

RESEARCH SCHOOL OF INTERNATIONAL  
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SWEEPING THE DIRT UNDER THE RUG:  
MEASURING SPILLOVERS OF AN ANTI-  
CORRUPTION  
MEASURE

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WORKING PAPER  
02/2021

EBERHARD KARLS  
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SCHOOL OF BUSINESS AND  
ECONOMICS

# SWEEPING THE DIRT UNDER THE RUG: MEASURING SPILLOVERS OF AN ANTI-CORRUPTION MEASURE \*

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May, 2021

## **Abstract**

This paper studies the spillover effects of an anti-corruption measure. Using data on the universe of procurement contracts of Italian municipalities, the paper documents two responses. First, in sectors that are more vulnerable to corruption, neighboring municipalities increase the number of contracts smaller than a threshold that involves less stringent evidentiary requirements, making it more challenging to prove an infraction. In particular, neighboring municipalities avoid stricter procurement rules by splitting large projects into multiple below-threshold contracts. This response is stronger in municipalities with more senior and educated employees. Second, neighboring municipalities renegotiate fewer contracts of public works, a practice that signals the existence of corruption. Together, these results suggest that municipalities neighboring one where an anti-corruption measure is implemented respond by exploiting less monitored margins of the procurement activity, and engaging less in activities that signal potential irregularities.

JEL CODES: D730, H570, K420

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\*This is the first chapter of my Ph.D. dissertation that I completed at University of Warwick. Special thanks to my former supervisors Miguel Almunia, Michael Best, James Fenske and Carlo Perroni for their invaluable support during the completion of this project. I am very grateful to Benjamin Chen, Rosetta Greco, Lucia Iannotta, Domenico Manente, Giampaolo Sellitto and Monica Vici who helped me collect data and clarify the institutional setting. I also thank Gianmarco Daniele and Tommaso Giommoni for letting me use their data on arrests of public officials. I thank Arun Advani, Audinga Baltrunaite, Randolph Bruno, Alessandra Casella, Luis Candelaria, Decio Coviello, Francesco Decarolis, Lucie Gadenne, Francois Gerard, Jonas Hjort, Lavinia Piemontese, Camilla Roncoroni, Gabriele Rovigatti and seminar participants at Four Fridays for Corruption, ICEE 2021, WEEE, University of Warwick, Columbia University, HEC University, Bocconi University and Linz University for their insightful comments. All errors are responsibility of the author. Email: a.tulli.eco@gmail.com. Website: <https://sites.google.com/view/andreatulli/home>. I gratefully acknowledge ESRC and the RSIT for their financial support and ANAC for providing access to data.

# 1 Introduction

Corruption represents a severe impediment to development. Estimates suggest that it accounts for over 120 billions Euro every year in the European Union alone (Commission 2014). Unfortunately, its cost is greater than merely the diversion of resources from their rightful purpose; it also creates the opportunity for organized crime to flourish (Gounev and Bezlov 2010). Therefore the prevention of corruption activities is essential; in practice, this relies on the implementation of law enforcement measures (United Nations 2004). Little is known, however, on whether these policies also affect unmonitored administrations.

I empirically analyse the spillover effect of the dissolution of a municipal government, an Italian national policy used to target municipalities colluding with organized crime. If there is evidence of collusion between elected officials and criminal organizations, the national government may dismiss all the elected officials and replace them with high-ranking members of the law enforcement agency.

Using an event study approach, I analyse the response of municipalities neighboring those where the dissolution measure has been implemented (hereon, neighboring municipalities). Using information on all procurement contracts of the Italian municipalities, I focus on public procurement as it is an important sector in this setting: it accounts for approximately 13 percent of OECD countries' GDP (OECD 2016), and is vulnerable to corruption (Conley and Decarolis 2016, Decarolis *et al.* 2019). Furthermore, in the last decades the procurement sector has been infiltrated by criminal organizations, because it generates additional revenue for organized crime business (7 billion Euros per year in Italy alone, Unioncamere 2014).

I present two main findings. First, I show that a municipal dissolution triggers neighboring municipalities to split large projects into multiple contracts smaller than a relevant threshold (i.e. 40,000 Euros). For these smaller contracts, municipalities face lower transparency requirements and can provide limited information on the contract itself. Moreover, for goods and services contracts specifically, municipalities have greater discretionary power in awarding contracts to a specific firm. Indeed, they also offer the possibility of legitimately awarding

a contract without conducting a public tender.<sup>1</sup> As such, contracts for goods and services are less transparent and involve fewer evidentiary requirements that law enforcement agencies could use to prove illicit behaviour. A simple back-of-the-envelope calculation shows that in response to a given municipality being dissolved, neighboring municipalities shift below the threshold approximately 8 percent of the average expenditure on procurement contracts larger than 40,000 Euros.<sup>2</sup>

Second, I show that after the implementation of the dissolution measure, neighboring municipalities reduce activities that may signal potential corruption. In particular, they issue fewer (and smaller) renegotiations of contracts for public works. Through contract renegotiation, the municipality can freely award additional resources to the winner bidder, leaving a large scope for rent seeking behaviours. Indeed, contract renegotiations are more common in cases where: the municipality has more discretion in the choice of the winning bidder; political accountability is lower (Ferraz and Finan 2011, D'Alpaos *et al.* 2013, Decarolis 2014, Decarolis and Palumbo 2015, Coviello and Gagliarducci 2017). Excessive contract renegotiations are also considered a signal of potential corruption by the Italian monitoring authority (ANAC 2015).

This paper highlights the need to take into account the indirect effect of law enforcement measures. In this case, failure to do so can lead to misleading conclusions on the overall impact of the municipal dissolution, since criminal organizations infiltrate multiple municipalities at the same time. Despite a growing literature showing how anti-corruption policies deter irregularities in neighboring municipalities (Colonnelli and Prem 2017, Galletta 2017, Avis *et al.* 2018, Chabrost and Saussier 2018), deterrence is not the only possible consequence. If the law enforcement measure triggers further investigations, I show how non-targeted municipalities strategically exploit less monitored margins of their activity to complicate the

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<sup>1</sup>Public tender can be avoided for contracts of public works regardless being larger (or smaller) than 40,000 Euro.

<sup>2</sup>The calculation takes into account the overall expenditure on procurement contracts larger than the threshold. Since the 40,000 Euro threshold is relevant for contracts of goods and services only, I repeat the same back in the envelope calculation focussing only on the yearly expenditure on contracts larger than 40,000 Euros for these two types. In this case, municipalities shift below the threshold 15 percent of the average expenditure on contracts larger than 40,000 Euros.

detection of irregularities. These policies can also incentivize corrupting firms to relocate elsewhere in order to continue their business (Lichand and Fernandes 2019).

I compare the change in procurement behaviour between neighboring municipalities and the other Italian municipalities. For the validity of the results, multiple assumptions must be satisfied. First, I assume that neighboring and control municipalities would exhibit a similar behaviour if the dissolution were not implemented. For robustness, I restrict the analysis to all the municipalities in the same region (or province) of the dissolved municipalities to maximise the similarity between neighboring municipalities and the control group. The second assumption I make is that neighboring municipalities are not aware of the dissolution, before its implementation. This assumption is based on the fact that the dissolution measure is a legal instrument managed by the national government and the entire process is not public until its implementation. Third, I assume that neighboring municipalities perceive a higher risk of detection after the implementation of a dissolution, since multiple dissolutions have resulted in additional investigations of neighboring municipalities' activities in following years (DIA 2013). Indeed, the law enforcement body can take advantage of a dissolution to access the documentation of the dissolved municipality and gather additional evidence on the criminal organization.<sup>3</sup> Finally, I address the recent concerns on the staggered adoption of a DiD design by using a different method for computing the results. In particular, I construct a statistical test for detecting a statistically significant increase in the number of procurement contracts smaller than the 40,000 Euro threshold for the neighboring municipalities (see Rosenbaum 2002).<sup>4</sup>

I complement the analysis with additional findings to rule out alternative hypotheses that could explain these results. First, I use a natural language processing technique for showing how issuing below-threshold contracts is not the consequence of a reduction in public spending. Instead, municipalities strategically exploit the existence of the 40,000 Euro threshold by

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<sup>3</sup>An example is the dissolution of Giugliano that provided abundant evidence on the infiltration of the local criminal organization (i.e., the clan of *Casalesi*) in multiple municipalities in the same area. The law enforcement bodies pursue the new leads during a new official investigation that involved several other municipalities in the same province (DIA 2013).

