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ECO-EFFICIENCY IN THE ITALIAN WASTE MANAGEMENT SECTOR

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Eco-Efficiency in the Italian Waste Management sector[1]

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ABSTRACT: In the light of the recent European environmental regulation, in Italy, waste collection management has been involved in some important changes both from environmental and management point of view. From the one hand, firms want to maximize the quantity of collected Municipal Solid Waste (MSW) showing an increasing capacity of waste collection per unit of labor and capital, from the other hand they want to minimize the level of Undifferentiated Solid Wastes (USW) in order to meet environmental goals. This paper extends the concept of Directional Distance Function (DDF) to the waste sector, in which previous applications of efficiency models have been mainly focused on the cost-function side. The idea of DDF (by Chambers et al.,1996; 1998) is here applied to treat asymmetrically two categories of outputs: one desirable (amount of MSW) and one undesirable (level of undifferentiated wastes) both observed (with inputs) from a sample of around 450 Italian municipalities during 2006. Computed efficiency scores are analyzed in light of different tariff systems (e.g. flat fee and pay as you through), different socio-economic contexts (e.g. Northern vs Southern Italy) and prevalent political side in local government (Left wings vs Right-wing parties). Keywords**:** 4-6 nanocompounds, atmospheric pollutants, social costs evaluation, social saving, titanium dioxide.

KEYWORDS: DEA, DDF, Waste Management, Waste Policies

JEL CODES: Q53, Q56, L23

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SUMMARY

1. INTRODUCTION

In Europe, the environmental regulation on waste production, European Directive (2008/98/EC), provides some targets of recycling and reducing municipal waste[2] and a generic hierarchy about waste (i.e. prevention, preparing for use, recycling, other recovery, disposal) that have to be honored by all European countries and by certain dates. In Italy, in particular, due to the ongoing evolution of environmental regulations and to the increasing management and technological complexity of the overall refuse cycle, during the last decades, waste management has been involved in some important changes both on corporate organization and on market structure side.

The recent main rules introduced in Italy are the Decreto Ronchi (D.l. 22/1997) and the Testo Unico Ambientale (l. 152/2006) and they had the aim to incentive the integrated cycle of management of refuses or, in other terms, the management of the three phase of management: collection, disposal and treatment of wastes. These different stages can be managed separately by different firms or integrated in a same company (integrated cycle of waste). Moreover, Decreto Ronchi has also introduced a new way of payment, the waste tariff (TIA, Tariffa d'Igiene Ambientale), which is to be proportional to waste quantity and quality produced per floor area unit, and that became mandatory in 2010, substituting the previous tax (TARSU, Tassa sui Rifiuti Solidi Urbani) for households on solid municipal waste collection. The differences between the two schemes are huge, both from the citizens and collecting firms sides (Bilitewski B., 2008).

Industrial complexity of the value chain of solid waste management (SMW) has been increasing as well, entailing significant investment, division of labor, specialization, management skills and technological content. The companies started to make more investments in new technologies and in new organizational systems in order to increase their added values and their efficiency.

Municipalized and private companies[3] of the sector are forced to increase the level of differentiated wastes to reduce their environmental impact, also if their economical costs are increasing, indeed, the cost of recycling is higher because it requires more labor force, new schemes of collection and new equipments and garbage bins. The important environmental target of reducing pollution, that is to increase separated waste collection, has to be followed by a management target of an increasing of efficiency for companies, during the collection stage.

Therefore, in this paper we would adopt a new research approach, in line with these legal provisions. On the one hand, from the purely technical side, municipalized and not municipalized firms want to maximize the quantity of collected wastes showing an increasing capacity of waste collection per unit of labor and capital. From the other hand, adopting a purely ecological vision, they also want to minimize the level of not separated solid wastes (NSW) which represent a clear

[2] In Italy, the EU recycling target is of 50% for MSW, by 2020.

[3] The old municipal enterprises that collect waste has been involved in a transformation of corporate structure and legal form. Often they were transformed in a joint stock company or other form of private companies, even if the municipality usually own the majority of stakes.

undesirable outputs to be minimized in order to meet environmental goals. Therefore, our aim is to extend previous literature on Directional Distance Function (DDF), proposed to deal with the problem of undesirable outputs to the case of waste-management firms. DDF method, introduced by Chambers et al. (1996), represents an extension of standard DEA model, where the underlying radial concept of distance is replaced by a more flexible tool. This framework allow us to treat asymmetrically the two categories of outputs, one desirable and one undesirable, which in this case are, respectively, the total amount of collected wastes and the level of undifferentiated wastes.

