A round trip on decentralization: Lessons from a quasi-natural experiment for the Italian tourism sector

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Abstract

This paper examines whether decentralization of administrative competences in the tourism sector affects the performance of the Italian regions as Tourism Destination (TD). The analysis uses a quasi-natural experiment setting due to the differences in the devolution between special statute regions and ordinary statute regions and the change in the degree of devolution granted to the latter that occurred with the Constitutional Reform of 2001. Using a panel of Italian regions for the period 1995-2010, in the first stage we assess the efficiency of each region with both a smoothed bootstrapped Data Envelopment Analysis (DEA) and an order-m frontier estimator. Then, we adopt both a difference-in-difference estimate, and a fully non-parametric approach to assess whether decentralization affects TDs’ performance. Our findings show that the regions interested by the reform worsened their performance. More in general, the gap of the former with respect to the regions not involved by the reform has increased.

Keywords: Decentralization; Tourism destination; Efficiency; Nonparametric frontier; Difference-in-Difference

JEL Classification: H11; H77; L83; L88; D21
1. Introduction

Tourism is an economic sector that which bears a significant economic relevance in several countries. Italy is one of these as tourism is a strategic industry for the country’s economy accounting for 6% of the Italian total added value and employs roughly 10% of the total workforce of the country. Special attention is given to cultural tourism that represents an important share of total tourism demand. According to the Osservatorio Nazionale del Turismo (2016 – National Tourism Observatory), in 2015 cultural tourists combined with sea and mountain tourists corresponded to 69% of total tourists, In 2015, 36% of tourist arrivals were registered in historic cities. A specific feature of Italy organisation of tourism relates to the changes in the organisation of the sector that have occurred. In 2001, a Constitutional Reform (Constitutional Law no. 3/2001) extended legislative powers on tourism to all regions. Whereas before only a small group, i.e. Special Statute regions, had authority on this sector.

The traditional theory of fiscal federalism shows various sources and types of efficiency gains that can derive from decentralization. Local public administrations are supposed to be more able than central government to provide services that conform to the preferences of the residents of their jurisdictions (Oates, 1972). It could also foster efficiency because of residential mobility (Tiebout, 1956) and ‘control’ Leviathan governments (Brennan and Buchanan, 1980). With respect to the traditional, primarily normative, theory of fiscal federalism, the political economic analysis brought by the so-called ‘second generation’ fiscal federalism depicts a more fragmented picture both theoretically and empirically.

As for decentralisation in Italy, the overall evaluation of the 2001 reform is rather controversial because the new division of powers between the State and the Regions is ambiguous and has generated several conflicts. It would, therefore, be interesting to assess empirically if the 2001 decentralization has affected the performance of the regions and, in this case, how. Specifically, this paper aims at investigating whether decentralization of legislative powers on tourism affected

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1 Italy occupies the 5th position in term of international tourists’ arrival (UNWTO, 2016). In the period 2001-2010 arrivals and bed nights raised, and tourism added value grew twice than GDP (Federculture, 2016). There are, however, differences among regions and the various macro-areas.

2 More details on the institutional setting are provided in Section 3.

3 Decentralization exists when there is devolution of decision-making authority to sub-national governments. It therefore differs from de-concentration, which does not imply this kind of devolution, but just a delegation of central government operations to sub-national governments.
the performance of the Italian regions as tourism destination (TD).\textsuperscript{4} It is a topic that has been not yet been extensively considered by the literature on decentralisation but for some exceptions (Yuksel et al, 2005; Candela et al, 2015).

We employ a two-stage approach. In the first stage, employing a panel of Italian regions in the period 1995-2010, we use a smoothed bootstrapped Data Envelopment Analysis (DEA) (Simar and Wilson, 1998; 2000) and an order-m estimator (Cazals et al. 2002) to assess the efficiency of each region. In the second stage, the relationship between the Constitutional reform and the efficiency of the Italian regions as TDs is estimated in a quasi-natural experimental setting, using as control group those regions whose competence remained unchanged. The treatment effect is evaluated by a difference-in-differences estimator, which allows addressing the counterfactual question of what would have been the efficiency path after 2001 in the group of TDs affected by the reform, if the decentralization of legislative power had not been introduced. Furthermore, to assess the robustness of our findings, we perform a large set of semi-parametric and fully non-parametric checks to ensure that any difference observed in the performance could be attributed to devolution and not to differences in the regional characteristics of the tourism sector. Our results show that the regions interested by the reform have worsened their performance and, more in general, have scored lower results than the other regions – i.e. those that were not interested by the reform.

This paper is organized as follows. Section 2 provides an overview of the literature related to our analysis. Section 3 illustrates the institutional background. Section 4 briefly describes some of the methods widely used to analyse the performance of a service provision. Section 5 indicates the data and empirical strategy adopted here. Section 6 reports some (preliminary) results, and Section 7 concludes the paper with some (preliminary) comments.

2. Related literature

This study relates to different strands of research. One relates to fiscal federalism and its impact on the efficiency of local provision of goods and services. The other follows the empirical literature evaluating tourism policies. Firstly, our investigation of the impact of decentralization on the performance of Italian regions is grafted onto the vast literature assessing the effects of decentralized policy-making. From its inception, the traditional theory of fiscal federalism suggests that decentralization leads to efficiency gains. Local public

\textsuperscript{4} Tourism Destinations (TD) are interpreted as defined geographical and administrative areas (country, region, city, etc.) where natural and cultural endowment, either tangible or intangible, are used and organized in order to attract tourists, and eventually enjoyed by them.
administrations are supposed to be more capable than central government to provide services that conform to the preferences of the residents of their jurisdictions (Oates, 1972). The latter are able to scrutiny and evaluate local government policies better than the central one – assertion on which relies the EU subsidiarity principle – because the costs of information about policy-making, and those of democratic participation are lower than in centralized political systems. Therefore, decentralized policy-making is expected to enhance the enforcement and protection of property and political rights, and to be less influenced by corruption and special interest goals than centralized politics (Inman 1999; Oates 1999). As a consequence, decentralization is expected to have a positive influence on economy's performance. These benefits of local provision have to be compared to potential inefficiencies caused by unexploited returns to scale and inter-jurisdictional spillovers due to differences in local provisions (Besley and Coate, 2013). Residential mobility also fosters efficiency, as citizens can move to those jurisdictions where policy allocations better match their preferences (Tiebout, 1956), while inter-jurisdictional fiscal competition (Zodrow and Mieszkowski, 1986; Wilson, 1999) helps to tame Leviathan governments (Brennan and Buchanan, 1980). Even in absence of mobility, efficiency may arise from inter-jurisdictional yardstick competition, when residents can observe policies from neighbouring governments; this information helps them to evaluate their own government and functions as a disciplinary device that improves accountability and limits government inefficiency (Salmon, 1987; Besley and Case, 1995; Bordignon et al., 2004).

