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# A Semi-parametric Analysis of Italian Regional Public Services' Provision [#]

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**Abstract**

We measure the performance of public spending in Italian regions regarding the provision of public services, by constructing a so-called total regional performance indicator for strategic sectors such as general administration, energy, water and sewage, solid waste, and transports. This composite indicator is the output measure selected to be used in the non-parametric DEA approach. The computation of efficiency scores allows to rank the regions and to detect some room for improvement in terms of efficiency gains at the regional level. GDP per capita and population density seem to be relavant non-discretionary factors to explain inefficiencies.

JEL Classification Numbers: C14, H42, H72, R50

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## 1 – Introduction

The purpose of this paper is to assess the efficiency of publicly provided services at the regional level in Italy. We measure the performance of Italian regions regarding the provision of public services by constructing a so-called total regional performance indicator for strategic sectors such as general administration, energy, water and sewage, solid waste, transports. Using such composite indicator as an output measure, we then use a non-parametric methodology, Data Envelopment Analysis (DEA), to estimate efficiency scores for public spending for the twenty Italian Regions in 2001. By means of frontier analysis we are able to identify regions that might qualify as "performing well" from those were some improvement might increase their efficiency.

Some available studies assess the performance and efficiency of public sector spending, notably in terms of international comparisons. For instance, Fakin and Crombrugghe (1997) and Afonso, Schuknecht and Tanzi (2005) assess public expenditure in the OECD, Clements (2002) analysis education spending in Europe, Gupta and Verhoeven (2001) addresses education and health in Africa, while Afonso and St. Aubyn (2005b) study health and education expenditure efficiency in the OECD. Nevertheless, the literature on the efficiency of local and regional government is rather scarce. De Borger and Kerstens (1996) apply non-parametric analysis to public spending efficiency in Belgian municipalities, while Afonso e Fernandes (2006) also use a non-parametric approach for municipalities in

the region of Lisbon. To our knowledge, this is a first effort of checking efficiency and productivity in Italian regions using non-parametric analysis.[1]

The paper is organised as follows. In section two we give some motivation and provide stylised facts regarding the Italian regions. Section three presents the analytical framework. In section four we compute a regional performance indicator, which is used as the output measure in the DEA calculations, and the relevance of so-called non-discretionary inputs is also addressed through a Tobit analysis. Section five provides conclusions.

**2 – Motivation and stylised facts**

The Italian utilities and network industries have changed significantly during the last ten years. This process was due notably to the response that Italy gave to European obligations in order to liberalise the public utilities sectors, in line to what happended across the euro area. Consequently, Italy's governance and markets were reformed and new relations established between the State, citizens, and the market.

Italy has devoted the last decade to "reform" public governance, shifting from a highly interventionist state towards a modern regulatory one, introducing transparent rules, market openness, and competition. According to the Regulator's aim, the reform should have been able to enforce the competition, but the reality was very complex, showing the presence of significant diversity among the Italian regions. In some cases, there was a bias either in

[1] Balassone, Francese and Giordano (2002) review non-parametric applications to some public services in Italy.

granting long concessions or to maintain the direct control on the service delivery. Nevertheless, in other cases, there was openness towards a more competitive market, introducing the tender system. Consequently, as more powers have been delivered to regional and local governments, the task of monitoring and correcting competition problems in regulation has become more complex, highlighting the absence of a well-established culture of competition in local governments.

In order to better understand the institutional framework a brief overview of the local government institutional features and responsibilities of the Italian regions is provided below. Italy is nowadays a regional state, whose local government is organised in three subnational levels as shown in Figure 1.

[Insert Figure 1 here]

The first level includes the twenty Italian regions, which are divided into Ordinary Regions (*regioni a statuto ordinario*) and regions with political autonomy in certain matters (*regioni a statuto speciale)*. While the latter (*Valle d'Aosta, Trentino Alto Adige, Sicilia, Sardegna* and *Friuli Venezia Giulia*) were formally established between 1943 and 1963, the former were only created in 1970. The choice of the distinction was due mainly to the pressing demand of authonomy according to the peculiar etnical culture of those regions. Despite this regional organisation being in place for more than twenty years, the country was characterised by a highly centralised model, where the other local entities at the second level, provinces and municipalities, had only a residual power.

Since 1997, after the introduction of the so-called "Bassanini reforms", a significant programme for public sector revitalisation helped the country in improving its use of best practice tools for regulatory quality. Legislation identifying the specific tasks of the regions and of the other local entities was introduced in order to guarantee the so-called *territorial empowerment,* reinforcing the effectiveness of the local policies.[2] Moreover, the Constitutional Reform that took place in 2000, modified substantially the regions' competences giving them new powers.[3] In particular, two main innovations should be mentioned: i) the range of competencies on which regions can legislate was fully modified, i.e. the law mentions that the regions have the legislative power on all the topics not expressly reserved to the national government;[4] ii) a series of exclusive competences are attributed to the regions, on which the national government has no longer power.

As shown in Table 1, regions have *de facto* implemented their local power, both on the provision of public goods and on the definition of the local regulatory system.[5]

[Insert Table 1 here]

[2] Laws n. 59/1997 and n. 127/97 modified by Laws n. 191/98 and n. 50/99.
[3] Constitutional Law n. 3/2001.
[4] This broadens the number of competences that can be regulated by the regional autorities. For an *historical excursus,* see Giarda (2004).
[5] In the Appendix, we provide more detailed information concerning the main interventions that occurred in some public utilities sectors.

During the last decade a variety of incentives, such as service contracts (*Contratti di servizio*) and citizens charts (*Carte dei Servizi*) for public services were introduced in order to improve the quality of the public services (transports, sanity, energy, communications), and to provide commitments to performance criteria and compensation for customer non-satisfaction. Moreover, an effort was made to liberalise local public utilities, with the attempt to introduce market principles in water distribution, energy (other than electricity), public transport, waste management, and a series of laws were approved to change the regulatory framework.

Alongside with the aforementioned institutional reforms, it was possible to notice the increase of both investment and employment levels in local public services. For instance, investment in total public services increased significantly in Italy between 1998 and 2002, around 33.9 per cent, while investment in local public services increased even more, by 43.3 per cent (see Figure 2). Additionally, Figure 2 shows also that employment in local public services broadly stabilised in the same period, vis-à-vis a decrease of some 10 per cent in total public services.

[Insert Figure 2 here]

The objective of the aforementioned reforms was mainly to promote competition, even if its effectiveness depended significantly on the support given by the local governments. In practice, the results were mixed across the Italian regions. In some cases, there was a strong will to maintain the direct control of the service delivery, while in other instances there was

also openness towards a more competitive market, introducing the tender system.[6] As more powers have been devolved to regional and local governments, the task of monitoring and correcting regulatory competition problems has become more complex. This stems partly from the fact that the culture of competition is still not well established in local governments. Indeed, many concession-granting powers remain under local and regional governments' control including licensing, land use, and planning and development.