Our aim would be also to focus on how the different tariff systems (e.g. flat fee and pay as you through scheme) introduced by the recent government normative and the different collection schemes of waste collection companies (e.g. drop off and door to door) could affect the efficiency in order to optimize the collection management and the environment quality. Indeed, a part of the European empirical literature shows that the increasing of promoting recycling activities does not lead to an increasing in the costs of solid waste collection (Bel and Fageda, 2010).

After a classical estimate of efficiency scores, per se useful for public managers in understanding the consequences of their choices (Guimarães et al. 2010), we perform an heuristic ‘second stage’ analysis of the results in order to understand some of the potential determinants of the detected inefficiency. At this stage of the work we just compute average over groups and we perform parametric and non-parametric test to underline the statistical significance of results.

The results from this part can help policies designers in understanding possible effects from different regulation schemes as well as some intrinsic characters of the operating environment in influencing technical and environmental aspect of waste management.

The reminder of the paper is organized as follow. The section 2 collects previous application of efficiency models to waste sector and it also describe the DDF method and its main theoretical assumptions. The section 3 describes the dataset and some empirical issues; while in the section results the main findings are commented and discussed. Some policy implications and general considerations conclude the present work.

2. LITERATURE AND METHODOLOGY

2.1 Previous literature on traditional efficiency in waste management

The investigation of technical efficiency in the waste management sector has been already carried out in many countries; previous applications of economic efficiency model to the waste industry were mainly focused on the cost side (Lombardo, 2009 for Italy; Rogge and De Jaeger, 2012 for Belgium) even if they apply standard non parametric tools such as Data Envelopment Analysis (DEA). Other application regards the waste industry in general and also in those cases the standard non-parametric efficiency approach is adopted. Waste management performance of local municipalities are measured by Worthington and Dollery (2001) in Wales, by García-Sánchez (2008) for a small sample in Spain, while Sarkis and Weinrach (2001) evaluate more generally different waste treatment technologies.

Other authors analyze waste management activity from the productivity growth perspective by estimating Malmquist productivity indexes, among the others Simões and Marques (2012) to quantify the effect of changing environmental protection. More recently Mendes et al. (2013) adopt a balance scorecard tool to evaluate performance enhancement in the waste management services in regions characterized by high seasonality.

Regarding the case of Italy, and in particular the city of Rome, Cherubini et al. (2008) adopt a Material Flow Accounting method and propose a first instrument to assess the environmental performance of waste collection and storage. To model a production process with different category of outputs jointly produced and characterized by different level of desirability, some additional assumption and constraints need to be added to the standard axiomatic approach.

2.2 Modeling waste collection technology with undesirable outputs

The main issue is the representation of waste collection activities using a production function defined on an output set, is that the standard approach require to be modified in order to accomplish with two category of outputs. Moreover, other additional restrictions need to be imposed to accommodate the particular features of such outputs. In fact, the Directional Distance Function approach coincides with the standard DEA except for some additional constraints on the outputs side. Let $x = (x_1,..., x_N) \in R_+^N$ be a vector of inputs, $y = (y_1,..., y_M) \in R_+^M$ a vector of good outputs and $b = (b_1,..., b_J) \in R_+^J$ a vector of bad outputs that in our case are represented by NSW quantities. Starting from the classical assumptions on technology and input-output sets, we assume that undesirable outputs are jointly collected with DSW.

This hypothesis is called null jointness, in notation:

$$\forall y \in Y, \forall b \in B, b = 0 \Rightarrow y = 0 \quad (1)$$

No collection activities of DSW are compatible without the collection of undifferentiated waste, because at least a minority fraction of total wastes cannot be differentiated.

Another assumption largely accepted is the so called weak disposability assumption: if there are some outputs, which are undesirable it is reasonable to assume that bad outputs could not be reduced without reducing also good outputs. Under our vision and adopting the point of view of municipal firms based on technical collection activities, an increase in global quantities represent a clear productivity enhancement under the assumption of fixed inputs. However, within the actual legal regime, increasing quantities of USW are linked to increasing costs, suggesting to include them among bad outputs.