A more recent political economic development of the literature, known as second generation fiscal federalism, highlights a more multifaceted context, where the incentives of the decision-makers and the institutional framework play a fundamental role in determining the outcome of decentralized policies (Qian and Weingast, 1997; Lockwood, 2005; Oates, 2005; Weingast, 2009). Agency problems between different levels of government need also to be considered (Rodden 2002, 2006). Within this new approach, from a theoretical perspective, new trade-offs of decentralization arise. The assertion that decentralized policy-making is more efficient because of a better control by the citizens becomes less straightforward. Using a general model of legislative bargaining, Lockwood (2002) demonstrates that cost-sharing of local public good provision through uniform taxation will cause a common-pool phenomenon and, therefore, the legislature will have a bias to minimize the cost of projects, rather than maximize the net benefit of public expenditure. Introducing the activity of interest groups, Persson and Tabellini (1994) shows that centralization tends to increase government expenditure and this will cause locally organized groups to lobby for an over-exploitation of common resources. In contrast, Mazza and van Winden (2002) show that an institutional setting with separation of powers in the
budgeting process represents a remedy to free riding, as it weakens the groups’ incentives to lobby, and eventually may even reduce the size of the public sector with respect to the case of no lobbying. Also Bardhan and Mookerjee (2000) focus on the relevance of the institutional framework, showing how it influences the ability of interest group to collude with decision-makers and distort policies. In particular, if the outcome of the election is more certain at the national level that increases capture from lobbies. However, there is less capture with centralized decision-making, when there are more parties at the national level and elections are based on proportional, rather than majoritarian representation.

An extensive empirical literature has tried to verify the theoretical results of both first and second generation literature. The empirical analysis investigating how the organization of the public sector contributes to efficiency, hence to growth and welfare, shows decentralization has an ambiguous impact on the economic outcome (Martinez-Vazquez, 2011; Martinez-Vazquez et al., 2016). Dell’Anno and Teobaldelli (2015) indicate that residential mobility represents a constraint for special interest politics and corruption. In that respect decentralization helps to improve the efficiency of policy-making. The hypothesis that the institutional setting is relevant for the impact that decentralization may have on the performance of the public sector is also supported by Sow and Razafimahefa (2015). They analyse the efficiency of public service delivery in health and education in 64 countries during 1990–2012, showing that decentralization has a positive effect on performance when there is an adequate political environment and sufficient decentralization of revenue and expenditure. This outcome is only partially corroborated by other empirical studies. Martin-Vazquez et al. (2016) suggest that, while revenue decentralization seems to lead to a smaller public sector, the opposite seems to happen in case of devolution of expenditure power.

Adam et al. (2014) also perform an international investigation on the influence of decentralization on the provision of health and education services, using a data set relative to 21 OECD countries for the period 1970-2000. They find an inverted U-shaped relationship, as efficiency increases with the degree of fiscal decentralization up to a certain degree and decreases thereafter. This nonlinear relationship is justified by the existence of trade-offs of decentralization such as that between unexploited returns to scale and higher accountability.

It is a common understanding that decentralization may enhance efficiency of public services because it involves larger involvement and better control of citizens on policy. Regarding this hypothesis, Geys et al. (2010) find that voter involvement, in terms of voter turnout, existence of voter unions, and the share of eligible voters to total population, has indeed a positive impact on the efficiency of public service provisions in German municipalities. The excellent and comprehensive survey by Martin-Vazquez et al. (2016) concludes that, although
the impact of decentralization on efficiency and growth is a very widely investigated issue, the empirical literature is quite divided on its existence and sign. The ambiguity of the results of these studies may be due to difficulties concerning the same definition and measurement of decentralization, which is not straightforward for the several potential alternatives (Rodden, 2004; Ashworth et al., 2012; Voigt and Blume, 2012), the absence of a clear-cut causation path, the existence of multiple trade-offs, the relevance of institutional, political, and socio-economic variables and also to the institutional differences that afflict international comparative studies (Adam et al., 2014; Hooghe et al., 2010). To lessen the latter problem, several studies now concentrate on single national federal systems while addressing the efficacy of decentralized policies to stimulate growth and respond to local needs (Faguet, 2004, 2008). In some cases, the analysis is more focused as it investigates the impact of decentralization on the performance of specific sectors, such as public works (for Italy: Guccio et al., 2014), health (for Italy: Porcelli, 2014; Cavalieri and Ferrante, 2016), education (for Switzerland: Barankay and Lockwood, 2007), or both (for Colombia: Faguet and Sánchez, 2014; see also Channa and Faguet, 2012, for a survey of empirical studies for both services in developing countries).

As mentioned, the second focal point of the analysis in this paper relates to the empirical literature evaluating tourism policy and looks at the performance of Italian regions as TDs. Decentralization of tourism governance has the advantages of involving local residents in policymaking and removing some obstacles that central legislation may impose on innovation and private initiatives. To be effective, however, it requires sufficient local resources and the cooperation of central bureaucracy and government (Yüksel et al., 2005). There is a great variety of studies investigating the performance of the tourism and hospitality sector. Some studies on the efficiency of the Tourism Destinations (TDs) can actually be considered as an evolution of the empirical studies that analyse the efficiency of the hospitality sector (See for instance Brida et al. 2015). As the survey of Assaf and Josiassen (2015) shows, the studies analysing the performance of the tourism and hospitality sector have been increasingly using frontier methods, employing both parametric (Stochastic Frontier, ST) and non-parametric methods (DEA). In this paper we focus our attention on non-parametric methods. Non-parametric techniques, such as DEA, have been largely employed for studying TDs efficiency. Within this line of research, studies which are relevant for our analysis of TDs performance are: Bosetti et al. (2007), Candela et al. (2015), Cuccia et al. (2016; 2017) on the Italian regions; Botti et al. (2009) and Barros et al. (2011) on the French regions; Benito et al. (2014) for Spain.

As we mentioned before, in this paper we follow the main literature on assessment of TDs using DEA. However, traditional non-parametric estimators such as DEA are sensitive to extremes and/or outliers, which can undermine the estimation of
performance. A robust alternative to DEA estimator is the partial boundaries of the production set. Two main partial frontier methods have been proposed in the literature, namely order-$m$ (Cazals et al. 2002) and order-$\alpha$ (Daouia and Simar 2007). With both methods the underlying idea is to estimate a partial frontier inside the cloud of data points but close to the lower (or upper) boundary. Thus, to provide a robustness check of our empirical findings, in line with Guccio et al. (2017), in this paper we also calculate the TDs’ efficiency using an order-$m$ (Cazals et al., 2002).

3. Institutional background

In Italy there are five special statute regions (Valle D’Aosta, Friuli Venezia Giulia, Sicily, Sardinia and Trentino-Alto Adige, which is further divided into two special statute provinces), and fifteen ordinary statute regions. Since their establishment, the former have enjoyed a higher level of legislative and administrative autonomy from the central government by virtue of constitutional laws emanated in 1948 (1963 for Friuli Venezia Giulia) and various Decrees of the President of the Republic.