## 3 – Analytical framework

In this section we briefly present the non-parametric methodology that we will use ahead. Data Envelopment Analysis, originating from Farrell (1957) seminal work and popularised by Charnes, Cooper and Rhodes (1978), assumes the existence of a convex production frontier, a hypothesis that is not required, for instance, in the Free Disposable Hull approach. The production frontier in the DEA approach is constructed using linear programming methods. The terminology "envelopment" stems out from the fact that the production frontier envelops the set of observations.[7]

DEA allows the calculation of technical efficiency measures that can be either input or output oriented. The purpose of an input-oriented study is to evaluate by how much input quantity can be proportionally reduced without changing the output quantities. Alternatively, and by computing output-oriented measures, one could also try to assess how

[6] As in the case of the local public transports in Rome and in Valle d'Aosta. For a review on local public transports, see Boitani and Cambini (2001).
[7] Coelli et al. (2002), and Thanassoulis (2001) offer good introductions to the DEA methodology.

much output quantities can be proportionally increased without changing the input quantities used. The two measures provide the same results under constant returns to scale but give different values under variable returns to scale. Nevertheless, and since the computation uses linear programming, not subject to statistical problems such as simultaneous equation bias and specification errors, both output and input-oriented models will identify the same set of efficient/inefficient producers or Decision Making Units (DMUs).[8]

The analytical description of the linear programming problem to be solved, in the variable returns to scale hypothesis, is sketched below. Suppose there are $k$ inputs and $m$ outputs for $n$ DMUs. For the i-th DMU, $y_i$ is the column vector of the outputs and $x_i$ is the column vector of the inputs. We can also define $X$ as the $(k \times n)$ input matrix and $Y$ as the $(m \times n)$ output matrix. The DEA model is then specified with the following mathematical programming problem, for a given i-th DMU: [9]

$$\begin{aligned} MIN_{\theta,\lambda}\ & \theta \\ \text{s. to}\ & -y_i + Y\lambda \geq 0 \\ & \theta x_i - X\lambda \geq 0 \\ & n1'\lambda = 1 \\ & \lambda \geq 0 \end{aligned} \quad . \qquad (1)$$

[8] In fact, the choice between input and output orientations is not crucial since only the two measures associated with the inefficient units may be different between the two methodologies.

[9] We simply present here the equivalent envelopment form, derived by Charnes et al. (1978), using the duality property of the multiplier form of the original programming model.

In problem (1), $\theta$ is a scalar (that satisfies $\theta \leq 1$), more specifically it is the efficiency score that measures technical efficiency of unit ($x_i$, $y_i$). It measures the distance between a decision unit and the efficiency frontier, defined as a linear combination of best practice observations. With $\theta<1$, the decision unit is inside the frontier (i.e. it is inefficient), while $\theta=1$ implies that the decision unit is on the frontier (i.e. it is efficient).

The vector $\lambda$ is a ($n \times 1$) vector of constants, which measures the weights used to compute the location of an inefficient DMU if it were to become efficient. The inefficient DMU would be projected on the production frontier as a linear combination, using those weights, of the peers of the inefficient DMU. The peers are other DMUs that are more efficient and therefore are used as references for the inefficient DMU.

$n1$ is a n-dimensional vector of ones. The restriction $n1'\lambda = 1$ imposes convexity of the frontier, accounting for variable returns to scale. Dropping this restriction would amount to admit that returns to scale were constant. Additionally, notice that problem (1) has to be solved for each of the $n$ DMUs in order to obtain the $n$ efficiency scores.

In a simple example, three different hypothetical regions display the following values for indicator $y$ and expense level $x$, as reported in Table 2:

[Insert Table 2 here]

Figure 3 illustrates DEA frontiers with the data of Table 2. The variable returns to scale frontier unites the origin (not depicted) to point A, and then point A to point C.

[Insert Figure 3 here]

Expenditure is lower in region A, and the output level is also the lowest. Region C does not exhibit the highest expenditure, and attains the best level of output. Region B may be considered inefficient, in the sense that it performs worse than region C. The latter achieves a better status with less expense.

## 4 – Efficiency analysis of regional spending in Italy

In our analysis we assess the efficiency in strategic sectors such as general administration, energy, water and sewage, solid waste, transports for the twenty Italian Regions in 2001. As inputs we use both public sector employees and public expenditure. Particularly, we use the database on Regional Public Accounts (MEF-DPS, Banca Dati Conti Pubblici Territoriali) collected by the Italian Ministry for Economics and Finance. Regarding the output measure we first construct a composite indicator that tries to take into account the several areas of regional public provision of services and goods.

### 4.1 – Total regional performance indicator

In this subsection we construct our measure of performance for Italian regions in providing public services to the population, by computing the so-called total regional performance indicator (TRPI) for 2001. This composite indicator is a simple average of seven sub-

indicators of regional public performance: water provision, waste collection, frequency of the accidental long interruptions of the electrical service, public transportation utilization, railway utilization, motorway network, and houses provide with gas.[10]

We compile the performance indicator from the various indices giving equal weight to each of them.[11] This weighing up of the variables is quite straightforward and economically intuitive (even though it is still somewhat ad hoc), and it avoids the problem of lack of economic justification of a more complex statistical approach such as principal component analysis that might come to mind in this context.

For those indicators where higher numbers are less favourable (e.g., irregularity in water provision, frequency of the accidental long interruptions of the electricity provision), we use the inverse of the original values. In order to facilitate the compilation, we normalised the values and set the average for all indices equal to unity (following the methodology adopted by Afonso et al., 2005). The values for each region are then recalculated relative to the average. Table 3 presents the results for the constructed TRPI indicator for the year 2001.

[Insert Table 3 here]

The computed sub-indicators suggest large differences in public services provision performance across regions. Regions with the highest values for sub-indicators include

[10] The data and the respective sources are provided in the Annex.
[11] For example, water provision contributes 1/7 per cent to the total regional performance indicator.

Friuli - Venezia Giulia (water provision, and electricity provision), Toscana (waste collection), Liguria (public transports and railway utilisation), Puglia (motorway network), and Lombardia (gas provision). Regions such as Friuli - Venezia Giulia, Liguria, Piemonte, Lombardia, Puglia, Emilia-Romagna, and Veneto report high TRPI indicators.

The derived TRPI will be used ahead in the next sub-section as our chosen output measure for the DEA analysis.

**4.2 – DEA analysis and results**

For our DEA analysis, we use two input measures: a financial measure, *X1*, which is the overall per capita spending in the region, and a quantitative measure, *X2*, the per capita number of civil servants employed in each region defined as follows (data and sources are again reported in the Annex):

*X1* - total spending in the region/inhabitants in the region;
*X2* - civil servants per 1000 inhabitants = (civil servants/inhabitants)*1000.