This approach allows us to highlight the existing trade-off between different categories of wastes: municipalities who show higher collection capacities are more productive in technical term, but they are penalized in the share of undifferentiated wastes is increasing. The vector *y* of good outputs represents the total amount of wastes collected by each municipality, while the vector *b* contain the USW quantities that each firms want to minimize in order to reduce the environmental damage, according to the Italian legal system.

Therefore, the classical assumption of free disposability on the output side does not hold anymore for all the outputs, but only for the subset of good outputs (Färe et al., 1989). In particular, the reduction of *y* can occur without additional costs, while reducing the amount of *b* requires additional costs. First of all the additional cost are purely technical and due to the increasing costs of differentiated collection, but they are also due to other collateral activities, for example communication costs for information/ awareness campaign , which are essential to increase sensibility to differentiate. In notation the weak disposability in *(y,b)*, where $0 \leq \alpha \leq 1$ and *P(x)* is the production possibility set:

$$(x, y, b) \in P(x) \Rightarrow (x, \alpha y, \alpha b) \in P(x) \quad (2)$$

Then, weak disposability implies that good and bad outputs can be proportionately contracted at fixed input, for example if some collection activities have been cut indiscriminately, but only good outputs can be freely reduced without costs. In fact, reducing the amount of USW with fixed good outputs (DSW+USW), directly imply and increase in the share of differentiated waste on the total collected quantities. However, as it is previously stated, increasing the amount of differentiated wastes is costly and the necessary additional amount of resources contradicts the assumption of fixed inputs. In notation, free disposability remains valid only for the subset of desirable outputs *y*, in our case the general collection of wastes:

$$\begin{aligned}(x, y, b) \in P(x) &\Rightarrow (x, \alpha y, b) \in P(x) \\ &\Rightarrow (x, y, \alpha b) \notin P(x)\end{aligned} \quad (3)$$

Other assumptions, which are normally accepted in standard production theory, such as inactivity, compactness and free disposability in inputs, continue to remain valid within this framework, see Färe et al. (2007) for additional details.

The Directional Distance Function (DDF) represents the maximum feasible proportional contraction in bad outputs (USW in our case) and expansion in good outputs (total quantities collected) along a pre-assigned direction (Chambers et al., 1996; Chambers et al., 1998; Färe et al., 2000). DDF takes a value equal to 0 for efficient firms, which contribute to the frontier identification and it increase with inefficiency as any standard distance measures. The directional output distance function is defined as follows:

$$\begin{aligned}&\vec{D}_0(x, y, b; g_y, g_b) = \\ &\max\{\beta : (y, b) + (\beta g_y, \beta g_b) \in P(x)\}\end{aligned} \quad (4)$$

Where $g = (g_y, -g_b)$ is the key parameter in using that tool. The choice of the direction is arbitrary, but the majority of the previous literature suggests a limited number of suitable directional vectors. The production possibility set, *P(x)*, and the value of the DDF[4] are estimated via non-parametric models, by solving, for each firm, the following linear problem after fixing a particular directional vector. In our case *g = (y,-b)*, in order to fit European Regulation that impose a reduction in USW and managerial goals that impose to maximize the global collected quantities.

$$\begin{aligned}\vec{D}_W(x_0, y_0, b_0; y, -b) &= \max \beta \\ \text{s.t.} \quad x_0 &\geq \mathbf{X}z \\ (1+\beta) y_0 &\leq \mathbf{Y}z \\ (1-\beta) b_0 &= \mathbf{B}z \\ z \geq 0, &\beta \geq 0\end{aligned} \quad (5)$$

[4] Directional Output Distance Function to be more precise, because inputs are considered as fixed.

In practice directional output distance function re-scales the observed output vector *(y,b)* on the frontier following the g direction, then *(y,-b)* in our case.

Applying DODF the represented production technology immediately derive from reality, without transformations and all the constraints on *P(x)* can be formulated in linear form, then DEA framework could be used. The value β, estimated for each DMU, represents directly the scaling factor, then the distance from the best practice frontier.