<sup>4</sup>In the Appendix, I also use the estimator suggested by De Chaisemartin and D'Haultfoeuille (2020).

splitting large projects in multiple contracts without changing their total size. Then, I prove that this response has to do with the corruption activities in the area, since it is linked exclusively with those sectors that are more vulnerable to the infiltration of organized crime (i.e., construction and waste management). Third, I rule out the hypothesis, suggested by Gerardino *et al.* (2020), that public employees use less transparent (but simpler) procedures for avoiding prosecution for involuntary procedural mistakes. Indeed, municipalities with more senior and educated employees have a stronger response to a neighboring municipal dissolution. Finally, abundant qualitative evidence confirms the exploitation of this threshold for illegal purposes. For example, in September 2019, an Italian verdict recognised how often organized crime exploited the 40,000 Euro threshold for its own interests. Evidence justifying the dissolution was based on the number of below-threshold contracts awarded to the same bidder.<sup>5</sup>

This paper contributes to multiple strands of literature. First, it contributes to literature on the effects of anti-corruption policies (Ferraz and Finan 2008, Acconcia *et al.* 2014, Daniele and Geys 2015, Di Cataldo and Mastrococco 2016, Bosio *et al.* 2020, Calamunci and Drago 2020, Vannutelli 2020 and Fenizia and Saggio 2021). The most closely related papers are those studying spillovers from monitoring policies (Colonnelli and Prem 2017, Galletta 2017, Avis *et al.* 2018, Chabrost and Saussier 2018, Lichand and Fernandes 2019). By showing how law enforcement measures can encourage other public entities to commit irregularities in a less inferable way, this paper highlights how the overall impact of anti-corruption policies should be carefully assessed.

Second, this paper contributes to a growing literature showing that, when under scrutiny, economic agents substitute activities to less well-monitored margins. There are examples of this type of response in the literature on procurement (Gerardino *et al.* 2020); taxation and subsidies (Asatryan and Peichl 2016, Carillo *et al.* 2017, Almunia and Lopez-Rodriguez 2018, Daniele and Dipoppa 2018) and corruption and crime (Yang 2008, Knight 2013, Niehaus and Sukhtankar 2013, Dell 2015). This paper supports these findings by showing that non-

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<sup>5</sup>Ruling of *Consiglio di Stato, Sez III, 10/01/2019, n.96*: "[...] *The infiltration of 'Ndrangheta clans on the municipality's business resulted in a chaotic organization of the municipality's procurement activity. Evidence of this is the large number of direct award of contracts (smaller than 40,000 Euros) to the firms owned by the criminal organization.*".

monitored agents have similar responses. The response can be complex and involve multiple variables at the same time. Municipalities engage less in activities with a higher risk of irregularities, but also increase the number of contracts requiring fewer evidentiary documentation.

This paper also relates to the literature discussing the determinants of renegotiations of a contract. Contract renegotiation is more likely when: the mayor has tenure in office or does not face a re-election incentive (Ferraz and Finan 2011, Coviello and Gagliarducci 2017); if the project is smaller or more complex; the contract was awarded with private negotiation or through first price auction (Decarolis 2014, D’Alpaos *et al.* 2013, Decarolis and Palumbo 2015). I show how renegotiations can be a relevant outcome to study when focussing on the response to anti-corruption measures.

Finally, this paper offers insight into the literature studying why public entities change contracts’ values so that they are below legal thresholds (Palguta and Pertold 2017 and Szucs 2017, Baltruinate *et al.* 2021). I show how a natural language modelling technique can identify whether the project is split into multiple contracts by comparing the descriptions of the object of the contracts.

The remainder of the paper proceeds as follows. Section 2 describes the institutional setting, focussing on how the dissolution works and the different procurement outcomes under analysis. Section 3 presents the data and descriptive statistics of the variables of interest; Section 4 discusses the empirical strategy used in the paper; Section 5 and Section 6 detail the findings on the contracts smaller than the 40,000 Euro threshold and renegotiations respectively. Section 7 discusses robustness checks, and Section 8 concludes.

## **2 Institutional Setting**

In this section, I discuss the institutional setting of the Italian procurement sector and how Italy uses the dissolution of a municipal government to prevent serious criminal infiltration into municipalities. I start by describing this particular legal instrument and its relevant features for this study. Then, I describe the procurement outcomes that I use in this study: I illustrate

how the procurement law changes for contracts below the 40,000 Euro threshold, discussing why this is relevant for enforcing the law and how organized crime can exploit this threshold. Finally, I discuss the main characteristics of contract renegotiations and why they are relevant for this study.

## **2.1 The dissolution of a municipal council**

During the 1980s, the infiltration of mafia clans into local administrations became increasingly common. Many past studies show how both local politicians and criminal organizations had an interest in cooperating with each other. The former could gain electoral votes through the mafia's influence over voters. The latter could gain access to public funds in the procurement sector through controlled firms, thereby differentiating their business in the legal economy. Given the severity of this phenomenon, in the 1990s the national government introduced stricter regulations for tackling collusion among public officials and criminal organizations. In particular, law 164/1991 introduced the dissolution of a municipal government because of serious criminal (mafia) infiltration. The national government can decree the dissolution of a municipal government when the law enforcement agencies provide evidence of direct (or indirect) links between members of the local government and the mafia. The dissolution is one of the most aggressive policies aimed at limiting organized crime's influence on municipal activities. When a municipal government is dismissed, the elected officers are replaced by three high-ranking members of law enforcement agencies (the *commissioners*). These commissioners replace the elected officials in all of their duties. The law prescribes the dissolution to last between 12 and 24 months. However, they usually last between 24 and 36 months.<sup>6</sup> After the dissolution, the municipality holds new elections for the municipal government.

The commissioners' role is to reduce the influence of criminal organizations on the municipal government; therefore, they only deal with the municipality's ordinary business. Di Cataldo and Mastrorocco (2016) show how infiltrated municipalities spend more in sectors vulnerable to infiltration by criminal organizations (i.e., construction and waste management) and less

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<sup>6</sup>Figure B.1 shows the distribution of the length of the dissolutions in the period of analysis.



on areas such as the municipal police and public transport. In contrast, during the dissolution period commissioners reduce the investment expenditure by an average of 15 percent (Galletta 2017). These results are not causal evidence of the effect of commissioners' activities on the corruption level in the dissolved municipality; they can be linked to a reduction of active waste (Bandiera *et al.* 2008). Anyway, the decline in investment is so relevant in magnitude that it has adverse effects on the level of GDP at the provincial level (Acconcia *et al.* 2014).<sup>7</sup>

The dissolution mechanism includes three phases. First, the provincial Prefect establishes a commission in charge of evaluating the municipality's activities for three months. The commission's goal is to provide evidence for the existence of a connection between the municipality and organized crime. The evidence may not necessarily constitute a crime, but it has to objectively prove the influence of organized crime on the local administration. The dissolution process can also start without an official (and public) investigation by the law enforcement agency of the municipal activity.<sup>8</sup> At the end of the three months, within 45 days, the commission produces a report for the Italian Ministry of Interior. Finally, the national government and the President of the Republic validate the decision. A relevant feature of the policy is that the steps and the timing of the dissolution process are explicitly stated in the national law (n.410/1991). The entire decision process lasts at most ten months before its implementation.

The three-phase process of the dissolution mechanism, and the timing therein, is an important element when taking into consideration these findings. In the analysis, I work off of the assumption that in the months leading up to the dissolution of a given municipal government, neighboring municipalities have no prior information regarding the process. This assumption takes into account the fact that the dissolution mechanism is implemented at a national level and it does not require any previous public intervention of the law enforcement body, it is unlikely that the dissolved and the neighboring municipalities have preliminary information on its implementation. Therefore, it is doubtful that the dissolution is correlated with the past

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<sup>7</sup>Italian provinces are the smallest institutions after the municipality. There are 110 provinces in Italy.

<sup>8</sup>Between 2011 and 2016, only 26 out of 73 dissolutions involved any public official being arrested before their implementations.

procurement activity of neighboring municipalities. However, it is still possible that the dissolution correlates with a time-varying factor un-observable to the econometrician. Therefore, I control for province linear trends in all the specifications.