We first use a one input (regional spending per capita) and one output (TRPI) model. Afterwards we expand the analysis to a two-input (regional spending and civil servants) and one output (TRPI) model. Since the number of DMUs is not very large, one has to be

careful in not using too many inputs or outputs, which would then increase the number of efficient by default DMUs.[12]

The general relationship for the theoretical production possibility frontier that we expect to test, regarding efficiency in regional provision on public services, can be given by the following function for region *i*:

$$Y_i = f(X1_i, X2_i),\ i=1,\ldots,n \qquad (2)$$

where $Y_i$ is the TRPI, and $X1_i$ and $X2_i$ are the previously defined two inputs for each region.

In Table 4 we report the DEA analysis results obtained with the one input, *X1*, and one output, TRPI, for the twenty Italian regions, both in terms of input and output oriented efficiency scores for 2001.

[Insert Table 4 here]

From the results it is possible to see that three regions would labelled as most efficient and located on the theoretical production frontier: Emilia – Romagna, Friuli – Venezia Giulia, and Piemonte. Interestingly, these are all regions from the north of Italy, as is also the case of the regions ranked fourth and fifth, respectively Veneto and Lombardia, in terms of input

[12] With less than three DMUs per input and output there is the risk that too many DMUs will turn out to be efficient.

oriented efficiency scores. One should also mention that there is no DMU that is efficient by default, in other words all DMUs on the frontier are at least once a peer of a non-efficient region. According to the average efficiency scores, there seems to scope for an improvement of around 39 per cent and 30 per cent respectively in terms of input efficiency and of output efficiency.

With a different specification, we added the number of civil servants per 1000 inhabitants as a second input, in other words, we now include *X2* in the production function (2). Table 5 reports those new efficiency scores.

[Insert Table 5 here]

From this new set of results, we see that now five regions are labelled as most efficient: Emilia – Romagna, Friuli – Venezia Giulia, and Piemonte, as before, plus Puglia and Veneto. In addition, Veneto is now efficient by default in the output oriented DEA analysis. Moreover, with such two inputs alternative specification, on average the same level of outputs might be obtained with 19 per cent less resources. On the other hand, regions might have able to increase their outputs by 28 per cent without necessarily increasing their resources

Figure 4 provides an alternative presentation of the ranking of the regions' efficiency scores from Table 5 for the input oriented analysis. Again, we conclude that all the efficient regions are located in the north of Italy, the exception being Puglia. This last region,

already well ranked in the one input analysis (seventh place) is now labelled efficient because it has the lowest ratio of civil servants per 1000 inhabitants in the sample.

[Insert Figure 4 here]

Notice however, that it is not easy to accurately identify the effects of regional spending on public services outcomes, and separate the impact of spending from other influences. For instance, it is difficult to assess to what extent does irregularity in water provision and electricity service failures reflect public intervention rather than other factors such as climate or geographical conditions. On that line of reasoning, adverse geographical conditions may also impinge on the quality and cost of a regional communications infrastructure.

**4.3 – Non-discretionary factors**

The standard DEA model incorporates only discretionary inputs, those whose quantities can be changed at the DMU will, and does not take into account the presence of environmental variables or factors, also known as non-discretionary inputs. However, socio-economic differences may play a relevant role in determining heterogeneity across the regions and influence performance outcomes. These exogenous socio-economic factors can include, for instance, the level of education of the population in a given region, the regions' per capita income, demographic factors or even its geographical distance to the main decision centres.

As non-discretionary and discretionary inputs jointly contribute to outputs, there are in the literature several proposals on how to deal with this issue, implying usually the use of two-stage and even three-stage models.[13] A usual approach is to explain efficiency scores from DEA using only controllable regional inputs and outputs in the first stage and then regress the efficiency scores on the non-discretionary inputs in a second stage.

Using the DEA output efficiency scores computed in the previous section, we can now evaluate the importance of environmental or non-discretionary inputs. We present the results from Tobit estimations by regressing the output efficiency scores, $\delta_i$, on a set of possible explanatory variables as as follows

$$\delta_i = \beta_0 + \beta_1 Y_i + \beta_2 E_i + \beta_3 Popd_i + \varepsilon_i, \qquad (3)$$

where, $Y$ is regional GDP per capita, $E$ is a measure of the educational level, and *Popd* is the regional population density. We report in Table 6 the results from the censored normal Tobit regressions for specification (3).

[Insert Table 6 here]

[13] See Ruggiero (2004) and Afonso and St. Aubyn (2005a) for an overview and discussion on how to control for non-discretionary factors.

Our empirical evidence indicates that spending efficiency is positively and strongly related to the level of regional wealth and to population density. Therefore, richer regional residents may impose an increased pressure in demanding more efficient local services. On the other hand, it is also worthwhile mentioning that the positive and significant estimates for population density could indicate that a higher proportion of inhabitants living in dense settlement structures may facilitate the organization and consumption of networked regional services. Therefore, more metropolitan and urban regions could be favoured in his regard.[14] We tried additional measures of possible non-discretionary factors, such as population growth, or the percentage of population in each region with various degrees of education, but the results were not statistically significant, apart from some evidence regarding the number of inhabitants with tertiary education.

## 5 – Conclusion

In this paper, we have evaluated efficiency in providing public services across Italian regions by assessing a so-called TRPI index, our output measure, against the inputs used: regional per capita spending and the number of per capita regional civil servants. With data for 2001, we constructed the performance index as a composite index of seven sub-indicators of regional public performance: water provision, waste collection, frequency of the accidental long interruptions of the electrical service, public transportation utilization, railway utilization, motorway network, and houses provide with gas.

[14] For instance, Hayes, Razzolini, and Ross (1998) and Grossman, Mavros and Wassmer (1999) argue that intra-metropolitan suburban competition does positively contribute for the improvement of efficiency and it may be expected that metropolitan suburbs within closer proximity of each other enhance higher mobility choices than non-metropolitan areas.

We computed input and output efficiency scores by solving a standard DEA problem with the twenty Italian regions as DMUs. The results indicate that inefficiencies may be significant, and some improvements may be possible across regions in order for them to move closer to the theoretical production possibility frontier. On average, and using the results from the one output and two input analysis, regions could have increased their output by 28 percent using the same resources (as can be seen from the average output score from Table 5), with a region like Sardegna having a theoretical margin for potential output improvement of 63 percent. On the other hand, on average, regions could have decreased their inputs by 19 percent and still obtain the same output, with a region like Valle D'Aosta displaying scope for a potential improvement of 78 percent.

Nevertheless, the fact that some regions are not located on the theoretical production possibility frontier, and not labelled efficient, does not mean that they could actually be on the frontier. For instance, regional policy makers may simply favour a different set of regional services provision. On the other, environmental factors play a role in determining efficiency. Interestingly, and as we reported, efficiency levels at the Italian regional level seem to be strongly related to per capita GDP and population density.

