

# Does Cooperation reduce Public Expenditures?

## Evidence from Italian Municipal Unions

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### Abstract

Inter-municipal cooperation is a widespread phenomenon among municipalities as a way to provide local public services, exploit economies of scale and internalise externalities. However, little is known about possible efficiency gains. We test their existence in terms of local public expenditures reductions by investigating the Italian experience of Municipal Unions. We exploit unique administrative data on municipalities located in the Emilia Romagna region, for the period 2001-2011. Using a difference-in-differences approach combined

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with matching models, we find that being in a Union reduces the total per capita current expenditures by around 5%, compared to municipalities not in a Union. The effect is robust to several checks, persistent and increasing up to nine years after entrance. Finally, joining a Municipal Union does not reduce the level of local public services.

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## 1 Introduction

In the last fifty years municipalities across Europe have faced different economic and government budget challenges that put pressure on their performances in terms of efficiency, effectiveness and quality of public services. On the one hand, the demand for the provision of public goods has registered a general increase. Citizens are more conscious and demand a wider and more skilled set of public goods, together with greater level of accountability than in the past. On the other hand, the fulfilment of public finance requirements, imposed by central governments to local governments to achieve the EU fiscal discipline, has led municipalities to reduce their expenditures [Bel and Warner, 2015]. Therefore, municipalities - especially small ones - might find difficult to meet the demands of standard levels of local public goods while reducing their expenditure, since they cannot take advantages of economies of scale. To deal with these issues, central governments tried to rethink service delivery through the implementation of new different institutional tools: amalgamation of municipalities and inter-municipal cooperation.

Municipal amalgamation is very different from inter-municipal cooperation, and

aims to reduce the number of units of sub-national governments, by compulsory merging neighboring borders and creating new entities. The objective of municipal amalgamation is to achieve efficiency gains, from both the exploitation of economies of scale, since a larger area can be served after the coordination agreements, and the internalization of externalities [Oates, 1972, Case et al., 1993]. On the contrary, in the inter-municipal cooperation case, municipalities reciprocally cooperate in order to provide a wide range of public services or organize service delivery between partners. Within this framework, the degree of institutionalization and the extent of decision-making powers are key elements [van Montfort and Hulst, 2011]. Municipalities can transfer their own decision-making powers on some public services to a standing organization. Hence, the latter becomes a new entity, along with the cooperating municipalities, entitled to provide only the transferred public services. Thus, municipalities enter into a formal agreement to co-operate without being replaced by a joint standing organization.

The literature has shown that the inter-municipal cooperation is a more flexible solution than amalgamation, since municipalities can maintain, on their own territory, local political representatives [Dollery et al., 2006, Feiock and Scholz, 2009, Blaeschke, 2014]. Saarimaa and Tukiainen [2015], using Finnish data, find that municipalities, before amalgamation, shift part of the costs of additional expenditures to the future partners by increasing debt or liquidating assets. Similar findings are shown by Fritz and Feld [2015], who observe higher debt dynamics for a sample of amalgamated German municipalities. They also show that debt dynamics are higher if the number of amalgamated municipalities increases, and if municipalities are either forced to merge or annexed.

Most empirical works have focused on the determinants of the inter-municipal cooperation. In particular, size of municipalities [Brasington, 2003, Carr et al., 2007],

regional characteristics [Feiock, 2007, LeRoux and Carr, 2007], geographic factors [Morgan and Hirlinger, 1991, Post, 2002] and spatial proximity of municipalities [Di Porto et al., 2013] appear to be relevant factors in favor of inter-municipal cooperation. However, few studies have analyzed the impact of inter-municipal cooperation on socio-economic variables<sup>1</sup> and, at the best of our knowledge, there are no studies that empirically explore the ex-post impact of the inter-municipal cooperation on both financial and service output variables.<sup>2</sup>

The aim of this paper is to fill this gap in the literature, by studying the causal impact of inter-municipal cooperation on local spending and on the provision of the local public services. More specifically, we investigate the Italian experience in the inter-municipal cooperation process<sup>3</sup>, which starts in 1990 with the institution of the Municipal Union (Unione dei Comuni). We use unique administrative data, that allow us to observe municipalities belonging to the region Emilia Romagna - one of the most active Italian region in promoting inter-municipal cooperation - over the period 2001-2011. Exploiting the different timing in entering/forming Municipal Unions, we employ difference-in-differences models to identify the causal effect of the inter-municipal cooperation. To control for the different sources of biases that may arise due to the heterogeneity of the municipalities in the sample, we adopt

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<sup>1</sup>See Bel et al. [2012] for the case of solid waste services and Brasington [1999, 2003] for the case of public schooling.

<sup>2</sup>Instead, there is a recent strand of literature testing the effect of amalgamation on municipal financial variables. Reingewertz [2012], by using data on Israeli municipalities, finds that amalgamated municipalities display lower per capita expenditure after amalgamation with respect to other municipalities. The same results are found for Swedish municipalities, as long as municipalities do not exceed a critical size [Hanes, 2015], and also for German municipalities [Blesse and Baskaran, 2016]. On the contrary, Moision and Uusitalo [2013], by using a ample of Finnish municipalities, find that municipalities' spending was higher in the merged municipalities compared to similar municipalities that chose to stay independent, even after ten years of amalgamation.

<sup>3</sup>The number of Municipal Unions has notably increased over the time. In 2009, for example, the Municipal Unions were 289, involving 1,335 municipalities (17% of total municipalities), while, in 2016, the Municipal Unions are 537, involving 3,117 municipalities (39% of total municipalities).

parametric and non-parametric difference-in-differences matching models. Overall, our results confirm that being a member of a Municipal Union reduces total current per-capita expenditures by around 5%, compared to municipalities not in a Union. We are also able to investigate the persistence of the policy effect, and we find that the expenditure reduction is consistent and increasing up to nine years after joining a Municipal Union. Our results survive a large number of robustness checks, thus we are confident that the link between the participation in a Municipal Union and local spending is causal. Finally, we find that spending cuts are not associated with a downsizing of local services, which confirms that the Union is effectively increasing municipalities efficiency.

The paper is organized as follows, Section 2 describes the institutional background, Section 3 and Section 4 illustrate, respectively, the empirical approach and the identification strategy, Section 5 comments the results, Section 6 presents our robustness checks and Section 7 concludes.

