECD Countries*, European Network of Economic Policy Research Institutes, Working Paper No. 1.

Thornton J.(2007), “Fiscal decentralization and economic growth reconsidered”, *Journal of Urban Economics* 61, 64–70

Tiebout, C.M. (1956),. “A pure theory of local expenditures”, *Journal of Political Economy* 64, 416–424.

Treisman D. (1999), *Decentralization and Corruption: Why are Federal States Perceived to be More Corrupt*, working paper, Annual Meeting of the American Political Science Association, Atlanta, September 1999.

Treisman D (2002) Decentralization and the quality of government. Working paper, Department of Political Science, UCLA, Los Angeles

Wildasin, D.E., 1986. Urban public finance. Harwood Academic Publishers, Chur, Switzerland.

Zellner, A. (1962), “ An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias.”, *Journal of the American Statistical Association* 57, 348-368.

Table 1 Capital Expenditure dynamics of Italian regions 1996-2001 vs 2002-2007

Regions	Average Total Government Capital Expenditure 1996-2001	Average Total Government Capital Expenditure 2002-2007	Percent Change	Average Central Government Capital Expenditure 1996-2001	Average Central Government Capital Expenditure 2002-2007	Percent Change	Average Regional Government Capital Expenditure 1996-2001	Average Regional Government Capital Expenditure 2002-2007	Percent Change	Average Local Government Capital Expenditure 1996-2001	Average Local Government Capital Expenditure 2002-2007	Percent Change
Piedmont	5173.8	6048.0	16.9	3092.3	3511.9	13.6	613.6	933.2	52.1	1468.0	2210.7	50.6
Valle d'Aosta	572.8	576.4	0.6	132.5	163.6	23.5	342.8	355.2	3.6	97.6	140.8	44.3
Lombardy	8674.5	11263.8	29.8	4717.1	5218.9	10.6	976.8	1519.1	55.5	2980.7	5412.3	81.6
Autonom. prov. of Bolzano	1479.3	1492.1	0.9	326.0	319.6	-2.0	747.4	871.8	16.6	405.9	540.5	33.2
Autonomous prov. of Trento	1441.6	1693.2	17.4	302.1	297.2	-1.6	705.4	1120.1	58.8	434.2	580.6	33.7
Veneto	4296.2	5232.4	21.8	2467.9	2701.3	9.5	582.4	958.5	64.6	1245.9	2164.0	73.7
Friuli Venezia Giulia	1992.9	2277.7	14.3	975.3	981.6	0.7	500.8	707.1	41.2	516.9	811.4	57.0
Liguria	2445.1	2574.9	5.3	1590.0	1517.3	-4.6	172.2	359.0	108.5	683.0	935.4	37.0
Emilia Romagna	4665.3	5605.9	20.2	2729.1	3197.3	17.2	596.1	902.5	51.4	1340.1	2058.0	53.6
Tuscany	4278.5	4651.5	8.7	2574.8	2761.7	7.3	474.6	612.6	29.1	1229.0	1722.9	40.2
Umbria	1342.5	1748.7	30.3	782.1	961.7	23.0	209.0	209.5	0.2	351.3	770.5	119.3
Marche	1835.9	1975.5	7.6	1041.7	1151.4	10.5	274.9	249.0	-9.4	519.3	759.1	46.2
Lazio	11798.7	12504.0	6.0	10054.7	10154.4	1.0	367.3	605.0	64.7	1376.8	2188.8	59.0
Abruzzo	1989.6	1959.4	-1.5	1316.9	1225.0	-7.0	305.1	351.4	15.2	367.7	539.1	46.6
Molise	737.3	642.7	-12.8	427.8	401.7	-6.1	177.7	126.1	-29.1	131.8	153.2	16.2
Campania	6939.0	7621.2	9.8	4941.5	4657.0	-5.8	517.6	1313.7	153.8	1479.9	2244.5	51.7
Apulia	3928.1	4096.5	4.3	2745.3	2847.8	3.7	486.8	383.5	-21.2	696.0	1154.1	65.8
Basilicata	1319.0	1206.3	-8.5	790.7	731.8	-7.5	255.8	230.4	-9.9	272.6	317.1	16.3
Calabria	3334.2	3683.6	10.5	2190.7	2625.8	19.9	613.9	605.3	-1.4	529.7	710.1	34.1
Sicily	5867.4	6530.9	11.3	3325.1	3933.4	18.3	1329.9	1934.4	45.5	1212.4	1165.7	-3.9
Sardinia	3061.3	3209.4	4.8	1440.9	1620.2	12.4	1015.9	974.4	-4.1	604.4	973.9	61.1
ITALY	77173.2	86594.0	12.2	47964.4	50980.5	6.3	11265.9	15321.9	36.0	17942.9	27552.7	53.6