To our knowledge, this is the first attempt at computing a performance composite indicator for public services provision at the Italian regional level. This same is true for the subsequent non-parametric efficiency analysis. However, these results have to be seen as indicative and need to be interpreted with some care. Indeed, and for instance, it would be

useful to use only the number of civil servants that are more directly involved in the provision of regional public services. This additional analysis may be pursued in future work if and when such data limitations can be overcome.

## Appendix

Table A1 – Main interventions that occurred in some public utilities sectors: water and waste

| Industry | Regulatory Framework | Regulatory Governance |
|---|---|---|
| *Water supply and waste water management* | Law 36/94, (so called Galli Law) has aimed to introduce competition within water service sector in order to ensure efficiency in production and management of the resource. | The Law has established new local water authorities Autorità d'ambito Territoriale Ottimale (*ATOs*) and a separation between water resource planning and the operation of water utilities.<br>ATOs, whose borders are set by the Italian Regions, have the task of<br>-defining the resource planning;<br>-assigning the operation to a private provider, selected through auction;<br>-setting the price (tariff) cap for the water utilities (including aqueduct systems, sewage systems and treatment plants);<br>-drawing up the Piano d'Ambito (a 30 year plan) which includes the timing and level of infrastructure investments, and ensures that the provider respects the contract requirements. |
| *Waste management* | EU Directive 91/156/CE<br>EU Directive 91/689/CE<br>EU Directive 94/62/CE<br>Legislative Decree 22/1997 (so called Ronchi Decree)<br>Legislative Decree 389/1998<br>Law 426/1998<br>Law 326/2004 | This group of legislative interventions covers collection, treatment and disposal of waste. It has introduced through several steps an increasing process of decentralisation of competences from the State to the Regions and the others local entities.<br>The regulatory governance is based on the definition of the integrated management of waste through regional and provincial plans.<br>The ATOs have the task to ensure the operation and the management of the waste according to the plans and in collaboration with the Regions, Provinces and Municipalities<br>The law has introduced the tariff mechanism to cover the operational costs, which should have replaced the TaRSU, a specific tax on waste, but by law the transition period was prorogated from Jannuary 1999 to jannuary 2005. |

Source: Elaboration on OECD (2001) and Confservizi (2004).

Table A2 – Main interventions that occurred in some public utilities sectors: energy sector

| Industry | Regulatory Framework | Regulatory Governance |
|---|---|---|
| -*Electric power* | Law 481/95 established the *Authority for Electricity and Gas* (AEEG), | There is an Independent National Authority called *Authority for Electricity and Gas* (AEEG), created in 1997. It has regulatory powers such as the determination of *i)* pricing ; *ii)* quality level of services i, *iii)* economical and technical conditions of the network access and interconnession. |
| | EU Directive 96/92/CE<br>Legislative Decree (so called Bersani Decree) 79/1999 liberalised the sector, promoting competition into generation and provision to liberalised customers | The production, import/export and distribution are liberalised<br>The transmission network is still public and managed by the State through the *Trasmission System Operator* (Gestore della Rete di Trasmissione), which has a concession contract, with the owner *Terma Spa*, a company of the *Enel Group*, the former monopolist public provider, transformed in a joint-stock company in 1999.<br>The *Operator* is obliged to connect to the network all the requiring providers, which have to pay a fee determinated by the AEEG. The market is divided in two: one part is captive and the other free. In the first case the providers pay a fee determinated by the AEEG and in the second a price determinated by the market.<br>In addition, the reform allows for only one concession for distribution on the territory of each municipality<br>The *Operator* has created the so called *Single Buyer* (Acquirente Unico) and the *Electric Market Manager* (Gestore Mercato elettrico). The former is encharged to sell the energy to those providers operating in the captive market. The tariffs are in this case regulated by AEEG.The latter has the task to regulate the generation market, ensuring the matching between demand and supply in acompetitive framework. In this case the price is determinated within the market.<br>The principle of uniform tariff is now applied only for captive consumers. |
| -*Natural Gas* | EU Directive 98/30/CE<br>Delegated legislative Decreee 625/96 eliminated the legal monopoly of ENI, the public monopolist<br>Delegate Legislative Decree 164/2000 (so called Letta Decree) | Starting from 2003 small customers and household are free to choose the providers, which cannot exceed a ceiling of 75% of total imports and production (decreasing by 2% a year, down to a 61% ceiling in 2010) nor to exceed a ceiling of 50% of the sales to final consumers. Both ceilings will be removed in 2010. The AEEG has the task to regulate Third Party Access to the storage, transmission and distribution networks. It fixes the tariffs for transmission, distribution and the captive customers (Decision 138/03). on the basis of price caps. Concessions for distribution are managed by the Municipalities through auctions |

Source: Elaboration on OECD (2001) and Confservizi (2004).

Table A3 – Main interventions that occurred in some public utilities sectors: transports sector

| Industry | Regulatory Framework | Regulatory Governance |
|---|---|---|
| -*Railway Sector* | EU Directive 95/18/CE<br>EU Directive 95/19/CE<br>President of the Republic Decree-Dpr 277/1998, introduced the access to international operators and the accounting separation<br>President of the Republic Decree-Dpr 146/1999 implemented the criteria for licencing and allocation of infrastructure capacity<br>Law 326/2004 | In 1992 *Ferrovie dello Stato*, the former monopolist became a joint stock company, still owned by the Ministry of Treasury.<br>The legal separation between the network operator (RTF) and the service company *(Trenitalia*) took place in 2000, after the inroduction of the accounting separation in 1999.<br>The State responsabilities for local railways have been decentralised to the regions. Competition for local should have been introduced in 2003, but the Budget Law of 2004 has prorogated the transition period, for the local public services<br>The international freeight segment has been liberlised during 2000 (licens has been granted. All other segments have been liberalised with the Budget Law of 2000 and 4 licences already issued for the international segment have been extended. In October 2000 the network operator has adopted a Network code for non-discriminatory access |
| -*Transports on roads* | CIPE Decision n.319/1996<br>IT Directive 1998 (so called Ciampi-Costa Directive)<br>Legislative Decree 400/1999<br>Law 448/2001<br>Law 326/2004 | The road network is still public and managed by the State through the *ANAS*, which has a concession contract, with the different companies and the former main operator Società Autostrade transformed in a joint-stock company and privatised.<br>ANAS has to define the parameters, which each company needs in order to determinate the price cup and consequently the tariff or toll.<br><br>The Legislative Decree 400/1999 has<br>-given a new definition of subsidy transfer mechanisms for minimum services by the Regional Governments;<br>-introduced the adoption of service contracts to regulate the relationship between the granting Authority and the service provider;<br>-affirmed the compulsory public tenders for the assignment of services by the end of 2003;<br>Additionally all the special companies and consortia should have been transformed into joint stock companies or cooperatives (within 31st December 2000);<br>Eeach Regional Government had to established a regional fund for transport replacing the old national transportation fund.<br>The Budget Law of 2004 has prorogated the transition period, for the local public services and pushed towards the adpotion of the "in house" provision, stopping the liberation process, which was confirmed in the Budget Law of 2001 |

Source: Elaboration on OECD (2001) and Confservizi (2004).