In fact, the regions with special autonomy, had been transferred responsibilities on tourism,\(^5\) well before ordinary statute regions. In the latter, tourism was under the responsibility of both the State and the regions: the state defined with a law (no.217/1983) the main legal framework of the tourism sector. The 2001 Constitutional reform has reshaped the distribution of powers and competencies between the central government and the ordinary statute regions, transferring to them among other matters, exclusive legislative power on tourism.\(^6\) All the ordinary statute regions have, indeed, exerted the new legislative powers, though with different speed.

However, the reform while transferring powers to the region, has also led to uncertainty, generating institutional conflicts (Senato, 2001). In fact, acknowledging the importance of the sector for the economy, law no. 135 of 2001 had set the fundamental policy principles and corresponding tools in the tourism sector. However, after the Constitutional reform, assigning exclusive legislative powers to ordinary statute regions, the implementation of such a law has been

\(^5\) Well before the Constitutional reform of 2001 the special stature regions had already been delegated powers on tourism (Friuli Venezia Giulia through several Decrees of the President of the Republic of 1965, 1975, 1987; Trentino Alto Adige - Decree of the President of the Republic of 1974; Sicily - Decree of the President of the Republic of 1956, Valle d’Aosta - Decree of the President of the Republic of 1982).

\(^6\) Interestingly, regions have been assigned powers also as for cultural matters, in particular for the enhancement of culture, which is an issue also related to tourism.
questioned by regions. Though an agreement has been reached on minimum standards of tourism services and products (DPCM 13/9/2002), several regions filed a lawsuit in front of the Constitutional Court. The Court has recognized the need for protecting the national interest through coordination while reaffirming with several judgments the exclusive legislative powers of the Regions (Camera dei Deputati, 2015).

Overall, several issues are still on the floor. First of all, previously the central government played a coordination role for the tourism sector. Secondly, tourism is connected with some matters that are still under the authority of both the regions and the state, for instance the internationalization of the regions. Thirdly, the reform allows each region to adopt its own promotion policies, thus they may diverge and the image of Italy at the international level as well as its policies for tourism may result fragmented. The difficult path followed by the Constitutional reform has been, sometimes, considered among the reasons for a loss of competitiveness of Italy for tourism and there is a call for more coordination at the central level (UPI, 2011).

At this level, two entities operate. The ministry of tourism responsible for the national policy promoting tourism and Italy’s image abroad, for guaranteeing a minimum quality of tourism supply, and for the safeguard of the rights of travellers. ENIT, the central agency responsible for international tourism development, promotes a unified tourist image of Italy, has a consultant role for the state and the regions, and cooperates with the offices of the Foreign Affairs Ministry.

In 2011, the central level made an attempt to reorganize state legislation on tourism (Legislative decree n. 79/2011), taking into account the competencies of various levels of government. At the central level the law has been welcome as it could help boosting the competitiveness and attractiveness of the country. The regions, on the contrary, criticized the law and suggest that the problems were mainly connected to the incomplete realization of decentralization. However, the Court declared that the attempt of coordinating regional competencies was in contrast with the 2001 Constitutional reform (judgment no. 80/2012). Hence only few articles are still valid.

4. Methods

4.1 Assessing TDs efficiency

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7 The agreement was signed within the Conference State-Regions. It is a body composed by the regions and the state where the negotiation between these two levels of government takes place.
The main formulations of DEA and \textit{m-order} estimators are presented in line with the notation used by Simar and Wilson (2008). Following previous literature (Barros et al. 2011; Benito et al. 2014; Cuccia et al. 2016, 2017; Guccio et al., 2017), in this study an output-oriented approach is adopted. A production process using the input vector \( \{x = x_i, i = 1, \ldots, n\} \in \mathbb{R}_+^N \) is considered to produce an output vector \( \{y = y_s, s = 1, \ldots, m\} \in \mathbb{R}_+^M \). The production process is constrained by the production possibility set \( \Psi \), which is the set of physically attainable points \((x, y)\) given by:

\[
\Psi = \{(x, y) \in \mathbb{R}_+^{N+M} | (x, y) \text{ is feasible}\}
\]  

(1)

The efficiency of a DMU is measured by the distance between the observed input-output mix from the optimal mix located on the frontier of \( \Psi \), which is the boundary of optimal production plans. The single DMU’s efficiency score, as defined by Farrell (1957) in the output oriented case, is:

\[
\theta(x, y) = \sup \{\theta | (x, \theta y) \in \Psi\}
\]

(2)

where a value of \( \theta(x, y) < 1 \) indicates the radial distance of the DMU to the full efficient frontier and a value of \( \theta(x, y) = 1 \) means that the DMU is efficient. Being \( \Psi \) the frontier and \( \theta(x, y) \) unknown, they should be estimated from a sample of \( i.i.d. \) observations \( \mathcal{X}_n = \{(x_i, y_i), i = 1, \ldots, n\} \).

The DEA estimator assumes the convexity of hull and, as a result, under the hypothesis of constant returns to scale (CRS), can be defined as:

\[
\Phi_{DEA} = \{(x, y) \in \mathbb{R}_+^{N+M} | y \leq \sum_{i=1}^{n} y_i y_i; x \geq \sum_{i=1}^{n} y_i x_i, \text{for } (y_1, \ldots, y_n) \text{ such that } \sum_{i=1}^{n} y_i = 1, y_i \geq 0, i = 1, \ldots, n \}
\]

(3)

A DEA non-parametric estimator of the efficiency scores can be calculated by replacing the true production set \( \Psi \) in (2) with the estimator \( \Phi_{DEA} \):

\[
\theta_{DEA}(x, y) = \sup \{\theta | (x, \theta y) \in \Phi_{DEA}\}
\]

(4)

where, by construction, \( \hat{\theta}_{DEA}(x, y) \geq \theta(x, y) \) (Simar and Wilson, 2008).
As stated before, non-parametric frontier estimators are very sensible to outliers and extreme data points since they do not allow for random noise in the Data Generating Process (DGP) (Simar and Wilson, 2008). Therefore, to account for DEA traditional limitations, which do not allow for any statistical inference and measurement error, Simar and Wilson (1998, 2000) introduced a bootstrapping methodology to determine the statistical properties of DEA estimators.⁸

As an alternative, partial frontiers can be investigated. Thus, to bypass one of the most critical issues of the DEA approach, in this paper we also calculate the TDs’ efficiency using an order-\(m\) (Cazals et al., 2002). In fact, the main advantage of using order-\(m\) instead of DEA lies in its superior robustness to extremes and/or outliers in the output direction, which results in a much better estimation of the corresponding economic efficiencies. According to the order-\(m\) estimators, which are based on FDH (Free Disposal Hull) estimator (Deprins et al., 1984), the expected maximum output achieved by any \(m\) number of TDs chosen randomly from the population, which employs a given level of inputs, is used as a benchmark. Furthermore, an order-\(m\) estimator does not envelop all the data, and thus is quite unaffected by outliers. These outliers, which in the output-oriented case will have an efficiency score below 1, will be considered as super-efficient with respect to the order-\(m\) frontier level.⁹

4.2 Two stage approach in non-parametric frontier

To assess whether devolution plays a role on TDs’ performance, we use both a difference-in-difference and a fully non-parametric approach. More specifically, for a first empirical exercise, we employ as a performance indicator the DEA estimates, and regress these in a difference-in-difference framework. Furthermore, to provide a more robust assessment of our findings, we employ the mixed kernel regression estimator proposed by De Witte and Kortelainen (2013) to obtain statistical inference on the direction of the influence of the environmental factors on the efficiency obtained by order-\(m\).

