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ELECTORAL REFORM AND PUBLIC SECTOR EFFICIENCY. SOME EVIDENCE FROM ITALIAN MUNICIPALITIES

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Abstract. We study the effect of Law 81/1993, which introduced a different electoral rule for the election of the mayor, on the technical efficiency of Italian cities. Since 1993, municipalities below 15,000 inhabitants vote with a single-ballot system, whereas cities above 15,000 inhabitants threshold are subject to a double ballot. We first estimate the technical efficiency in 1994 (taken as a pre-change year), and 1999 and 2004 for a sample of Italian municipalities, through a non-parametric DEA, and then we perform on both input and output oriented efficiency scores a difference-in-differences analysis, through various panel techniques. We find evidence that, after the reform, municipalities voting under a double-ballot show low levels of efficiency compared to cities voting under a single-ballot, by about 16 (input oriented) and 4 percentage points (output oriented). We speculate that the difference in the level of efficiency among cities voting under a different electoral rule is essentially driven by a lower average quality of politicians elected under a double ballot compared to those elected with a single ballot.

Keywords: Electoral reforms, Technical efficiency, Difference-in-differences, DEA

JEL: C21, C23, C24, D72, H76

1. Introduction

In Italy, municipal administrations have a number of important functions including the management of public utilities (local roads, water, sewage, and garbage collection), the provision of public housing, transportation and nursery schools, and the assistance of elderly people. Since these services have a great impact on citizens' daily lives, voters are generally very interested in the performance of local governments.

Electoral systems translate votes into seats. Under the so-called single-ballot plurality rule, only the winner of the highest vote share is elected in a given electoral district. On the other hand, at elections held under a double-ballot plurality scheme if in the first round none of the candidates obtains an absolute majority, the second ballot is held between the two most voted candidates (this scheme is also often labelled as a runoff system). Finally, proportional representation awards legislative seats in proportion to votes in each electoral district. In Italy, Law 81/1993 has introduced the direct election of mayors, as well as a different electoral scheme based on population size at the local level. In particular, municipalities below 15,000 inhabitants vote under a single-ballot, whereas cities above the threshold of 15,000 inhabitants are subject to a double-

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ballot: clearly, the single-ballot applying for Italian municipalities below the threshold of 15,000 inhabitants after 1993 is an example of plurality rule.

In the period before the introduction of Law 81/1993, many Italian cities were devastated by corruption and bad administration, as documented by numerous judicial inquiries. In such a compromised context, the direct election of mayors led to high expectations by citizens about the advent of well-functioning local governments.

In the intentions of the legislator, Law 81 was meant to substantially change the relations between the executive body and the municipal council with the aim of facilitating a stable and efficient administration. Directly-elected mayors would have enjoyed autonomous popular legitimacy strengthening their position vis-à-vis the council and freeing them from excessive conditioning of the parties. Secondly, since the election of the mayor was directly linked to the outcome of the electoral competition, the formation of the executives was freed from any external influences, such as agreements between parties at national level.

Indeed, on the one hand, the possibility to directly elect the top of the municipal executive could increase citizens' civicism, reconciling voters with the policy-making process. Yet on the other hand, the establishment of virtuous processes allowing the realization of these aims also depended on the occurrence of changes in the political parties, as well as in the quality of candidates whose role was exalted by Law 81/1993.

Many authors have analyzed the determinants of local government efficiency mainly focusing on environmental/political variables, such as age, educational attainment and gender of mayors (Loikkanen *et al.*, 2011), re-election and number of years for elections (Carosi *et al.*, 2014; Da Cruz and Marques, 2014; Doumpos and Cohen, 2014), political concentration/fragmentation and political strength (Revelli and Tovmo, 2007; Borge *et al.*, 2008; Bruns and Himmeler, 2011; Štastná and Gregor, 2011; Doumpos and Cohen, 2014; Pacheco *et al.*, 2014; Yusfany, 2015), and ideological position (Geys *et al.*, 2010; Agasisti *et al.*, 2015; Boetti *et al.*, 2012; Bruns and Himmeler, 2011), yet little is still known about the impact of the electoral system on the efficiency of local governments.

Rather, the literature on electoral rules has essentially focused on political competitiveness (see for instance Chamon *et al.*, 2008) and turnout (Barone and de Blasio, 2013), with essentially mixed empirical results. In particular, relating to the relationship between electoral rules and political competition, Callander (1999) finds that plurality elections tend to see more candidates running, and Cox and Neto (1997), and Chamon *et al.* (2008) highlight how more candidates are observed in runoff elections. The same conclusions are reached by Bordignon *et al.* (2016) for Italian municipalities. They find that under runoff elections, the number of political candidates is larger, but the influence of extremist voters on equilibrium policy, and hence policy volatility, is smaller, because the bargaining power of the political extremes is reduced compared to single round elections. These works also confirm that in cities interested by a double-ballot rule, a greater number of candidates and parties compete at the electoral race, leading in turn to an increase in the level of political competition.

Moreover, the electoral rule might affect both the quality of local politicians (De Benedetto, 2018), and the policies implemented once candidates are elected (Rizzo and Zanardi, 2010; Bracco and Brugnoli, 2012). In turn, the electoral rule should also affect the efficiency level of the whole government apparatus. For this purpose, we provide evidence of the effect of the electoral rule on the technical efficiency of Italian municipalities. Using data from the Italian Ministry of Internal Affairs (*Certificati Consuntivi del Ministero dell'Interno*), we estimate technical efficiency for a sample of Italian cities, through DEA non-parametric techniques, both in 1994 (taken as a pre-change year) and 1999 and 2004.

In order to assess the impact of the electoral reform on the efficiency level of Italian cities, we implement a difference-in-difference (diff-in-diff, hereafter) design and compare the changes in the technical efficiency scores across the treatment group (cities voting under a double ballot) and the

control group (municipalities voting under a single-ballot rule) before and after the reform was enforced.

We add to the existing literature on the efficiency of local government in two different perspectives. First, to the best of our knowledge, this is the first contribution aimed at analyzing the effect of the electoral rule on the technical efficiency of a sample of cities. Second, the literature investigating the efficiency of local government in Italy is scant, and most contributions relate to a rather limited sample of municipalities, often in a cross-section setup (see for instance, Lo Storto 2013; 2016).

Our findings show that, after the implementation of the reform, in municipalities with a population size larger than 15,000 residents input oriented efficiency scores are lower by roughly 16 percentage points compared to those in cities with a population size lower than 15,000 inhabitants. Similar results hold true when we consider output oriented technical efficiency scores. In this case the magnitude of the impact of the electoral reform seems to be smaller, i.e., 4 percentage points.

Our results are robust to different checks, such as implementing the diff-in-diff analysis through Simar and Wilson (2007) truncated regression model, and through Ramalho *et al.* (2010) fractional regression model (both these techniques are motivated by the peculiar statistical properties of efficiency scores). Moreover, our findings are not affected by the inclusion of control variables at the municipal level.

The remainder of the paper is organized as follows. Section 2 reviews the literature. Section 3 presents the institutional setup and describes the data. Section 4 illustrates the empirical procedures, while the results of the empirical analysis are presented in Section 5. In Section 6 some robustness checks are shown. Section 7 concludes and draws implications for future research.