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## Annex - Data and Sources

Table A1 - Original data set for the TRPI (2001)

| Region | Irregularity in the water provision | Solid waste collection, kg per Inhabitants | Frequency of o Accidental long interruptions of electrical service | Public services users over total users, moving for work reasons (%) | | Motorway network (km) | Houses provided with gas (thousands) |
|---|---|---|---|---|---|---|---|
| | | | | Public transport utilization index | Railway utilization index | | |
| | 1/ | 2/ | 3/ | 1/ | 1/ | 4/ | 1/ |
| Abruzzo | 21.8 | 540.9 | 3.37 | 26.7 | 2.6 | 7422 | 385 |
| Basilicata | 28.2 | 485.3 | 4.91 | 30.5 | 1.8 | 4855 | 122 |
| Calabria | 51.1 | 343.1 | 8.19 | 26.7 | 3.7 | 10147 | 224 |
| Campania | 19.4 | 448.5 | 4.92 | 31.6 | 5.9 | 10239 | 1031 |
| Emilia - Romagna | 5.9 | 589.3 | 2.18 | 17.6 | 3.8 | 10945 | 1489 |
| Friuli - Venezia Giulia | 2.2 | 479.3 | 1.76 | 20.1 | 3.5 | 3593 | 401 |
| Lazio | 13.9 | 520.3 | 4.14 | 35.7 | 6.6 | 9958 | 1754 |
| Liguria | 5.3 | 523.8 | 2.46 | 36.2 | 11.7 | 4067 | 628 |
| Lombardia | 7.9 | 507.9 | 1.82 | 29.9 | 6.5 | 11860 | 3346 |
| Marche | 9.7 | 505.0 | 2.46 | 19.0 | 1.7 | 6831 | 422 |
| Molise | 21.1 | 468.9 | 4.02 | 31.2 | 1.6 | 2839 | 91 |
| Piemonte | 7.5 | 491.8 | 2.66 | 24.0 | 5.8 | 22636 | 1534 |
| Puglia | 30.1 | 462.7 | 3.62 | 21.2 | 4.4 | 11630 | 913 |
| Sardegna | 42.9 | 526.5 | 7.37 | 23.6 | 2.9 | 8543 | 10 |
| Sicilia | 39.6 | 387.3 | 5.80 | 19.5 | 1.7 | 16339 | 636 |
| Toscana | 11.5 | 664.0 | 3.30 | 19.1 | 4.3 | 11299 | 1186 |
| Trentino - Alto Adige | 4.5 | 537.4 | 3.50 | 26.2 | 3.1 | 4554 | 143 |
| Umbria | 12.9 | 657.3 | 2.26 | 18.3 | 3.2 | 4287 | 235 |
| Valle D'Aosta | 9.4 | 637.4 | 1.80 | 12.7 | | 762 | 10 |
| Veneto | 8.9 | 595.6 | 2.73 | 20.2 | 3.8 | 10097 | 1273 |
| Average | 17.7 | 518.6 | 3.66 | 24.5 | 3.9 | 8645 | 792 |
| Minimum | 2.2 | 343.1 | 1.8 | 12.7 | 1.6 | 762.0 | 10.0 |
| Maximum | 51.1 | 664.0 | 8.2 | 36.2 | 11.7 | 22636.2 | 3346.0 |

1/ Source: Istat, I servizi pubblici e di pubblica utilità: utilizzo e soddisfazione. Indagine Multiscopo sulle famiglie, “Aspetti della vita quotidiana”, 2001.
2/ Source: Istat - Statistical Yearbook, 2001-2002.
3/ Frequency of the accidental long interruptions of the electrical service (average number for customer). Source: Istat and MEF-DPS on data provide by the Autorità per l'energia elettrica e il gas. Indicatori di contesto, 2003.
4/ Regional data are calculated on the indication of DPCM from 21/09/2001, which identifies the regional network lenght. Source: Istat, Statistical Yearbook 2002

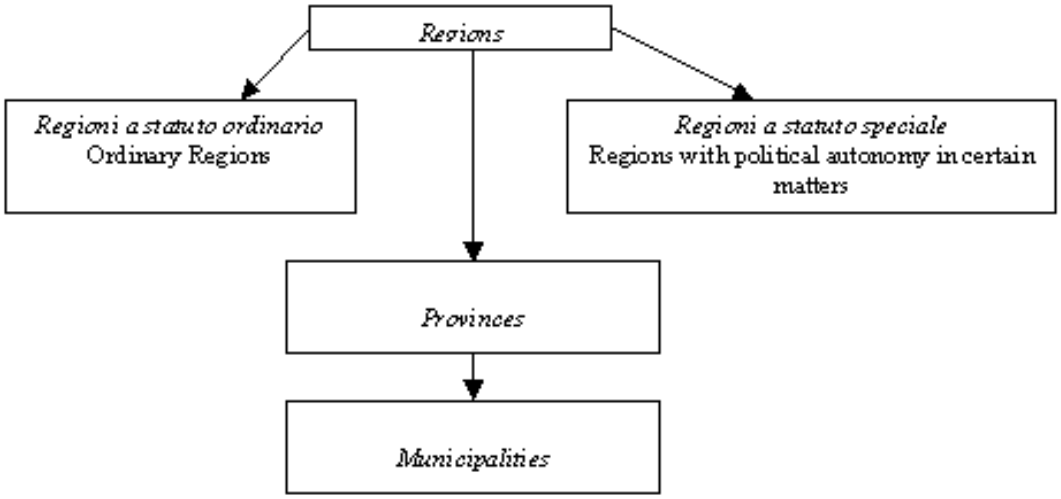
Table A2 – Additional original data set (2001)