Source: DPS TPA. All absolute data are in millions of euros

Table 2 Composition of Capital expenditure across Italian regions

Regions	% Average Total I Government Capital Expenditure 96-97	% Average General Government Capital Expenditure 06-07	Percent change 96-97 vs 06- 07	% Average Central Government Capital Expenditure 96-97	% Average Central Government Capital Expenditure 06-07	Percent change 96-97 vs 06-07	% Average Regional Government Capital Expenditure 96-97	% Average Regional Government Capital Expenditure 06-07	Percent change 96-97 vs 06- 07	% Average Regional Government Capital Expenditure 96-97	% Average Regional Government Capital Expenditure 06-07	Percent change 96-97 vs 06-07
Piedmont	6.12	7.13	16.42	6.15	6.90	12.18	4.19	5.41	28.99	7.29	8.57	17.55
Valle d'Aosta	0.66	0.68	3.16	0.30	0.23	-23.87	2.47	2.46	-0.55	0.61	0.49	-19.01
Lombardy	10.89	11.57	6.23	9.59	10.37	8.12	6.32	10.31	63.18	15.94	14.50	-9.02
Autonom prov.of Bolzano	1.64	1.71	4.43	0.56	0.53	-5.42	6.18	5.23	-15.34	2.06	1.86	-9.75
Autonomous prov.of Trento	1.80	2.13	18.42	0.66	0.60	-9.70	6.52	7.31	12.07	2.28	1.94	-15.00
Veneto	5.39	6.18	14.57	5.03	5.23	4.06	5.11	5.93	15.90	6.84	8.07	18.12
Friuli Venezia Giulia	2.52	2.85	12.82	2.07	1.94	-6.47	4.73	5.03	6.33	2.51	3.26	29.75
Liguria	3.11	2.74	-11.80	3.39	2.66	-21.46	1.37	2.43	77.23	3.54	3.09	-12.87
Emilia Romagna	6.16	7.34	19.16	5.58	7.34	31.43	4.65	5.66	21.54	8.91	8.30	-6.83
Tuscany	5.12	5.50	7.42	5.05	5.58	10.50	3.54	3.22	-8.99	6.34	6.66	5.13
Umbria	1.45	2.0	38.08	1.50	1.86	23.85	1.15	1.52	31.75	1.50	2.54	69.12
Marche	2.14	2.32	8.45	2.01	2.32	15.61	2.30	1.49	-35.41	2.48	2.83	14.34
Lazio	16.39	14.49	-11.60	21.64	20.47	-5.43	2.50	3.97	59.20	9.01	9.49	5.31
Abruzzo	2.82	2.22	-21.13	2.94	2.32	-21.06	3.12	1.82	-41.58	2.22	2.30	3.79
Molise	1.02	0.77	-24.05	0.98	0.76	-22.39	1.54	0.88	-42.72	0.80	0.73	-8.48
Campania	9.41	8.55	-9.17	11.00	8.47	-22.99	4.70	8.47	80.19	7.35	8.78	19.37
Apulia	5.12	4.68	-8.68	5.65	5.24	-7.23	4.44	3.79	-14.77	3.77	4.17	10.56
Basilicata	1.82	1.35	-25.87	1.67	1.35	-19.14	2.62	1.31	-49.79	1.79	1.38	-22.54
Calabria	4.62	4.18	-9.58	4.79	5.40	12.63	5.98	2.96	-50.55	3.12	2.63	-15.59
Sicily	7.95	7.85	-1.15	6.43	7.32	13.89	15.59	15.54	-0.35	7.75	4.34	-44.04
Sardinia	4.30	3.75	-12.63	3.01	3.12	3.64	10.96	5.27	-51.94	3.90	4.06	4.14