2. Literature Review

According to Persson and Tabellini (2008), both theory and evidence suggest that individual accountability under plurality rule strengthens the incentives of politicians to please the voters and is conducive to good behaviour (meaning less political rents and corruption). On the other hand, proportional representation, implemented with open rather than closed lists, has more controversial effects. Furthermore, the winner-takes-all features of plurality rule reduce the minimal coalition of voters needed to win the election. Under plurality rule, a party can control the legislature with only one quarter of the national vote: half the vote in half the districts. Under full proportional representation, at least one half of the national vote is needed, which gives politicians a stronger incentive to provide benefits for many voters. A switch from proportional representation to plurality rule, accompanied by a change in the ballot structure from party lists to voting over individuals, is then likely to be beneficial to the efficiency of the political bodies interested by the electoral reform.

These points have been tested in various setups. Empirical analyses in this literature are primarily interested in total government spending. But the difference between coalition and single-party governments is likely to influence other economic policy dimensions, such as budget deficits or the composition of spending and taxation. Milesi-Ferretti *et al.* (2002) study the effects of electoral institutions on the size and composition of public expenditure in OECD and Latin American countries. They emphasize the distinction between purchases of goods and services, which are easier to target geographically, and transfers, which are easier to target across social groups. Their model predicts higher total primary spending in proportional (majoritarian) systems when the share of transfer spending is high (low). Their evidence offers considerable support for these predictions.

Less favourable evidence for the received wisdom is found in Funk and Gathmann (2013). They estimate how the adoption of proportional representation affects policies in Swiss cantons.

Similarly to Milesi-Ferretti *et al.* (2002), they show that proportional systems tilt spending toward public goods like education and welfare but decrease spending for targeted transfers like roads and agricultural subsidies. Their evidence shows that, all in all, proportional representation does not increase the size of government. On the other hand, party fragmentation and better representation of left-wing parties are associated with more spending.

An important feature characterizing this literature, which should be duly emphasized, is that broad reforms of electoral systems are very rare. In the sample of 60 democracies studied by Persson and Tabellini (2003), only two enacted important reforms of the electoral system between 1960 and 1990 (Cyprus and France). These patterns make it difficult to draw causal inferences from the data. Cross-country comparisons carry the risk of confusion between the effects of the electoral system with other country characteristics, since the electoral rule itself could be selected on the basis of unobserved variables that also influence policy outcomes.

Our work also relates to the literature investigating the efficiency of local government, especially at the Italian level. In this literature, Barone and Mocetti (2011) analyze the links between public spending inefficiency and tax morale using a sample of 1,115 municipalities for data from 2001 to 2004. Moreover, Boetti *et al.* (2012) evaluated 262 Italian municipalities in the province of Turin in 2005, assessing whether efficiency of local governments is affected by the degree of vertical fiscal imbalance. Similarly, Carosi *et al.* (2014) focus on 285 Tuscan municipalities in 2011, while Agasisti *et al.* (2015) use a sample of 331 Lombardy municipalities with more than 5,000 inhabitants from 2010 to 2012. Finally, Lo Storto (2013, 2016) evaluates the cost efficiency of 108 Italian major municipalities, and investigates to what extent the municipality efficiency is also associated to the effectiveness of public expenditure, and consequently to quality of services offered to citizens. The study suggests the existence of a trade-off between expenditure efficiency and the quality of public service provided.

As a general comment to the Italian literature, we note that the mean efficiency scores in Italian municipalities vary drastically (from 0.19 to 0.88), depending on the specification, sample, and method employed.

3. Local Electoral Systems: Institutional Setup and Data

3.1 The Italian Institutional Setting

Up to 1993, the electoral system in Italian municipalities was mainly following the canons of proportional representation (however, it must be immediately pointed out that very small municipalities - with less than 5,000 residents - had a majoritarian system). People voted for local parties/lists and municipal councilors. Then, after the election, the elected city council selected from its own ranks both the mayor and the municipal government members. This system came to be widely held as a major hindrance for the good governance of Italian municipalities. On 25 March 1993 the Italian Parliament approved Law 81, also known as the Law for the direct election of the mayors. Irrespective of the size of the municipality, the new framework envisaged that (i) residents vote directly for a mayor; (ii) the mayor can appoint and dismiss the municipal government members, who can also be recruited from outside the council. Crucially for our purposes, the reform predisposed two different electoral rules according to the municipality population:

- *Below the threshold of 15,000 inhabitants*, a single-ballot applies. The candidate who wins the relative majority in the single election is appointed mayor. Under this scheme, each candidate for the seat of mayor can be backed by one list only and there is a substantial victory bonus: the list supporting the winner gets two-thirds of the seats in the council, while the rest of the seats are assigned to the remaining lists according to a criterion of proportionality.

- *Above the threshold of 15,000 inhabitants*, a double-ballot applies. Under this scheme, each candidate can be backed by a number of lists instead of just one. There is no direct link between lists and mayoral candidates: voters can split their vote by opting for one mayoral candidate and a list associated with a different candidate (disjoint vote). Voters can also abstain in the election for the council, voting only for the mayoral candidate. However, voting only one list automatically implies a preference for the mayoral candidate supported by that list.

If a candidate obtains an absolute majority (that is, over 50% of the votes cast) he or she become the mayor; if no candidate wins an absolute majority, then those ranked first and second in the vote go to a second round, in which they can seek the support of lists whose candidates have been eliminated. After the mayor has been appointed, the council is elected. If the lists supporting the winning candidate have received over 50% but less than 60% of the votes, then they receive 60% of the seats in the Council; otherwise, seats are assigned by the criterion of proportionality. For a mayoral candidate who is elected in the second round, the 60% bonus is only granted if no other coalition got at least 50% of the votes in the first round. Since there is the option of a disjoint vote, in principle this possibility could arise.

The establishment of two different municipal electoral systems is explained by budgetary reasons. Compared to the single ballot, the dual ballot entails substantial extra outlays, as the fixed costs for the polls and the counting process basically double. Therefore, in an effort to minimize the impact on public finance for small towns, it was decided to apply a single ballot scheme to municipalities with less than 15,000 inhabitants. After the approval of the reform in March 1993, the new rules began to be implemented gradually, according to the schedule for the new elections envisaged at the local level.

3.2 Data Description

Our empirical exercise is based on data from the Italian Ministry of Internal Affairs (*Certificati Consuntivi del Ministero dell'Interno*, see Destefanis and Pavone, 1999, and Guadalupi, 2008, for further details) for 1994, 1999 and 2004. We could reasonably assume that the 1994 data adequately represents the condition of municipalities before the implementation of Law 81/1993 (one year is a too short period of time for a law of this type to fulfil its impact). Yet, to be on the safe side, we mainly report results obtained with a sample excluding municipalities that held elections in 1993 and 1994 in order to make sure that our pre-reform city sample cannot be affected by the electoral reform⁴.

For the purposes of our empirical exercise, we rebuild the same sample of municipalities in two post-reform years. The choice fell on years 1999 and 2004, which still leave a sufficient amount of time for the law to carry out its short and long-term effects. On the other hand, 1999 is the first year for which sufficiently reliable results can be obtained from the Ministry of Internal Affairs (Guadalupi, 2008).