Traditionally, DEA studies that employ a second stage analysis also regress DEA efficiency scores on a vector of environmental variables using the following general specification:

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⁸ In our empirical assessment, the bootstrapping algorithm (Simar and Wilson, 2000) is used to control for consistency among the efficiency estimates.⁹ Note that, differently from DEA or FDH efficiency scores, the order-\(m\) efficiency scores are not bounded by 1. In these cases, values equal to 1 correspond to efficient DMUs, whereas values higher than 1 correspond to inefficient DMUs. See Simar and Wilson (2008) for detailed description of these estimators.
\[ \hat{\theta}_{DEA} = f(z) + \varepsilon \]  \hspace{1cm} (5)

where \( \hat{\theta}_{DEA} \) represents the scores that resulted from DEA estimates, \( z \) is a set of possible environmental variables and \( \varepsilon \) is a vector of error terms. As for equation (5), Simar and Wilson (2007) state that common estimators, such as Tobit and OLS, are biased because of the violation of independence between environmental variables and error terms. Although there is no general consensus on the method to be used in order to account for such a bias (Simar and Wilson, 2007; 2011; Banker and Natarajan, 2008; McDonald, 2009), the two-step bias-corrected semiparametric estimator proposed by Simar and Wilson (2007) ensures a feasible, consistent inference on the parameters for estimation in the second stage of the regression. However, Banker and Natarajan (2008) generate statistically consistent estimators for the two-stage procedure, which involve nonparametric estimation of productivity in the first stage followed by OLS regression. Notably, Banker and Natarajan argued that their statistical model requires less restrictive assumptions than the Simar and Wilson model (2007). Nonetheless, according to Simar and Wilson (2011), the two-step bias-corrected semiparametric estimator proposed by Simar and Wilson (2007) ensures a feasible and consistent inference on the parameters for estimation of the regression in the second stage. Hence, to check the robustness of our results, in our difference-in-difference framework we employ the Banker and Natarajan procedure (2008) as well as that by Simar and Wilson (2007).

As for order-\( m \) efficiency estimates, based on the probabilistic definition of the frontier developed by Cazals et al. (2002), Daraio and Simar (2005, 2007) proposed a full non-parametric conditional approach to assess the role of exogenous factors, which affect efficiency but are not under DMUs’ control. The main advantage of this approach is that it does not require the separability condition, and allows assessing the causal impact robustly. However, this method detects the positive, negative or neutral influence of \( z \), according to the slope of the non-parametric kernel regression. Furthermore, the model proposed by Daraio and Simar (2005, 2007) is not suitable for discrete or dichotomous exogenous factors like those used here.

De Witte and Kortelainen (2013) extend the conditional efficiency approach of Daraio and Simar (2005) to include discrete variables and, more importantly, to provide an empirical test to detect the influence of \( z \) on the efficiency. This model does not suffer from inference problems as two-stage models with the traditional and deterministic FDH and DEA models. More in particular, De Witte and Kortelainen (2013) propose a mixed kernel regression estimation, and use a nonparametric test based on the work of Li and Racine (2007) to obtain statistical inference on the direction of the influence of environmental factors on the
efficiency\textsuperscript{10}. Thus, in what follows we also employ this procedure to robustly assess the influence of the reform on TDs’ performance.

5. Data and empirical strategy

Based on the institutional framework discussed above, a main question of this paper is whether the decentralization of legislative powers matters for the efficiency of our sample of TDs. By exploiting the differences in the devolution of the competences between ordinary and autonomous regions and provinces, we first perform an assessment of TDs’ efficiency using two different product functions and employing both smoothed bootstrapped DEA (Simar and Wilson, 2000) an order-\textit{m} estimator (Cazals et al. 2002). Then the treatment effect is evaluated by a difference-in-difference estimator, which allows addressing the counterfactual question of what would have been the efficiency path after 2001 in the group of TDs affected by the reform, had the devolution of administrative competences not been introduced. Finally, in Section 5.2 we provide a number of robustness checks of our empirical findings.

In the first stage of this analysis, our assessment of TDs’ performance uses data covering the 21 Italian ordinary and special statute regions and the autonomous provinces over the period 1995-2010,\textsuperscript{11} leading to a balanced panel data with 336 observations.

The literature previously reviewed points out that efficiency assessment requires the definition of the proper set of inputs and outputs representing the production process under investigation. In the TDs’ literature, the use of the accommodation capacity and tourism arrivals as inputs and the number of nights slept as outputs is well established (Botti et al. 2009; Barros et al. 2011; Benito et al. 2014; Cuccia et al. 2016, 2017; Guccio et al. 2017).

Thus, also to make our results comparable to the previous literature, we adopt the above set of inputs and outputs.\textsuperscript{12} In the first stage of this analysis, we assume an output-oriented model to maximize the outputs that could be produced given the inputs. It is worth to note that in such a case for an order-\textit{m} estimator, an efficient TD, which is located on the best practice frontier, obtains an efficiency score of one. Inefficient TDs are denoted by efficiency scores higher than one. Efficiency

\textsuperscript{10} In particular, they use a nonparametric naïve bootstrap procedure to estimate the finite-sample distribution and a critical value of the nonparametric test statistics (De Witte and Kortelainen, 2013).

\textsuperscript{11} One region, Trentino Alto Adige, has two fully autonomous provinces.

\textsuperscript{12} Other studies consider also other inputs, such as the number of employees and governmental investments (e.g. Assaf and Josiassen 2012; Tsionas and Assaf 2014; Assaf and Tsionas 2015). For a discussion on different models see Assaf and Jostassen (2015).
scores lower than one represent super-efficient TDs. To make our efficiency estimates using smoothed bootstrapped DEA (Simar and Wilson, 2000) more comparable with those obtained with order- \( m \) estimator, we assume a Farrell (1957) output-oriented distance function and, consequently, efficient TDs obtain a score of one while inefficient TDs are denoted by efficiency scores higher than one.

We report in Table 1 the description of the variables used in the study, while Table 2 provides the efficiency estimates for the model (MOD_1), where \( T_{BEDS} \) and \( T_{ARRIVALS} \) are inputs to produce \( T_{NIGHTS} \), and the efficiency estimates for the model (MOD_2), distinguishing between different accommodations (i.e. hotels and other establishments).