## 2 Institutional framework

The Italian Constitution counts five administrative government layers: from central government to, at local level, Regions, Provinces, Metropolitan Area (yet to be constituted) and Municipalities. While most Regions and Provinces are ruled by “ordinary” statutes, some of them – the “autonomous” Regions and Provinces – are ruled by “special” statutes<sup>4</sup>. Municipalities are the nearest jurisdiction level to the citizens, and they are in charge of several public functions in the fields of social welfare services, territorial development, local transport, infant school education,

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<sup>4</sup>There are five Autonomous Regions (Sicilia and Sardegna, which are insular territories, and Valle d’Aosta, Trentino Alto Adige and Friuli Venezia Giulia, which are northern boundary territories) and two Autonomous Provinces (Trento and Bolzano).

sports and cultural facilities, local police services, water delivery, waste disposal and infrastructural spending.

In Italy, there are more than 8,000 municipalities and, approximately 70% of them have a population lower than 5,000 inhabitants. The presence of so many small municipalities has led the national government, over the last 25 years, to stimulate processes of both amalgamation and inter-municipal cooperation. In particular, the inter-municipal cooperation has formally been introduced by the Law 142/1990, which allows municipalities to transfer their own decision-making powers, in terms of expenditure decisions, to a standing organization called Municipal Union (Unione di Comuni). The Italian Municipal Unions can be compared to the Mancomunidades in Spain, the Intergemeentelijke diensten in Netherlands, the Zweckverbände in Germany, the Sivu, Sivom, Syndicats mixtes in France and the Opdrachthoudende & dienstverlenende verenigingen in Belgium/Flanders.

According to the Law 142/1990, a Municipal Union provides the public services transferred by the cooperating municipalities. In this framework, municipalities transfer the money related to the public function(s) they want to share, and the Union provides the corresponding service(s). Therefore, the Union is a legal entity, with its own balance sheet, its own president – chosen among the mayors of municipalities joining the Union – and its own council – composed by the council members of cooperating municipalities. Moreover, the Italian law prescribes that each municipality can be member of only one Union. The functions commonly transferred to the Unions are Administration and Management, Municipal police, Education, Roads & Transport Services, Planning and Environment and Social welfare. Municipalities can also transfer other functions, such as Economic development, In-house production services, Culture, Sport and Tourism.

Finally, the regional administrations are endowed with strong regulatory powers

regarding municipalities belonging to Unions. In fact, each region, through its own law, can stimulate and promote Municipal Unions within its territory, by means of regional transfers. Some Regions - such as Veneto, Toscana and Emilia Romagna - sustained the creation of Municipal Unions using different financial incentives (e.g length of permanence or size of the Union), whereas other regions did not promote any form of support. A particular case is Lombardia, which has created a special register of Municipal Unions (Unioni di Comuni Lombardi), such that only registered municipalities have access to regional transfers.

The share of the Municipal Unions budget on the total expenditure of local governments has increased over time. For example, in 2007, the total expenditures of Municipal Unions accounted for about 0.10% (403 million of euro) of the total local expenditures in Italy (350 billion of euro). In 2013, the total expenditures of Municipal Unions are more than doubled, accounting for about 0.30% (970 million of euro) of the total local expenditures in Italy (334 billion of euro). However, these percentages do underestimate the real expenditure quota of the Unions, because Municipalities do not often write off their quota of the delegated function, and continue to register it as their own expenditure.

In terms of revenues, the Municipal Union relies on both transfers from municipalities within the Union and transfers from higher level of governments (State and regional governments).

### **3 Empirical Approach**

As discussed in the previous section, the regional administrations regulate and implement the Municipal Unions through their own laws. Consequently, the organisation process has not been homogeneous both over space, i.e. across regions in Italy, and

over time (during the period of our analysis 2001-2011). This implies that municipalities in Unions located in different regions are not properly comparable, and we cannot identify a unique (aggregate) effect of the policy on local expenditures.

We have therefore decided to restrict our analysis to one region only, Emilia Romagna. This is an administrative region of northern Italy, with an average population of about 4 million inhabitants over the period 2001-2011 (approximately 7.50% of the Italian population). The average GDP, over the same period, is 116 billion euros (approximately 9% of the Italian GDP).

Our choice of Emilia Romagna depends, first of all, on the availability of data on all municipalities on its territory. Second, inter-municipal cooperation is a widespread phenomenon throughout Emilia Romagna. During the last decade, indeed, the number of Municipal Union has noticeably increased, involving the greatest proportion of municipalities among ordinary status regions. Thus we think that the effect of Municipal Unions in this region may be a good predictor of the overall efficacy of the policy.

### **3.1 Data**

We use data on Italian municipalities, resulting from a combination of different archives publicly available from the Italian Ministry of the Interior, the Italian Ministry of Economy and the Italian Institute of Statistic. Our data includes a full range of information organized into two sections: 1) municipal financial data; 2) municipal demographic and socio-economic data, such as total current expenditures, population size, age structure, average income of inhabitants. By only considering Emilia Romagna we can observe 348 municipalities for the period 2001-2011. However, we exclude Bologna because of its specific status of Metropolitan Area, which nor-



mally provides a much wider range of services than other municipalities. Moreover, due to missing values in some variable of interest our final sample reduces to 335 municipalities, over the period 2001-2011, for a total of 3,686 observation.<sup>5</sup>

### 3.2 Municipal Unions in Emilia Romagna

Our data show exactly the year of entrance of a municipality in a Union during the period 2001-2011. Figure 1 shows the map of all municipalities in Emilia Romagna in 2001. There is only one Municipal Union, including 9 municipalities and serving 20,767 inhabitants, around 1% of the regional population. Figure 2 shows a completely different picture, in 2011 the Municipal Unions sum up to 31, involving 160 municipalities and serving 1.5 million of inhabitants, that is 34% of the total population of Emilia Romagna.

Municipal Unions are composed, on average, by 5 municipalities (from a minimum of 2 to a maximum of 10) and cover an average population of approximately 43,000 inhabitants. The *Unione Valle Tidone*, includes only two municipalities, and it is the smallest serving 3,096 people. The *Unione Comuni Modenesi del Distretto Ceramico*, is composed by 4 municipalities, and it is the largest Union serving 107,138 inhabitants.