In Table 1, we report some characteristics of the original sample of municipalities under scrutiny. We have essentially a sample of medium and small municipalities located in the northern and central parts of Italy. This somewhat restricted nature of our sample owes to the difficulty to find data for 1994.

[Insert Table 1 here]

An important point to be stressed is that municipalities below 5,000 inhabitants in the original sample presented in the previous table, are basically excluded from our analysis both because a plurality rule already existed for these municipalities before 1993, and because in 2001 fiscal rules

⁴ In accordance with our intuition, results (available upon request) are virtually unchanged if we keep in the sample also the municipalities that voted in 1993 and 1994.

aimed at imposing fiscal discipline on municipalities were relaxed for municipalities below 5,000 inhabitants (see Grembi *et al.*, 2016). In any case, as shall be seen in the following section, we end up with larger samples than those usually considered in the literature.

In Table 2 we report some descriptive statistics about the variables used in the empirical analysis over various sample cuts (the rationale for these different cuts will become apparent in the next section). Measuring the technical efficiency of municipalities requires the specification of an appropriate production set: inputs are simply proxied by the operating expenses that city councils engage to undertake in a given year (*Impegni di Spese Correnti*) split into personnel (*Personnel Current Expenditures*) and non-personnel expenses (*Other Current Expenditures*). These engagements, more than actual expenditures, reflect the outcome of the budgetary decisions taken by the local governments. On the other hand, capital account expenditures are too erratic for their inclusion to make sense in an analysis focusing only on a few points over time.

In order to measure the services provided by local authorities, we choose a set of indicators including: 1) the number of residents aged 15-64, and 2) the number of residents aged 65 or above, as proxies of a series of administrative and care services, 3) the number of students enrolled in public schools, 4) the amount of waste (in quintals), 5) the length of roads (in Km.), 6) of sewers (in Km.), and 7) of aqueducts (in Km.). The choice of this variable set reflects the desire to use data that are representative of a sizeable share of total operating expenses and yet are available for a number of municipalities as large as possible. As was made clear in Destefanis and Pavone (1999), data availability imposed a trade-off in this respect. In any case, we have already commented about the relative size of our sample, and the representativeness of our input and output set is vouched by a look to the most used variables in the survey carried out by Narbon-Perpina and De Witte (2018).

[Insert Table 2 here]

Moreover, our dataset contains information at municipal level both provided by the Ministry of Internal Affairs and by Istat (*Istituto Nazionale di Statistica*) about the total number of residents in a municipality (*Population Size*), the ratio of people with a college degree (% *Graduated*), an indicator of expense management speed (*Expenditure Speed*) and the ratio between extra-tax revenues and total expenditures (*Ratio*).

4. The Empirical Methodology

Our empirical approach is characterized first of all by the combination of a nonparametric technique for the measurement of municipality efficiency (DEA) and a set of regression-based techniques for the application of a diff-in-diff setup on these efficiency measures. It must be however stressed from the outset that we are not interested in a two-stage analysis of efficiency in order to analyze extensively various sources of relative inefficiency, but rather in implementing a simple diff-in-diff exercise through different regression techniques.

Data Envelopment Analysis (DEA) is a technique designed to evaluate the relative efficiency for a group of comparable decision-making units, called *DMU's*. The mathematical programming technique can take several forms according to different criteria, so it can be oriented either to minimize input values or to maximize output. The DEA methodology calculates an efficiency frontier for a set of *DMU's* and the distance to the frontier for each unit.

DEA is a well-established and useful technique for measuring efficiency in public sector activities for different reasons. First, multiple inputs and outputs can be taken into account without a priori assumptions for a specific functional form of production technologies; second, it

returns a simple summary efficiency measurement for each *DMU*, without requiring a priori a relative weighting scheme for the input and output variables.

However, some concerns should be addressed before the DEA is accepted as a routine tool in applied analysis. As DEA is an estimation procedure that relies on extreme points, it may be extremely sensitive to data selection, aggregation, and model specification. Typically, the selection of input and output variables is a major issue for efficiency measurements. The principal strengths of DEA, which include no a priori knowledge requirement for functional relationships, can only be fully exploited under the premise that the input and output variables are relevant for all *DMU*'s considered. Finally, it is well-known that the DEA estimator for technical efficiency is biased by construction (Simar and Wilson 1998, 2000). As this bias may be relevant, in our analysis, a bootstrap method has been used to correct it (Simar and Wilson, 1998).

We report the main descriptive statistics for our efficiency scores (both original and bias-corrected, as well as both input- and output-oriented) in Table 3. The rationale for the different sample cuts over which these statistics are provided will be elucidated below. Here it is sufficient to say that efficiency scores show considerable variation across these sample cuts (which will be subsequently taken up in the empirical analysis) lending additional scope to the subsequent diff-in-diff analysis. Indeed, once the technical efficiency scores are obtained through DEA, we investigate the effect of the electoral rule on these scores by means of a diff-in-diff regression approach.

[Insert Table 3 here]

The diff-in-diff method provides robust estimates of the policy reform if information is available pre and post policy intervention about the units included and excluded from the policy, but not on the selection process (see, for example, Meyer, 1995; Angrist and Krueger, 1999). To better understand the structure of the method, let us immediately take the example of Law 81/1993. The direct election of the mayor with the entire city council under a double-ballot scheme was introduced only in some of the municipalities (labeled *Runoff*). As this system does not apply to other municipalities (those voting under a single-ballot rule), one can use the latter as a control group to compare the change occurred under and over 15,000 residents in the years before and after the introduction of Law 81/1993.

We estimate the following model by Ordinary Least Squares (OLS) with fixed effect at the municipal level:

$$Efficiency_{it} = \beta_0 + \beta_1 After_t + \beta_2 Runoff_i + \beta_3 DiD_{it} + \mu_i + \varepsilon_{it}, \quad [1]$$

where $Efficiency_{it}$ is the technical efficiency of a municipality i at time t , $After_t$ is a dummy variable taking the value 1 for the period after the Italian law came into force and 0 otherwise, $Runoff_i$ is a dummy for municipalities voting with a double-ballot system (e.g. those with a population size larger or equal to 15,000 residents), DiD_{it} that is the interaction term between $After_t$ and the treatment status. Specifically, the coefficient β_3 attached to DiD_{it} is our ATE (Average Treatment Effect) estimate, measuring the difference in terms of technical efficiency between municipalities that vote under a single or double ballot, before and after the implementation of the law. Furthermore, we control for the fixed effects μ_i that account for time-invariant characteristics of the municipality (or the municipality's province), either observable or unobservable; ε_{it} is the stochastic error of our model. Following Wooldridge (2002, p. 78) we include municipal fixed effects in [1] as it allows a more robust specification of persistent municipal characteristics (possibly related to policy inclusion and its effects).

Equation [1] closely follows the protocol of a two-stage analysis of efficiency, where efficiency scores are first obtained through non-parametric methods and then regressed in order to analyze extensively various sources of relative inefficiency. There are however some important differences between the present analysis and the two-stage approaches usually found in the literature. We proceed now to clarify these differences.