Figure 1 shows the geographical distribution of the municipal dissolutions in the period of the analysis (between 2011–2016); most of the dissolutions are in the south of Italy, in particular in Sicily, Calabria, and Campania. Multiple reasons can explain the high concentration of dissolutions in these three regions. First, the law enforcement agency may monitor the activity of southern municipalities more closely, which increases their chance of being dissolved. Alternatively, southern municipalities may be more vulnerable to organized crime infiltration because, to name one reason among many, they have been exposed longer to the presence of organized crime. The geographical concentration of dissolutions could be considered a risk to the identification strategy if the neighboring municipalities in Southern regions respond differently to the law enforcement agency’s close monitoring compared to the control municipalities in other areas of the country. To address this risk, I show in Section 7 how the results do not change when I use only municipalities within the same province (or region) of the dissolved municipality as control groups.

I focus on the reaction of neighboring municipalities after the dissolution of a municipal government for two reasons. First, criminal organizations often influence the economy of large areas. There are many examples of criminal organizations affecting multiple neighboring municipalities simultaneously (DIA (2016)). Second, municipalities can react to the dissolution of a neighboring municipal government because they perceive that they are more likely to be scrutinised next. In many cases where the dissolution of a municipal government occurs, evidence showing illicit activities taking place with public entities in nearby municipalities is also found—prompting investigations to be expanded into nearby municipalities (DIA 2013). Indeed, even though the geographical location of a given municipality is not a valid indicator determining involvement with criminal organizations, it is also unlikely that municipalities neighboring a dissolved municipality have no interactions with the same crim-

inal organizations.<sup>9</sup> Therefore, this study focuses on responses of municipalities that have likely interacted with a prosecuted criminal organization and that may likely be the object of future investigations.

When implementing a dissolution, the law enforcement agency publishes a detailed report describing the evidence justifying the dissolution, including information gathered on the criminal organization's influence. In all the cases of dissolution examined in this study, the criminal organizations infiltrated most notably the procurement sector. For the purposes of this study, I use these reports for determining which sector was infiltrated by organized crime in the dissolved municipality and for collecting information about the irregularities found in the procurement sector.<sup>10</sup> An analysis of these reports indicates that it is five times more likely for a law enforcement agency to gather evidence on irregularities for contracts that exceed the 40,000 Euro threshold. In approximately 70 percent of the dissolution cases, the criminal organizations infiltrated the two sectors of construction and waste management. In the remaining 30 percent of the cases, they infiltrated one of the other 44 municipal activity sectors. In Section 5, I show that neighboring municipalities only react in regards to contracts linked to construction and waste management (which are incidentally the most vulnerable sectors to the infiltration of organized crime).

## **2.2 The procurement outcomes**

Italian procurement law varies based on a few characteristics of the procured goods. For example, the law regulating contracts for public works is different to that regulating goods and services. Similarly, Italian procurement law changes depending on the value of the contract. In general, larger contracts have stricter regulations on different aspects of the procurement process. For example, they have more publicity requirements, there is a strong limitation in the discretion of the choice of the winner firm, and the municipality has to provide (and

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<sup>9</sup>A passage of an Italian ruling (*T.A.R. Lazio sez. I - Rome 28/09/2019, n.11396*) clarifies the policymaker's point of view in this context: "[...] Even though a municipality should not be considered infiltrated by organized crime simply for its geographical location, it can be a relevant information if the law enforcement body proves the existence of behaviours signaling potential irregularities."

<sup>10</sup>Figure B.2 and B.3 show this two information graphically.

collect) more information for the monitoring authority. Figure 2 shows the distribution of all the procurement contracts of all Italian municipalities in the period of analysis by face value. Municipalities have strong incentives in issuing contracts smaller than the 40,000 Euro threshold.

The procurement law prescribes three changes in the law for contracts below the 40,000 Euro threshold.<sup>11</sup> First, these below-threshold contracts are less transparent since the municipality does not have to publish any documentation for awarding the contract. Second, only limited information must be provided to the Italian monitoring authority (*ANAC*) for below-threshold contracts. For example, information on the winning bidder's identity is not even requested for these contracts. Finally, municipalities can legally avoid a public tender and award a below-threshold procurement contract directly to a firm.

Award procedures for contracts exceeding the 40,000 Euro threshold differ according to the type of object procured. Contracts for public works can be awarded without a public tender regardless of size, but those for goods and services must be awarded following public tender regulations.<sup>12</sup> This law change makes the 40,000 Euro threshold a relevant threshold for the monitoring activity of the law enforcement agency on contracts for goods and services. For example, if during a corruption case the municipality avoids a public tender and legitimately awards a contract to a bidder linked to organized crime, the law enforcement agency cannot claim a violation of the procurement law or provide evidence for the illicit behaviour of the elected municipal official. Because of this, I expect contracts for goods and services to shift to below threshold contracts after a municipal dissolution is implemented, taking advantage of the variation in the public procurement law. In line with this logic, I do not expect any change in public work contracts since direct awards are allowed for these contracts, irrespective of their size.

Figure 3 shows the geographical distribution of bunching at the 40,000 Euro thresh-

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<sup>11</sup>The relevant procurement law for the analysis is the *D.Lgs. n.163/2006*.

<sup>12</sup>The only exception to this rule is in case of emergency. In practice, municipalities often exploit the emergency clause, even when there is no emergency, to avoid the public tender. The use of the emergency clause without a real need is risky for the municipality since the law enforcement body can easily verify an emergency that could justify the use of the direct award.

old. Municipalities in the south of Italy, where criminal organizations are historically more widespread, exploit the threshold more. Indeed, municipalities in southern provinces exploit the threshold on average three times more than northern municipalities. This figure does not imply that they exploit the threshold for corruption purposes. I verify this by collecting numerous qualitative pieces of evidence. In particular, I collect different passages of Italian rulings describing how organized crime exploited the threshold for their business. For example, ruling *T.A.R. Lazio sez. I - Roma, 28/09/2019, n. 11396* explicitly states: "[...] *The evidence collected by the law enforcement body shows how often the criminal organization exploited the 40,000 Euro threshold during its activity. In particular, they split different projects in multiple smaller contracts to award the contracts directly to firm XXXX without any justification, violating publicity requirements and distorting competition.*".<sup>13</sup>

Figure 4 shows how municipalities exploit the 40,000 Euro threshold when the chance of being monitored is higher. After a neighboring municipality is dissolved, the number of goods and service contracts just below 40,000 Euros increases substantially, while municipalities reduce the number of contracts issued just above the threshold. This evidence is consistent with the hypothesis that, after a neighboring dissolution, municipalities exploit the 40,000 Euro threshold to impede the law enforcement body from gathering any evidence on possible infractions. Indeed, issuing smaller contract municipalities can avoid public tender, involving a smaller number of economic agents, reducing the paperwork, choosing the winner firm autonomously, and, therefore, lowering the evidentiary requirements for detecting irregularities.

Every year ANAC publishes a report describing the phases of the procurement process that the law enforcement agencies should monitor more closely during their investigations and the common signs of illicit behaviours that the authority recognised over the years (ANAC (2015)).<sup>14</sup> I focus on one of the most common practices identified by ANAC in corruption cases: the renegotiation of public works contracts. Different sources recognise contract renegotiation in procurement processes as being vulnerable to corruption since they are often

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<sup>13</sup>In the Appendix, I collect additional passages of numerous rulings showing how often criminal organizations exploited the 40,000 Euro for their business.

<sup>14</sup>In the Appendix, I list all the elements of the procurement process that, as suggested by the monitoring authority, should be monitored more closely because of their vulnerability to corruption.

exploited for illegal purposes (e.g., Di Cristina 2012). Ferraz and Finan (2011), and Coviello and Gagliarducci (2017) show how these renegotiations are more exploited in the absence of electoral incentives; and Decarolis (2014) how bidding firms use them to gain greater access to resources after the awarding stage.

In a contract renegotiation process, the winning firm requests additional funds to complete the contract due to unforeseen costs or complications during its execution. The firm can seek additional resources of up to one-fifth of the original contract's value. The contract renegotiation is not meant to change the quality of the good procured: it should only allow the winning firm to complete the original contract. Since the municipality can directly award the additional resources without issuing another procurement contract, these contract renegotiations have been exploited extensively for corruption purposes.<sup>15</sup> Figure 5 shows the average share of public works that underwent contract renegotiation in the different Italian provinces over the period studied. There is a lot of heterogeneity since firms use contract renegotiation in many situations, not necessarily related to corruption. Nevertheless, renegotiating a contract for public works is also common in areas where organized crime is widespread, like Sicily.