| Region | Population | Civil servants (regional) | Area (square km) | Total expenditure per region (million euro) | Expenditure per capita (euro) | Civil servants per 1000 inhabitants | Ph. D, or Bachelor degrees (thousands) |
|---|---|---|---|---|---|---|---|
| | 1/ | 2/ | 1/ | 3/ | | | 1/ |
| Abruzzo | 1281283 | 18635 | 10763 | 174.9 | 137 | 14,5 | 70 |
| Basilicata | 604807 | 7775 | 9995 | 150.5 | 249 | 12,9 | 23 |
| Calabria | 2043288 | 30150 | 15081 | 530.6 | 260 | 14,8 | 113 |
| Campania | 5782244 | 75774 | 13590 | 2103.1 | 364 | 13,1 | 298 |
| Emilia - Romagna | 4008663 | 60831 | 22117 | 480.9 | 120 | 15,2 | 280 |
| Friuli - Venezia Giulia | 1188594 | 23755 | 7858 | 393.9 | 331 | 20,0 | 71 |
| Lazio | 5302302 | 68439 | 17236 | 1377.8 | 260 | 12,9 | 441 |
| Liguria | 1621016 | 26559 | 5422 | 511.2 | 315 | 16,4 | 119 |
| Lombardia | 9121714 | 118209 | 23863 | 1332.3 | 146 | 13,0 | 612 |
| Marche | 1469195 | 22550 | 9694 | 256.3 | 174 | 15,3 | 92 |
| Molise | 327177 | 5073 | 4438 | 108.9 | 333 | 15,5 | 16 |
| Piemonte | 4289731 | 60975 | 25402 | 586.3 | 137 | 14,2 | 254 |
| Puglia | 4086608 | 46537 | 19358 | 614.0 | 150 | 11,4 | 214 |
| Sardegna | 1648044 | 29091 | 24090 | 565.2 | 343 | 17,7 | 84 |
| Sicilia | 5076700 | 77039 | 25711 | 1308.5 | 258 | 15,2 | 271 |
| Toscana | 3547604 | 54010 | 22994 | 632.1 | 178 | 15,2 | 221 |
| Trentino - Alto Adige | 943123 | 42508 | 13607 | 1411.3 | 1496 | 45,1 | 51 |
| Umbria | 840482 | 14300 | 8456 | 168.0 | 200 | 17,0 | 53 |
| Valle D'Aosta | 120589 | 6395 | 3263 | 226.0 | 1874 | 53,0 | 6 |
| Veneto | 4540853 | 64182 | 18399 | 564.2 | 124 | 14,1 | 257 |
| Total | 57844017 | 852785 | 301336 | 13496.0 | | | 3598 |
| Average | 2892201 | 81218 | 15067 | 1285.3 | 372 | 18.3 | 163.5 |
| Minimum | 120589 (VDA) | 5073 (MOL) | 3263 (VDA) | 108.9 (MOL) | 120 (ER) | 11.4 (PUG) | 6 (VDA) |
| Maximum | 9121714 (LOM) | 118209 (LOM) | 25711 (SIC) | 2103.1 (CAM) | 1874 (VDA) | 53.0 (VDA) | 612 (LOM) |

Note: Campania – CAM; Emilia - Romagna – ER; Lombardia – LOM; Molise – MOL; Puglia – PUG; Sicilia – SIC; Valle D'Aosta – VDA.

1/ Source: Istat, Statistical Yearbook 2002.
2/ Source: Statistiche delle Amministrazioni Pubbliche-ISTAT, 2002.
3/ Source: MEF-DPS, Banca Dati Conti Pubblici Terrritoriali, specific data compilation for the present work, http://www.dps.tesoro.it/cpt-eng/cpt.asp.

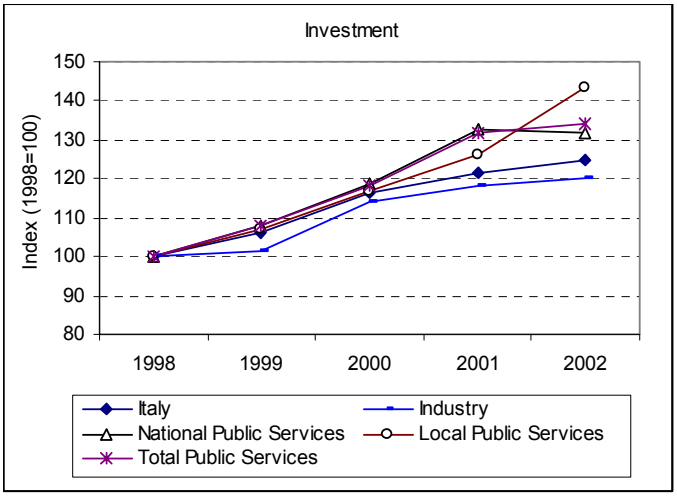
Figure 1 – The organization of the local government in Italy



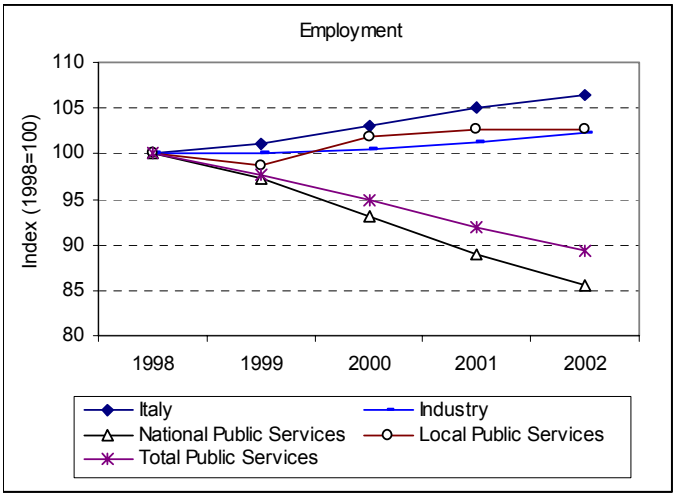

Note: Ordinary regions (Abruzzo, Basilicata, Calabria, Campania, Emilia – Romagna, Lazio, Liguria, Lombardia, Marche, Molise, Piemonte, Puglia, Toscana, Umbria, Veneto); regions with relative political autonomy (Valle d'Aosta, Trentino Alto Adige, Sicilia, Sardegna and Friuli Venezia Giulia).

Figure 2 – Investment and employment developments (1998-2002)

2a

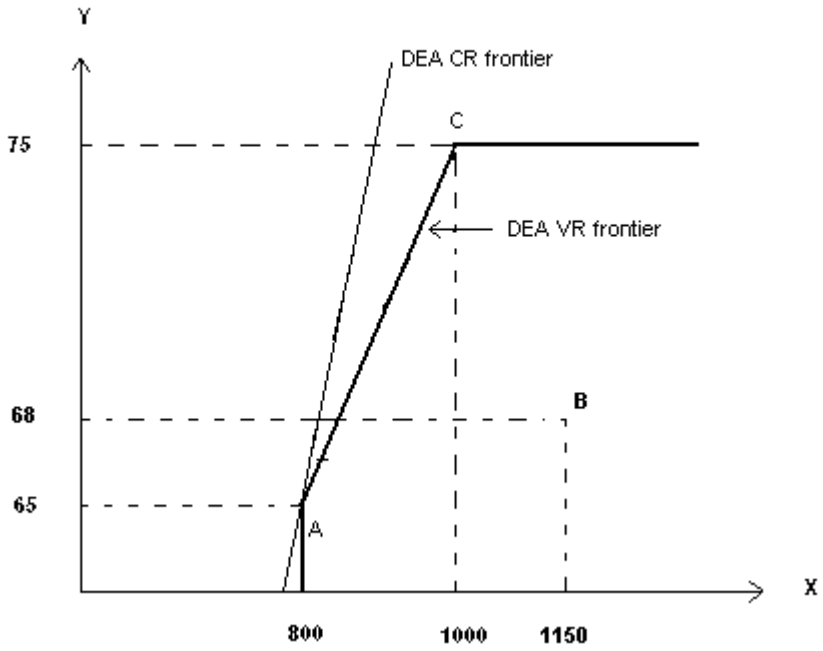



2b




Source: adapted from Confservizi (2004).

