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Does inter-municipal cooperation increase efficiency? Evidence from Italy

Giuseppe Gori[a], Patrizia Lattarulo[a], Francesco Porcelli[b], Leonzio Rizzo[c], Riccardo Secomandi[d]

Abstract

Evidence on the impact of municipal amalgamation and cooperation is mixed and most of the existing literature is focused on the effect on the cost per capita, which, however, is not sufficient to test for a potential increase in efficiency. Therefore, the evaluation of the impact on the physical output of municipal services is needed. This is why we use a panel dataset with all Italian municipalities, covering four years, with details on expenditure and output related to six different local services provided by municipalities. The first novelty of our work is including the local service dimension in the analysis. This dimension is extremely important to properly evaluate the impact of inter-municipal cooperation, which, differently from amalgamation, usually covers only some specific services. In our analysis, we exploit the fact that municipalities choose to enter a municipal association at different years. Therefore, we evaluate the impact of intermunicipal cooperation on per-capita expenditure and output by using the within variation in each municipality and municipal service. The second novelty is the use of specific indexes of direct output for the provided services. We find that inter-municipal cooperation decreases per capita expenditure leaving output unchanged, thus generating an increase in efficiency. Interestingly, when we concentrate the analysis on small municipalities with less than 3,000 inhabitants, inter-municipal cooperation leads also to increase in output. We conclude that inter-municipal cooperation is extremely relevant in sorting out financial constraints of small municipalities when they need to provide services with high fixed costs. This result is particularly important in Italy where 56% of municipalities has less than 3,000 inhabitants. The effect is more pronounced as the number of associated municipalities increases and when there is at least one big municipality in the association.

Keywords

Inter-municipal cooperation, local services, difference-in-difference analysis, output municipal services.

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H72; H73; C23.

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1. Introduction

Over the past 50 years, public spending per capita in Europe has doubled (Schuknecht, 2020), and in 2022, about 22 percent of public spending in Europe was provided by local governments (Eurostat). Municipalities are very active in providing social services to children and the elderly, providing waste collection, managing water supply, providing local police services, and are responsible for many public investments such as roads, territorial maintenance, libraries, and sports facilities. The reason is that municipalities thanks to their proximity to citizens and their understanding of the characteristics of the local economic system, can play a leading role in shaping the welfare of local communities (Oates, 1972). However, it can be shown that this is true in the case of absence of economies of scale in the provision of local public service. In fact, if fixed costs are too high, the high cost could offset the benefit given by the better-informed local government about the needs of the citizens.

In many European countries, the size of municipalities is, in fact, very small: in France, the average size of municipalities is 435 inhabitants, in Spain it is 570, in Germany 1,710 and in Italy 2,430. The consequence of this high institutional fragmentation is that municipalities cannot absorb the fixed costs associated with local public services and these are not delivered or are delivered at extremely high costs. In recent times, because of increasing budget constraints and the weakening of financial and human resources in many administrations, increasing attention has been devoted to analysing the effects of institutional reorganization letting the local governments satisfy the needs of their citizens but at the same time exploiting the economies of scale of the joint provision of public services.

Two kinds of institutional reorganization have been observed: amalgamation and inter-municipal cooperation. These two institutional arrangements are often promoted by central governments through dedicated financial incentives or are, in some cases, mandated by law. The interest of central governments in stimulating this aggregative behavior has strengthened in the last decade as a measure to control local government budgets and meet consolidated budget targets, particularly those arising from the fiscal stability pact in Europe (Venturini, 2020). A municipal amalgamation is defined by the merger of two or more municipalities, which come together to form a single municipality. This is a strong form of reorganization involving the sharing of financial and human resources, as well as political and administrative activity. Unlike amalgamation, inter-municipal cooperation is a more flexible form of expenditure consolidation that does not entail the political and administrative merger, but only an agreement on the shared management of specific services. Based on a formal agreement, two or more municipalities cooperate on the provision of specific services, sharing resources and expertise.

Between the late 1990s and the beginning of the 21st century, a generalized phenomenon of rationalization of the institutional framework involving municipalities was observed both in Europe

and the United States. For example, in Spain municipalities have consorted into *Mancomunidades* (Bel and Mur, 2009), in France into *Etablissements Publics de Coopération Intercommunale* (Frèr *et al.*, 2014), in Germany into *Gemeindeverbände* (Heinz, 2007), and in the United States into special districts and consolidated governments (Warner, 2004). In addition, as a result of merger processes, the number of municipalities in Germany between 2002 and 2014 fell from 13,299 to 11,040 (Council of Europe, 2017), in Denmark in 2007 it fell from 239 to 98 (Blom-Hansen, 2009), in Finland between 2005 and 2013 they fell from 452 to 320 (Uusitalo and Moisio, 2013), in Israel in just one year (2003) a law reduced municipalities from 264 to 253 (Reingewertz, 2012).[1]

In Italy we assisted to a massive increase in inter-municipal cooperation. Italy passed from 11% in 2010 of municipal services managed by different forms of inter-municipal cooperation such as Municipal Unions, Mountain Communities, *Convenzioni* or *Consorzi*, to 25% in 2016. In addition, in Italy, recently, there has been an increase in the merger process: the number of municipalities fell from 8,101 in 2001 to 7,926 in 2019. The reorganization of municipalities is an important issue in the Italian context, which is characterized by a preponderant proportion of small-sized municipalities, and by public budget constraints that have been particularly tight over the past decade. In Italy, in addition to central government incentives, some regions have also provided financial incentives and support for the reorganizational process. On the one hand, incentives have provided resources and eased the burden of budgetary constraints. On the other hand, the reorganizational strategy has been mainly aimed at efficiency gains, maintaining the previous service provision, or increasing it where necessary.

A large international literature has analysed the effects of reorganization but focusing either on the budgetary effects (total or per capita expenditure) or on the level (output) of a restricted group of provided services. The aim of our work is to assess the efficiency of inter-municipal cooperation by also exploiting the within variation in spending and output across services as well as across municipalities. To do so, we use a panel of data on expenditure and output level broken down by municipality and local service.