The decision to enter a Union belongs to the single municipality, even though the regional government has the power to regulate the process of inter-municipal cooperation. Specifically, the government of the Emilia Romagna approved in 2008 an important regional law (LR 2008, n.10) aiming at rationalising public expenditures through a reorganisation of the institutional bodies on its territory. Emilia Romagna transformed the mountain communities (an institutional organisation formed only by

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<sup>5</sup>Summary and descriptive statistics are reported in Table A.1 .

mountain municipalities) in Municipal Unions and strongly encouraged municipalities to form Unions, giving to the latter direct financial incentives. This is reflected in Figure 3, which depicts the percentage of municipalities belonging to a Municipal Union over the time. Notice that the rate of participation of municipalities in Municipal Unions is less than 20% until 2007, but it has a striking increase from 2008, reaching almost 50% by the end of the decade.<sup>6</sup>

Table 1 shows that the number of municipalities in Union increases over the time, switching from 9 (2.67% of all municipalities) in 2001 to 160 (47.06% of municipalities) in 2011. As previously said, the bulk of municipalities forming and/or joining a Union occurred between 2007 and 2009. Indeed, in 2007, 54 municipalities (16.12%) were in a Union, while in 2008 the number of municipalities in a Union increased up to 70 (20.83%). Finally, for the years 2009 and 2010, the number of municipalities in a Union was, respectively, 132 (39.88%) and 150 (43.73%).

### 3.3 Expenditures

We are interested in the impact of belonging to a Municipal Union on the fiscal performance of municipalities. We use the total current expenditure of each municipality, in per-capita terms, as an aggregate measure to compare the performances of those municipalities in Union and those not.

It is important to note that the total current expenditure for municipalities in a Union includes their transfers to the Union. Indeed, the services provided by the Unions are essentially financed through those transfers and by direct expenditures registered in the budget of the municipalities.

As a preliminary piece of evidence, it is interesting to see that the average per

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<sup>6</sup>The trend is continuously growing and by 2016 the percentage of municipalities in unions is 81%.

capita expenditure of municipalities in a Union is 751.10 euros whereas for the others is 835.99 euros. This gives a differences of 84.88 euros p.c.<sup>7</sup> which is statistically significant at 1%.

Figure 4 depicts the evolution of the (logs of) current expenditure p.c. for municipalities in a Union and not in a Union. The trends look a bit different in the first 3 years of the sample, when however there are at most 5 Unions and 23 municipalities (see Table 1). From 2004 to 2007 the trends are similar, and then start to diverge, with an important decrease in the expenditure of municipalities in a Union after 2009. Notice that this timing corresponds to the introduction in 2008 of the regional reform law mentioned above, which has been followed by a strong increase in the number of Municipal Unions.

## 4 Identification strategy

In this section we describe the main strategies to identify the causal effect of being a member of a Municipal Union on the spending decisions of single municipalities. Ideally, we would like to compare decisions on expenditure for municipalities in a Union (treated group), to the same decisions for municipalities in the counterfactual situation of not being in the Union. This is impossible, and the best alternative would be a randomized control trial which assigns participation and non participation in a Municipal Union across municipalities, and allows us to compare the average expenditures of the two groups. In our analysis, however, we have to use quasi-experimental methods to define a suitable control group that can credibly estimate the counterfactual. The main concern on the identification using these approaches is due to the unobservable characteristics that may vary between municipalities in

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<sup>7</sup>From now on per capita is reported as p.c.

Union and not, and which might be correlated to the expenditures. To remove the unobservables that are fixed over time, we exploit the panel dimension of our data and employ a difference-in-differences methodology.

For each year, we have municipalities in Unions (treated group) and municipalities not in Unions (control group). We therefore compare the change in expenditures in the treatment group before and after the participation in a Municipal Union, to the change in expenditures in the control group for the same period. We estimate the following two-way fixed effect linear model

$$Y_{it} = \mu_i + \tau_t + \gamma MU_{it} + \beta \mathbf{x}_{it} + \varepsilon_{it} \quad (1)$$

where  $Y_{it}$  is log per capita expenditure in municipality  $i$  at time  $t$ ,  $MU_{it}$  is a dummy variable that takes the value one if municipality  $i$  at time  $t$  belongs to the Municipal Union and zero otherwise.  $\mu_i$  are a set of municipalities fixed effects, and we also control for exogenous shocks,  $\tau_t$ , common to all municipalities in period  $t$ .  $\mathbf{x}_{it}$  is a vector of time-varying variables, accounting for demographic and socio-economic characteristics. In particular, we include the population of the municipality (*population*), the population density, calculated as the number of citizens per area (*population density*), and the inverse of the population (*1/population*). These variables can capture the presence of scale economies or dis-economies in the provision of public goods and congestion effects. The proportion of citizens aged between 0 and 5 (*child*) and the proportion of citizens aged over 65 (*aged*) can account for some specific public needs (e.g., nursery school, nursing homes for the elderly). In terms of economic and financial controls, we include the average per capita income proxied by the personal income tax base (*income*) and the proportion of taxpayers (*taxpayers*). We also control for the total per capita revenue collected by the Municipal Union,

given by the sum of its own total revenue and the transfers from higher levels of government.<sup>8</sup> Not including this variable would bias our estimates, since we could not properly separate the effect of being in the Municipal Union from the variation in the financial resources raised by the Municipal Union.<sup>9</sup> Finally, the error term  $\varepsilon_{it}$  is assumed to be independent of  $\mu_i$  and  $\tau_t$ , and we cluster the standard errors at municipal level. In this framework,  $\gamma$ , is the difference-in-difference estimate of the effect of being in a Municipal Union on expenditure.

## 5 Results

In Table 2 we show the difference-in-differences (DiD) estimates. In particular, in column 1 we estimate equation 1 in the full sample, including only municipality and year fixed effects. We find that being a member of a Municipal Union decreases the municipalities expenditures by 6.5%, and the effect is significant at 1%. One issue is that there may be municipality characteristics varying across time and space, potentially correlated to participation to a Union and expenditures. We therefore estimate our DiD model controlling for a series of demographic and socio-economics factors described in Section 4. The inclusion of the control variables slightly changes

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<sup>8</sup>This variable varies every year at the Municipal Union level, implying that all municipalities belonging to the same Unions share the same value.