Figure 3 – DEA frontiers




Note: CR – constant returns to scale; VR – variable returns to scale.

Figure 4 – Ranking of efficiency scores for the Italian regions, 2001
(DEA input oriented, 2 inputs, 1 output)

Table 1 – Main areas on which the Italian regions have both legislative and administrative competence

| Social Services | Planning and use of the territory | Government of Economics |
|---|---|---|
| - Health care system<br>- School sid<br>- Cultural supply<br>- Professional training<br>- Social sid<br>- Welfare assistance | - Urban and territorial planning<br>- Water and sewage system<br>- Defence of the territory<br>- Protection of the environment<br>- Transport planning with the possibility to give transfer funds in order to help local inefficient public companies | - Tourisme<br>- Commerce<br>- Agriculture<br>- Fishery<br>- Handicrafts |

Source: Scaglioni (2005).

Table 2 – Values for regions A, B and C

| | Indicator | Expenditure |
|---|---|---|
| Region A | 65 | 800 |
| Region B | 68 | 1150 |
| Region C | 75 | 1000 |

Table 3. Total regional performance indicator (TRPI), 2001
(Sub-indicators are normalised to unity)

| Region | Irregularity in water provision | Waste collection | Electric service failures | Public transport utilization index | Railway utilization index | Motorway network (km/ square km) | Gas (% houses provided) | TRPI (equal weights 1/) |
|---|---|---|---|---|---|---|---|---|
| Abruzzo | 0.43 | 1.04 | 0.90 | 1.09 | 0.62 | 0.92 | 1.14 | 0.88 |
| Basilicata | 0.33 | 0.94 | 0.62 | 1.24 | 0.43 | 0.65 | 0.84 | 0.72 |
| Calabria | 0.18 | 0.66 | 0.37 | 1.09 | 0.89 | 0.90 | 0.39 | 0.64 |
| Campania | 0.49 | 0.86 | 0.61 | 1.29 | 1.43 | 1.01 | 0.92 | 0.94 |
| Emilia - Romagna | 1.59 | 1.14 | 1.39 | 0.72 | 0.93 | 0.66 | 1.48 | 1.13 |
| Friuli - Venezia Giulia | 4.22 | 0.92 | 1.72 | 0.82 | 0.85 | 0.61 | 1.30 | 1.49 |
| Lazio | 0.67 | 1.00 | 0.73 | 1.45 | 1.60 | 0.77 | 1.41 | 1.09 |
| Liguria | 1.77 | 1.01 | 1.23 | 1.48 | 2.83 | 0.69 | 1.24 | 1.46 |
| Lombardia | 1.20 | 0.98 | 1.66 | 1.22 | 1.56 | 0.92 | 1.58 | 1.30 |
| Marche | 0.96 | 0.97 | 1.23 | 0.78 | 0.41 | 1.69 | 1.22 | 1.04 |
| Molise | 0.44 | 0.90 | 0.75 | 1.27 | 0.39 | 0.16 | 1.03 | 0.71 |
| Piemonte | 1.25 | 0.95 | 1.14 | 0.98 | 1.40 | 3.13 | 1.35 | 1.46 |
| Puglia | 0.31 | 0.89 | 0.83 | 0.86 | 1.07 | 3.51 | 0.97 | 1.21 |
| Sardegna | 0.22 | 1.02 | 0.41 | 0.96 | 0.70 | 0.45 | 0.02 | 0.54 |
| Sicilia | 0.24 | 0.75 | 0.52 | 0.80 | 0.40 | 1.13 | 0.49 | 0.62 |
| Toscana | 0.82 | 1.28 | 0.91 | 0.78 | 1.04 | 0.63 | 1.39 | 0.98 |
| Trentino - Alto Adige | 2.09 | 1.04 | 0.86 | 1.07 | 0.76 | 0.24 | 0.57 | 0.95 |
| Umbria | 0.73 | 1.27 | 1.34 | 0.75 | 0.77 | 0.25 | 1.24 | 0.91 |
| Valle D'Aosta | 1.00 | 1.23 | 1.68 | 0.52 |  | 0.07 | 0.19 | 0.78 |
| Veneto | 1.05 | 1.15 | 1.11 | 0.82 | 0.92 | 1.60 | 1.23 | 1.13 |
| Average | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Maximum | 4.22 (FVG) | 1.28 (TOS) | 1.72 (FVG) | 1.48 (LIG) | 2.83 (LIG) | 3.51 (PUG) | 1.58 (LOM) | 1.49 (FVG) |
| Minimum | 0.18 (CAL) | 0.66 (CAL) | 0.37 (CAL) | 0.52 (VDA) | 0.39 (MOL) | 0.07 (VDA) | 0.02 (SAR) | 0.54 (SAR) |

1/ Each sub-indicator contributes 1/7 to total indicator.
Note: Abruzzo – ABR; Basilicata – BAS; Calabria – CAL; Campania – CAM; Emilia - Romagna – ER; Friuli - Venezia Giulia – FVG; Lazio – LAZ; Liguria – LIG; Lombardia – LOM; Marche – MAR; Molise – MOL; Piemonte – PIE; Puglia – PUG; Sardegna – SAR; Sicilia – SIC; Toscana – TOS; Trentino - Alto Adige – TAA; Umbria – UMB; Valle D'Aosta – VDA; Veneto – VEN.