Thanks to its suitable properties the DDF concept, has been extensively applied to environmental field since its introduction (Chung et al., 1997; Boyd et al., 2002; Domalizlicky and Weber, 2004; Picazo-Tadeo and Prior, 2009; Bellenger and Herlihy, 2010; Macpherson et al., 2010) aimed to create global efficiency measure. One of the only references for efficiency in the waste field considering different categories of outputs is represented by Chang and Yang (2011) who applies the slack-based measures with non-separable desirable and undesirable outputs, but they analyze the efficiency of municipal incinerators and not waste management activities.

2.3 Explaining waste collection inefficiency

After the estimation of environmental efficiency scores of firms operating in the waste management, the aim of this paper is to infer about those technical differences in order to get some policy implications and for this reason the attention is focused on the pricing systems to cover the cost of collection. From the literature large differences arises when the two main financing systems (tax or tariff) to recover the costs of collection have been adopted in certain municipalities Reichenbach (2008). The important issue is addressed at different level, firstly TE is compared among the two group of tariff versus tax municipalities.

However, this approach is limitative: many interactions seem to arise between geo-political variables and the kind of scheme chosen by local authorities. An Italian report about the introduction of the tariff (Ispra Report, 2012) provides an overview of the geographical trend. From 2000 to 2011 years, the north of Italy has 1,077 municipalities with tariff system; while the center has 127 and the south 143 municipalities with Tia.

Moreover, other aspect can deeply influence efficiency, as has been already highlighted recently by Rogge and De Jaeger, (2013) who apply conditional DEA estimators to control for the influence of demography and household income in municipalities, then in the direct estimation of efficiency scores.

Given the numerous variables that can potentially affect performances the approach adopted in the present paper is different and is based on the idea that those variables influence efficiency, but they do not affect the shape of the technology that remains the same across the subgroups.

3. DATA AND EMPIRICAL STRATEGY

3.1 Inputs and outputs data

The database includes 540 Italian municipalities, observed during the year 2006. Publicly available Istat[5] data are used as demographic and socio-economic indicators; information on amounts of collected waste

[5] Istat is the Italian National Institute of Statistics.

Table 1. Descriptive statistics of inputs and outputs (Year 2006)

Variables	mean	min	max	sd
Input (000 of euros)				
Total collection costs	4,346	29	382,000	21,400
Desirable output (tonnes)				
Municipal solid wastes	21,475.76	167.04	1,670,425	87,044.86
Undesirable output (tonnes)				
Not-Separated wastes	17,422.24	136.12	1,460,214	74,165.33

Source: Ecocerved

and costs of management are from EcoCerved[6]. The sample is geographically well distributed over the national area and it covers 182 municipalities in the Northern regions, 97 in the Centre, 150 in the South and 60 in the islands. The sample represents over a third of the Italian population.

From a methodological point of view, DDF is applied in a non-parametric setting, by using economical data from balance sheet (focused on the costs side) and environmental data for each Decision Making Units (waste collection enterprises in our case). One input, given by the total amount of cost by collection activities then by combinations of labor and capital, is implied during the production process in order to obtain a total amount of collected wastes (MSW) and a physical quantity of not-separated wastes (NSW). The costs includes the sum of the cost of sweeping and cleaning the streets, the cost of NSW and differentiated solid waste (DSW) collection, the cost of separated waste collection management and the cost of capital[7]. MSW represent the items of the desirable since the company wants to maximize the quantity of collected wastes showing an increasing capacity of waste collection per unit of labor and capital. NSW represents the item of the undesirable output that a company wants to minimize for many points of view[8]. First, NSW could generate the problem of saturation of the landfills with consequent problems in terms of risk fir the wealth of the people and environmental damage. Second, a higher NSW generation means an increasing of the opportunity cost to not reuse or to not recycle parts of these wastes since from recycling can come the decreasing of the overall generated wastes. Total production of waste (MSW) is around 21,475 tonnes (470 kg per capita) per year on average, with the share of separated waste collection around 20 per cent, on average. There is quite high variability in the sample according to total amount of waste collected and waste sorting policies. Indeed, while some municipalities do not have a serious recycling programme (more than 100 municipalities – mainly in the South - register less than 5 per cent of separated waste collected in 2006), others have achieved as much as 76.5 per cent of waste to recycling. The following table shows some statistical findings about and inputs and outputs used to run the efficiency model (Table 1).

[6] EcoCerved is an Italian company that, among other functions, organizes and collects data on waste management from municipalities.

[7] In our treatment, we exclude the cost of treatment and disposal.

[8] We consider MSW = NSW + (D)SW.