In the literature, two main approaches are suggested to consider indicators of the economic or institutional environment within DEA (Cordero-Ferrera *et al.*, 2008; Narbon-Perpina and De Witte, 2018). The first, one-stage, approach partitions the sample (according to categories of the environmental indicators) or includes environmental indicators as inputs when estimating the efficiency frontier (Charnes *et al.* 1981; Banker and Morey 1986). The second, two-stage, approach first uses DEA techniques to evaluate the relative DMU efficiency and then regresses the DEA efficiency scores on a set of appropriate covariates. Some econometric problems with the latter approach have been highlighted in the literature (see, e. g., Simar and Wilson, 2007).

In our case, the implementation of a one-stage approach would be problematic in case we want to take into account municipality or province fixed effects. As recalled by Cordero-Ferrera *et al.* (2008), including a large number of variables in the production set would push virtually all the observations on the efficient frontier, rendering the analysis meaningless. However, our dataset makes it possible to partition the sample across categories of interest (pre- and post-reform years; runoff vs. plurality rule municipalities) and still obtain reasonably large samples (see Tables 2 and 3 in the Appendix for details about sample size). Then, by performing a diff-in-diff analysis over the DEA scores obtained in this way we enact the one-stage approach first proposed in Charnes *et al.* (1981)⁵. On the other hand, it could also be desirable to obtain DEA scores over a larger sample (such as our basic subsample comprising all municipalities with total population over 5,000 in 1994, where elections were not held in 1993 and 1994), and then to include these scores in a diff-in-diff regression. This would be a traditional form of two-stage analysis, but its estimates could be compared with the previously obtained one-stage results in order to assess the presence of eventual confounding factors.

Furthermore, in our baseline setup, equation [1] is estimated through fixed-effect OLS. However, two-stage analysis of DEA efficiency scores has often stressed the peculiar nature of the outcome variable, bounded between zero and one and with the unity value occurring with non-zero probability for efficient DMU's. Various estimation methods have been proposed to take into proper account these data features. Most notable among them are the truncated regression model proposed in Simar and Wilson (2007) and the fractional regression model described in Ramalho *et al.* (2010). Simar and Wilson also propose a bootstrap-based correction of the regression standard errors that allows for the fact that efficiency scores are not (by construction) i.i.d. variables. In our empirical analysis we also provide estimates based on the truncated regression and the fractional regression models. In both these cases, reasons of computational feasibility imply the substitution of municipality fixed effects with province (NUTS3) fixed effects. As a final check of the impact of confounding factors within our diff-in-diff setup, we include in [1] a vector X_{it} of control variables (potentially linked to observable differences between treated and untreated units). We stress that in this case we are, once more, solely interested in the robustness of the estimates for the ATE estimate.

In all regressions, standard errors are robust to heteroscedasticity and clustered at the municipal level as efficiency scores across municipalities may be affected by common shocks.

5. Empirical Results

⁵ To be sure, the analogy is complete only when a random effect OLS is used. Results are consistent with those found with fixed effect OLS.

The baseline estimates which we present in this section are obtained through fixed-effect OLS because of the importance of fixed effects in policy evaluation (Wooldridge, 2002, p. 78). We start with results obtained through OLS because this estimation method allows a more flexible treatment of (municipal or provincial) fixed effects that is a very important characteristic of the diff-in-diff setup. In particular, in Table 4 we present the diff-in-diff results obtained within a one-stage approach closely following that of Charnes *et al.* (1981). In all the specifications, standard errors are robust to heteroscedasticity and clustered at the municipality level, and we include municipal fixed effects. In the first two columns we investigate the effect of the runoff scheme on the input efficiency scores, whereas in column (3) and (4) the outcome variable is the output oriented efficiency of Italian cities in the sample. Efficiency scores were obtained on separate annual subsamples for the treated and the control group of municipalities. We analyze scores both corrected and not corrected for small-sample bias, because the latter is by far more common in the literature, and also because this sheds some light on the actual relevance of this correction.

[Insert Table 4 here]

The ATE estimate turns out to be always negative and statistically significant around or below the 1 percent level. This means that municipalities voting under runoff after 1993 exhibit a lower level of efficiency compared to those voting with single ballot. The absolute value of the ATE estimate ranges between 0.24-0.28 (for input-oriented scores) and 0.11-0.13 (for output-oriented scores). There are some differences (especially for input efficiency) between the results for original or bias-corrected scores, suggesting the relevance of the bias correction in these relatively small samples.

The estimates of Table 4 were replicated in a purely random effect setup (which would be a strict replica of the one-stage approach of Charnes *et al.*, 1981) and substituting municipal fixed effects with province fixed effects. Results were in both cases very close to those commented above and are available upon request.

In Table 5 we focus instead on diff-in-diff estimates within a two-stage setting. Efficiency scores were obtained on annual subsample for all cities that did not vote in years 1993 and 1994, and with a population size larger than 5,000 inhabitants. We focus on input-oriented efficiency scores in columns (1)-(3) and on output-oriented efficiency scores in columns (4)-(6). By comparing columns (1) and (4) with the other estimates, we can conclude that bias correction is less relevant in this relatively larger sample. This is especially true for input-oriented efficiency scores.

In column (2) the coefficient of interest is negative and statistically significant at 1 percent level. Municipalities voting under runoff exhibit a lower level of efficiency compared to those voting with single ballot by 15.2 percentage points after the reform came into force.

[Insert Table 5 here]

In column (3) we include by way of controls some municipal characteristics, such as the total number of residents, the rate of people with a college degree, an indicator of expense management speed and the ratio between extra-tax revenues and total expenditures (the latter two being proxies of the quality of municipal governance and service provision)⁶. The inclusion of these controls leaves the results virtually unchanged. The efficiency level of treated cities is

⁶ The inclusion of this set of variables relies on both the availability of information at municipal level in our dataset, and on a VIF (Variance Inflation Factor) analysis aimed at checking if the model is affected by multicollinearity among control variables. A full discussion of this issue is displayed in Section 6, alongside with the related evidence.

smaller by 16.7 percentage points compared to control cities after the electoral rule was implemented.

Also in the case of output-oriented efficiency scores we find that municipalities voting under runoff are characterized by a lower level of efficiency compared to cities voting under a single ballot after 1993. The magnitude of the electoral rule effect is smaller than that highlighted for input oriented efficiency scores (4.1 percentage points -see column 5- against 16.7). Yet, all in all our results highlight how the new electoral rule produces a detrimental effect on both input and output oriented efficiency scores. Once more the inclusion of control variables does not affect the evidence obtained⁷.

The main explanation of our results, in line with those found in the literature (see De Benedetto, 2018), relies on the fact that in municipalities below 15,000 inhabitants candidates running for mayor are supported only by one single list. In the case of victory, the designated mayor, together with his or her supporting list of candidates, will gain full control of local government; otherwise, if he/she loses the competition, the opposition will hold the majority of seats within the council. For this reason, parties have a strong incentive in selecting high-quality politicians (in the list supporting the mayor, candidates with a more homogeneous educational background are expected to be found). Conversely, in cities above 15,000 inhabitants candidates may be supported by one or more lists. In these municipalities, political parties bring together more lists (and here candidates with a more heterogeneous educational background are expected to be found) exclusively in order to get more votes, allowing their candidates to win the electoral race and become mayors. The more candidates in each list, the higher the chance that a candidate supported by parties becomes mayor. As a consequence, runoff elections compared to single-ballots attract low-skilled candidates who do not manage the local public pursue in a proper way, leading to a lower level of efficiency of municipalities.