The data on output have been collected by Soluzioni per il Sistema Economico Spa (SOSE) through a questionnaire to mayors and the economic financial managers of municipalities. Hence, we use a unique information about outputs of six services for all Italian municipalities along the years 2010, 2013, 2015 and 2016, which has been collected through a direct survey to municipalities. The output

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[1] Other particular examples are: in Georgia the number of municipalities in four years (2002-2006) passed from 1,004 to 69, in Latvia in four years (2006-2010) from 527 to 118, in Albania five years (2010-2015) passed from 373 to 61 (Council of Europe, 2017).

indicator for Social Service is equal to the ratio between total users served and the total resident population. The number of total users served is given by the sum of people with disabilities, families and adults in economic and social difficulty, children, elderly. The output indicator for waste collection is the percentage of sorted waste, that is the ratio between the urban sorted waste and the total urban waste. For Education, Local Police, Territory, and Public Road the dataset contains composite indicators, which use different weighted measurements of output, where the weights are constant throughout the observation period. For the Education service, for example, the composite indicator is a weighted sum of the number of users of different municipal services, as the number of transported school pupils and transported pupils with a disability, number of canteen users, number of summer camp users and number of pupils using the pre-post school service.

We find that inter-municipal cooperation is effective in increasing efficiency in the provision of local public services especially for small municipalities. This effect is higher if in the association there is at least one big municipality or there is a high number of municipalities.

The rest of the paper is organized as follows. Section 2 provides a review of the related literature, while Section 3 reports a detailed description of the Italian institutional setting and of the dataset. Section 4 describes the empirical model and the identification strategy devised to estimate the impact of inter-municipal cooperation on per capita expenditure and output of local public services. Section 5 discusses the results and Section 6 reports the robustness check. Finally, Sections 7 concludes and derives some policy implications.

2. Related literature

The existing literature has mainly focused on the impact of amalgamation and inter-municipal cooperation in terms of per capita spending, while a relatively small number of papers have also considered the efficiency dimension of the service provision, explicitly including its output level in the analysis.

2.1 Amalgamation

As for the literature on municipal amalgamation, Reingewertz (2012), finds a 9 percent per capita expenditure reduction effect in Israeli municipalities following the amalgamation reform introduced in 2003. However, the efficiency impact, which the paper concludes to be positive, is investigated only indirectly by looking at some output measures such as migration, housing construction, birth rate, school test scores and average class size. A different result is obtained by Blom-Hansen (2009) who examine the impact of the amalgamation of Danish municipalities in 2007 and find no reduction in spending, whether defined as total, disaggregated or per unit of output. Allers and Geertsema (2016) estimate the impact of amalgamation on Dutch municipalities in terms of levels of spending,

taxation, and the level of output/quality of services provided using, in the latter case, housing prices as a proxy. The authors find no significant effects on any of the three dimensions of analysis. Blesse and Baskaran (2016) find that mergers of municipalities between 2000 and 2003 in the German federal state of Brandenburg were effective in decreasing only administrative spending when merger was mandatory, but they do not consider efficiency measures.

The only work that studies the impact of amalgamation on a direct measure of output is the one by Rouse and Putterill (2005). They use the data envelopment analysis (DEA) to test whether mergers that occurred in 1989 in New Zealand increased efficiency in highway maintenance. They use physical outputs - such as miles of surface resealing and rehabilitation - and relate them to their cost before and after merger. They find no effect on output for a given cost.

2.2 Inter-municipal cooperation

Regarding inter-municipal cooperation, some papers find a positive effect in terms of aggregate expenditure or cost of the service covered by the cooperation. Bel and Mur (2009) and Bel, Fageda, and Mur (2012) show that inter-municipal cooperation in the Spanish region of Aragon decreases the cost of providing the waste collection service. This result is also confirmed by Dijkgraaf and Gradus (2013), who use a short panel data of Dutch municipalities between 1998 and 2010. Ferraresi, Migali, and Rizzo (2018), using a panel dataset limited to the Italian region of Emilia Romagna, show that the associated management of municipal services reduces aggregate expenditure per capita by approximately 5%. They indirectly examine the effect on output using three possible measures of municipal attractiveness: per capita birth rate, net migration into the municipality and primary school class size per capita.

Other studies on total expenditure per capita find conflicting results on the effect of inter-municipal cooperation. For example, Allers and de Greef (2018) analyse 2005-2013 panel data on municipal institutional cooperation (MCI) in the Netherlands to find that cooperation is associated with increased spending in the case of small and large local governments, while it has no effect on medium-sized municipalities. Manestra *et al.* (2018) analyse 500 municipal unions in Italy from 1998 to 2015 and find a reduction in budgetary costs associated with cooperation. However, Frère *et al.* (2014) using a dataset on French municipalities in the period 1994-2003 find no effect of cooperation on the amount of local government expenditure.

Regarding the impact of inter-municipal cooperation on efficiency, the two main papers are Blaeschke and Haug (2018) and Luca and Modrego (2019). The former finds that inter-municipal cooperation in the wastewater sector increases the efficiency of small municipalities in the German federal state of Hessen. The result is obtained by estimating a production frontier and calculating, for a given output, the ratio of actual input to frontier input, to rank different institutional arrangements

for service provision. The latter uses a cross-sectional dataset for Italian municipalities in 2013, containing outputs on the expenditure functions of municipalities released by SOSE for the Italian Ministry of Economy and Finance. They construct a synthetic output index and then use an aggregate Data Envelopment Analysis at the national level, which allows municipalities to be ranked according to their distance from the frontier, for a given input. They find no evidence of increased efficiency for municipalities that engage in inter-municipal cooperation.