Source: DPS RPA

	QPIE	QLIG	QLOM	QNW	QTAA	QVEN	QFRI	QEMI	QNE	QTOS	QUMM	QLAZ	QCEN	QABM	QCAM	QPUG	QBAS	QCAL	QSIC	QSAR	QSOU	Cost.	R2	AdjR2	
DPIE	0.11*	0.07**	0.14*						0.08				0.10									0.08	0.97		
	(0.04)	(0.04)	(0.04)						(0.16)				(0.15)									(0.13)	(0.22)	0.19	0.17
DLIG	0.10*	0.13*	0.04						0.27**				0.18									0.12	0.16		
	(0.05)	(0.05)	(0.06)						(0.16)				(0.15)									(0.14)	(0.23)	0.16	0.13
DTAA				0.06	0.13*	0.05	0.07	0.09					0.06									0.08	0.14		
				(0.09)	(0.06)	(0.10)	(0.08)	(0.1)					(0.15)									(0.16)	(0.27)	0.64	0.62
DVEN				0.17*	0.13*	0.07	0.05	0.09***					0.18***									0.08	0.05		
				(0.07)	(0.04)	(0.06)	(0.05)	(0.06)					(0.12)									(0.12)	(0.19)	0.33	0.31
DFRI				0.05	0.06***	0.08***	0.09**	0.11**					0.08									0.10	0.07		
				(0.07)	(0.04)	(0.06)	(0.05)	(0.06)					(0.12)									(0.12)	(0.19)	0.52	0.50
DEMI				0.12*	0.08*	0.13**	0.04	0.13*					0.08									0.13***	0.08		
				(0.06)	(0.04)	(0.06)	(0.05)	(0.06)					(0.10)									(0.10)	(0.17)	0.09	0.06
DTOS				-																					
				0.87*					0.03	0.39*	-0.22*	-0.19*										0.03	-0.94		
				(0.06)					(0.12)	(0.06)	(0.05)	(0.5)										(0.12)	*(0.17)	0.64	0.63
DUMM				-																					
				0.67*					-0.11	-0.23*	0.57*	-0.25*										0.06	-0.71*		
				(0.06)					(0.13)	(0.05)	(0.04)	(0.04)										(0.11)	(0.17)	0.34	0.32
DLAZ				-0.10					0.07	-0.41*	0.13***	0.73*										0.73*	0.30		
				(0.09)					(0.19)	(0.09)	(0.08)	(0.07)										(0.18)	(0.26)	0.14	0.12
DABM				-																					
				0.67*					-0.77*				-0.73*	0.75*	0.05	-0.19*	-0.06	-0.20*	0.85**	-0.04		-1.51*			
				(0.08)					(0.15)				(0.13)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)		(0.21)	0.42	0.40	
DCAM				-																					
				1.32*					-0.56				-0.77*	0.04	0.34*	0.06	-0.04	0.04	-0.009	-0.07		-1.53*			
				(0.10)					(0.17)				(0.15)	(0.06)	(0.06)	(0.05)	(0.06)	(0.04)	(0.05)	(0.06)		(0.24)	0.61	0.59	
DPUG				-																					
				0.90*					-0.46*				-0.25*	0.05	-0.13*	0.28*	0.08***	0.13*	0.20*	-0.11*		-1.11*			
				(0.08)					(0.13)				(0.11)	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.06)		(0.20)	0.30	0.27	
DBAS				-1.2*					-0.38*				-0.92*	0.11**	-0.16*	0.02	0.47*	-0.1*	0.13*	0.005		-1.7*			
				(0.11)					(0.17)				(0.15)	(0.06)	(0.07)	(0.06)	(0.06)	(0.05)	(0.5)	(0.06)		(0.20)	0.49	0.46	
DCAL				-																					
				0.85*					-0.56*				-0.84*	0.27*	0.05	0.17*	-0.16**	0.35*	0.09***	-0.04		-1.13*			
				(0.12)					(0.2)				(0.18)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.07)		(0.30)	0.16	0.12	
DSIC				-																					
				0.24*					-0.50*				-0.71*	0.06	0.025	0.012	0.06	-0.12*	0.61*	-0.007		0.46*			
				(0.09)					(0.18)				(0.16)	(0.5)	(0.06)	(0.05)	(0.05)	(0.04)	(0.05)	(0.06)		(0.25)	0.29	0.26	
DSAR				-1.2*					-0.37*				-0.90*	0.14*	-0.14*	0.03	0.009	-0.18*	0.18*	0.59*		-1.13*			
				(0.09)					(0.14)				(0.13)	(0.05)	(0.06)	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)		(0.21)	0.59	0.57	