In order to gain further understanding on our evidence, in panels (a) and (b) of Table 6 we look at the effect generated by the electoral reform on the efficiency scores of Italian municipalities in the short (when the 1999 is taken as a post-change year) and in the long (when the 2004 is taken as a post-change year) run. We work within the two-stage approach in order to take advantage from the larger size of its subsamples. Again we first focus on input-oriented efficiency scores (columns (1)-(2)) and then on output-oriented efficiency scores (columns (3)-(4)).

Results displayed in panel (a) show that in the short run the difference in the efficiency scores between cities voting under runoff and single ballot is negative and significant at conventional levels only for input-oriented efficiency scores.

[Insert Table 6 here]

Conversely, in Panel (b), the diff-in-diff estimate is always negative and statistically significant at 1 percent level both for input and output scores. Our findings suggest that the electoral reform has negatively affected input oriented efficiency scores at the municipal level in Italy both in the short and in the long run (the magnitude of the electoral reform impact is similar to that presented in Table 5), whereas it produces a negative effect on the output scores only in the long run, i.e. when the 2004 is used as a post-change year.

This dynamic behaviour is compatible with an institutional setup where municipal decision-makers can act upon their budgets (related to expenditures and hence to our inputs) more promptly than on the actual outcomes (populations shares, roads, and so on) that measure the municipality outputs.

⁷ In the next section we explore the role of province fixed effects. Pure random effect estimates (available upon request) are very close to those of Table 5.

6. Robustness Checks

As a first robustness check of our empirical design, we replicate estimations presented in Table 5, but we control for fixed effect at province level, in order to show that our findings are unchanged when we use this different specification of our model. Results are reported in Table 7. In columns (1) and (2) we focus on the input oriented efficiency scores, whereas in the last two columns the dependent variables are the output oriented efficiency scores. Findings are similar in terms of significance and magnitude compared to those reported in Table 5. Moreover, we find almost identical results when we investigate the short and long run impact of the electoral reform on local government efficiency (these results are not reported and are available upon request).

[Insert Table 7 here]

In the province fixed-effect model, we can straightforwardly implement a VIF (Variance Inflation Factor) analysis. In this way, we can quantify the severity of multicollinearity in an OLS setting, and check whether the variables at municipal level represent a valid set of controls in our analysis. This analysis provides an index that measures how much the [variance](#) of an estimated regression coefficient increases because of collinearity. Results are displayed in panel (b) of Table 6, where the VIFs and 1/VIFs (in the brackets) are reported. Findings do not show any strong correlation among control variables since the VIFs are always lower than 10, and the VIF mean is roughly 4 in all the specifications.

Given the peculiar nature of DEA efficiency scores, generally bounded between zero and one and with the unity value occurring with non-zero probability for efficient DMU's, OLS may not be the most appropriate estimation method. For this reason, as an additional robustness check, in Tables 8 and 9 we report marginal effects for two models that allow for these statistical properties: a fractional and a truncated regression model. In both cases computational reasons exclude the use of municipal fixed effects. We rely instead on province fixed effects.

First, we implement our diff-in-diff analysis through a fractional regression model, which is applied to the original efficiency scores because it requires the actual existence of a bound (zero or one) in the data. Findings from Table 8 highlight a negative and statistically significant effect of the electoral reform on local government efficiency, again stronger for input-efficiency scores and with a dynamic pattern (short-run vs. long-run results) similar to that found in Table 6. The absolute values of the ATE estimates are slightly larger than those obtained previously.

[Insert Table 8 here]

As a last robustness check, we implement Simar and Wilson (2007) approach (with algorithm #1 and 1,000 bootstrap replications) which implements a truncated regression model on the bias-corrected efficiency scores. Results are displayed in Table 9. Also in this case, findings are qualitatively unchanged compared to those presented above. In terms of significance and magnitude of the coefficient attached to our variable of interest, the resemblance with results of Tables 5 and 6 is even stronger than that obtained for the fractional regression model⁸.

[Insert Table 9 here]

⁸ As a final check, both the fractional and the truncated regression model were applied within the one-stage approach. This produced results that were very similar to those presented in Table 4.

7. Concluding Remarks

In this paper we have proceeded to assess the impact of the introduction of a runoff electoral scheme in 1993 on the technical efficiency level of Italian municipalities. We have computed technical efficiency scores through a DEA approach, and compared, through a diff-in-diff regression design, the changes in the technical efficiency scores across the treatment group (cities voting under a double ballot) and the control group (municipalities voting under a single-ballot rule) before and after the reform was enforced.

Moreover, adding to the relatively scant literature about efficiency of local government in Italy, our work is, to the best of our knowledge, the first contribution analyzing the effect of changes in the electoral rule on the technical efficiency of a sample of cities.

Our findings show that, after the implementation of the reform, in municipalities with a population size larger than 15,000 residents input oriented efficiency scores are lower by roughly 16 percentage points compared to those in cities with a population size lower than 15,000 inhabitants. Similar results hold true when we consider output oriented technical efficiency scores. In this case the magnitude of the impact of the electoral reform seems to be smaller, i.e., 4 percentage points.

It is important to stress that we use our diff-in-diff design in two different ways, basically implementing both a one-stage and a two-stage analysis of the impact of the new electoral rule on efficiency. Both approaches provide highly similar results (at least from the qualitative standpoint). Our evidence is also robust to different checks, such as implementing the diff-in-diff analysis through Simar and Wilson (2007) truncated regression model, and through Ramalho *et al.* (2010) fractional regression model (both these techniques are motivated by the peculiar statistical properties of efficiency scores). Moreover, our findings are not affected by the inclusion of control variables at the municipal level.

A final comment to our results relates to the findings from Lo Storto (2013, 2016) that suggest the existence of a trade-off between expenditure efficiency and the quality of public service provided. It might be that our results are at least partially linked to an increase in the quality of public services provided by municipalities after the electoral reform. Further evidence on this issue is obviously needed. We can point out immediately, however, that some of our control variables (the graduate ratio, the indicator of expense management speed and the ratio between extra-tax revenues and total expenditures) are believed, both in the literature and by practitioners, to be positively related with the quality of municipal services. The lack of impact of their inclusion on our ATE estimates is at least suggestive evidence that no significant role is played by changes in the quality in the present context.