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- Table 1 around here –

- Table 2 around here –

In Table 2 we report the estimates employing both smoothed bootstrapped DEA and an order- \( m \) estimator. As a first step, we analyze the efficiency scores using DEA in MOD_1. The average efficiency amounts to 1.3986, indicating that the average region could increase its provision of output by 39.86\% if it would work as efficient as the best practice DMUs. We also observe a significant amount of variation around the mean (standard deviation of 0.2493). As showed by Table 2, the results remain quite unchanged using the smoothed bootstrapped algorithm proposed by Simar and Wilson, (2000) indicating that the efficiency estimate are quite robust to sampling variation. Furthermore, overall these results are clearly comparable with those obtained by Cuccia et al. (2016). A similar picture are showed by efficiency estimates using order- \( m \) and also reported in Table 2. As

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13 More precisely a DMU that performs better than the average \( m \) observations in its reference set may obtain a score lower that one, thus being super-efficient. This indicates that the evaluated DMU is performing better than the average \( m \) observations in its reference set (Daraio and Simar, 2005). Furthermore, the inefficiency measure indicates the potential percentage increase in the output that an inefficient TD could achieve performing as efficiently as its reference peers \( m \) (Daraio and Simar, 2005).

14 As pointed out by Cuccia et al. (2016) this distinction potentially allows capturing differences in the performance due to the specialization of regional tourism sector.

15 Note that in the nonparametric formulation (DEA or order- \( m \)), benchmarks are not identified \textit{a priori}, but are the result of the linear optimization problem. The calculation with DEA and order- \( m \) estimators performs quite well in term of identification obtaining a good correlation between the estimates. Results are available upon request.

16 Following Daraio and Simar (2005), one should choose a value of \( m \) for which the number of super-efficient DMUs stabilizes. In our empirical estimates, \( m \) corresponds respectively, in MOD_1 to \( m=35 \), and in MOD_2 to \( m=50 \) using for the order- \( m \) estimates 2,000 Monte Carlo replications for both models.
expected, due the characteristic of \emph{order-m} estimator, the mean efficiency was higher (the average efficiency amounts to 1.2045) but also in this case with a significant amount of variation around the mean (standard deviation of 0.1482). Whole the efficiency estimates using \emph{order-m} appear comparable with those obtained by Guccio et al. (2017) on a similar sample of Italian regions for the time span period 2004-2010. Similar pictures are obtained by the efficiency estimates for the model (MOD_2) for convenience also reported in Table 2. The results, reported in Table 2, show, as expected, that an increased number of variables in MOD_2 influences the observations near the frontier, and increase the average efficiency. Thus, compared with MOD_2 MOD_1 shows lower average efficiency and many TDs with high level of inefficiency.

More importantly in our perspectives the efficiency estimates employing DEA and \emph{order-m} in both models are satisfactorily correlated. As we can see from the scatterplot matrix reported in the Figure 1 the correlation between efficiency estimates tell us a quite similar story in terms of TDs’ performance indicating that we are able to robustly identify the TDs assessment.\footnote{We performed both pairwise correlation and Sperman rank-correlation between efficiency estimates employing DEA \emph{an order-m} in both models obtaining in all estimates a correlation larger than 0.7. These additional results are available upon request}

\textit{- Figure 1 around here –}

To evaluate the TDs’ performance in time span period, in Figure 2, we report the average efficiency estimates by year for both MOD_1 and MOD_2 employing a smoothed bootstrapped DEA estimator (Simar and Wilson, 2000). In Figure 3, we show the average efficiency estimates by year employing an \emph{order-m} estimator (Cazals et al. 2002) also for MOD_1 and MOD_2. A first inspection of both Figures shows that, on average, Italian regions perform poorly after the year 2001. However, those evidences could be connected to several exogenous factors (e.g. Cuccia et al. 2016; 2017), which are independent from decentralization be totally cut off with devolution of administrative competences in tourism sector.

\textit{- Figure 2 around here -}

\textit{- Figure 3 around here -}

We are interested here in the counterfactual question of what would have been the efficiency path after 2001 in the group of TDs affected by the reform if the devolution of administrative competences had not been introduced. So, if the
evidence shows a declining performance for the whole Italian tourism sector we try to assess if decentralization has helped to contrast the negative trend in the performance of the group of TDs affected by the reform? Exploiting the panel data dimension of our sample, a difference-in-difference approach is used, since it allows for an *ex ante* and *ex post* analysis of the intervention compared to the control group. More specifically, the panel data dimension of our sample- six year before the devolution and ten years after - allows us to identify changes in the efficiency of ordinary statute regions relative to the changes in the efficiency of autonomous statute regions. To address the potential time lags in the implementation of the reform, five individual regression models are applied to compare the pre-devolution period, 1995 to 2000, with five post-devolution periods. In the next section we describe more in depth our empirical strategy, present our estimates, and report the robustness checks.

### 6. Results

#### 6.1 Preliminary evidence

Firstly, the effects of the devolution of competences on the efficiency of TDs are investigated by testing the difference in the performance of our intervention group (*i.e.* ordinary statute regions) compared to the control group (*i.e.* autonomous statute regions) in different periods of time. More precisely, we test the conditional distributions of the TDs’ efficiency estimates - obtained in the previous section - in our intervention group vs. the control group, for the three different time span periods (*i.e.* before the reform, one and five years after the reform) and for our two different models (MOD_1 and MOD_2). Table 3 presents the results of the Mann-Whitney and the Kolmogorov-Smirnov two sample tests.\(^\text{18}\) A first analysis of the results reported in Table 3 clearly shows that the reform has not boosted the performance of the regions in the intervention group with respect to those in the control group.

---

\(^{18}\) Efficient TDs obtain a score of one while inefficient TDs are denoted by efficiency scores higher than one.
method\(^{19}\) to determine densities of the TDs’ efficiency estimates, respectively in our intervention group (dash line) vs. the control group (solid line), for the three different time span period and for the two different models. The criterion for bandwidth selection follows the plug-in method proposed by Sheather and Jones (1991). The kernel density functions, reported in Figure 4, allow us to confirm the above-mentioned results.\(^{20}\)

- Figure 4 around here -

In what follows, we follow both a difference-in-difference and a fully non-parametric approach to more robustly assess whether devolution plays a role on TDs’ performance. As a first empirical exercise, we employ as a performance indicator the DEA estimates and regress these in a difference-in-difference framework. Furthermore, to provide a more robust assessment of our findings in Section 6.3 we employ the mixed kernel regression estimator proposed by De Witte and Kortelainen (2013), to obtain statistical inference on the direction of the influence of environmental factors on the efficiency obtained by order-\(m\).

6.2 Difference-in-difference estimates

We now identify the effect of devolution of competence on the efficiency of TDs by exploiting the natural experiment described above. As mentioned, the relationship between devolution and efficiency of TDs can be estimated in a quasi-experimental setting using a difference-in-difference methodology, and employing the autonomous statute regions as the control group for the policy changes affecting ordinary statute regions.\(^{21}\) The difference-in-difference estimator can be used to assess the magnitude of the “treatment effect” given by Constitutional reform in 2001. Thus, in the second stage we estimate the following general model:

\[
\hat{\theta}_{DEA} = \beta_0 + \beta_1 Devolution_i + \beta_2 2001_{reform} + \beta_3 Devolution_i \cdot 2001_{reform} + \eta_i + \epsilon_{it} \tag{6}
\]

\(^{19}\)Doing so, we avoid the problems of bias and inconsistency at the boundary of support (Simar and Wilson, 2008).