3.2 *Variables affecting waste collection activities*

The idea of testing different hypotheses about the influence of potential determinants of environmental productivity of waste collection firms comes from Picazo-Tadeo and Garcìa-Reche (2007) who try to explain DEA scores, estimated with an environmental correction, in the tile sector. Here, explanatory variables try to catch those differences across municipalities which can determine different performances in term of collected wastes. Those variables can be partially suggested by previous work on the field of waste collection activities. In particular, Simões and Marques (2011) show the importance of the operating environment in influencing performance.

Even from the economics empirical literature about the waste generation and delinking could be a reference to test some socio economic and demographic variables, since the link between the generation of a higher quantity of waste and the efficiency indicator could be significant. We suppose that density, population, household income and tariff/tax system of payment are some of potential variables that could affect the waste generation, before, and the efficiency, after.

Many previous empirical studies find a relationship between income and waste generation and, in particular, most of them find a positive correlation. There exist a huge literature about the relative delinking that suggests the presence of a bell shaped path between income and waste showing that wastes increase until some maximum point, so called turning point, over which the waste starts to decrease. In particular, Abrate and Ferraris (2013) show how the effort to reach that inversion of trend could depend on income and other explanatory socio economic variables. In this overview, the income effect could be also a strategic variable not only for the inversion of trend to reduce the total amount of refuses but also for the increasing of efficiency on the costs side.

Further, following Geys (2006) who finds significant proximity effect conclude that municipalities with more efficient neighbors tend to be more efficient themselves, and this is the main motivation to include geographical dummies to control for proximity factors. For this reason we identify the Italian macro (North-West, North-East, South, and Islands, the Centre is used as control group) as interesting subgroup to be investigated separately in order to isolate economical, geographical and proximity effects.

Moreover, the influence of the system of tariff (Pay as You Through, PAYT) or tax is also tested in our paper: in Italy, regulation affects both the management structure of the firms operating in the waste sector and waste generation and its prevention. However, the TIA (Tariffa di Igiene Ambientale) has been still implemented in only a small share of municipalities[9]. One of objectives of the TIA was to introduce mechanisms to reward consumers who separated their waste (e.g., into composting, paper, glass, aluminum for recycling) as part of a “pay-as-you-throw” scheme that provides incentive for reducing waste and increasing recycling. The introduction of tariff incentives for households has a significant impact on promoting separated collection by compensating the opportunity cost associated with the recycling effort. However, the

[9] From 2013 TIA will be replaced by a new municipal tax on waste and waste services - ‘TARES’ (Tassa sui rifiuti e servizi, Legislative Decree 201/2011)

Table 2. Descriptive statistics explanatory variables, macro-region focus

Macroarea	Number of inhabitants				
	mean	min	max	sd	N
Centre	64,314	993	2,711,491	280,229	97
Isles	36,812	3,365	662,046	89,134	60
North-East	40,200	2,460	212,500	51,013	63
North-West	48,025	1,042	1,297,244	147,461	119
South	24,684	2,673	321,747	37,165	150
Italy	41,733	993	2,711,491	150,881	489

Source: Istat, Sole24 ore

incentive is not significant for reducing total waste (Abrate & Ferraris, 2013). Finally, we also include some political aspects (Right-wing parties, Left-wing parties and commissionership) in order to find some consequence of the political rules on the environmental side, since many environmental policies in the collection stage are adopted by the municipal government.

4. RESULTS

4.1 *Technical Efficiency in collection activities*

For each Italian municipality in the sample with complete data, environmental efficiency score are calculated by solving linear program, where the share of undifferentiated wastes is considered as a negative outcome. All programs are written and solved using R. Before results interpretation, it should be underlined that efficiency is a relative concept and then what we get from estimation is the position of each DMU (collecting firm) in respect to the best of the sample in the specific time period used (in our case 2006). Once efficiency scores are computed on the basis of the DODF framework, a set of hypotheses regarding their potential determinants can be tested in order to verify a-priori expectations and to draw some policy implications. In particular, we test for the significance of socio-economic aspects, financing schemes and political color in determining the performance of municipal waste-collecting firms.Tests are based on subgroups comparisons and on parametric and non-parametric tests. Non parametric Kruskal-Wallis tests for multiple groups confirm that the emerging differences in table 3 can be considered as significant assuming 95% confidence.First of all we can observe a strong heterogeneity from a geographical point of view as it is clearly underlined by table 3.