2.3 The contribution of the paper

All the works we have discussed study the impact of amalgamation or inter-municipal cooperation using data defined at the municipal level. However, as already pointed out, in the case of inter-municipal cooperation, an important feature is that municipalities agree to cooperate on specific public services. Although some of the mentioned works focus on specific services, none fully analyses the service dimension together with the municipality dimension. Assessing the impact of cooperation on indicators at municipal level (expenditure or output) requires explicitly considering such service dimension, to account for the effect of cooperation at municipal level, net of the possible change in expenditure or output related to services for which there is no cooperation.

We construct a four-year panel (2010, 2013, 2015 and 2016), collecting, for each municipality, expenditure, and output data for six services provided by municipalities. Since we know which municipality decided to enter a municipal cooperation scheme for a specific service each year, we can investigate the impact of cooperation on municipal per-capita expenditure and output. As far as we know, no one has previously examined the impact of inter-municipal cooperation on direct outputs of local public service in a panel analysis disaggregated by municipality and public service. Using this approach, we find that inter-municipal cooperation implies during the years we consider an average saving of 1.9 billion euros out of almost 16 billion euros of spending, leaving output unaffected. Moreover, when we limit the analysis to small municipalities (with less than 3,000 inhabitants), which corresponds to 56% of total Italian municipalities, we also find an increase in output. This last result is very important because it establishes the relevance of the cooperative tool to let small municipalities provide appropriate levels of public services.

3. Institutional setting

Territorial public government in Italy consists of four administrative levels: Regions, Provinces, Metropolitan Municipalities and, Municipalities. Municipalities are the nearest jurisdiction level to the citizens, and they are in charge of several public functions in the field of social welfare, territorial development, local transport, infant school education, sports and cultural facilities, local police, water delivery, waste disposal and infrastructural spending.

The Legislative Decree n. 267/2000 defines various forms of inter-municipal cooperation: from formal agreements (*convenzioni*) to consortium or municipal unions and mountain communities. In the former case, local governments may enter into agreements to join the provision of specific services. When participating in a union or mountain community, municipalities instead combine service provisions. The new local authority will have its own statute and share existing human resources, but the main objective is to carry out municipal services in association. Both formal agreements and unions of municipalities or mountain communities are thus distinguished from mergers of municipalities (amalgamations), which instead lead to the establishment of a new municipality. Unlike amalgamation, inter-municipal cooperation does not imply the merger of political institutions and allows cooperation only on specific services that could be characterized by economies of scale. For the sake of completeness, it is important to point out that, unlike mergers, the various forms of inter-municipal cooperation in Italy do not involve joint management of revenues, with a few exceptions in the case of some tariffs related to jointly managed services.[2]

4. Data

Our dataset contains information on about 5,313 municipalities from 15 Italian Regions with Ordinary Statute, for the years 2010, 2013, 2015 and 2016. Expenditure data refer to budget data for each service, while output indicators come from SOSE 's statistical survey on behalf of the Italian Central Administration (https://www.opencivitas.it/). These data are merged with other statistical information from the Italian Central Statistical Office (Istat) that describe political, demographic, territorial and socio-economic characteristics of the Italian municipalities. The dataset on outputs and expenditure is available for six municipal services: Education, Local Police, Social Service, Territory, Public Road, and Waste collection. We also know if each municipal service is provided directly by the municipality or through an association of municipalities. The inter-municipal cooperation can be formalized through a formal agreement, a municipal union, or a consortium. In our analysis, we decided to consider all three cooperation forms equivalent, as they are very similar from an economic point of view.

The dataset is organized in a panel structure over three different layers: at the time layer we have four years; at the municipal level we have more than five thousand municipalities and, finally, at the service level we have information on expenditure, output, and managerial choice for six different services for each municipality.

4.1 Expenditures variables

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[2] In the Italian case during 2010-2016 municipal unions (the main form of inter-municipal cooperation) managed on average 116 million euros corresponding to 0.06% of total government revenues.

The annual current expenditure of each municipality is available for every local service, and it is directly taken from the municipal public budgets. Local government services for *Education* include the transportation of pupils to school, school meals, and current expenditures for the maintenance of school buildings. Expenditure related to the *Local Police* function covers the salaries of local police officers and the cost of cars and other equipment necessary to ensure the safety of citizens in the territory. Expenditure on *Social Services* finances a plurality of services: assistance to the disabled (help in daily life, work, sports, and transportation to school), help to families, children, adults, and the elderly in economic and social difficulties (public housing, scholarships and educational communities, excluding the cost of daycare centers, contribution to hospice fees or transportation). The *Territory* services absorb all costs due to land maintenance, such as parks and rivers, and administrative activity for building and infrastructure permits and environmental protection. The *Public Road* services relate to the costs necessary for the routine maintenance of municipal roads, sidewalks, parking lots, bike paths, and street lighting. This also includes administrative procedures for the management of parking permits, traffic-restricted zone access, and driveways. *Waste collection* includes the costs of collecting, transporting, and processing waste; part of these expenses also finances the cleaning of streets, squares, and markets.

In the period of our analysis (2010-2016), the municipal services described above represent on average more than 65% of total municipal current expenditure.[3]

4.2 Output indicators

Output indicators are provided by the SOSE dataset, on Central Government behalf, and can be considered the official source of output indicators for local services. As described in the introduction they regards Social Service, Waste collection, Education, Local Police, Territory, and Public Road. We use simple and composite indicators. In Appendix A, we describe in detail the construction of the composite indexes. To ensure homogeneity across different units of measurement that characterize the output variables of each type of service, all output variables have been standardized between zero and one using a *min-max* procedure. The outputs of each service are then weighted by the share of expenditure of each service on the total municipal expenditure.

4.3 Outliers

Although output indicators have been officially computed by SOSE and expenditure data are taken from the budgets, since the data are directly recorded by municipalities, we checked measurement

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[3] For services related to the general administration such as Registry Office, Tax office, Technical Office (29% of total current expenditure), it is extremely difficult to collect the level and quality of output that measure citizen's utility, like the number of certificates or council meetings.

and imputation errors. We found and dropped 868 outliers, of which 446 for anomalous values in the distribution of the output indicator, 412 for anomalous values in the distribution of the expenditure and 10 for being both anomalous in the distribution of the output indicator and of the expenditure. Excluding these observations from the analysis, the dataset is reduced by less than 0.5%.