\(^{20}\)For convenience here we report the conditional kernel density estimates only for smoothed bootstrapped DEA estimator (Simar and Wilson, 2000). The kernel density estimates with DEA and order-\(m\) frontier estimators tell us a quite similar story. Results are available upon request.

\(^{21}\)In this setting, it is important to note that the Constitutional reform in 2001 can be considered an exogenous variation since this institutional change was not an autonomous decision of the regional governments.
where $\hat{\theta}_{DEA}^{Efficiency}$ are DEA efficiency estimates of the region $i$ at time $t$ obtained before; \textit{Devolution} is a dummy variable with value 1 for regions in the intervention group and with value 0 for regions in the control group; \textit{2001_reform} is a dummy that take the value 0 in the period 1995 to 2001, and 1 in the period 2002 to 2010. Given the long panel structure (the data-set include 21 regions over 16 years), regional fixed effects can be treated parametrically, including a set of regional-specific dummies $\eta_i$. Finally, $\varepsilon$ is the error term that accounts for the statistical noise. The effect of devolution on TDs’ efficiency is captured by coefficient $\beta_i$ that identifies changes in efficiency relative to changes in efficiency in the control group.

In equation (6) a key identifying assumption underlying the use of special regions as a counterfactual is that, in the period considered, other effects are common to both groups of regions. This implies that any macro effect, for example idiosyncratic shocks in the tourism sector, should affect each region in similar fashion. We believe that this assumption is quite reasonable for the Italian tourist system. Nevertheless, to provide more robustness to our findings, and to address the potential time lags in the implementation of the reform, five individual regression models are used by introducing time lags in equation (6) to compare the pre-devolution period with five post-devolution periods.

In the estimated equation (6) we employ different estimators. In line with the proposal of Banker and Natarajan (2008), we employ a simple OLS both with and without including a full set of regional-specific dummies to assess the role of environmental variables in the two-stage approach. Results are reported in Table 4 and show that the reform appears to have not affected the performance.

- Table 4 around here -

However, as pointed out by Simar and Wilson (2011), the OLS produces unbiased estimates only under strong restrictive assumptions. Thus, to take into account that estimated efficiency scores are truncated from below, we perform the two-step bias-corrected semi-parametric truncated estimator proposed by Simar and Wilson (2007). In fact, the authors underline that traditional estimators yield biased estimates due to serial correlation of DEA efficiency scores. Therefore, the authors suggest to apply a two-step bias-corrected semi-parametric estimator, which has been shown to be the only known method for ensuring a feasible and consistent inference on the second stage regression (Simar and Wilson, 2011). In Table 5 we report these further estimates.

\footnote{More specifically we employ both a pooled OLS and a least square dummy variables (LSDV) model that is the simplest consistent estimator equivalent to the within the group estimator.}
The above results show that overall the reform has impacted negatively on the efficiency of the intervention group more than on the control group.

6.3 A fully nonparametric assessment

As a robustness checks on the role of devolution for TDs’ performance, in this section we use a fully nonparametric conditional efficiency estimator to examine the direction of the influence of the exogenous variation on TDs’ performance. Daraio and Simar, (2005, 2007) suggest that the ratio between the conditional and the unconditional order m estimates can be (non-parametrically) regressed on the exogenous factor using a smooth non-parametric Kernel regression, in order to visually detect positive, negative, and neutral effects of the exogenous variation on the production process. However, the model proposed by Daraio and Simar (2005, 2007) is not suitable for discrete or dichotomous exogenous factors like those in equation (6). DeWitte and Kortelainen (2013) extend the previous work using a non-parametric bootstrap procedure to obtain statistical inference on the direction of the influence. The proposed approach is applied in several sectors to robustly detect the influence of the exogenous variation on performance (e.g. Asatryan and DeWitte, 2015). In our view, this approach has several advantages. First, it is suitable for dichotomous variables. Second, it enables us to obtain standard errors and p-values of the significance, and to make results relatively more comparable with those previous obtained. Finally, this approach does not suffer from limitations due to the “separability condition” in the two-stage DEA (Simar and Wilson, 2007).

In Table 6, we report the estimates obtained with the model developed by De Witte and Kortelainen (2013). Since the dependent variable is the ratio between conditional and unconditional efficiency estimates the direct interpretation of coefficients is flawed (DeWitte and Kortelainen, 2013). Thus, following the literature, here we report only positive, negative, and neutral effects of the exogenous variation and the p-value (Asatryan and DeWitte, 2015). Our main variable of interest - Devolution*2001_reform - has a significantly unfavourable

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23 We would like to thank Kristof De Witte for providing us the R codes routine to perform the estimates reported in Table 7.
association with TDs’ efficiency on both models. The remaining results substantially overlap with those previously obtained.  

7. Concluding remarks

This paper has examined the impact of devolution of administrative competences for tourism on the performance of the Italian regions as tourism destinations. The results show that the assignment of wider competences to ordinary statute regions has worsened their performances with respect to autonomous statute regions. An explanation could be that the devolution of competences has not been met by a parallel increase of fiscal responsibilities of Regions. Moreover, the reform has preserved a coordination power at the State level, generating a rather confusing institutional picture. Furthermore, given the important role of cultural tourism within the overall tourism sector in Italy, another explanation, might be found in the weaker governance of cultural policies in the ordinary statute regions. In fact, they enjoy less autonomy in the cultural field than special autonomous regions and, therefore, they might have been less able to exploit the ‘resilience’ of the cultural sector (Pratt, 2015).

Further research could investigate the performance of those regions that, following the reform of 2001, have adopted the ‘Local tourist Systems’ (Sistemi Turistici Locali), and verify if it differs from the performance of the regions who have not such a system. Another potential difference in the performance could be connected to the ‘use’ of agencies to manage tourism vs. the direct execution of tourism policies.