### **3 Data and descriptive statistics**

The primary source of data for this study is the universe of procurement contracts issued by all Italian municipalities from 2011 to 2016. The data contains 7,965,123 contracts; a large share of these are tiny, averaging 18,453 Euro, with a median of 1,230 Euro. ANAC collects information on each contract and is in charge of monitoring the procurement sector. Data for each contract includes: information on its value, the purchasing municipality, the awarding mechanism (e.g., public tender or discretionary procedure), the purchase date, and a description of each item. For contracts of public works larger than 150,000 Euro, the data

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<sup>15</sup>For example, in the motivation documents for the dissolution of the municipality of Taurianova (2013), it is possible to read that the municipal government agreed to renegotiate contracts of public works without justifications. In the motivation of the dissolution of Palazzo Adriano (2016) the law enforcement body describes how extreme the exploitation of the renegotiations for illegal purposes can be. They show how the municipal government allowed renegotiations of contracts worth more than the contracts.

also contains information on the renegotiations from 2007 to 2016, the renegotiation date, and its value. The data includes additional information on the good procured for contracts larger than 40,000 euros. In particular, each contract larger than 40,000 Euros is associated with a nine-digit code (i.e., the *CPV*) that categorises the type of good in detail.<sup>16</sup> I also include municipal and public employees' characteristics from the Italian national bureau of statistics and mayors' characteristics from the Italian Home Department.

Table 1 shows descriptive statistics of the variables of interest. First, the average Italian municipality has approximately 7,000 inhabitants and shares its borders with six other municipalities. Furthermore, 40 percent of municipalities are ruled by a mayor born in the municipality. In this table I also show the average number of contracts municipalities issue per year. Since standard deviations are larger than the average values, there is substantial heterogeneity in the number of contracts issued. Nonetheless, it is approximately ten times more likely for a below-threshold procurement contract to be given than one just above. This difference is justified by the numerous variations within the procurement law regarding the threshold, making it more convenient to issue smaller contracts. Contracts smaller than 40,000 Euros represent a relevant share of the municipal spending; indeed, they account for more than 13 percent of the yearly municipal expenditure. Furthermore, municipalities issue about 80 percent of contracts to goods and services, which are the types of contracts affected the most by the variation in the procurement law at the threshold. Finally, one-third of the procurement contracts for public works are subject to contract renegotiation. The average increase of the original contract value in these renegotiations is in line with the maximum value prescribed by the law (i.e., no more than 20 percent of the original contract value). Still, the substantial heterogeneity in size suggests that the renegotiation process is often misused.

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<sup>16</sup>The CPV establishes a single classification system for public procurement used to describe the contract subject. More info at <https://simap.ted.europa.eu/cpv> .

## 4 Estimation strategy

In this section, I introduce the estimation strategy. I estimate both a triple difference-in-difference and a difference-in-difference, comparing municipalities with a neighboring dissolved municipality at time  $t$  with those that at the same time do not share any border with a dissolved municipality.

Section 5 shows the results on the number of contracts below the 40,000 Euro threshold computed from Equation 1. I focus on contracts smaller than 100,000 Euro issued per year by each municipality. These are split into bins of 5,000 Euros each. Therefore, the resulting estimation strategy is a triple difference-in-difference in which the outcome variable is the inverse hyperbolic sine of the number of contracts issued by municipality  $m$ , in bin  $b$  at time  $t$ . This estimation strategy compares the change in the number of contracts in each bin, between neighboring and control municipalities, before and after the implementation of the dissolution; it shows whether the effect is larger for contracts issued in the bins below the threshold. Equation 1 allows me to compare the effect of the dissolution taking into account time-invariant characteristics of municipalities and bins.

$$\begin{aligned}
 N_{b,m,t} = & \alpha_b + \alpha_m + \alpha_t + \delta_0 T_{reat-m,t} + \\
 & + \beta_0 T_{reat-m,t} \times \mathbb{1}\{25,000 \leq b \leq 40,000\} + \\
 & + \gamma'_0 X_{m,t} + \gamma'_1 \bar{X}_{-m,t} + \epsilon_{b,m,t}
 \end{aligned} \tag{1}$$

The outcome variable is the inverse hyperbolic sine of the number of procurement contracts issued by municipality  $m$ , in year  $t$ , in bin  $b$ . The  $\alpha$  terms are, respectively, bin, municipality, and year fixed effects.  $T_{reat-m,t}$  is a dummy taking a value one if a neighboring municipality is dissolved.  $X_{m,t}$  are municipality controls, and  $\bar{X}_{-m,t}$  are the average of neighbours' controls. I control for the logarithm of the population, a dummy equal to one if the mayor is born in the municipality. All the standard errors account for spatial heteroskedas-



ticity and autocorrelation for all municipalities within a ten kilometer radius (Conley 2008).<sup>17</sup> The coefficient  $\beta_0$  shows the differential effect of nearby dissolution on the number of contracts between 25,000 Euros and 40,000 Euros.

Subsequently, I provide additional findings to support the interpretation of the results of Equation 1. First, I show that municipalities shift large projects below the 40,000 Euro threshold by splitting them into multiple smaller contracts. In order to prove it, I use natural language processing (i.e., Word embedding, Mikolov *et al.* 2013a and Mikolov *et al.* 2013b) on the descriptions of the contracts smaller than 40,000 Euros. Word embedding allows me to compare the meaning of the descriptions of all the contracts issued by a municipality in the same year and identifying those contracts that belong to the same project. I am interested in those contracts smaller than the threshold but belonging to a project that would be larger than 40,000 Euros if issued in a single contract (hereon split projects). Using Word Embedding in this context is useful since it is a language modeling technique based on the co-occurrence of words. This technique represents the meaning of the words in a low-dimensional Euclidean space and specifies their meanings based on co-occurring words. This implies that synonyms (which often do not appear in the same sentence) have a similar vector representation since they occur in similar contexts. Second, the direction of the difference between two words also conveys meaning.<sup>18</sup>

Once I identify the split projects, I estimate Equation 2. The outcome variables are the expenditure of split projects and the overall expenditure around the threshold by municipality  $m$ , in year  $t$ . The  $\alpha$  terms are municipality and year fixed effects.  $Treat_{-m,t}$  is a dummy taking a value one if a neighboring municipality is dissolved.  $X_{m,t}$  are municipality controls, and  $\bar{X}_{-m,t}$  are the average of neighbours' controls. I control for the logarithm of the population, a dummy equal to one if the mayor is born in the municipality. All the standard errors account for spatial heteroskedasticity and autocorrelation for all municipalities within a ten kilometer

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<sup>17</sup>I would like to thank Thiemo Fetzter and Solomon Hsiang for sharing online their codes for running the Conley standard errors. <http://www.trfetzter.com/conley-spatial-hac-errors-with-fixed-effects/> and <http://www.fight-entropy.com/2010/06/standard-error-adjustment-ols-for.html>.

<sup>18</sup>I discuss the details of the Word embedding in the Appendix.

radius (Conley 2008).

$$Y_{m,t} = \alpha_m + \alpha_t + \beta_0 Treat_{-m,t} + \gamma'_0 X_{m,t} + \gamma'_1 \bar{X}_{-m,t} + \epsilon_{m,t} \quad (2)$$

Then, I show how municipalities shift contracts below the 40,000 Euro threshold only for sectors that are more vulnerable to the infiltration of organized crime: construction and waste management. Therefore, I exploit the *CPV*, which specifies precisely the sector related to each contract larger than 40,000 Euros. Since the same information is not available for smaller contracts, rather than showing which sectors bunch more below the threshold, I study which are the sectors of the contracts shifting from above the threshold. Given the limitations in the data, I assume that municipalities do not issue contracts in different sectors when they shift them below the threshold.

Therefore I estimate Equation 3.  $Y_{m,t}$  corresponds to the number of contracts issued above the 40,000 Euro threshold for two different sectors: those in which the infiltration of organized crime is more likely (i.e., construction and waste management), and all others combined. I control for the population, a dummy equal to one if the mayor is born in the municipality and the corresponding average controls for the neighboring municipalities.

$$Y_{m,t} = \alpha_m + \alpha_t + \beta_0 Treat_{-m,t} + \gamma'_0 X_{m,t} + \gamma'_1 \bar{X}_{-m,t} + \epsilon_{m,t} \quad (3)$$

For Section 6, I use a contract-level specification. I make use of the information on the type of object procured to control for time-invariant characteristics that increase the likelihood of a contract renegotiation taking place.<sup>19</sup> I estimate Equation 4.  $Y_{g,m,t}$  can be: a dummy taking value one whether the contract has been renegotiated; the value of the renegotiation; the total value of the project; or the rebate. The notation of Equation 4 and controls do not change with respect to the other Equations. Since it is a contract-level regression, I also control for good fixed effect (i.e.,  $\alpha_g$ ).