<sup>9</sup>An example can be useful for interpretation. Consider a municipality M that enters in year T in a Municipal Union. M transfers a given amount of money, say 100 euros, to the Union. The total expenditure of M, including the transfer to the Union, for the year T is 900+100=1,000 euros. Then, suppose that the same municipality in year T+1 transfers to the Union a lower amount of money, say 50 euro. This because in year T+1 the Municipal Union has received more transfers from the regional government. Assume that the expenditure of municipality M, net of transfers to the Union, is constant (900) between year T and T+1. Therefore, the total expenditure of municipality M in year T+1 is 950 euro. If we compared the total expenditure of municipality M, between year T and year T+1, we would observe a reduction (from 1000 to 950). However, such a reduction, would not be due to efficiency gains resulting from the participation to the Union. On the contrary, this would be due to the reduction in transfers from the municipality to the Municipal Union.

the magnitude of the treatment effect. In fact, looking at column 2, we notice that the coefficient of Municipal Union is still negative (-4.7%) and significant (at 1%), however it drops by 1.8 percentage points. This implies that it is important to control for differences among municipalities.

We also investigate whether there is evidence of heterogeneity in the effects of the policy. One way of thinking about this is whether the effect of the policy varies with respect to the permanence in Municipal Union. In fact, the models estimated so far did not directly take into account of the length of time spent by each municipality in the Union after joining it. This is an important issue since we are dealing with multiple treatment groups and multiple time periods. We, therefore, estimate a modified version of equation 1, where we add a continuous variable that measures the permanence (*permanence*) in the Union (from zero to 11 years), and we also include its quadratic term (*permanence square*). In column 3 of Table 2 we notice that permanence in a Union has a concave effect, and one additional year reduces on average the expenditures by 2.2%. To better understand the dynamic of the permanence in a Union, we have disentangled the aggregate effect in annual effects, and reported the results in Table 3. It is interesting to observe that the reduction in expenditures almost doubles after 3 years in a Union (from -3% to -6.4%). The effect is highly significant and strongly increases up to 6 years from the entrance in a Municipal Union, then stabilises at around -8%. It clearly decreases after 7 years and then disappears.

The estimations carried out so far might, however, suffer of two potential sources of bias, because the effect of entering a Union is not homogeneous and varies according to the characteristics of the municipalities. The first bias, indeed, arises when municipalities in the treatment group are somehow different than those belonging to the the control group. The second source of bias might be due to different dis-

tributions, within the treatment and the control groups, in the vector of observable characteristics that affect expenditures.

We attempt to eliminate these biases in the estimations by adopting propensity score matching models. The main purpose of matching is to find a group of non-treated municipalities, who are similar to the treated in all relevant pre-treatment characteristics,  $\mathbf{x}$ , the only remaining difference being that one group enters a Union and another group does not.

In the first stage we therefore estimate the propensity score<sup>10</sup> using a discrete response model of entering a Municipal Union. In particular, we use data from the 2001 Census and run a logit regression, where the dependent variable is given by a dummy variable which takes the value of 1 if a municipality entered in the Municipal Union during the period 2001-2011 and zero otherwise. The included control variables are: a dummy variable equal to 1 if the municipality is located close to the coast and zero otherwise (*coastal zone*), a dummy variable equal to 1 if the municipality is a rural municipality and zero otherwise (*rural municipality*); surface in square km of the municipality (*area*) and its square (*area*<sup>2</sup>); a categorical variable (*altimetry zone*) equal to 1 if the municipality is located in plain, equal to 2 if the municipality is located on hills, and equal to 3 if the municipality is located in mountains; municipal unemployment rate (*unemployed*); number of houses (*houses*); number of firms (*firms*); an interaction term between the municipal surface and the number of houses (*int\_houses*); an interaction term between the number of firms and the unemployment rate (*int\_unemployment*). Once we have obtained the the propensity score (PS), following Smith and Todd [2005], we adopt a trimming procedure to define the common support as the region of values of PS that have

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<sup>10</sup>The probability of entering a Union conditional on pre-treatment characteristics  $\mathbf{x}$ ,  $P(\mathbf{x}) = Pr(MU = 1|\mathbf{x})$

positive density within both the treatment and control groups distributions.

We then re-estimate equation 1 by using information only on the observations that lie on the common support. The results in columns 4, 5 and 6 of Table 2, restricted to the subsample of matched municipalities, all confirm our previous findings. This approach should control for the first source of bias mentioned above.

However, within the common support, the distribution of  $\mathbf{x}$  might be different between treated and control observations, keeping the second source of bias. Therefore, we control for it by using a non-parametric DiD kernel matching estimator<sup>11</sup>. Following Heckman et al. [1998], we estimate

$$\gamma^{DiD} = \sum_{i \in MU} \left\{ [Y_{it_1} - Y_{it_0}] - \sum_{j \in NMU} W_{ij} [Y_{jt_1} - Y_{jt_0}] \right\} w_i \quad (2)$$

where  $t_0$  and  $t_1$  are time periods before and after entering a Union. Specifically,  $MU$  is formed by municipalities not Municipal Union in  $t_0$  that will join a Union in  $t_1$ ,  $NMU$  is formed by municipalities not Municipal Union in  $t_0$  that will remain out of any Union in  $t_1$ .  $W_{ij}$  is the weight placed on the  $j$ th observation in constructing the counterfactual for the  $i$ th treated observation.  $Y$  is the expenditure of municipalities and  $w_i$  is the re-weighting that reconstructs the outcome distribution for the treated sample. In order to have a balanced sample between the two comparison groups, we choose the years 2008 and 2010 as pre-treatment and post-treatment period, respectively.

We have already mentioned the important regional reform law approved in Emilia Romagna in 2008, and the subsequent strong increase in the number of municipalities that entered and/or formed a Union (this pattern is clear looking at Figures 3 and

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<sup>11</sup>The Kernel matching approach has been performed by using the Stata command *diff* developed by Villa (2012). The standard errors are clustered at municipal level.