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Table 1 – Some features of the original sample of municipalities under scrutiny

Regions	Italian municipalities			Municipalities in the sample			Coverage Rate (%)		
	1994	1999	2004	1994	1999	2004	1994	1999	2004
Abruzzo	305	305	305	1	1	1	0,0033	0,0033	0,0033
Basilicata	131	131	131	1	1	1	0,0076	0,0076	0,0076
Calabria	409	409	409	2	2	2	0,0049	0,0049	0,0049
Campania	551	551	551	3	3	3	0,0054	0,0054	0,0054
Emilia-Romagna	348	348	348	210	210	210	0,6034	0,6034	0,6034
Friuli-Venezia Giulia	219	219	218	51	51	51	0,2329	0,2329	0,2339
Lazio	377	377	378	177	177	177	0,4695	0,4695	0,4683
Liguria	235	235	235	53	53	53	0,2255	0,2255	0,2255
Lombardia	1546	1546	1544	597	597	597	0,3862	0,3862	0,3867
Marche	239	239	239	132	132	132	0,5523	0,5523	0,5523
Molise	136	136	136	1	1	1	0,0074	0,0074	0,0074
Piemonte	1206	1206	1206	347	347	347	0,2877	0,2877	0,2877
Puglia	258	258	258	1	1	1	0,0039	0,0039	0,0039
Sardegna	376	377	377	129	129	129	0,3431	0,3422	0,3422
Sicilia	390	390	390	32	32	32	0,0821	0,0821	0,0821
Toscana	287	287	287	196	196	196	0,6829	0,6829	0,6829
Trentino-Alto Adige	339	339	333	92	92	92	0,2714	0,2714	0,2763
Umbria	92	92	92	63	63	63	0,6848	0,6848	0,6848
Valle d'Aosta	74	74	74	23	23	23	0,3108	0,3108	0,3108
Veneto	580	581	581	201	201	201	0,3466	0,3460	0,3460
	8098	8100	8092	2312	2312	2312	0,2855	0,2854	0,2857
Population size	Italian municipalities			Municipalities in the sample			Coverage Rate (%)		
	1994	1999	2004	1994	1999	2004	1994	1999	2004
below 500	823	835	834	52	52	51	0,0632	0,0623	0,0612
501-1,000	1133	1141	1118	205	204	193	0,1809	0,1788	0,1726
1,001-2,000	1712	1677	1641	413	408	404	0,2412	0,2433	0,2462
2,001-3,000	1020	1005	1017	333	316	299	0,3265	0,3144	0,2940
3,001-4,000	685	709	690	225	239	242	0,3285	0,3371	0,3507
4,001-5,000	508	491	470	208	206	196	0,4094	0,4196	0,4170
5,001-10,000	1165	1157	1180	450	451	462	0,3863	0,3898	0,3915
10,001-15,000	414	435	458	157	160	170	0,3792	0,3678	0,3712
15,001-20,000	178	184	203	77	81	90	0,4326	0,4402	0,4433
20,001-30,000	177	178	183	82	82	86	0,4633	0,4607	0,4699
30,001-40,000	102	109	114	39	44	48	0,3824	0,4037	0,4211
40,001-50,000	44	41	47	14	12	14	0,3182	0,2927	0,2979
50,001-65,000	51	52	50	20	18	19	0,3922	0,3462	0,3800
65,001-80,000	21	23	22	9	12	10	0,4286	0,5217	0,4545
80,001-100,000	23	22	22	14	14	14	0,6087	0,6364	0,6364
100,001-250,000	30	29	31	14	13	14	0,4667	0,4483	0,4516
250,001-500,000	6	6	6	0	0	0	0,0000	0,0000	0,0000
above 500,000	6	6	6	0	0	0	0,0000	0,0000	0,0000
	8098	8100	8092	2312	2312	2312	0,2855	0,2854	0,2857

Source: Italian Ministry of Internal Affairs (various years).

Table 2 –Descriptive Statistics for Outputs, Inputs and Other Variables

Variables	Mean	S.D.	Min	Max
Full Sample, All Years, N=6,936				
<i>Output Variables</i>				
Length of Sewers (in Km.)	29.49713	42.7129	1	1,100
Length of Streets (in Km.)	86.14646	105.9063	1	1,684
Length of Aqueducts (in Km.)	51.62771	76.5334	1	1,085
Waste (in Kg.)	38,098.62	80,876.93	89.52	1,255,208
Population 15-64	5,543.333	10,266.25	94	147,439
Population above 65	1,559.012	3,185.671	28	55,679
No. of Enrolled Students	833.8054	1,654.088	6	24,076
<i>Input Variables</i>				
Personnel Current Expenditures	2,268.549	5,849.384	1.22	148,736.5
Other Current Expenditures	4,877	11,242.5	89.40	215,667
<i>Municipal Characteristics</i>				
Population Size	8,172.433	15,219.86	141	223,413
% Graduated	0.0429	0.0229	0.0039	0.2562
Expenditure Speed	0.7870	0.0702	0.1916	1.5037
Ratio	0.2483	0.1768	0.0064	6.8758
Sample for Two-Stage Approach, All Years, N=1,695				
<i>Output Variables</i>				
Length of Sewers (in Km.)	48.65068	60.10104	3	1,100
Length of Streets (in Km.)	122.9975	131.6589	6	1,684
Length of Aqueducts (in Km.)	82.6782	96.24788	2	892
Waste (in Kg.)	71,565.79	104,125.4	1,651.88	1,255,208
Population 15-64	10,311.23	12,799.9	2,680	120,261
Population above 65	2,867.35	3,926.672	455	39,567
No. of Enrolled Students	1,535.62	2,155.54	35	24,076
<i>Input Variables</i>				
Personnel Current Expenditures	4,209.572	7,761.875	454.871	99,207.99
Other Current Expenditures	9,158.968	15,169.22	859.754	198,057.2
<i>Municipal Characteristics</i>				
Population Size	15,143.34	18,936.14	4,070	178,107
% Graduated	0.0499	0.0239	0.0087	0.1717
Expenditure Speed	0.7769	0.0655	0.2117	0.9925
Ratio	0.2652	0.1384	0.0235	1.3357
Sample for One-Stage Approach, Control Group, All Years, N=1,416				
<i>Output Variables</i>				
Length of Sewers (in Km.)	34.20903	24.98789	3	251
Length of Streets (in Km.)	96.3461	94.22652	6	842
Length of Aqueducts (in Km.)	61.15787	56.31641	2	700
Waste (in Kg.)	37,449.06	18,559.31	1,651.88	165,274.1
Population 15-64	5,781.843	1,785.564	2,680	10,911
Population above 65	1,544.582	576.1005	401	3,769
No. of Enrolled Students	811.471	379.6779	35	5,932
<i>Input Variables</i>				
Personnel Current Expenditures	1,984.376	1,109.228	454.871	14,230.99
Other Current Expenditures	4,595.738	2,786.43	859.754	44,979.25
Sample for One-Stage Approach, Treated Group, All Years, N=603				
<i>Output Variables</i>				
Length of Sewers (in Km.)	94.35425	98.92986	7.58	1,100
Length of Streets (in Km.)	207.753	188.8491	24	1,684
Length of Aqueducts (in Km.)	146.6775	155.2648	3	1,085
Waste (in Kg.)	179,185.1	1,68273.8	13,900	1,255,208
Population 15-64	24,621.76	19,658.01	9,718	120,261
Population above 65	7,063.768	6,421.033	1,452	39,567
No. of Enrolled Students	3,806.271	3,336.137	407	24,076
<i>Input Variables</i>				
Personnel Current Expenditures	11,217.35	12,859.81	1,265.757	99,207.99
Other Current Expenditures	23,484.96	24,854.93	3,640.336	198,057.2

Source: Italian Ministry of Internal Affairs (various years).