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<sup>19</sup>I use the first two digits of the *CPV*. They categorise the contracts in 44 different categories of good.

$$Y_{g,m,t} = \alpha_g + \alpha_m + \alpha_t + \beta_0 Treat_{-m,t} + \gamma'_0 X_{m,t} + \gamma'_1 \bar{X}_{-m,t} + \epsilon_{g,m,t} \quad (4)$$

Finally, in Section 7 I validate the results of Equation 1 using a randomisation inference method (Rosenbaum 2002). I relate to the literature on collusion (see Abrantes-Metz and Bajari 2021 for a review of the different methods). I take an approach similar to Hendricks and Porter (1989) and Conley and Decarolis (2016), using the information about contracts in the dataset and constructing an empirical test for proving the exploitation of the 40,000 Euro threshold by the neighboring municipalities. In practice, the test compares the average bunching for neighboring municipalities to the same measure for comparable control municipalities. First, I selected neighboring municipalities based on their geographical location with respect to the dissolved one. Starting from the the municipality neighboring that which undergoes dissolution, I identify its neighboring, as well as those sharing a border with the latter. I repeat this operation up to the 10th degree of connection. In order to increase the comparability of the neighboring municipalities, I limit the analysis to all those municipalities in the same region of the dissolved municipality.

Fundamental to the effectiveness of this test is the choice of the proper control municipalities. Therefore, I use a rich set of municipal characteristics to identify municipalities as similar as possible to the neighboring one.<sup>20</sup> Focussing on municipalities from a single region with no dissolved municipality in the period of analysis, I use a propensity score matching technique to identify the most similar control municipality for every neighboring one. Then, I compute the number of contracts that neighboring (and control) municipalities issue below the 40,000 Euro threshold. I calculate the average number of contracts below the threshold after the dissolution for the neighboring municipalities, and I divide it by the average number of contracts issued per year. I compare the former measure to the yearly average of the same variable for control municipalities.

I test the hypothesis that neighboring municipalities exploit the 40,000 Euro threshold

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<sup>20</sup>I use the following controls: population, the share of women employees, share of employees with at least 20 years of experience, and the share of employees older than 35 years old.

more by testing that their value of the bunching draws from a distribution induced by a uniform draw from the group of control municipalities. This is commonly referred to as a randomisation inference (Rosenbaum 2002). A two-sided 10 percent level test of our null hypothesis that the bunching of neighboring municipalities is not unusual relative to the behaviour of control municipalities corresponds to the following decision: reject if the bunching value is outside the range between the fifth and ninety-fifth percentiles of the control bunching distribution.

## **5 Results on the 40,000 Euro threshold**

Table 2 shows the results of Equation 1 using all contracts smaller than 100,000 Euros. Columns 1 and 2 present the results for services and goods; these are the only ones responding to the dissolution of a neighboring municipality, and they increase on average by approximately 20 percent. The coefficients are stable to the inclusion of province-specific linear trends. Instead, columns 3 and 4 show no effect on the number of contracts issued for public works. Figure 6 shows the effect every year on services and goods contracts. The number of small contracts increases during the commissioners' presence (i.e., from time +1 to +3) and after the dissolution (i.e., +4 and +5). These results show how municipalities quickly exploit the 40,000 Euro threshold in response to a neighboring municipality's dissolution. The effect is persistent when the commissioners are in charge of the dissolved municipality, and it lasts even after the end of the implementation of the measure. Furthermore, since municipalities respond by only shifting contracts for goods and services, they make use of the variation in the procurement law that allows for avoiding a public tender and awarding a contract directly.

Multiple hypotheses can explain these results. For example, Galletta (2017) suggests that a reduction in public investments can explain a shift towards smaller contracts. This would be consistent with the hypothesis that the dissolution has a deterrence effect on neighboring municipalities' behavior. However, this hypothesis does not explain the findings in Table 2 for two reasons. First, the response at the threshold relates only to goods and services contracts, which are not included in the municipal budget for public investments. Second, I

study how neighboring municipalities shift procurement contracts larger than 40,000 Euros to below-threshold contracts. There is no decrease in the expenditure levels, even though there is a shift of resources towards smaller contracts. Indeed, a municipality can keep contracts below the 40,000 Euro threshold by breaking a larger contract into multiple smaller contracts. Project splitting makes the award of the overall project less transparent and would provide less circumstantial evidence for the law enforcement bodies to prove any potential irregularity without necessarily affecting real variables such as the quality of the good.

Table 3 shows the results of Equation 2 using as an outcome the yearly expenditure on split projects of goods and services (column 1 and 2) and public works (column 3 and 4). After the dissolution of a municipal government, neighboring municipalities increase the average expenditure on split projects by approximately 36,000 Euro on a baseline of 58,000. In line with the findings on Table 2, there is no change in the expenditure in split projects for public works. Moreover, Figure 7 shows graphically the results of Equation 2, focussing on aggregate expenditure (top figure) and the one for split projects (bottom figure). The two figures show how municipalities split more projects into multiple contracts without changing the overall expenditure level during the dissolution of neighboring municipality. Therefore, municipalities make their public expenditure less transparent, without any change in the aggregate amount of resources.

Nevertheless, after the dissolution of a neighboring municipality, municipalities may exploit the 40,000 Euro threshold for various reasons, not only to make their public expenditure less transparent. An alternative hypothesis is based on the fact that the dissolution affects the procurement market in the area, reducing the number of potential customers (i.e., the municipalities) for firms operating in the procurement sector. Indeed Di Cataldo and Mastrococco (2016), and Galletta (2017) show how dissolved municipalities reduce their expenditure during the dissolution. Neighboring municipalities could exploit the increase in their bargaining power to deal directly with the firms.

This hypothesis would imply that municipalities prefer avoiding public tenders in future contracts, and conducting direct contracting with firms. Indeed, Coviello *et al.* (2018) show

how greater use of this preferred contractual procedure can also have positive effects on the execution of a procurement contract. I show that this hypothesis does not explain the results by assessing which sector responds more to the neighboring municipal dissolution. If municipalities want to want to make use of their increase in bargaining power, we should expect an effect of the dissolution on multiple (most) sectors of the neighboring municipalities' procurement activity.

Table 4 shows the results of Equation 3 using as an outcome the number of contracts larger than 40,000 Euros issued in two broad categories of sectors.<sup>21</sup> Columns 1 and 2 show the results for those sectors in which the infiltration of criminal organizations is more likely (i.e., construction and waste management). Columns 3 and 4 show the results for all the other sectors.

The neighboring municipalities reduce the number of contracts larger than 40,000 Euros for goods and services in the construction and waste management sectors. There is no statistically significant change in the number of contracts in any other sector, or in public works contracts of the construction and waste management sectors. These results suggest that the municipalities' response to a neighboring municipality's dissolution does not depend on a change in the municipalities' bargaining power. Instead, municipalities make expenditure less transparent in those sectors that are more vulnerable to the infiltration of criminal organizations and, as a consequence, are more subject to monitoring by law enforcement agencies.

Less transparent contracts have another characteristic that local public entities can favor when subject to higher monitoring: they are easier to implement. Gerardino *et al.* (2020) shows that public entities may prefer less transparent procedures because they are less likely to commit any (involuntary) irregularity. Indeed, suppose monitoring authorities spend more time on checking procedures with many auditable steps. In that case, the probability of committing an irregularity in one of the steps can discourage the use of transparent procedures in the first place. This hypothesis does not seem the most credible in this setting for three reasons. First, the results suggest that public entities with a lower probability of committing

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<sup>21</sup>I focus on the contracts shifting from above the threshold since the information on the type of good (i.e., the *CPV*) is available only for contracts larger than 40,000 Euros.

unintended mistakes are the ones exploiting the variation in the law the most. In order to assess this, I investigate whether municipalities with more skilled public employees respond differently to a neighboring dissolution. Table 5 shows the effect of the dissolution on municipalities with different employees' characteristics. Column 1 shows the results of Table 2, whereas Columns 2 to 5 show the effect of the dissolution considering the share of employees with at least 20 years of working experience, that with a university degree, that over 35 years old and the share of women respectively. Municipalities with more educated and more senior employees exploit the 40,000 Euro threshold more than the other municipalities. These results suggest that public bodies with a lower probability of committing unintended mistakes are the ones exploiting the change in the law the most.