4.4 Some descriptive analysis

With regards to municipalities, it is interesting to note that (Table 1) as the population of the municipality grows, the percentage of services managed through inter-municipal cooperation tends to decrease. Municipalities under 500 inhabitants manage 32% of all municipal services with an inter-municipal cooperation, while in municipalities with a population between 10,000 and 20,000 about 14% of all municipal services is managed with an inter-municipal cooperation.

Table 1 – Municipal services managed with an intermunicipal cooperation, for different demographic classes.

DEMOGRAPHIC CLASS	% OF MUNICIPAL SERVICES IN AN INTERMUNICIPAL COOPERATION
<500 inhabitants (inh.)	32.16
500<inh.<=1,000	26.40
1,000<inh.<=2,000	23.94
2,000<inh.<=3,000	22.77
3,000<inh.<=5,000	21.35
5,000<inh.<=10,000	17.76
10,000<inh.<=20,000	14.39
Total	21.66

Notes: Inter-municipal cooperation include Municipal Unions, Mountain Communities and other forms of formal cooperation (convenzione and consortium).

Social services are those municipal services (Table 2) where the inter-municipal cooperation is most widespread: almost 50% of social services are managed with an inter-municipal cooperation. Inter-municipal cooperation is also significantly important for Local Police (28%), Territory (25%), and Waste Collection (21%). On the other hand, inter-municipal cooperation is not very usual (less than 10%) for Education and Public Road. This confirms an important degree of variability among services using cooperation and so making important to distinguish among different services in the estimation of the impact of the inter-municipal cooperation.

Table 2 – Municipal services managed with an inter-municipal cooperation, for different municipal services.

MUNICIPAL SERVICE	% MUNICIPAL SERVICES IN AN

	INTERMUNICIPAL COOPERATION
Social	*48.97*
Local Policy	*27.53*
Territory	*25.40*
Waste Collection	*21.09*
Education	*6.17*
Public Road	*4.03*
Total	*21.66*

Notes: Inter-municipal cooperation include Municipal Unions, Mountain Communities and other forms of formal cooperation (convenzione and consortium).

5. Empirical Strategy

Our empirical strategy allows the identification of the causal effect of inter-municipal cooperation on expenditure and output.

We implement a difference in differences estimation identifying two groups of municipalities for each type of services. The treated group includes municipalities where the monitored service changed its management structure entering in association with other municipalities. The control group includes municipalities that continue to directly manage the monitored service over the entire period of our analysis. For each service, we compare the change in per capita expenditure and per capita outputs for the treated municipalities before and after the inter-municipal cooperation while we control for the change of the same outcome variables in the control group, which consists of municipalities that directly offer the service (without inter-municipal cooperation) during the whole period.

The novelty of our approach stands in the three levels panel structure that allows us to exploit the variation along time not only by municipality, but also by service. Therefore, for each year, we have several services managed with an inter-municipal cooperation in certain municipalities from a certain point in time (*group of treated*) and the same services not managed with an inter-municipal cooperation for other municipalities (*control group*) or other services not managed with an inter-municipal cooperation for the same municipalities (*control group*).[4] As a result, we identify the causal relationship between inter-municipal cooperation and expenditure and/or output related to the public service managed through an inter-municipal cooperation. The novel structure of the panel is essential to properly identify the effect of being in association, considering that inter-municipal cooperation usually involves that only a subset of the services is provided by the municipality.

[4] In order not to obtain distorted results, we exclude municipal services managed with an inter-municipal cooperation throughout the observation period (*ever-treated*). In addition, we exclude municipal services observations which leave at some point in time after treatment the inter-municipal cooperation.

The methodological approach described above, however, could suffer from *selection bias*, since the municipal service of a municipality belonging to the treated group may differ in some characteristics from those of the control group. These differences could operate as a confounding factor generating a biased estimate of the treatment effect. To minimize this risk, we apply the propensity score method (Smith and Todd, 2005). We do that by identifying, through some characteristics measured before the beginning of the treatment, a group of non-treated municipalities that are very similar to the municipalities in the treated group. We estimate through a probit model the probability (*propensity score*) that a given municipality manages a particular service in an inter-municipal cooperation conditioned to different municipal characteristics. Following Hirano and Imbens (2001) the observations in the difference in differences specification are weighed using the propensity score.[5] We then estimate the following model:

$$Y_{kct} = \alpha + \beta IC_{kct} + \gamma X_{ct} + \mu_k + \pi_c + \delta_t + \varepsilon_{kct} \qquad (1)$$

where Y_{kct} is the outcome variable relative to municipal service k in the municipality c and in the year t, that alternatively measures expenditure per capita or output. IC_{kct} is a dummy variable equal to 1 when the municipal service k in the municipality c and in year t is managed through inter-municipal cooperation. β accounts for the impact of being in inter-municipal cooperation. X_{ct} is a vector of municipal socio-economic controls varying only at municipal and year level, that could affect the demand of local public services (Revelli, 2003; Solè-Ollè, 2006). These controls include percentage of the total population aged between 3 and 14, total amount of urban waste, number of houses and resident population. Finally, μ_k accounts for the service fixed effects, π_c for the municipal fixed effect and δ_t for the year fixed effects. The error term ε_{kct} is clustered at the municipal level.

6. Results

In what follows we use the propensity score estimates.[6] We find a positive impact of the joint service management on expenditure savings (Table 3, column 1). To estimate the impact of intermunicipal cooperation for small municipalities, we add to Equation (1) a *Small Municipality* dummy which is equal to 1 if the municipality has less than 3,000 inhabitants (the median value of the distribution of the census population). We find evidence for small municipalities (Table 3, column 2) of a lower cost up to 7.32[7] euros per capita, which corresponds to a reduction of 10.18 percentage points with respect

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[5] The propensity score procedure is reported in Appendix B.