Table 3. Eco-efficiency results, by geographical area

Macro-Region	Eco-efficiency	
	Mean β	N
North-West	0.318	119
North-East	0.296	63
Center	0.408	97
South	0.452	150
Islands	0.451	60

Table 4. DDF results, by taxation scheme

Efficiency results	mean	N
Tax	0.403	288
Tariff	0.357	134
Total sample	0.389	422

In particular, we can find a large gap between the North of Italy and the rest of the country.

The most efficiency regions are in the North-West area, where the most efficient region is Veneto. In these regions, policy programs of recycling and tariff pay systems were implemented a lot in many municipalities and, as a consequence, they show the most efficiency systems of collection and reduction of NSW. The Centre and South areas are more inefficient, indeed, in that areas difficulties in waste collection management are mainly due to the highest density of those areas and to the lack of economic resources to make efficient the collection system and the prevention of NSW generation. Moreover, the saturation of landfills has generated highest costs for some particular region in the South and Islands, while companies of the North-East of Italy present many innovative systems of collection with high technological levels. This could be a significant element of how in that areas efficiency tends to be higher also in the reduction of NSW. Indeed, in some cases, strong policies of awareness of the people on the environmental issues are matched with policies in the efficiency in the collection[10].

The new tariff system seems to be significant. Indeed, also in this case, Kruskal-Wallis non parametric tests confirms that municipalities adopting a tariff financing scheme show an higher technical efficiency, that is significantly higher than in case of pure taxation scheme (assuming 95% confidence) as shown in the Table 4.

This will suggests that a different financing method for the waste collection sector, based on a tariff “pay-as-you-throw”, can have positive influence on the efficiency performance of firms operating in those municipalities. The motivations rely in the incentive for citizens in optimizing the differentiate collection of wastes to save money.

Finally, also the color of the municipal administration plays certain role in the efficiency performance evidence. From our dataset, if we compute the average of the efficiency scores on the political color we obtain 4 groups: Right-wings vs Left-wings parties from the one hand, and Civic Lists /Commiserated municipalities from the other hand. The former two groups characterize larger cities, where the political organization is similar than at national level, on the contrary Civic lists characterize smaller town (less than 5,000 inhabitants). We cannot observe better performances for the latter groups, while a significant better performance emerges for municipalities administrated by Right-wings parties. That evidence is also confirmed by Kruskal-Wallis non parametric tests.

[10] In some companies of the North, for instance, there exists systems of GPS in the vehicles and in the garbage bins that help collectors to monitor wastes and make an efficient use of resources during the collection stage.

Table 5. DDF results, by political color

Political side	mean	N
Right wings	0.371	124
Left wings	0.393	192
Civic List	0.396	129
Commissariat*	0.414	11
Total sample	0.388	456

* This group represents an exception, due to administrative/political problems.

5. CONCLUSIONS

This paper examines the relationship between technical efficiency and environmental protection in the Italian waste collection industry. The novelty of the current approach is in the identification of two categories of outputs that has been asymmetrically treated in the efficiency model, with a resulting opposite influence on productivity and performances. A classic non-parametric directional output distance function is applied under the assumption of a bad outputs (undifferentiated-not separated solid wastes, NSW) produced together with one desirable output (total collected wastes, MSW). This methodology leads to a more accurate estimate of technical efficiency with respect to previous works. Indeed, it distinguishes between performances obtained by discarding undifferentiated solid wastes and those obtained by running a more selective recycling process. This empirical analysis provides a measure of efficiency by using a representative sample of 540 Italian municipalities, during the year 2006. We collect data of municipal waste generation, costs of collection and other socio economic variables like household income, population, density, tax/tariff system. The efficiency performance are higher in the north are of Italy, where the policies of implementation of recycling and tariff pay systems is more developed. At the same time what emerges is that right parties seem more aware of the environmental performance of the waste collecting activities, probably for their strength in the North-West part of Italy.

The present paper represents one of the first attempts to investigate the determinants of environmental sensitive efficiency scores in the waste industry, even if applying basic econometrical tools based on group comparison and related tests. One of the future extensions will consider the interaction between different aspects that in this paper are treated separately: the interaction between socio-economical variables, the taxation scheme and the political orientation cannot be un-influent.

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