The second reason that the hypothesis suggested by Gerardino *et al.* (2020) does not apply to this context is that the monitoring activity of the law enforcement body targets evidence of corruption rather than unintended procedural mistakes.<sup>22</sup> The third and final reason draws from evidence from numerous Italian rulings that acknowledge that the 40,000 Euro threshold has been exploited extensively by organized crime for corruption purposes. The Appendix, provides a translation of some passages of the rulings. Therefore, I conclude that municipalities shift to below-threshold procurement contracts when a neighboring municipality is being dissolved, in order to exploit less monitored margins of their procurement activity.

## 6 Results on contract renegotiation

Table 6 shows the results of Equation 4 on four different outcomes. Column 1 shows the effect of a neighboring municipality's dissolution on the probability of conducting a renegotiation (i.e., the extensive margin); column 2 shows the change in (the logarithm of) the value of the existing contract renegotiations (i.e., the intensive margin). The neighboring dissolution decreases the probability of municipalities issuing a renegotiation by 3 percent, but they also reduce the average renegotiation size by 65 percent. Therefore, municipalities respond to

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<sup>22</sup>Figure B.2 in the Appendix shows the most common evidence that the law enforcement body used to motivate a dissolution.

the neighboring dissolution by recurring to fewer renegotiations. This result is in line with the hypothesis that renegotiations are exploited for illegal purposes. An increase of the law enforcement bodies' attention to the municipalities' activities reduces the probability of them engaging in activities that signal potential irregularities.

Nevertheless, municipalities also have the option of behaving strategically in this situation. In this specific case, they could redistribute the resources of renegotiations in less monitored phases of the procurement process. For example, instead of awarding additional resources through the contract renegotiation, they could increase the contract value for the same good. In order to exclude this hypothesis, I estimate Equation 4 on the (logarithm of the) total value of the project and the rebate for those contracts that are not renegotiated. Suppose redistribution of resources is in place because of the dissolution. In that case, I should observe an increase in the project's value for those contracts that are not renegotiated, since after the dissolution they would also include the hypothetical additional resources coming from the renegotiation stage. Columns 3 and 4 show that this is not the case: there is no variation either on the rebate or on the project's total value. Therefore, I conclude that a neighboring municipality's dissolution creates a deterrent effect for municipalities that engage less in practices that the monitoring authority considers an indicator for potential corruption.

## **7 Robustness checks**

This section shows the robustness checks of the results in Section 5. I show two different robustness checks. First, I validate the results of Section 5 using the randomisation inference method described in Section 4. Figure 8 shows the results for the neighboring municipalities and the selected control group. The horizontal axis shows the degree of connection of the neighboring municipalities to the dissolved one, whereas the vertical axis shows the average bunching. Therefore, observations with an x-axis of 1 and 2 represent the average bunching of neighboring municipalities and the one of the latter's neighbors municipalities. The dotted line represents the average bunching of the 5th and 95th percentiles of the control distribution. The



solid line is the average bunching of the neighboring municipalities after the dissolution for every degree of connection. The test shows two main findings. First, it confirms the results of Section 5: it rejects the hypothesis that, after a dissolution, neighboring municipalities have a level of bunching similar to that of control municipalities. The level of bunching of the neighboring municipalities is greater than the bunching of the 95th percentile of the control group. It also shows how the effect of the dissolution is a function of the geographical distance from the dissolved municipality; indeed, more distant municipalities (i.e., those with a higher degree of connection) bunch on average less than the neighboring one after the dissolution. For example, municipalities at the 10th degree of connection have almost half the neighboring municipalities' bunching after a municipal dissolution.

Then, I verify that the results of Equation 1 hold even when restricting the control group to municipalities closer to the neighboring municipalities. In this way, I compute Equation 1 taking into account potential unobserved and time-varying characteristics that I could not control if I focus the analysis on all Italian municipalities. Indeed, results in Table 2 can have biased estimates if time-varying unobserved characteristics influence differently neighboring and control municipalities. Therefore, Table 7 shows the results of Equation 1 focusing on a smaller (but more similar) group of controls municipalities. The first column shows the results of Table 2; whereas the second column focuses on municipalities in the same region of the dissolved municipalities. Regressions in column 2 should reduce the bias from all these unobserved features varying at the regional level. In any case, unobserved variables may influence municipalities at the provincial level. Therefore, in column 3, I further restrict the sample of municipalities focussing only on those in the same provinces of the dissolved municipalities. Finally, column 4 uses the staggered implementation of the dissolution and limits the analysis to municipalities that are neighboring a dissolved municipality in the analysis period. Regardless of the control group, results shown in Table 2 still hold, and they are extremely similar one to the other. Indeed, the dissolution of a neighboring municipality increases the number of procurement contracts issued below the 40,000 Euro threshold by approximately 20 percent.

Finally, I compute other robustness checks of the results in Section 5, as detailed in the

Appendix. In particular, I compute equation 1 focussing on contracts of different sizes, considering a different number of neighboring bins smaller than 40,000 Euros, and changing the bin size. I also estimate the results of Equation 1 using the estimator proposed by De Chaisemartin and D’Haultfoeuille (2020) as well as the Poisson QML estimator (Wooldridge 1997). I also compute the results of Table 5 focussing instead on the mayor’s characteristics.

## 8 Conclusion

In this paper, I study the spillover effects of a municipal dissolution on neighboring municipalities’ procurement behavior. I document how municipalities respond strategically to the implementation of their neighboring municipality’s dissolution. In particular, they increase the number of contracts for goods and services issued below the 40,000 Euro threshold; doing so, they can legitimately award contracts directly to specific firms, as well as reduce the evidentiary requirements that law enforcement bodies may use to prove any irregularities. This response is consistent with the hypothesis that neighboring municipalities exploit a less monitored margin of procurement activity after the neighboring municipality has been dissolved. I provide three additional pieces of evidence to confirm this interpretation. First, changes in neighboring municipalities’ procurement behaviour only applies to sectors more vulnerable to the infiltration of criminal organizations. Second, large projects are split into multiple below-threshold contracts so that the overall size of the project does not change, but each contract is subject to less transparent rules. Third, qualitative evidence shows that criminal organizations exploit the 40,000 Euro threshold extensively for corruption purposes.

I also document a second strategic response by municipalities to a neighboring municipal dissolution: mainly, a decrease of contract renegotiation activities and a reduction of the average size of the issued renegotiations. Since both *ANAC* and the law enforcement body consider contract renegotiation as a vulnerable phase of the procurement process, they monitor the renegotiations more closely. As such, this response is consistent with the hypothesis that municipalities also engage less in activities that signal potential irregularities. Unlike

the results on the 40,000 Euro threshold, I observe that municipalities do not distribute the resources from the renegotiation in any other stage of the procurement process.

This study contributes to the larger debates surrounding monitoring policies, and the numerous responses that they can generate. It highlights the importance of taking into account the wider, perhaps more indirect, effects of policy implementation. The findings can also apply to other contexts in which unmonitored public entities perceive a higher probability of detection, after a monitoring procedure has been implemented. Furthermore, results have wider policy implications: they highlight how details of policy making have a crucial role in understanding the effect of a public policy. Small institutional details can result in different responses from what the theory predicts (Duflo 2017). These findings suggest that the impact of monitoring policies should be assessed by taking into account all the economic agents involved. If neighboring municipalities make the detection of future irregularities more complicated after a dissolution, the overall benefit of each dissolution is reduced.