[6] Tables A5 and A6 in the Appendix C. contain estimates of the treatment effect without weight for the propensity score.

[7] This effect is computed as follows: -7.317 = -1.566-5.751, and it is statistically significant at the 1% level. The mean of expenditure per capita is 71.92.

to the mean of the per capita expenditure. Moreover, we do not observe a significant increase in output (Table 4), except for small municipalities (below 3,000 inhabitants) where inter-municipal cooperation increases the output by 7.15 percentage points with respect to the output average.[8] Therefore, municipalities, with less than 3,000 inhabitants, benefits both from the expenditure and the output side providing more services at a lower cost once municipalities participate to an association. This result is extremely relevant since it tells us that inter-municipal cooperation matters to let small municipalities provide adequate services to their citizens. Moreover, this is particularly important in the case of Italy, where 56% of total municipalities have less than 3,000 inhabitants.

Table 3 – Difference in difference analysis with propensity score weights, point estimates of the treatment effect of inter-municipal cooperation on expenditure per capita.

	(1)	(2)
Dip. Var: expenditure per capita		
Inter-municipal cooperation	-5.666***	-1.566*
	(0.939)	(1.040)
Inter-municipal cooperation*Small municipality		-5.751***
		(1.839)
Observations	40,557	40,557
R-squared	0.321	0.345
Number of municipalities	4,039	4,039
Municipal, year and service FE	Yes	Yes

Notes. Estimate of the model in equation (1). All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

Table 4 – Difference in difference analysis with propensity score weights, point estimates of the treatment effect of inter-municipal cooperation on output.

	(1)	(2)
Dip. Var: output		
Inter-municipal cooperation	0.066	0.049
	(0.065)	(0.074)
Inter-municipal cooperation*Small municipality		0.231*
		(0.125)
Observations	40,557	40,557
R-squared	0.794	0.357
Number of municipalities	4,039	4,039
Municipal, year and service FE	Yes	Yes

Notes. Estimate of the model in equation (1). All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

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[8] This effect is computed as follows: 0.28= 0.049+0.231, and it is statistically significant at the 1% level. 0.28 is the 7.15 per cent of the average of the output variable (3.914).

6.1 Autor test

The key identifying assumption in difference in differences models is that the treatment municipalities have similar trends to the control municipalities in the absence of the treatment. This can be indirectly tested by investigating the presence of a parallel trend in the dependent variable between treated and untreated units during the pre-treatment period. Following the recent literature on the argument related to models with staggered time[9], meaning that treatments start at different moments in time, we implement an Autor test to verify the presence of the parallel trend considering separately the year of the beginning of the treatment (2013 Group, 2015 Group, and 2016 Group). Table 5 contains the results of the Autor test for expenditure for the whole sample. Table 6 contains the same test for the output but including only municipalities with population with less than 3,000 (as it is the only demographic subset for which being in an inter-municipal cooperation positively affects the output). We augment the specification of equation (1) with two dichotomous variables indicating two and one year before the beginning of the treatment (T-2, and T-1) and one and two years after the beginning of the treatment (T+1, and T+2).

For the cohort of municipalities entering a cooperation scheme in 2013, we find that there is a significant effect (negative on expenditure and positive on output) of the inter-municipal cooperation in the year of the beginning of the treatment, and one and two years after, with respect to the reference year 2010. For the cohort of municipalities entering a cooperation scheme in 2015, we find no significant effect for the year before the start of inter-municipal cooperation, compared to the base year 2013. For this cohort, the years after the start of inter-municipal cooperation show significant and negative coefficients in the case of expenditure, while in the case of output the impact is not statistically different from zero. Finally, for the cohort of municipalities entering a cooperation scheme in 2016, we find that all coefficients of the time treatment variables are not significant, however, this result could be driven by the fact that few municipal services started an inter-municipal cooperation in 2016 (less than 10 percent of all services operated under inter-municipal cooperation in the period of our analysis). In conclusion, it thus appears that inter-municipal cooperation has no impact on per capita expenditure and output in the year prior to the treatment, regardless of the year of entry into treatment (2013, 2015 and 2016). This indirectly tests that the parallel trend assumption is satisfied.

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[9] See Athey and Imbens (2022), Callaway and Sant'Anna (2021), de Chaisemartin and D'Haultfoeuille (2020), and Goodman-Bacon (2021).

Table 5 – Autor test, with propensity score weights, expenditure per capita.

Dip. Var: expenditure per capita	(1) Group 2013	(2) Group 2015	(3) Group 2016
T-2			-0.630
			(2.718)
T-1		4.345	-3.769
		(2.674)	(2.562)
T	-10.756***	-3.742**	-0.055
	(1.556)	(1.889)	(2.848)
T+1	-7.233***	-5.526***	
	(1.623)	(1.941)	
T+2	-7.594***		
	(1.556)		
Observations	36,036	32,154	30,608
R-squared	0.335	0.379	0.376
Number of municipalities	3,945	3,777	3,694
Municipal, year and service FE	Yes	Yes	Yes

Notes. Estimate of the model in equation (1). All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

Table 6 – Autor test, with propensity score weights, output.

Dip. Var: output	(1) Group 2013	(2) Group 2015	(3) Group 2016
T-2			0.170
			(0.295)
T-1		0.215	0.018
		(0.233)	(0.298)
T	0.567***	-0.004	0.553*
	(0.150)	(0.245)	(0.323)
T+1	0.341**	0.085	
	(0.162)	(0.254)	
T+2	0.135		
	(0.166)		
Observations	16,139	13,748	12,984
R-squared	0.649	0.605	0.594
Number of municipalities	2,089	1,928	1,872
Municipal, year and service FE	Yes	Yes	Yes

Notes. Sample with municipalities with less than 3,000 inhabitants. Estimate of the model in equation (1). All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

6.2 Heterogeneous effects

We investigate different heterogeneities of the effect of inter-municipal cooperation on expenditure and output of the municipal services. A first source of heterogeneity is the presence of medium-sized municipalities within the inter-municipal cooperation, that we believe can provide the experience and skills necessary for the provision of complex services such as social care and education. Therefore,

we expect that the presence of a medium-sized municipality in the association can improve the management of municipal services.