4 and at Table 1). In the treatment group we include only municipalities that join a Municipal Union in 2009, and in the control group municipalities that never joined a Union. We then perform the matching approach as in equation 2, by comparing expenditure between treated and control municipalities, in 2008 and in 2010. The result of this analysis is reported in column 7 of Table 2. We find that being in a Municipal Union reduces the expenditure by around 7%: such an effect is significant at 1% and in line with the previous results.

The results presented so far show that inter-municipal cooperation increases the efficiency of the single municipality, since its expenditure reduces once the municipality enters a Union. However, such a save might not be a real gain in efficiency, but, instead, the consequence of a reduction of the level or the quality of public services. To verify whether this is the case is not an easy task, because we would need exact measures of the quantity or quality of all local public services provision. However, we can test whether local public services are affected by inter-municipal cooperation using four proxies of their level. In particular, drawing from the literature [Blesse and Baskaran, 2016; Reingewertz, 2012], we consider per capita birth rate, net migration to the municipality, p.c. primary school class size and p.c. number of road accidents. If local services were to decline we would expect a negative impact on these indicators, as a consequence of the reduction in expenditures. For example, poor local public services may imply lower migration and lower birth rates, as a result of lower attractiveness of the municipality. Less expenditures may increase the school class size, a typical indicator of the quality of the school service. Finally, a decrease in current expenditures which leads to a worsening of roads or bridges maintenance might increase car accidents.

The results of the estimations using alternative outputs are reported in Table 4, for both the full sample and the matched municipality sample. It is clear that being

in a municipal union does not affect any of our four local service indicators. Thus the inter-municipal cooperation is not associated to any reduction in the provision of public services, therefore all expenditure savings coming from the participation to a Municipal Union can be interpreted as an efficiency gain.

## 6 Robustness Checks

The key identification assumption of the difference-in-differences approach is the common time trend in the pre-treatment periods for both comparison groups. Figure 4 shows the trends between treated and control groups, however, this is not helpful for a visual inspection of the pre-treatment trends when using treatments at different times.

Therefore, we perform a formal test re-estimating equation 1 including the interactions of the time dummies and the treatment indicator for the first three pre-treatment periods. If the expenditure trends between treatment and control group are the same, then the coefficients of the interactions should be insignificant, i.e. the difference in differences is not significantly different between the two groups in the pre-treatment period. An attractive feature of this test is that also the interaction of the time dummies after the treatment (up to 3 years) with the treatment indicator is informative, it can show whether the treatment effect changes over time. The literature generally refers to the interactions of the treatment indicator with the pre-treatment periods as “leads” and the interaction with the post-treatment time dummies as “lags”.<sup>12</sup> In our analysis, we estimate the following version of equation 1:

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<sup>12</sup>See Autor [2003] for an application of this method.

$$Y_{it} = \mu_i + \tau_t + \sum_{j=0}^m \gamma_{-j} MU_{i,t-j} + \sum_{j=1}^n \gamma_{+j} MU_{i,t+j} + \beta \mathbf{x}_{it} + \varepsilon_{it} \quad (3)$$

where the sum of  $\gamma_{-j}$  allows for  $m$  lags effects and the sum of  $\gamma_{+j}$  allows for  $n$  leads or anticipatory effects. A test of the difference in differences assumption is  $\gamma_{+j} = 0$  for each  $j = 1 \dots n$ , i.e. the coefficients of all leads of the treatment should be zero. Furthermore,  $\gamma_{-j}$  may not be identical and if the effect of the treatment is growing over time  $\gamma_{-j}$  increases in  $j$ .

In Table 5, column 1, using the full sample, we do not find any significant effect of the leads up to a pre-treatment period of 3 years.<sup>13</sup> The main effect of Municipal Union is, instead, still negative (around -4.4%) and statistically significant at 1%. The same results hold when using the matched municipality sample (column 3).

In column 2, using the full sample, we add the lags and we notice that the corresponding coefficients are not identical. This suggests that the negative effect of the Municipal Union on expenditure is growing over time. The coefficients of the leads remain not statistically significant. Similar results are obtained on the matched sample (column 4). Overall, this test reassures on the validity of the common trend assumption.

Another important assumption in our models is the absence of reverse causality, that is we exclude any direct effect of expenditure on the decision to join a Municipal Union. In order to test this assumption we estimate the conditional probability,  $h_{it}$ , to enter a Union for a municipality  $i$  at time  $t$ , given that the event has not yet

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<sup>13</sup>In order to build the leads variables we have collected information about the participation of the single municipality in the Municipal Union for the years 2012, 2013 and 2014. For example, the lead variable for municipality  $i$  in year 2011 implies to know whether municipality  $i$  will join a Municipal Union in 2012.

occurred

$$h_{it} = P[T_i = t | T > t - 1, Y_{it}, \mathbf{x}_{it}] \quad (4)$$

where  $T$  is the time in years before joining a Union and  $\mathbf{x}_{it}$  is a vector of observed explanatory variables, which can be time-variant and time-invariant, and  $Y_{it}$  is log expenditure. Following Jenkins [1995] we specify the form of the hazard function as a complementary log-log hazard rate and we use a piecewise-constant baseline hazard by including dummy variables for each year. Thus, within each time interval the duration dependence is assumed constant. This represents a semi-parametric, discrete-time, homogenous hazard model which can be written as

$$h_{it} = 1 - \exp(-\exp(\alpha \mathbf{d}_{it} + \beta \mathbf{x}_{it} + \eta Y_{it})) \quad (5)$$

In the vector of covariates  $\mathbf{x}_{it}$  we include the share of young and old per capita population of the municipality, its density, the number of taxpayers and the p.c. personal income tax base. We also estimate a heterogeneous hazard model, generalising equation 5 to account for any unobserved municipality-specific effect by including a random intercept  $q_i$ , which is uncorrelated with all the covariates [Narendranathan and Stewart, 1993]. Our hypothesis is that the coefficient  $\eta$  of log expenditures is not significant, i.e. there is no reverse causality.

In Table 6, we report the estimates for the homogeneous and heterogeneous duration models. We notice that unobserved heterogeneity does not appear to be an issue, indeed the coefficient of log expenditure is identical for both models. This is also clear looking at the high p-value of the likelihood ratio test of the hypothesis of zero unobserved heterogeneity. For ease of interpretation we have expressed the estimated coefficient of the log expenditure variable as a hazard ratio. Looking

at these results it is evident that there is no reverse causality, because the effect of expenditure on the conditional probability to enter and/or form a Union is not significant.