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## 9 Tables

Table 1: Descriptive statistics

	All municipalities	
	Mean	Standard deviation
<i>Municipalities characteristics</i>		
Population	7,277	(40,297)
Local mayor	0.39	(0.49)
N. neighbours	5.89	(2.12)
N. mun. within 10km	14.1	(11.1)
<i>Procurement</i>		
Contract size (in thousands Euro)	18.45	(3,456)
N. contracts	169	(228)
N. contracts btw. 10,000 and 40,000 Euro	19	(38)
N. contracts btw. 40,000 and 100,000 Euro	2	(11)
Expenditure (in thousands Euro)	3,113	(49,663)
Exp. btw. 10,000 and 40,000 Euro (in th. Euro)	396	(844)
Exp. btw. 40,000 and 100,000 Euro (in th. Euro)	140	(695)
Share pub works	0.18	(0.14)
Share goods	0.48	(0.14)
Share services	0.34	(0.13)
Sh. renegotiations	0.28	(0.40)
Value (as share of contract value)	0.22	(5.12)
<hr/>		
N. of contracts	7,965,123	
N. of municipalities	7,753	
N. of neighboring municipalities	176	

The table summarises the following yearly variables: first, the municipality's characteristics such as average population, average share of mayors who are born in the municipality, average number of neighbor municipalities and average number of municipalities within a 10 km radius. *N. contracts* is the average number of contracts issued in a year. *N. contracts btw. 40,000 and 100,000 Euro* corresponds to the average number of contracts between 40,000 and 100,000 Euro. *N. contracts btw. 10,000 and 40,000 Euro* is the average number of contracts between 10,000 and 40,000 Euro. The same applies for the expenditure variables. *Sh. public works* is the average share of contracts in a year that are about public works, *Sh. services* is the average share of services, while *Sh. goods* is the average share of goods. Finally, *Sh. renegotiations* is the average share of contracts for public works larger than 150,000 Euro that have been renegotiated. Neighboring municipalities are the municipalities sharing a border with a municipality where the dissolution has been implemented in the period of analysis.

Table 3: Effect of the dissolution on the expenditure for split projects.

	Goods and services		Public works	
	(1) Exp.	(2) Exp.	(3) Exp.	(4) Exp.
$Treat_{m,t}$	48,222*** (11,322)	35,637*** (11,412)	420 (2,147)	-1,127 (2,223)
Province linear trends	N	Y	N	Y
Observations	43,939	43,939	43,939	43,939
Baseline mean	57,888	57,888	16,252	16,252

The Table studies the effect of the neighboring dissolution on expenditure on split projects. The outcome variable is the expenditure on split projects, that is contracts smaller than 40,000 Euros which are about the same object and pooled together would be a contract larger than 40,000 Euro. I identify them using Word2Vec for comparing the objects' descriptions. Two contracts are considered to be part of the same project if the similarity is 90 percent or higher. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within a 10 kilometer radius for all Italian municipalities.

Table 2: Effect on the number of contracts below 40,000

	Goods and services		Public works	
	(1) Num. Proc.	(2) Num. Proc.	(3) Num. Proc.	(4) Num. Proc.
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000)$	0.196*** (0.031)	0.209*** (0.031)	-0.027 (0.017)	-0.027 (0.017)
Bin Fe.	Y	Y	Y	Y
Province linear trends	N	Y	N	Y
Observations	893,107	893,107	893,107	893,107
Baseline Mean	3.40	3.40	0.79	0.79

The Table studies the effect of the neighboring dissolution on bunching below the 40,000 Euro threshold. The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin, the first two columns are the results considering contracts of goods and services only. Instead, columns 3 and 4 show the results for public works. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within a 10 kilometer radius for all Italian municipalities.

Table 4: Effect on the number of contracts above 40,000 Euros by sectors.

	Construction and waste man.		Others	
	Services and furn.	Pub. works	Services and furn.	Pub. works
	(1)	(2)	(3)	(4)
	N	N	N	N
$Treat_{m,t}$	-0.065** (0.026)	-0.033 (0.035)	-0.082 (0.064)	0.019 (0.014)
Observations	43,945	43,945	43,945	43,945
Baseline mean	0.07	0.30	0.47	0.05

The Table studies the effect of the neighboring dissolution on the number of contracts issued above the 40,000 Euro threshold. The outcome variable is the number of contracts in the two categories of sectors. Contract size is between 40,000 Euro and 70,000 Euro. The waste management category includes the following types of services: waste management, removal of sewage, cleaning and environmental services. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within a 10 kilometer radius for all Italian municipalities.

Table 5: Heterogeneous effect based on employees' characteristics

	(1)	(2)	(3)	(4)	(5)
	Num. Proc.	Num. Proc.	Num. Proc.	Num. Proc.	Num. Proc.
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000)$	0.209*** (0.031)	0.113* (0.075)	0.104** (0.052)	-0.377** (0.187)	0.116* (0.063)
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times Share_{20yexp_{m,t}}$		0.001 (0.001)			
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times Share_{degree_{m,t}}$			0.005** (0.002)		
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times Share_{over35_{m,t}}$				0.006*** (0.002)	
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times Share_{women_{m,t}}$					0.002 (0.002)
Observations	893,107	893,107	893,107	893,107	893,107
Baseline Mean	3.40	3.40	3.40	3.40	3.40

The Table studies the heterogeneous effect of the dissolution on the bunching at the 40,000 Euro threshold. The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin for contracts of goods and services.  $Share_{20yexp_{m,t}}$  is the share of employees with at least 20 years of working experience,  $Share_{degree_{m,t}}$  represents the share of employees with a university degree,  $Share_{over35_{m,t}}$  shows the share of over 35, and  $Share_{women_{m,t}}$  the one of women. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within a ten kilometer radius for all Italian municipalities.

Table 6: Effect of the dissolution on the contract renegotiations.

	(1) Renegotiation=1	(2) Value	(3) Rebate	(4) Tot. Project Value
$Treat_{m,t}$	-0.030* (0.017)	-0.647** (0.297)	-0.006 (0.008)	0.003 (0.047)
Observations	71,088	18,341	50,744	50,744
Baseline	0.282	28,188	0.11	636,916

The Table studies the effect of the neighboring dissolution on contract renegotiations. In the first column the outcome variable is a dummy taking value 1 if the public works contract had been renegotiated, 0 otherwise. In the second column, the outcome is the logarithm of the renegotiation value. Instead, column 3 shows the results focussing on the value of the rebate for contracts without a renegotiation, and column 4 shows the results on the total value of the project for contracts without renegotiations. Even though there is a decrease in the renegotiation both in the extensive and intensive margins (columns 1 and 2), there is no redistribution of the resources to other phases of the contract (columns 3 and 4). All the specifications have good, municipality and year fixed effects and the following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within a ten kilometer radius for all Italian municipalities.

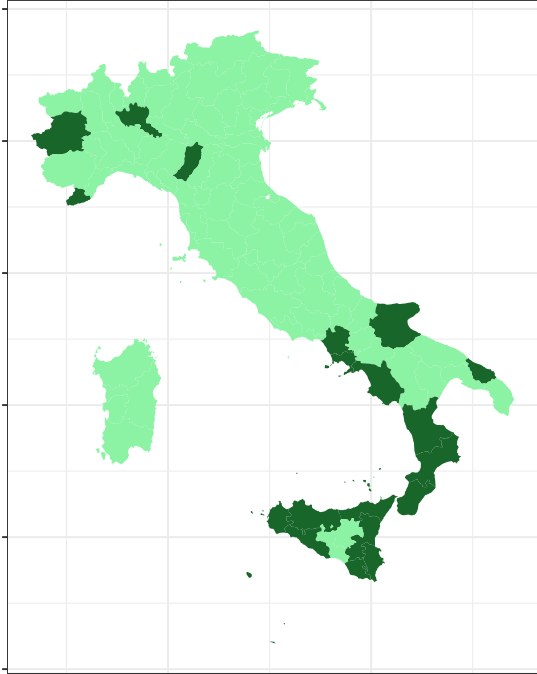
Table 7: Effect of the dissolution using different control groups

	(1) Num. Proc.	(2) Num. Proc.	(3) Num. Proc.	(4) Num. Proc.
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000)$	0.209*** (0.031)	0.213*** (0.031)	0.162*** (0.033)	0.193*** (0.039)
All mun.	X			
Same Region		X		
Same Province			X	
Neighboring municipalities only				X
Observations	893,107	484,784	162,157	19,478

The Table studies the effect of the neighboring dissolution considering different control groups. The first column estimates Equation 1 on the full sample, the second one restricts it to those in the same region of the dissolved municipalities. Similarly, column three focuses on municipalities in the same province. Finally, the fourth column estimates the results based only on the neighboring municipalities. The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin. The following controls are included: population, indicator whether the mayor is born in the municipality, number of years until the next election, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within a ten kilometer radius for all Italian municipalities.