*Significant at 5%, ** Significant at 10%, *** Significant at 20%

Table 3 Estimates of DS model (NUTS2 and NUTS1) –Numeraire: Lombardy; Regions are DPIE=Piedmont and Valle d’Aosta, TAA=autonomous provinces of Bolzano and Trento, UMM=Umbria and Marche, ABM=Abruzzo and Molise. Reference model is number (16) in the paper

	QPIE	QLIG	QLOM	QNW	QTAA	QVEN	QFRI	QEMI	QNE	QTOS	QUMM	QLAZ	QABM	QCEN	QCAM	QPUG	QBAS	QCAL	QSIC	QSAR	QSOU	Cost.
DPIE	+	+	+						+					+							+	+
DLIG	+	+	+						+					+							+	+
DTAA				+	+	+	+	+						+							+	+
DVEN				+	+	+	+	+						+							+	+
DFRI				+	+	+	+	+						+							+	+
DEMI				+	+	+	+	+						+							+	+
DTOS				-					+	+	-	-									+	-
DUMM				-					-	-	+	-									+	-
DLAZ				-					+	-	-	+									+	+
DABM				-					-				+	-	+	-	-	-	+	-		-
DCAM				-					-				+	-	+	+	-	+	-	-		-
DPUG				-					-				+	-	+	-	+	+	-	-		-
DBAS				-					-				+	-	-	+	+	+	+	+		-
DCAL				-					-				+	-	+	+	+	+	+	+		-
DSIC				-					-				+	-	+	+	+	+	+	+		+
DSAR				-					-				+	-	-	+	+	+	+	+		-

Table4 Qualitative analysis of NUTS2 and NUTS1 –Numeraire: Lombardia– shaded grey denote statistically significant signs with α at least 20%. Aggregated regions are DPIE=Piedmo nt, Valle d’Aosta, TAA=autonomous provinces of Bolzano and Trento, UMM=Umbria and Marche, ABM=Abruzzo and Molise. Reference model is number (16) in the paper

	QPIV	QLIG	QLOM	QNOV	QTAA	QVEN	QFRI	QEMI	QNES	QTOS	QUMM	QLAZ	QABM	QCEN	QCAM	QPUG	QBAS	QCAL	QSIC	QSAR	QSUD	Cost.	
DPIV	+	+	+						+					+								+	+
DLIG	+	+	+						+					+								+	+
DLOM	+	+	+						+					+								+	+
DTAA				+	+	+	+	+						+								+	+
DVEN				+	+	+	+	+						+								+	+
DFRI				+	+	+	+	+						+								+	+
DEMI				+	+	+	+	+						+								+	+
DTOS				-					+	+	-	-										+	+
DUMM				-					+	-	+	-										+	-
DABM				-					-				+	-	+	-	-	-	+	-			-
DCAM				-					-				+	-	+	+	-	-	-	-			-
DPUG				-					-				+	-	-	+	-	+	+	-			-
DBAS				-					-				+	-	-	+	+	+	+	+			-
DCAL				-					-				+	-	+	+	+	+	+	+			-
DSIC				-					-				+	-	+	+	+	+	+	+			-
DSAR				-					-				+	-	-	+	-	-	+	+			-