We estimate a modified version of equation (1), where we add the interaction between *Inter-municipal Cooperation* and *Medium Size Cooperation*. The variable *Medium Size Cooperation* is a dummy variable equal to 1 if in the inter-municipal cooperation there is at least one municipality with at least 20,000 inhabitants or a provincial capital. As expected, the interaction is negative and statistically significant in case of expenditure (Table 7), suggesting higher cost savings thanks to the presence of a medium sized municipality: the point estimate of the extra reduction in cost is quite large, above 46 euros per capita. Instead, we do not observe any significant effect in terms of output. Secondly, we test whether the number of entities forming engaging in inter-municipal cooperation affects the impact of per capita expenditure and output. The relationship between the number of municipalities and the activation of economies of scale should be non-linear and so depending on the number of collaborating municipalities. To test this hypothesis, we add an interaction term between the dummy *inter-municipal cooperation* and a continuous variable that measures the number of municipalities in the inter-municipal cooperation (*Number of Municipalities*) and with its quadratic term (*Squared Number of Municipalities*). The idea is that increasing the number of municipalities can let fully exploit scale economies, however the consequent reduction in expenditure or increase in output should be milder and milder, the bigger becomes the number of municipalities. We find that the number of municipalities in association matters (Table 8): the coefficient of the interaction between *Inter-municipal Cooperation* and the *Number of Municipalities (and its square)* is significant. As the number of municipalities involved in the association becomes larger, expenditure savings and output raise at a decreasing rate as it can be observed (Figure 1) for cooperating municipalities ranging from 2 to 26.

Table 7 – Heterogeneity analysis with propensity score weights, middle municipality in the intermunicipal cooperation.

|	(1) Expenditure p.c.	(2) Output
Intermunicipal cooperation	-6.451***	-0.025
	(1.042)	(0.068)
Intermunicipal cooperation *Medium Size Cooperation	-46.107**	-0.631
	(19.291)	(1.227)
Observations	40,553	18,362
R-squared	0.319	0.654
Number of municipalities	4,053	2,158
Municipal, year and service FE	Yes	Yes

*Notes. All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population, and the interaction between all variable controls and fixed effects with Medium Size Cooperation. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1*

Table 8 – Heterogeneity analysis with propensity score weights, numbers of municipalities in the intermunicipal cooperation.

	(1) Expenditure p.c.	(2) Output
Intermunicipal cooperation	-1.914	-0.279**
	(1.409)	(0.139)
Intermunicipal cooperation *n. municipalities	- 0.628***	0.055***
	(0.179)	(0.015)
Intermunicipal cooperation *n. municipalities^2	0.009***	-0.0005*
	(0.003)	(0.0003)
Observations	40,553	18,362
R-squared	0.329	0.654
Number of municipalities	4,053	2,158
Municipal, year and service FE	Yes	Yes

Notes. All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1. The average number of municipalities in municipal cooperation is equal to 11.33.

Figure 1 – Estimated effect on expenditure (left) and output (right) related to the number of municipalities in the intermunicipal cooperation.
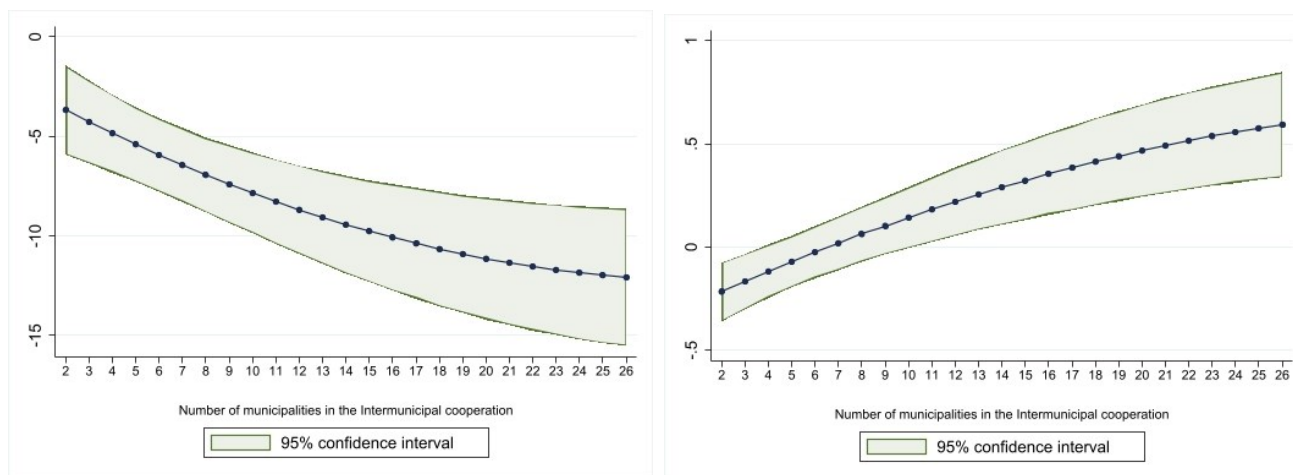
7. Robustness Check

The presence in Italy of many small municipalities (56% have a population lower than 3,000) has prompted the Italian government to stimulate inter-municipal cooperation through central government transfers to support the organization of local services within municipal unions and mountain communities. These transfers are distributed according to population, number of municipalities and number of services jointly provided by the municipal union or mountain community. Since 2006, the management of state transfers to municipal unions and mountain communities has been transferred to the regions. During the period 2010-2016 the state transfers

managed by regions were about 67 million euros, financed 292 different unions or mountain communities, for an average annual contribution of € 65,000. In addition to state transfers, some regions provide additional regional incentives, financed through their own resources.[10]

On one side, the presence of these transfers can bias the result we obtain on the impact of inter-municipal cooperation, by increasing expenditure per capita after joining the intermunicipal network and so offsetting the potential decrease in expenditure per capita. On the other side the availability of these transfers can cause the increase in output observed after the introduction of intermunicipal cooperation. Therefore, we check if the presence of these transfers affects our results by controlling for state and regional transfers and interacting the dummy for intermunicipal cooperation with state and regional transfers. The impact of the intermunicipal cooperation on per capita expenditure continues to be negative and statistically significant. Moreover, the estimated coefficient does not depend on state and regional transfers, since their interaction with the dummy intermunicipal cooperation is not significant (Table 9, column 1). The positive impact of inter-municipal cooperation for output in the subsample of small municipalities is also confirmed. Also, in this case the estimated coefficient does not depend on state and regional transfers, since their interaction with the dummy intermunicipal cooperation is not significant (Table 9, column 2).