Table 3 –Descriptive Statistics for DEA Efficiency Scores

Variables	Mean	S.D.	Min	Max
Full Sample, All Years, N=6,936				
Input Orient. Score	0.6322	0.1874	0.0644	1.0000
Input Orient. Score (Bias-Corrected)	0.5668	0.1624	0.0579	0.9625
Output Orient. Score	0.6678	0.1750	0.1042	1.0000
Output Orient. Score (Bias-Corrected)	0.6058	0.1550	0.0952	0.9681
NB: Efficiency scores have been obtained on separate annual subsamples (of 2,312 observations each). Here we present descriptive statistics pooled over 1994, 1999 and 2004.				
Sample for Two-Stage Approach, All Years, N=1,695				
Input Orient. Score	0.6521	0.1837	0.1863	1.0000
Input Orient. Score (Bias-Corrected)	0.5759	0.1541	0.1586	0.9589
Output Orient. Score	0.7285	0.1436	0.3353	1.0000
Output Orient. Score (Bias-Corrected)	0.6611	0.1230	0.2910	0.9634
NB: Efficiency scores have been obtained on separate annual subsamples (of 565 observations each) and then used in the two-stage diff-in-diff analysis. These subsamples include municipalities with total population over 5,000 in 1994, where vote was not held in 1993 and 1994. Here we present descriptive statistics pooled over 1994, 1999 and 2004.				
Sample for One-Stage Approach, Control Group, All Years, N=1,416				
Input Orient. Score	0.7126	0.1985	0.1876	1.0000
Input Orient. Score (Bias-Corrected)	0.6343	0.1722	0.1575	0.9434
Output Orient. Score	0.8000	0.1396	0.4093	1.0000
Output Orient. Score (Bias-Corrected)	0.7445	0.1229	0.3708	0.9671
NB: Efficiency scores have been obtained on separate annual subsamples (of 472 observations each) and then used in the one-stage diff-in-diff analysis. These subsamples include municipalities with total population over 5,000 in 1994 and below 15,000 across all years, where vote was not held in 1993. Here we present descriptive statistics pooled over 1994, 1999 and 2004.				
Sample for One-Stage Approach, Treated Group, All Years, N=603				
Input Orient. Score	0.8193	0.1566	0.3530	1.0000
Input Orient. Score (Bias-Corrected)	0.7500	0.1365	0.3205	0.9599
Output Orient. Score	0.8514	0.1287	0.4570	1.0000
Output Orient. Score (Bias-Corrected)	0.7935	0.1126	0.4284	0.9597
NB: Efficiency scores have been obtained on separate annual subsamples (of 201 observations each) and then used in the one-stage diff-in-diff analysis. These subsamples include municipalities with total population over 15,000, where vote was not held in 1993. Here we present descriptive statistics pooled over 1994, 1999 and 2004.				

Source: Own calculations on data from Italian Ministry of Internal Affairs (various years).

Table 4 – Electoral Rule Effect on the Efficiency Scores. Diff-in-diff estimates, Municipal fixed effects, One-stage Approach, All Years

VARIABLES	(1) Input Oriented Efficiency Scores	(2) Input Oriented Efficiency Scores (BC)	(3) Output Oriented Efficiency Scores	(4) Output Oriented Efficiency Scores (BC)
After	0.157*** (0.008)	0.181*** (0.007)	0.057*** (0.005)	0.061*** (0.004)
Runoff	0.002 (0.039)	0.145*** (0.029)	-0.104*** (0.031)	-0.085*** (0.027)
After*Runoff	-0.240*** (0.011)	-0.283*** (0.009)	-0.111*** (0.008)	-0.129*** (0.007)
Constant	0.688*** (0.013)	0.562*** (0.009)	0.831*** (0.009)	0.770*** (0.008)
Observations	2,019	2,019	2,019	2,019
R-squared	0.337	0.475	0.188	0.275
Number of codice	673	673	673	673

Note: Dependent variable: DEA efficiency scores obtained over separate annual samples (of respectively 201 and 472 observations each) for the treated and the control group. Standard Errors are robust to heteroscedasticity and are clustered at the municipal level (shown in brackets). Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 5 – Electoral Rule Effect on the Efficiency Scores. Diff-in-diff estimates, Municipal fixed effects, Two-stage Approach, All Years

VARIABLES	(1) Input Oriented Efficiency Scores	(2) Input Oriented Efficiency Scores (BC)	(3) Input Oriented Efficiency Scores (BC)	(4) Output Oriented Efficiency Scores	(5) Output Oriented Efficiency Scores (BC)	(6) Output Oriented Efficiency Scores (BC)
After	0.104*** (0.009)	0.124*** (0.007)	0.055*** (0.009)	0.002 (0.006)	0.004 (0.005)	-0.062*** (0.006)
Runoff	0.168*** (0.029)	0.116*** (0.028)	0.077*** (0.028)	0.066*** (0.023)	0.026 (0.022)	-0.012 (0.024)
After*Runoff	-0.157*** (0.026)	-0.152*** (0.011)	-0.167*** (0.011)	-0.033*** (0.007)	-0.027*** (0.008)	-0.041*** (0.0083)
Population Size			0.001*** (0.001)			0.001*** (0.001)
Population Size^2			-0.001*** (0.001)			-0.001*** (0.001)
% Graduated			2.761*** (0.311)			2.580*** (0.267)
Ratio			-0.214** (0.092)			-0.129** (0.064)
Ratio^2			0.134 (0.087)			0.088 (0.056)
Expenditure Speed			0.092 (0.070)			0.019 (0.049)
Constant	0.566*** (0.009)	0.490*** (0.008)	0.075 (0.091)	0.718*** (0.007)	0.656*** (0.006)	0.284*** (0.069)
Observations	1,695	1,695	1,695	1,695	1,695	1,695
R-squared	0.173	0.260	0.335	0.015	0.007	0.152
Number of municipalities	565	565	565	565	565	565

Note: Dependent variable: DEA efficiency scores obtained over separate annual samples (of 565 observations each) for municipalities with total population over 5,000 in 1994, where vote was not held in 1993 and 1994. Standard Errors are robust to heteroscedasticity and are clustered at the municipal level (shown in brackets). Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 6 – Electoral Rule Effect on the Efficiency Scores. Diff-in-diff estimates, Municipal fixed effects
Two-stage approach, Short and Long Run