However, a potential limitation in our robustness check should be mentioned. In a recent contribution, Mastromarco and Simar (2015) introduced a time-dependent order m conditional frontier models for panel data, to control for the effect of time dependent technological change in the efficiency frontier. However, as point out by Guccio et al. (2017), it is reasonable to assume that, due our simple production process, there are no significant technological changes in our sample of the TDs. This makes us confident that empirical findings in this Section are quite robust.
References


Camera dei deputati (2015), Turismo, Servizio studi, Roma


Osservatorio Nazionale del Turismo (2016). Il turismo culturale in Italia. Available at: [http://www.ontit.it/opencms/opencms/ont/it/focus/focus/2016_turismo_citta_arte](http://www.ontit.it/opencms/opencms/ont/it/focus/focus/2016_turismo_citta_arte)


Table 1 - Variable used to assess regional efficiency – MOD_1 & MOD_2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Meanings</th>
<th>Mean</th>
<th>St. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_BEDS</td>
<td>Total accommodation capacity in the region in 1,000s</td>
<td>194.02</td>
<td>138.91</td>
</tr>
<tr>
<td>H_BEDS</td>
<td>Accommodation capacity in hotel in the region in 1,000s</td>
<td>93.59</td>
<td>66.74</td>
</tr>
<tr>
<td>O_BEDS</td>
<td>Accommodation capacity in other establishments in the region in 1,000s</td>
<td>100.44</td>
<td>88.69</td>
</tr>
<tr>
<td>T_ARRIVALS</td>
<td>Total arrivals in the region in 1,000s</td>
<td>3,967.93</td>
<td>3,465.50</td>
</tr>
<tr>
<td>H_ARRIVALS</td>
<td>Arrivals in hotel in the region in 1,000s</td>
<td>3,275.46</td>
<td>2,850.94</td>
</tr>
<tr>
<td>O_ARRIVALS</td>
<td>Arrivals in other establishments in the region in 1,000s</td>
<td>692.47</td>
<td>791.90</td>
</tr>
<tr>
<td>T_NIGHTS</td>
<td>Total nights slept in the region in 1,000s</td>
<td>16,132.29</td>
<td>13,392.75</td>
</tr>
<tr>
<td>H_NIGHTS</td>
<td>Nights slept in hotel in the region in 1,000s</td>
<td>11,063.93</td>
<td>8,796.54</td>
</tr>
<tr>
<td>O_NIGHTS</td>
<td>Nights slept in other establishments in the region 1,000s</td>
<td>5,068.36</td>
<td>5,958.65</td>
</tr>
</tbody>
</table>

Source: our computation on data provided by ISTAT.

Table 2 - TDs efficiency estimates

<table>
<thead>
<tr>
<th>Estimator</th>
<th>Mean</th>
<th>St. dev.</th>
<th>Min.</th>
<th>Quartile 1</th>
<th>Median</th>
<th>Quartile 3</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOD_1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEA efficiency estimates</td>
<td>1.3983</td>
<td>0.2493</td>
<td>1.0000</td>
<td>1.2166</td>
<td>1.3538</td>
<td>1.5400</td>
<td>2.0842</td>
</tr>
<tr>
<td>DEA bias corr. efficiency estimates</td>
<td>1.4224</td>
<td>0.2524</td>
<td>1.0185</td>
<td>1.2396</td>
<td>1.3731</td>
<td>1.5616</td>
<td>2.1231</td>
</tr>
<tr>
<td>order-m efficiency estimates</td>
<td>1.2045</td>
<td>0.1482</td>
<td>0.8763</td>
<td>1.1251</td>
<td>1.1813</td>
<td>1.2580</td>
<td>1.8259</td>
</tr>
</tbody>
</table>

| MOD_2                            |        |          |        |            |        |            |        |
| DEA efficiency estimates         | 1.2163 | 0.1743   | 1.0000 | 1.0842     | 1.1695 | 1.3201     | 1.8222 |
| DEA bias corr. estimates         | 1.2611 | 0.1732   | 1.0362 | 1.1310     | 1.2123 | 1.3619     | 1.8822 |
| order-m efficiency estimates     | 1.0477 | 0.1466   | 0.6307 | 0.9754     | 1.0973 | 1.1545     | 1.3172 |

Source: our computation on data provided by ISTAT.

Note: the numbers represent descriptive statistics for the efficiency scores yielded by smoothed bootstrapped DEA and order-m. DEA scores yielded by smoothed bootstrapped DEA estimators by year assuming a Farrell (1957) output-oriented distance function. Should be note that for order-m efficiency estimates an efficiency score closer to 1 indicates better performance, an efficiency score of 1 implies that a DMU is fully efficient, and an efficiency score lower than 1 indicates a “super-efficient” unit.
Figure 1 – Scatterplot matrix between efficiency estimates.

Source: our computation on data provided by ISTAT.

Figure 2 - Mean DEA efficiency estimates across TDs by year.

Source: our computation on data provided by ISTAT.

Note: the figures represent average efficiency scores yielded by smoothed bootstrapped DEA estimators by year assuming a Farrell (1957) output-oriented distance function.
Figure 3 - Mean order-\( m \) efficiency estimates across TDs by year.

<table>
<thead>
<tr>
<th>Estimator &amp; models</th>
<th>Before 2001 reform</th>
<th>One year after 2001 reform</th>
<th>Five year after 2001 reform</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MW</td>
<td>KS</td>
<td>MW</td>
</tr>
<tr>
<td>DEA efficiency estimates</td>
<td>2.523</td>
<td>0.357</td>
<td>2.299</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.001)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>DEA bias corr. efficiency estimates</td>
<td>2.682</td>
<td>0.381</td>
<td>2.486</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.000)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>order-( m ) efficiency estimates</td>
<td>1.935</td>
<td>0.290</td>
<td>2.022</td>
</tr>
<tr>
<td></td>
<td>(0.071)</td>
<td>(0.013)</td>
<td>(0.062)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimator &amp; models</th>
<th>Before 2001 reform</th>
<th>One year after 2001 reform</th>
<th>Five year after 2001 reform</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MW</td>
<td>KS</td>
<td>MW</td>
</tr>
<tr>
<td>DEA efficiency estimates</td>
<td>1.369</td>
<td>0.1810</td>
<td>2.303</td>
</tr>
<tr>
<td></td>
<td>(0.171)</td>
<td>(0.280)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>DEA bias corr. efficiency estimates</td>
<td>0.825</td>
<td>0.176</td>
<td>2.860</td>
</tr>
<tr>
<td></td>
<td>(0.409)</td>
<td>(0.309)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>order-( m ) efficiency estimates</td>
<td>0.201</td>
<td>0.186</td>
<td>3.255</td>
</tr>
<tr>
<td></td>
<td>(0.841)</td>
<td>(0.252)</td>
<td>(0.001)</td>
</tr>
</tbody>
</table>

Source: our computation on data provided by ISTAT.

Note: the figures represent average efficiency scores yielded by order-\( m \) estimators by year.

Table 3 - Testing efficiency gain from Constitutional reform in ordinary statute regions.

Source: our computation on data provided by ISTAT.

Note: Mann–Whitney (MW) test; Kolmogorov–Smirnov (KS) two-sample test. \( p \)-values in parentheses.
Figure 4 - Kernel densities estimates of the DEA bootstrap corrected efficiency scores distribution for the estimated models

<table>
<thead>
<tr>
<th>Before 2001 reform</th>
<th>One year after 2001 reform</th>
<th>Five year after 2001 reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOD_1 - DEA bias corr. efficiency estimates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOD_2 - DEA bias corr. efficiency estimates</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: our computation on data provided by ISTAT.