Table 9 – Difference in difference analysis with propensity score weights, point estimates of the treatment effect of inter-municipal cooperation on expenditure per capita and output, controlling for state and regional transfers.

	(1)	(2)
	Expenditure per capita	Output
Intermunicipal cooperation	-9.624***	0.327**
	(3.339)	(0.168
Intermunicipal cooperation*State transfers	0.453	0.033
	(0.337)	(0.208)
State transfers	-0.434	-0.032
	(0.338)	(0.315)
Intermunicipal cooperation*Regional transfers	5.126	-0.067
	(3.453)	(0.175)
Observations	40,771	18,443
R-squared	0.356	0.733
Number of municipalities	4,010	2,136
Municipal, year and service FE	Yes	Yes

Notes. Estimate of the model in equation (1). In column (2) sample with municipalities less than 3,000 inhabitants. All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

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[10] From the municipal budget, we do not know the amount of regional transfers. However, we know from any single regional web site the case of regions financing with their own resources intermunicipal cooperation. They are Emilia Romagna, Lazio, Lombardia, Molise, Piemonte, Puglia, Toscana, Umbria and Veneto. This information allows us to build up a dummy *regional transfers* equal to 1 for municipalities receiving regional transfers.

8. Conclusions

Italy is characterized by a strong fragmentation of municipalities, in fact more than 69% of municipalities has a resident population less than 5,000 inhabitants. The presence of many municipalities, small or very small, is a limit to the financial sustainability of the service provision. A possible way out has been identified by the Italian legislator in the possibility of inter-municipal cooperation. The main objective of the inter-municipal cooperation is to supply adequate local public goods and services in small municipalities which would otherwise be difficult to guarantee due to high fixed cost.

In our analysis we take advantage from a set of detailed information on output and expenditure of six different local services, from 2010 up to 2016. This information has been combined with other variables that capture the different political, demographic, territorial and socio-economic characteristics of the Italian municipalities. The information on output and expenditure is detailed by municipality, local service and year. In particular, the identification of the heterogeneity of inter-municipal cooperation in terms of local service expenditure is crucial to identify correctly the impact determined by the joint service management. Municipalities mainly cooperate on the provision of selected services. With our dataset we could properly estimate the impact of inter-municipal cooperation on these services. In fact, we compare, for each municipal service, the variation of expenditure and output per capita before and after the inter-municipal cooperation, controlling for the variation of expenditure and output, in the same period, for municipalities which directly managed the municipal service.

We find that inter-municipal cooperation stimulates economies of scale generating a reduction of expenditure without any detrimental effect on output. Moreover, our work is, as far as we know, the first attempt using direct measure of output, within a panel of provided public services. Regarding this feature, we detect a positive and statistically significant effect on output only in the subsample of municipalities below 3,000 inhabitants. Therefore, we can conclude that joint management is a good strategy for improving efficiency for any kind of municipality but, especially for municipalities with population lower than 3,000. This is exactly the goal of national governments trying to stimulate inter-municipal cooperation. They do it to sort out small local communities from the financial problem they face when providing some services with high fixed costs. This result is particularly relevant for Italy where more than 56% of municipalities has less than 3,000 inhabitants.

We also investigate the possible heterogeneity effect of managing municipal services through inter-municipal cooperation. We find that the presence of a medium size municipality (with at least 20,000 inhabitants) in the association can be beneficial, especially in terms of expenditure savings, bringing the expertise and the skills necessary to realise economies of scale. Also, the number of municipalities

participating in the association is a key factor in improving efficiency. On average the larger the number of participants, the lower the expenditure and the higher the output.

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Appendices

A. Description the of the weights used to build up the composite indexes

The weights (Table A.1) for the Education are the marginal costs for each provided service that SOSE estimated for the evaluation of standard expenditure needs: the idea is that the higher the cost for a given number of pupils is, the higher the value of the output (for more details see SOSE, 2018).

Table A.1 – Output aggregation weights – Education service.

Output	Aggregation weight
School pupils with a disability transported	6.0175
Canteen users	1
School transported pupils	0.7075
Summer camp users and pre-post school pupils	0.1685

The composite indicator for the Local Police is computed as the weighed sum of different types of sanctions and actions for administrative procedures[11]. As reported in SOSE (2018), aggregation weights are identified through the Benefit of the Doubt methodology (Table A.2). This methodology makes it possible to determine weights flexibly and endogenously through the Data Envelopment Analysis (DEA) model (Cherchye *et al*., 2007).

Table A.2 – Output aggregation weights – Local Police.

Output	Aggregation weight
Administrative arrests and seizures	355.6118
Appeals against the Judicial Authority	130.264
Sanctions for commercial and administrative activity	112.9528
Removals of vehicles	41.5548
Authorisations for the occupation of public land	87.12
Information and investigation for municipal or other public administrations	34.4911
Sanctions for violations of the Highway Code	1

Various administrative procedures concluded by municipal offices are used to build up Public Road and Territory indicators, using the weights identified by SOSE through the Benefit of the Doubt methodology (Table A.3). For Public Road the output is built up by aggregating the number of administrative procedures to build new streets or public infrastructures. These procedures are tests for new streets, tenders, contracts and projects, authorizations regarding streets like limited traffic zone, parking, excavation permits and the spreader and snow shovel operations. The output of the Territory service is built up by aggregating the number of procedures to build or renovate private

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[11] The more serious the sanctioned crime is, the higher the weigh associated with the sanction. Administrative arrests and seizures have a weigh which is the triple of sanctions for commercial and administrative activity, which is, as well, the triple of procedures for removals of vehicles.

houses and private infrastructure. The procedures regard environmental permits, environmental regulations and the trees planted or pruned or the cleaned rivers.