As a final robustness check we estimate our DiD model using a more homogeneous definition of the control group. Firstly, we restrict the sample to the years 2001-2008 and we exclude municipalities that never enter a Union (never treated). Then, we include in the control group the municipalities that join a Union between 2009 and 2011 (future treated) together with all the municipalities observed in the years before entrance (within the period 2001-2008). This is important because it means that we include in the control group municipalities that are simply further down the ‘queue’ for participation in the policy.

We estimate equation 1 in the full sample (column 1, Table 7) and in the matched sample of municipalities (column 2), finding that the effect of being in a Municipal Union is associated with a 7% reduction in the municipality expenditures, statistical significant at 1% and consistent with our previous findings.

## 7 Conclusion

Inter-municipal cooperation is a widespread phenomenon among local governments, and it is used by municipalities in order to provide local public services. However, we still know very little about its efficiency. In this study we investigated whether this local form of coordination has an impact on the level of per-capita expenditure of the single municipalities. Each cooperating municipality can exploit economies of scale and internalise externalities, and we test whether there are efficiency gains in terms of local expenditure reduction.

In particular, we analysed the Italian experience of Municipal Unions, using

unique administrative data on the municipalities belonging to the Emilia Romagna region. In the period considered, 2001-2011, almost half of the municipalities decided to enter or form Municipal Unions. We employed a difference-in-differences approach combined with matching models to estimate the causal effect of being member of a Municipal Union on local expenditures. We found that participation to a Union reduces the total current per-capita expenditures by around 5%, compared to municipalities not in a Union. The effect is persistent and increases up to nine years from the participation in a Municipal Union. Moreover, we showed that entering the Municipal Unions do not decrease the quality of public services provided to the residents. We can conclude that the Municipal Union is an efficient tool that allows municipalities to gain efficiency, in terms of a reduction in public expenditures, while maintaining unchanged the level of public services.

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Figure 1: Emilia Romagna municipalities - 2001