Table 4. DEA results for Italian regions, 2001,
1 input (expenditure) and 1 output (TRPI)

| Region | Input oriented | | Output oriented | | Peers | CRS TE |
|---|---|---|---|---|---|---|
| | VRS TE | Rank | VRS TE | Rank | Input/output | |
| Abruzzo | 0.879 | 6 | 0.605 | 14 | Emilia – Romagna/ Piemonte, Emilia – Romagna | 0.604 |
| Basilicata | 0.482 | 12 | 0.488 | 16 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.272 |
| Calabria | 0.462 | 14 | 0.433 | 18 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.232 |
| Campania | 0.330 | 18 | 0.633 | 12 | Emilia – Romagna/Friuli - Venezia Giulia | 0.244 |
| Emilia - Romagna | 1.000 | 1 | 1.000 | 1 | Emilia – Romagna/Emilia – Romagna | 0.883 |
| Friuli - Venezia Giulia | 1.000 | 1 | 1.000 | 1 | Friuli - Venezia Giulia/ Friuli - Venezia Giulia | 0.423 |
| Lazio | 0.462 | 15 | 0.738 | 8 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.394 |
| Liguria | 0.588 | 11 | 0.984 | 4 | Friuli - Venezia Giulia, Piemonte/ Friuli - Venezia Giulia, Piemonte | 0.436 |
| Lombardia | 0.882 | 5 | 0.893 | 6 | Emilia – Romagna, Piemonte/ Friuli - Venezia Giulia, Piemonte | 0.837 |
| Marche | 0.688 | 8 | 0.710 | 9 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.559 |
| Molise | 0.360 | 16 | 0.474 | 17 | Emilia – Romagna/Friuli - Venezia Giulia | 0.199 |
| Piemonte | 1.000 | 1 | 1.000 | 1 | Piemonte/Piemonte | 1.000 |
| Puglia | 0.825 | 7 | 0.828 | 7 | Emilia – Romagna, Piemonte/ Friuli - Venezia Giulia, Piemonte | 0.754 |
| Sardegna | 0.350 | 17 | 0.363 | 20 | Emilia – Romagna/Friuli - Venezia Giulia | 0.148 |
| Sicilia | 0.465 | 13 | 0.417 | 19 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.225 |
| Toscana | 0.673 | 9 | 0.668 | 10 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.515 |
| Trentino - Alto Adige | 0.080 | 19 | 0.634 | 11 | Emilia – Romagna/Friuli - Venezia Giulia | 0.059 |
| Umbria | 0.600 | 10 | 0.618 | 13 | Emilia – Romagna/ Friuli - Venezia Giulia, Piemonte | 0.426 |
| Valle D'Aosta | 0.064 | 20 | 0.524 | 15 | Emilia – Romagna/Friuli - Venezia Giulia | 0.039 |
| Veneto | 0.966 | 4 | 0.930 | 5 | Emilia – Romagna/Emilia – Romagna | 0.852 |
| Average | 0.608 | | 0.697 | | | 0.455 |

Notes: CRS TE - constant returns to scale technical efficiency.
VRS TE - variable returns to scale technical efficiency.

Table 5. DEA results for Italian regions, 2001,
2 inputs (expenditure, civil servants) and 1 output (TRPI)

| Region | Input oriented | | Output oriented | | Peers | CRS TE |
|---|---|---|---|---|---|---|
| | VRS TE | Rank | VRS TE | Rank | Input/output | |
| Abruzzo | 0.942 | 8 | 0.605 | 14 | Puglia, Veneto/ Piemonte, Emilia – Romagna | 0.604 |
| Basilicata | 0.884 | 9 | 0.538 | 15 | Puglia/Piemonte, Puglia | 0.528 |
| Calabria | 0.770 | 14 | 0.439 | 18 | Puglia/ Friuli - Venezia Giulia, Piemonte | 0.409 |
| Campania | 0.870 | 11 | 0.696 | 10 | Puglia/ Piemonte, Puglia | 0.681 |
| Emilia - Romagna | 1.000 | 1 | 1.000 | 1 | Emilia - Romagna/Emilia – Romagna | 0.883 |
| Friuli - Venezia Giulia | 1.000 | 1 | 1.000 | 1 | Friuli – Venezia Giulia/ Friuli - Venezia Giulia | 0.705 |
| Lazio | 0.884 | 10 | 0.815 | 8 | Puglia/ Piemonte, Puglia | 0.800 |
| Liguria | 0.954 | 7 | 0.997 | 6 | Friuli - Venezia Giulia, Piemonte/ Friuli - Venezia Giulia, Piemonte | 0.844 |
| Lombardia | 0.978 | 6 | 0.965 | 7 | Puglia, Piemonte, Veneto/ Piemonte, Puglia | 0.963 |
| Marche | 0.808 | 12 | 0.710 | 9 | Puglia, Piemonte/ Friuli - Venezia Giulia, Piemonte | 0.651 |
| Molise | 0.735 | 16 | 0.483 | 17 | Puglia/ Friuli - Venezia Giulia, Piemonte | 0.431 |
| Piemonte | 1.000 | 1 | 1.000 | 1 | Piemonte/Piemonte | 1.000 |
| Puglia | 1.000 | 1 | 1.000 | 1 | Puglia/Puglia | 1.000 |
| Sardegna | 0.644 | 18 | 0.366 | 20 | Puglia/ Friuli - Venezia Giulia, Piemonte | 0.289 |
| Sicilia | 0.750 | 15 | 0.422 | 19 | Puglia/Friuli - Venezia Giulia, Piemonte | 0.383 |
| Toscana | 0.801 | 13 | 0.669 | 11 | Puglia, Veneto/ Friuli - Venezia Giulia, Piemonte | 0.616 |
| Trentino - Alto Adige | 0.253 | 19 | 0.634 | 12 | Puglia/ Friuli - Venezia Giulia | 0.198 |
| Umbria | 0.715 | 17 | 0.618 | 13 | Puglia, Veneto/ Friuli - Venezia Giulia, Piemonte | 0.510 |
| Valle D'Aosta | 0.215 | 20 | 0.524 | 16 | Puglia/ Friuli - Venezia Giulia | 0.139 |
| Veneto | 1.000 | 1 | 1.000 | 1 | Veneto/Veneto | 0.852 |
| Average | 0.810 | | 0.724 | | | 0.624 |

Notes: CRS TE - constant returns to scale technical efficiency.
VRS TE - variable returns to scale technical efficiency.

Table 6. Censored normal Tobit results

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Constant | 0.0384 | | -4.3376 ** | -3.9729 ** | -4.7045 *** |
| | (0.19) | | (-2.53) | (-2.04) | (-2.68) |
| *Y* | 2.50E-05 *** | 2.51E-05 *** | | | |
| | (2.77) | (8.44) | | | |
| *Log(Y)* | | | 0.4937 *** | 0.4196 ** | 0.4991 *** |
| | | | (2.84) | (2.16) | (2.82) |
| *Log(E)* | | | | 0.1373 ** | 0.1103 *** |
| | | | | (1.94) | (2.82) |
| *Popdens* | 0.0011 *** | 0.0011 *** | 0.0011 *** | 0.0001 | |
| | (2.70) | (3.72) | (2.75) | (0.15) | |
| Nº obs. | 20 | 20 | 20 | 20 | 20 |
| $\hat{\sigma}_\varepsilon$ | 0.168 | 0.166 | 0.167 | 0.181 | 0.173 |
| $\bar{R}^2$ | 0.458 | | 0.466 | 0.503 | 0.516 |

Notes: *Y* – per capita GDP; *E* – Population with tertiary education; *PopDens* – population density. The *z* statistics are in brackets. *, **, *** - Significant at the 10, 5 and 1 per cent level respectively. $\hat{\sigma}_\varepsilon$ – Estimated standard deviation of $\varepsilon$.