Notes: figure show respectively the MOD_1 and MOD_2 kernel density estimates of DEA efficiency scores employing a smoothed bootstrapped DEA estimator (Simar and Wilson, 2000).
Table 4 - OLS estimation results using DEA efficiency scores

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEA_MOD_1</td>
<td>DEA_MOD_1</td>
<td>DEA_MOD_2</td>
<td>DEA_MOD_2</td>
</tr>
<tr>
<td>Constant</td>
<td>1.274***</td>
<td>1.563***</td>
<td>1.142***</td>
<td>1.299***</td>
</tr>
<tr>
<td></td>
<td>(0.0301)</td>
<td>(0.023)</td>
<td>(0.018)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>Devolution</td>
<td>0.116***</td>
<td>0.318***</td>
<td>0.051*</td>
<td>0.153***</td>
</tr>
<tr>
<td></td>
<td>(0.0413)</td>
<td>(0.026)</td>
<td>(0.027)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>2001_reform</td>
<td>0.0847**</td>
<td>0.085***</td>
<td>0.050*</td>
<td>0.050***</td>
</tr>
<tr>
<td></td>
<td>(0.0423)</td>
<td>(0.017)</td>
<td>(0.028)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Devolution*2001_reform</td>
<td>0.026</td>
<td>0.026</td>
<td>0.015</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.022)</td>
<td>(0.037)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Regional fixed effects</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>336</td>
<td>336</td>
<td>336</td>
<td>336</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.073</td>
<td>0.852</td>
<td>0.047</td>
<td>0.802</td>
</tr>
</tbody>
</table>

Interaction term with time lags *

| t+1  | 0.025 | 0.025 | -0.010 | -0.010 |
| | (0.054) | (0.021) | (0.036) | (0.016) |
| t+2  | 0.022 | 0.022 | -0.008 | -0.008 |
| | (0.054) | (0.020) | (0.037) | (0.016) |
| t+3  | 0.021 | 0.021 | -0.003 | -0.003 |
| | (0.056) | (0.020) | (0.038) | (0.016) |
| t+4  | 0.012 | 0.012 | -0.012 | -0.012 |
| | (0.064) | (0.023) | (0.044) | (0.018) |

* In this section of the table we report only the coefficient $\beta_3$ for estimates of equation (6) employing the time lags to define the different cut-off points for the variable 2001_reform.

Source: our computation on data provided by ISTAT.

Notes. ***, **, and * denote significance at the 1%, 5% and 10% level respectively. Robust standard errors in parentheses.
Table 5 – Bootstrap truncated semi-parametric estimates

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) DEA_MOD_1</th>
<th>(2) DEA_MOD_2</th>
<th>(3) DEA_MOD_2</th>
<th>(4) DEA_MOD_2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \hat{\beta} )</td>
<td>95% Bootstrap confidence intervals</td>
<td>( \hat{\beta} )</td>
<td>95% Bootstrap confidence intervals</td>
</tr>
<tr>
<td>Constant</td>
<td>1.131***</td>
<td>0.978</td>
<td>1.264</td>
<td>1.567***</td>
</tr>
<tr>
<td>Devolution</td>
<td>0.215***</td>
<td>-0.054</td>
<td>0.378</td>
<td>0.311***</td>
</tr>
<tr>
<td>2001_reform</td>
<td>0.163*</td>
<td>-0.007</td>
<td>0.334</td>
<td>0.104***</td>
</tr>
<tr>
<td>Devolution*2001_reform</td>
<td>0.057*</td>
<td>-0.038</td>
<td>0.076</td>
<td>0.037*</td>
</tr>
<tr>
<td>Regional fixed effects</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Observations</td>
<td>336</td>
<td>336</td>
<td>336</td>
<td>336</td>
</tr>
</tbody>
</table>

In this section of the table we report only the \( \hat{\beta}_i \) for estimates of equation (6) employing the time lags to define the different cut-off points for the variable 2001_reform.

Source: our computation on data provided by ISTAT.

Notes. Bias-adjusted coefficients using double bootstrap truncated estimates algorithm 2 (n=2000), (Simar and Wilson, 2007), ***, **, and * denote significance at the 1%, 5% and 10% level using the bootstrap-estimated confidence intervals.

Table 6 – Conditional non-parametric bootstrap estimates

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) MOD_1 conditional</th>
<th>(2) MOD_1 conditional</th>
<th>(3) MOD_2 unconditional</th>
<th>(3) MOD_2 conditional</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Influence (P-Value) significance</td>
<td>Influence (P-Value) significance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devolution</td>
<td>-</td>
<td>Unfavourable (0.000) **</td>
<td>-</td>
<td>Unfavourable (0.000) ***</td>
</tr>
<tr>
<td>2001_reform</td>
<td>-</td>
<td>Unfavourable (0.003) ***</td>
<td>-</td>
<td>Unfavourable (0.000) ***</td>
</tr>
<tr>
<td>Devolution*2001_reform</td>
<td>-</td>
<td>Unfavourable (0.016) **</td>
<td>-</td>
<td>Unfavourable (0.007) ***</td>
</tr>
<tr>
<td>Mean</td>
<td>1.2045</td>
<td>1.3172</td>
<td>1.0477</td>
<td>1.1993</td>
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<tr>
<td>St. dev.</td>
<td>0.1482</td>
<td>0.1626</td>
<td>0.1466</td>
<td>0.1772</td>
</tr>
<tr>
<td>Observations</td>
<td>336</td>
<td>336</td>
<td>336</td>
<td>336</td>
</tr>
<tr>
<td>R-square</td>
<td>-</td>
<td>0.6083</td>
<td>-</td>
<td>0.6409</td>
</tr>
</tbody>
</table>

Interaction term with time lags a

<table>
<thead>
<tr>
<th></th>
<th>MOD_1 unconditional</th>
<th>MOD_1 conditional</th>
<th>MOD_2 unconditional</th>
<th>MOD_2 conditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>t+1</td>
<td>-</td>
<td>Unfavourable (0.037) **</td>
<td>-</td>
<td>Unfavourable (0.088) *</td>
</tr>
<tr>
<td>t+2</td>
<td>-</td>
<td>Unfavourable (0.071) *</td>
<td>-</td>
<td>Unfavourable (0.607)</td>
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<tr>
<td>t+3</td>
<td>-</td>
<td>Unfavourable (0.105)</td>
<td>-</td>
<td>Neutral (0.905)</td>
</tr>
<tr>
<td>t+4</td>
<td>-</td>
<td>Unfavourable (0.338)</td>
<td>-</td>
<td>Neutral (0.827)</td>
</tr>
</tbody>
</table>

a In this section of the table we report only the coefficient \( \hat{\beta}_t \) for estimates of equation (6) employing the time lags to define the different cut-off points for the variable 2001_reform.

Source: our computation on data provided by ISTAT.

Notes. Table reports estimates of the conditional non-parametric bootstrap procedure proposed by De Witte and Kortelainen (2013). Favourable indicates an efficiency-enhancing association. ***, **, and * denote significance at the 1%, 5% and 10% level respectively.