Figure 2: Emilia Romagna municipalities - 2011

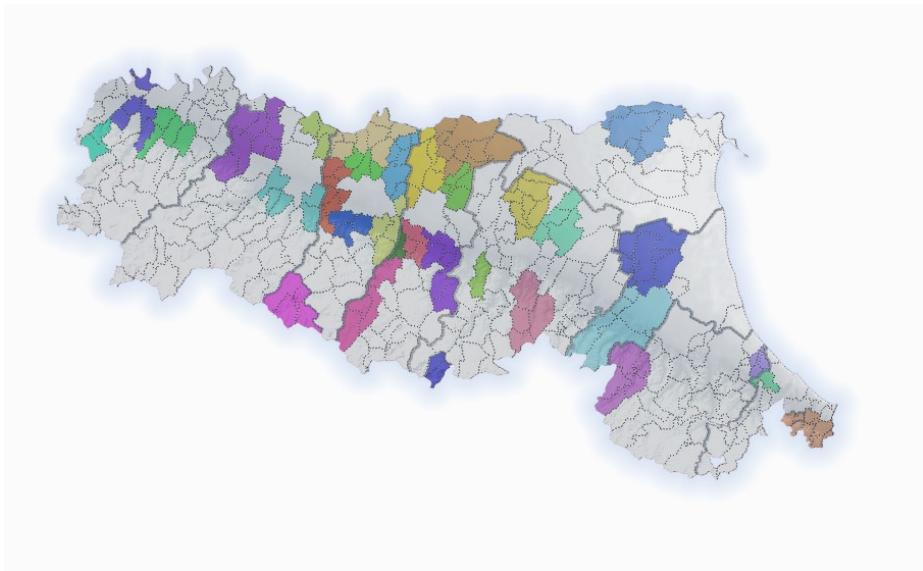


Figure 3: Percentage of municipalities in union

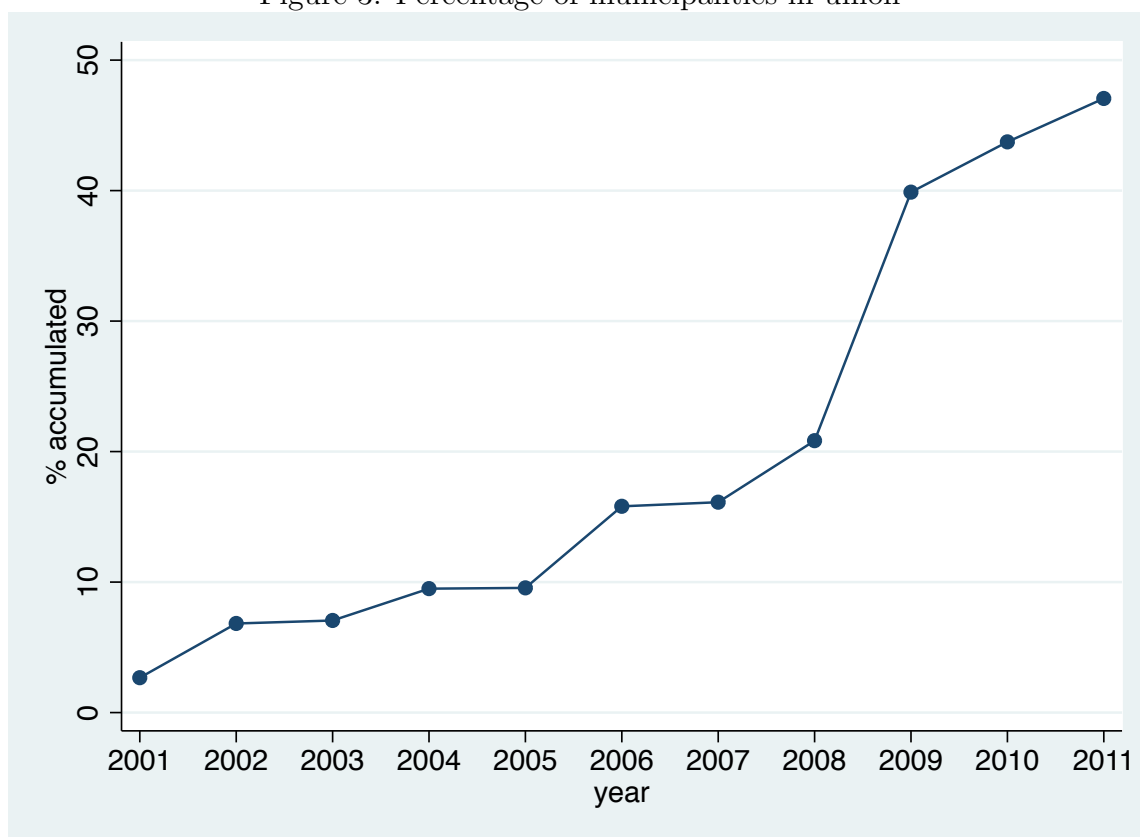


Figure 4: Evolution of expenditures - 2001-2011

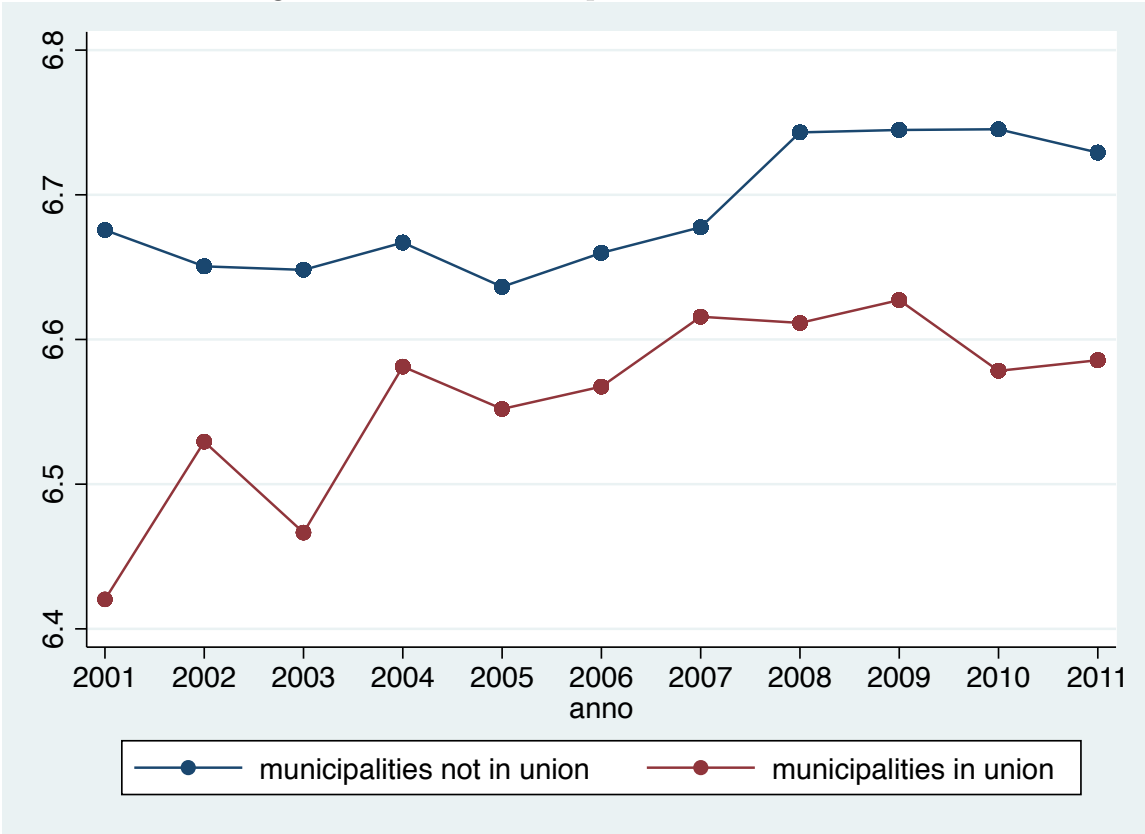


Table 1: Municipalities in Unions in Emilia Romagna 2001-2011

Year	Municipal Unions	Municipalities not in Unions	Municipalities in Unions	% of Municipalities in Unions	Total Municipalities
2001	1	328	9	2.67	337
2002	5	314	23	6.82	337
2003	5	303	23	7.06	326
2004	6	305	32	9.50	337
2005	6	303	32	9.55	335
2006	10	277	52	15.81	329
2007	10	281	54	16.12	335
2008	13	266	70	20.83	336
2009	25	199	132	39.88	331
2010	29	193	150	43.73	343
2011	31	180	160	47.06	340

Table 2: Effect of the Union on Log Expenditures

Dependent variable:	Log Expenditures						
	Full sample			Matched sample			Kernel matching <sup>a</sup>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Municipal Union	-0.065*** (0.012)	-0.047*** (0.015)	-0.030** (0.015)	-0.063*** (0.013)	-0.048*** (0.016)	-0.030** (0.015)	
Permanence			-0.022*** (0.006)			-0.021*** (0.006)	
Permanence square			0.002*** (0.000)			0.002*** (0.000)	
Union <sub>08-10</sub>							-0.069*** (0.020)
N	3686	3586	3586	3411	3311	3311	434
Year FE	✓	✓	✓	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓	✓	✓	
Municipality controls		✓	✓		✓	✓	

Standard errors clustered at municipality level.

Significance levels: \*\*\* 1% \*\* 5% \* 10%.

<sup>a</sup> Kernel difference in differences matching. Control group= municipalities never in Union.

Treatment group: municipalities that joined a Union in 2009.

Sample size restricted to years before and after the Union 2008 and 2010

Table 3: Permanence in the municipal union

Dependent variable: Log Expenditures - 2001-2011		
	Full sample	Matched sample
	(1)	(2)
1 year	-0.030** (0.015)	-0.030** (0.015)
2 years	-0.049*** (0.016)	-0.049*** (0.016)
3 years	-0.064*** (0.018)	-0.064*** (0.018)
4 years	-0.075*** (0.020)	-0.074*** (0.021)
5 years	-0.081*** (0.023)	-0.079*** (0.024)
6 years	-0.082*** (0.026)	-0.080*** (0.027)
7 years	-0.080*** (0.029)	-0.077*** (0.029)
8 years	-0.072** (0.032)	-0.069** (0.032)
9 years	-0.061* (0.034)	-0.057 (0.035)
10 years	-0.044 (0.037)	-0.040 (0.038)
11 years	-0.024 (0.040)	-0.018 (0.041)

Significance levels: \*\*\* 1% \*\* 5% \* 10%.