Table A.3 - Output aggregation weights – Public Road and Territory.

| Output	Aggregation weight
Public road	
Tests	32.996
Contracts	19.415
Public land concessions for construction sites and excavations	18.981
Tenders	8.94
Progress and final status reporting	8.111
Disabled parking permits and ZTL access	5.308
Projects	4.139
Directions of Works	3.022
Spreader and/or snow shovel operations	1.408
Territory	
Environmental ordinances	26.487
Cleaning rivers and streams	21.092
Citizens alerts managed	15.179
Authorisations granted	13.345
Environmental compatibility	9.561
Tenders	6.451
New trees	4.58
Plants subject to pruning	1

B. Variables used to estimate the Propensity Score and results

The variables, related to the period before the begging of the treatment, that we use to determine the propensity score (Table B.1) are per capita income (personal income tax base), demographic composition (share of population under 5 and share of population over 65), territorial characteristics (average altitude and density), demographic size of the municipality (population), characteristics of the mayor (age of the mayor and level of education of the mayor), and presence of municipal elections in the year 2010 (Election). Moreover, following the official classification of municipalities provided by the Italian Institute of Statistics, we identify six clusters (Internal Areas) according to the degree of urbanization: urban pole, inter-communal pole, belt, intermediate, peripheral, and ultra-peripheral. Following the combination of individual observations of the control group with the group of treated units through the *propensity score* the matched differences are all reduced, until the difference becomes insignificant as reported in Figure B.1.

Table B.1 – Variables used to estimate the propensity score.

Variable	Year	Source
Age of the mayor	2010	Ministry of the Interior
Average altitude	2001	ISTAT
Density	2001	ISTAT
Election	2010	Ministry of the Interior
Income per capita	2010	MEF
Internal areas	2010	ISTAT
Level of education of the mayor	2010	Ministry of the Interior
Population	2001	ISTAT
Share of population over 65	2010	ISTAT
Share of population under 5	2010	ISTAT

Figure B.1 – Balancing test of the pre-treatment characteristics.
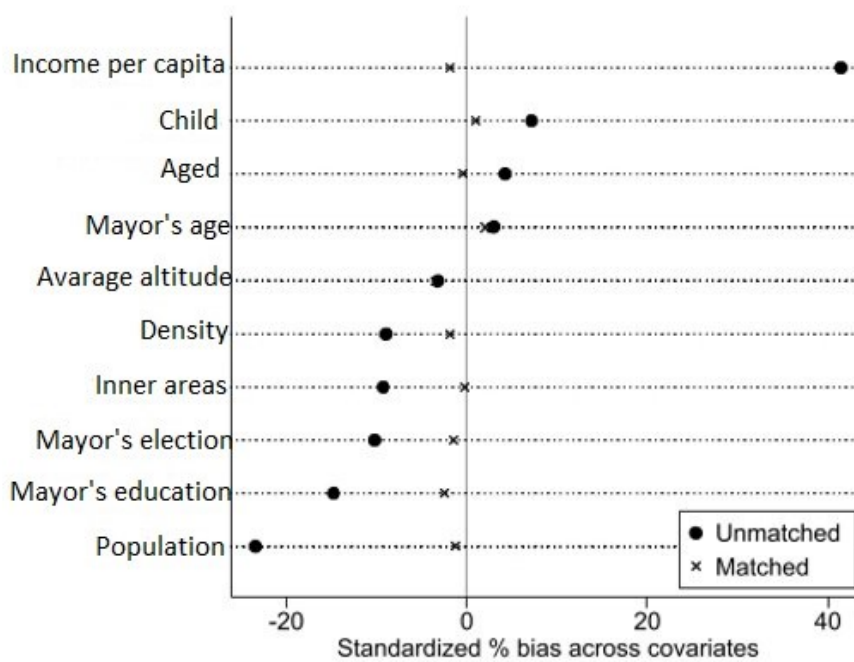
C. Estimates without the propensity score weights

Table C.1 – Difference in difference analysis, point estimates of the treatment effect of inter-municipal cooperation on expenditure per capita without propensity score weights.

	(1)	(2)
Dip. Var: expenditure per capita	.	
Inter-municipal cooperation	-6.359***	-3.095*
	(0.831)	(0.991)
Inter-municipal cooperation*Small municipality		-4.564***[12]
		(1.660)
Observations	40,557	40,557
R-squared	0.346	0.367
Number of municipalities	4,039	4,039
Municipal, year and service FE	Yes	Yes

Notes. Estimates of the model in equation (1). All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

Table C.2 – Difference in difference analysis, point estimates of the treatment effect of inter-municipal cooperation on output per capita without propensity score weights.

	(1)	(2)
Dip. Var: output	.	
Inter-municipal cooperation	0.055	0.066
	(0.066)	(0.078)
Inter-municipal cooperation*Small municipality		0.178[13]
		(0.123)
Observations	40,557	40,557
R-squared	0.765	0.777
Number of municipalities	4,039	4,039
Municipal, year and service FE	Yes	Yes

Notes. Estimates of the model in equation (1). All specifications include a constant term and the following controls: population aged between 3 and 14, total amount of urban waste, the number of houses per capita, total resident population. Robust standard errors in parentheses clustered at municipal level, *** p<0.01, ** p<0.05, * p<0.1

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[12] We compute the interaction effect as follows: -7.659= -3.095-4.564, and it is statistically significant at the 1% level.

[13] We compute the interaction effect as follows: 0.243= 0.065+0.178, and it is statistically significant at the 1% level.