Table 5 Qualitative analysis of NUTS2 and NUTS1 – Numeraire: Lazio – s haded grey denote statistically significant signs with α at least 20%. Aggregate regions are DPIE=Piedmont, Valle d'Aosta, TAA= autonomous provinces of Bolzano and Trento, UMM=Umbria e Marche, ABM=Abruzzo e Molise. Reference model is number (16) in the paper.

	Cost.	QSOU_C	QNW_C	QNE_C	QCEN_C	QSOU_R	QNW_R	QNE_R	QCEN_R	QSOU_L	QNW_L	QNE_L	QCEN_L
DSOUC	1.54* (0.13)	0.82* (0.04)	0.39* (0.068)	0.23* (0.07)	0.24* (0.09)	0.06 (0.15)				0.03 (0.05)			
DNE_C	-0.33* (0.1)	-0.47 (0.05)	-0.62* (0.08)	0.90* (0.09)	-0.21* (0.11)			-0.27* (0.12)				-0.007 (0.04)	
DCEN_C	0.18*** (0.11)	-0.91* (0.05)	-0.16* (0.08)	0.22** (0.08)	0.35* (0.09)				0.15* (0.06)				0.01 (0.03)
DSOU_R	0.57* (0.20)					0.4* (0.13)	0.06 (0.08)	-0.25* (0.13)	0.02 (0.06)	-0.01 (0.04)			
DNW_R	0.80* (0.2)		-0.05*** (0.03)			0.39* (0.13)	0.51* (0.08)	0.23** (0.13)	-0.01 (0.06)		0.02 (0.03)		
DNE_R	0.62* (0.17)			-0.03*** (0.02)		0.04 (0.12)	-0.15* (0.07)	0.88* (0.11)	0.10* (0.05)			0.02 (0.03)	
DCEN_R	0.83* (0.1)					0.32* (0.12)	-0.21* (0.07)	0.21*** (0.07)	0.79* (0.06)				0.01 (0.03)
DSOU_L	0.83* (0.08)	-0.002 (0.01)				0.05 (0.04)				0.77* (0.12)	0.08 (0.15)	-0.06 (0.11)	0.01 (0.1)
DNW_L	0.82* (0.08)									0.05 (0.12)	0.6* (0.1)	0.05 (0.1)	0.06 (0.1)
DNE_L	0.81* (0.08)			0.005 (0.02)								0.77* (0.12)	0.03 (0.1)
DCEN_L	0.78* (0.09)							0.02 (0.04)		-0.03 (0.1)	0.02 (0.1)	(0.12)	0.80* (0.1)
					0.03 (0.04)				-0.004 (0.03)	-0.11 (0.13)	0.16 (0.16)	-0.05 (0.12)	

*Significant at 10%, ** Significant at 5%

Significant at 10%, *** Significant at 20%

Table 6 Estimates of DS model NUTS1 – Numeraire: North-West (Central Expenditure)

Macro-region: SOU_C=South central expenditure, SOU_R= South regional expenditure, SOU_L=South local expenditure, NW_C=North-West central expenditure, NW_R=North-West regional expenditure, NW_L=North-West local expenditure, NE_C= North-East central expenditure, NE_R= North-East regional expenditure, NE_L= North-East local expenditure, CEN_C=Centre central expenditure, CEN_R=Centre regional expenditure, CEN_L=Centre local expenditure.