Table 4: Effect of the Union on alternative output

	(1)	(2)	(3)	(4)
<i>Full sample</i>				
Municipal Union	0.000	0.000	-6.256	-0.000
	(0.000)	(0.000)	(7.666)	(0.000)
N	3613	2320	3613	3524
<i>Matched sample</i>				
Municipal Union	0.000	0.000	-4.414	-0.000*
	(0.000)	(0.000)	(6.984)	(0.000)
N	3586	2301	3586	3498
Year FE	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓
Municipality controls	✓	✓	✓	✓

Standard errors clustered at municipality level.

Significance levels: \*\*\* 1% \*\* 5% \* 10%.

Dependent variable: col.1 p.c. birth rate; col.2 p.c. primary school class size; col.3 net migration; col.4 p.c. road car crash pc.



Table 5: Evaluation of the common trend

Dependent variable:	Log Expenditures			
	Full sample		Matched sample	
	(1)	(2)	(3)	(4)
Municipal Union	-0.044*** (0.011)	-0.018* (0.009)	-0.043*** (0.011)	-0.017* (0.009)
lead <sub>t+1</sub>	0.006 (0.010)	0.004 (0.010)	0.007 (0.010)	0.005 (0.010)
lead <sub>t+2</sub>	-0.010 (0.011)	-0.009 (0.011)	-0.013 (0.011)	-0.013 (0.011)
lead <sub>t+3</sub>	0.013 (0.009)	0.008 (0.010)	0.015 (0.009)	0.010 (0.010)
lag <sub>t-1</sub>		-0.025** (0.010)		-0.025** (0.010)
lag <sub>t-2</sub>		-0.022* (0.013)		-0.021 (0.013)
N	3631	3631	3356	3356
Year FE	✓	✓	✓	✓
Municipality FE	✓	✓	✓	✓
Municipality controls	✓	✓	✓	✓

Standard errors clustered at municipality level.

Significance levels: \*\*\* 1% \*\* 5% \* 10%.

<sup>a</sup> We exclude transfers because not available for entrants in 2011

Table 6: Estimates of the effect of the expenditures on the probability to join the union

	<i>Homogenous</i>				<i>Heterogenous</i>				
	<i>Coeff.</i>	<i>s.e</i>	<i>Hazard Ratio</i>	<i>LogL</i>	<i>Coeff.</i>	<i>s.e</i>	<i>Hazard Ratio</i>	<i>LogL</i>	<i>P-val*</i>
Log expenditures	-0.317	(0.330)	0.728	-473.537	-0.317	(0.330)	0.728	-473.537	0.496

\*LR test of model with Normal distributed heterogeneity against model without controlling for heterogeneity.

All models contain the same control variables.

Significance levels: \*\*\* 1% \*\* 5% \* 10%.

Table 7: More homogeneous control groups

Dependent variable:	Log Expenditures - 2001-2008	
	Full sample (1)	Matched sample (2)
Municipal Union	-0.069*** (0.018)	-0.071*** (0.018)
N	1217	1201
Year FE	✓	✓
Municipality FE	✓	✓
Municipality controls	✓	✓

Standard errors clustered at municipality level.

Significance levels: \*\*\* 1% \*\* 5% \* 10%.

We exclude transfers because not available before 2006.

Control group includes future treated.

# A Appendix

Table A.1: Municipalities in Unions in Emilia Romagna 2001-2011

Variables	Obs	Mean	Std. Dev.	Min	Max
Log expenditure	3686	6.663	0.287	5.733	8.329
Municipal Union	3784	0.196	0.397	0.000	1.000
Population	3686	11419.580	23150.210	91.000	186690.000
Child	3686	0.051	0.013	0.000	0.083
Aged	3686	0.238	0.066	0.120	0.638
Income	3686	13223.430	2086.341	5425.244	20525.250
Population density	3686	0.017	0.025	0.000	0.275
Taxpayers	3686	0.706	0.099	0.324	1.083
1/population	3686	0.000	0.001	0.000	0.011
Revenue of Municipal Unions	3684	11.198	37.796	0.000	321.683
Permanence	3784	0.587	1.812	0.000	15.000
Permanence square	3784	3.627	16.803	0.000	225.000
Birth rate per capita	3686	0.009	0.003	0.000	0.027
N. children in infant school pc	2351	0.024	0.007	0.000	0.061
Net migration	3784	41.461	121.474	-1773.000	1366.000
Per capita road car crash	3592	0.004	0.003	0.000	0.024

Figure A.1: Data sources

Variable	Definition and measure	Available from-to	Source
Log expenditure	Log of current expenditure per resident; 2011 Euros	2001-2011	Italian Ministry of Interior
Municipal Union	Dummy variable that takes on the value one if municipality $i$ at time $t$ belongs to a Municipal Union and zero otherwise.	2001-2011	Italian Ministry of Interior
Birth rate per capita	birth rate per capita	2001-2011	ISTAT
Number of childre enrolled in infant school	Number of childre enrolled in infant school (per-capita)	2004-2011	ISTAT
Net migration	Difference between new regisired members and unregistered members	2002-2010	ISTAT
Per capita road car crash	Number of accients within the municipal roads	2001-2011	ISTAT
Taxpayers	share of the taxpayers of the municipality	2001-2011	Italian Ministry of Economy, Department of Finance
population	Population of the municipality	2001-2011	ISTAT
child	Share of the population aged between 0-5	2001-2011	ISTAT
old	Share of the population over the age of 65	2001-2011	ISTAT
population density	Numbers of citizens per area	2001-2011	Our computation
income	Real personal income tax base per resident; 2011 Euros	2001-2011	Italian Ministry of Economy, Department of Finance
1/population	inverse of the population	2001-2011	Our computation
Revenue of Municipal Unions	Sum of the revenue from fees and charges and transfers from other level of governments per resident; 2011 Euros	2001-2011	Italian Ministry of Interior
Permanence	Number of years joining the Municipal Union	2001-2011	Our computation
Permanence square	Square of number of years joining the Municipal Union	2001-2011	Our computation