VARIABLES	(1)	(2)	(3)	(4)
	Input Oriented Efficiency Scores (BC)	Input Oriented Efficiency Scores (BC)	Output Oriented Efficiency Scores (BC)	Output Oriented Efficiency Scores (BC)
Panel (a) - Short Run (1994 and 1999)				
After	0.085*** (0.008)	0.092*** (0.020)	-0.040*** (0.005)	-0.032** (0.012)
Runoff	0.033 (0.056)	0.026 (0.056)	-0.019 (0.043)	-0.028 (0.042)
After*Runoff	-0.145*** (0.011)	-0.144*** (0.012)	0.0048 (0.008)	0.007 (0.008)
Population Size		0.001 (0.001)		0.001 (0.001)
Population Size^2		-0.001 (0.001)		-0.001 (0.001)
% Graduated		0.390 (1.209)		0.505 (0.732)
Ratio		-0.262* (0.145)		-0.237** (0.097)
Ratio^2		0.216* (0.123)		0.184** (0.079)
Expenditure Speed		0.167 (0.103)		0.078 (0.073)
Constant	0.510*** (0.014)	0.359* (0.192)	0.668*** (0.011)	0.557*** (0.127)
Observations	1,130	1,130	1,130	1,130
R-squared	0.213	0.225	0.134	0.153
Number of municipalities	565	565	565	565
Panel (b) - Long Run (1994 and 2004)				
After	0.166*** (0.008)	0.194*** (0.022)	0.049*** (0.005)	0.073*** (0.016)
Runoff	0.046* (0.028)	0.025 (0.029)	0.004 (0.024)	-0.018 (0.025)
After*Runoff	-0.163*** (0.011)	-0.161*** (0.012)	-0.061*** (0.009)	-0.058*** (0.009)
Population Size		0.001** (0.001)		0.001*** (0.001)
Population Size^2		-0.001 (0.001)		-0.001** (0.001)
% Graduated		1.086 (0.665)		1.020** (0.496)
Ratio		-0.215** (0.095)		-0.166** (0.067)
Ratio^2		0.153** (0.068)		0.120** (0.049)
Expenditure Speed		0.132 (0.093)		0.043 (0.058)
Constant	0.507*** (0.007)	0.296*** (0.110)	0.662*** (0.006)	0.494*** (0.077)
Observations	1,130	1,130	1,130	1,130
R-squared	0.458	0.474	0.127	0.160
Number of municipalities	565	565	565	565

Note: Dependent variable: DEA efficiency scores obtained over separate annual samples (of 565 observations each) for municipalities with total population over 5,000 in 1994, where vote was not held in 1993 and 1994. Standard Errors are robust to heteroscedasticity and are clustered at the municipal level (shown in brackets). Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 7 – Electoral Rule Effect on the Efficiency Scores. Diff-in-diff estimates, Province fixed effects

VARIABLES	(1)	(2)	(3)	(4)
	Input Oriented Efficiency Scores (BC)	Input Oriented Efficiency Scores (BC)	Output Oriented Efficiency Scores (BC)	Output Oriented Efficiency Scores (BC)
Panel (a) – Main Estimates, All Years				
After	0.123*** (0.008)	0.123*** (0.008)	0.003 (0.005)	0.001 (0.006)
Runoff	0.220*** (0.011)	0.151*** (0.017)	0.124*** (0.009)	0.056*** (0.014)
After*Runoff	-0.154*** (0.010)	-0.152*** (0.011)	-0.030*** (0.008)	-0.029*** (0.008)
Population Size		0.001*** (0.001)		0.001*** (0.001)
Population Size^2		-0.001*** (0.001)		-0.001*** (0.001)
% Graduated		0.169 (0.209)		0.236 (0.191)
Ratio		-0.448*** (0.067)		-0.340*** (0.057)
Ratio^2		0.261*** (0.067)		0.191*** (0.056)
Expenditure Speed		0.039 (0.049)		-0.007 (0.047)
Constant	0.529*** (0.016)	0.512*** (0.045)	0.694*** (0.014)	0.693*** (0.043)
Province FE	Yes	Yes	Yes	Yes
Observations	1,695	1,695	1,695	1,695
R-squared	0.364	0.427	0.304	0.374
Panel (b) - VIF Analysis, All Years				
	Input oriented		Output oriented	
Population Size	8.09 (0.1236)		8.09 (0.1236)	
Population Size^2	7.34 (0.1362)		7.34 (0.1362)	
% Graduated	1.45 (0.6877)		1.45 (0.6877)	
Ratio	8.54 (0.1172)		8.54 (0.1172)	
Ratio^2	7.59 (0.1318)		7.59 (0.1318)	
Exp. Speed	1.18 (0.8460)		1.18 (0.8460)	
Mean VIF	3.93		3.93	

Note: Dependent variable: DEA efficiency scores obtained over separate annual samples (of 565 observations each) for municipalities with total population over 5,000 in 1994, where vote was not held in 1993 and 1994. Standard Errors are robust to heteroscedasticity and clustered at the municipal level (shown in brackets). Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 8 – Electoral Rule Effect on the Efficiency Scores. Fractional Regression Model estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	All Years		Short Run (1994 and 1999)		Long Run (1994 and 2004)	
VARIABLES	Input Oriented Efficiency Score	Output Oriented Efficiency Score	Input Oriented Efficiency Score	Output Oriented Efficiency Score	Input Oriented Efficiency Score	Output Oriented Efficiency Score
After	0.095*** (0.009)	-0.002 (0.006)	0.058*** (0.009)	-0.039*** (0.007)	0.133*** (0.009)	0.037*** (0.007)
Runoff	0.288*** (0.018)	0.188*** (0.015)	0.298*** (0.018)	0.194*** (0.014)	0.281*** (0.017)	0.181*** (0.015)
Runoff*After	-0.167*** (0.021)	-0.052*** (0.018)	-0.164*** (0.025)	-0.027 (0.021)	-0.172*** (0.023)	-0.078*** (0.019)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No
Observations	1,695	1,695	1,130	1,130	1,130	1,130
Pseudo R-squared	0.355	0.394	0.369	0.385	0.424	0.380

Note: Dependent variable: DEA efficiency scores obtained over separate annual samples (of 565 observations each) for municipalities with total population over 5,000 in 1994, where vote was not held in 1993 and 1994. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.

Table 9 – Electoral Rule Effect on the Efficiency Scores. Truncated Regression Model estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	All Years		Short Run (1994 and 1999)		Long Run (1994 and 2004)	
VARIABLES	Input Oriented Efficiency Score (BC)	Output Oriented Efficiency Score (BC)	Input Oriented Efficiency Score (BC)	Output Oriented Efficiency Score (BC)	Input Oriented Efficiency Score (BC)	Output Oriented Efficiency Score (BC)
After	0.124*** (0.007)	0.004 (0.006)	0.086*** (0.009)	-0.040*** (0.007)	0.164*** (0.009)	0.049*** (0.007)
Runoff	0.223*** (0.012)	0.128*** (0.014)	0.223*** (0.013)	0.127*** (0.010)	0.224*** (0.013)	0.128*** (0.010)
Runoff*After	-0.155*** (0.014)	-0.031*** (0.012)	-0.144*** (0.015)	0.003 (0.012)	-0.163*** (0.015)	-0.063*** (0.013)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No
Observations	1,695	1,695	1,130	1,130	1,130	1,130
Wald Chi2 (69)	1,019.21 (0.000)	859.71 (0.000)	628.33 (0.000)	667.10 (0.000)	1,035.63 (0.000)	623.25 (0.000)

Note: Dependent variable: DEA efficiency scores obtained over separate annual samples (of 565 observations each) for municipalities with total population over 5,000 in 1994, where vote was not held in 1993 and 1994. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***.