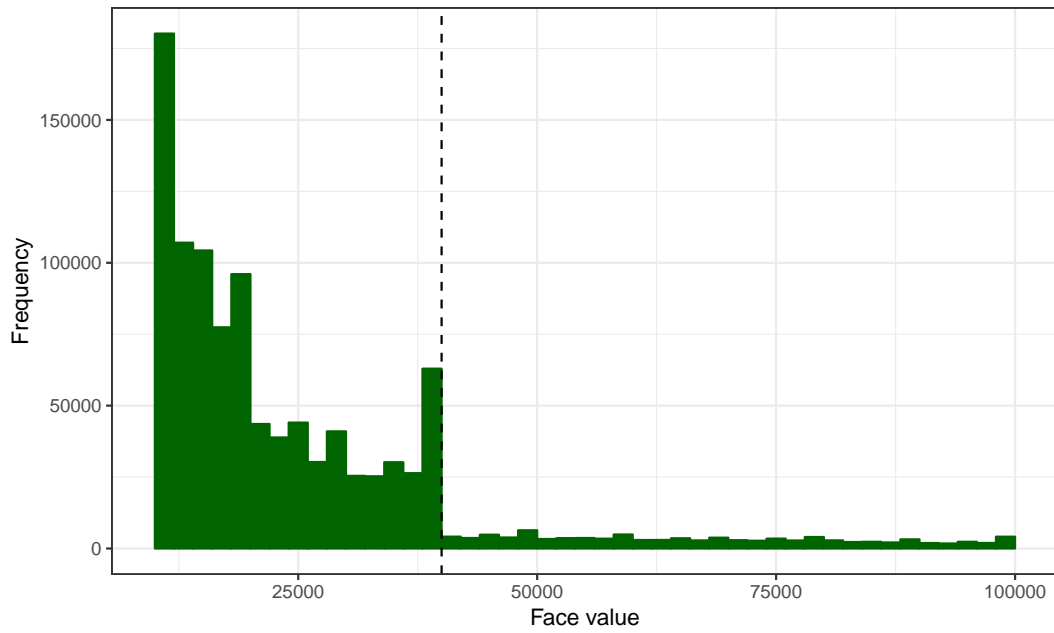
# 10 Figures

Figure 1: Map of the dissolutions



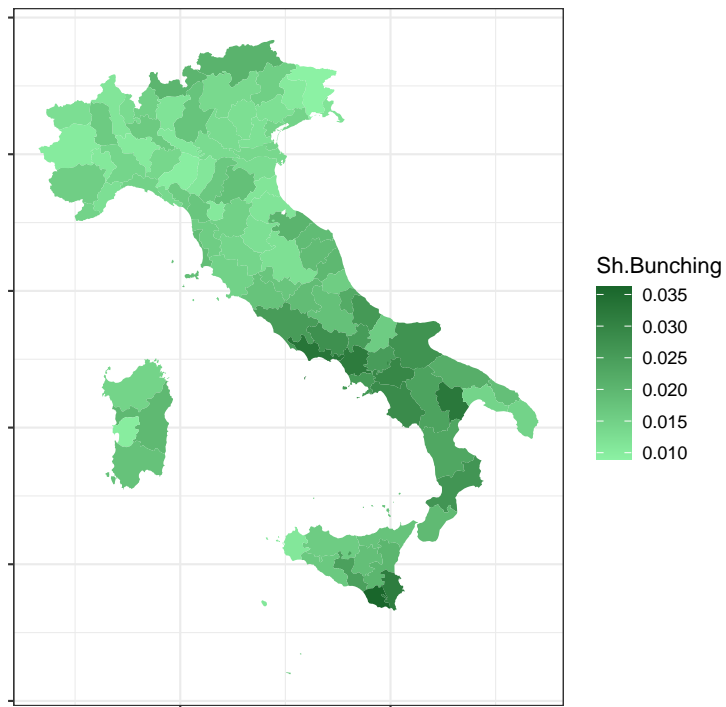
The map shows the Italian provinces where there has been at least a dissolution in the period of analysis (2011-2016).

Figure 2: Distribution of contracts by face value



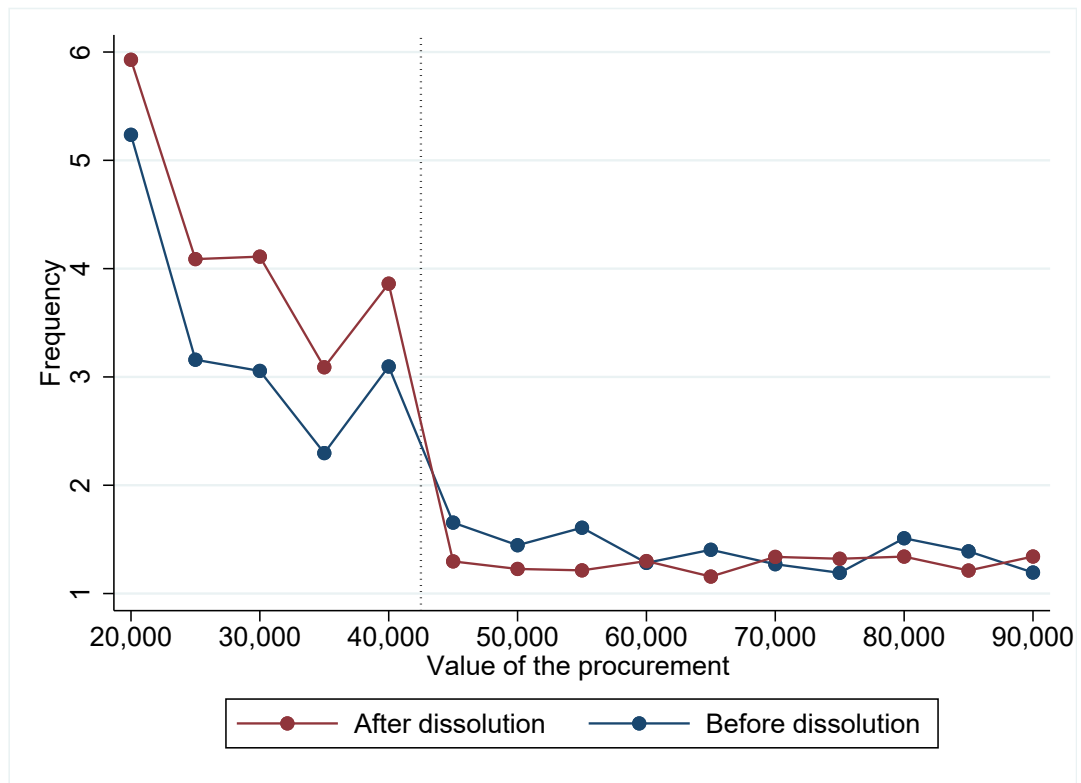
The figure shows the distribution of the procurement contracts of all the Italian municipalities by face value in the period 2011-2016. There is a substantial bunching at the 40,000 Euro threshold (dashed line). The figure does not include contracts larger than 100,000 Euros.

Figure 3: Average bunching by province



The figure shows the average yearly bunching at the 40,000 Euro by province. The bunching is computed as the share of contracts between 35,000 and 40,000 over the total number of contracts.

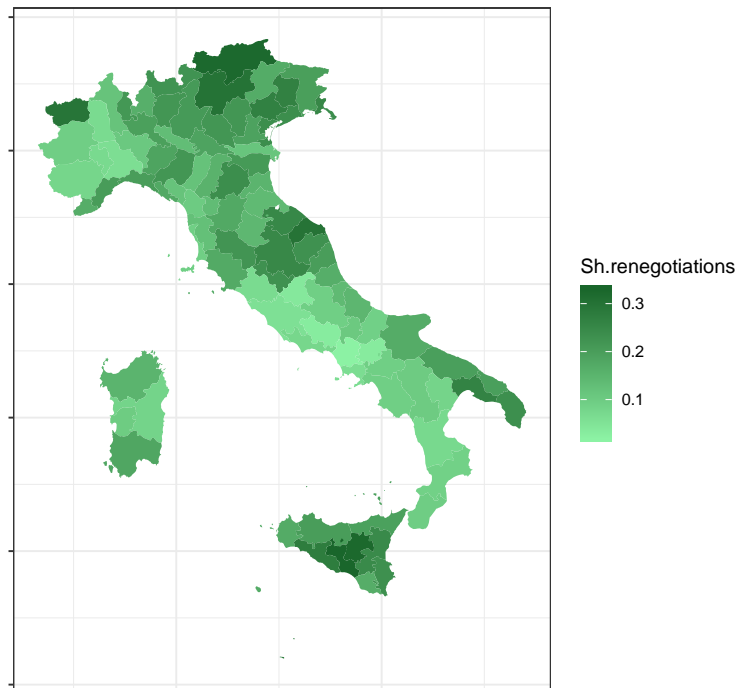
Figure 4: Bunching pre (and post) a neighbour's dissolution



The figure shows the change in bunching for the neighboring municipalities after a dissolution. The bin size is 5,000 Euro.

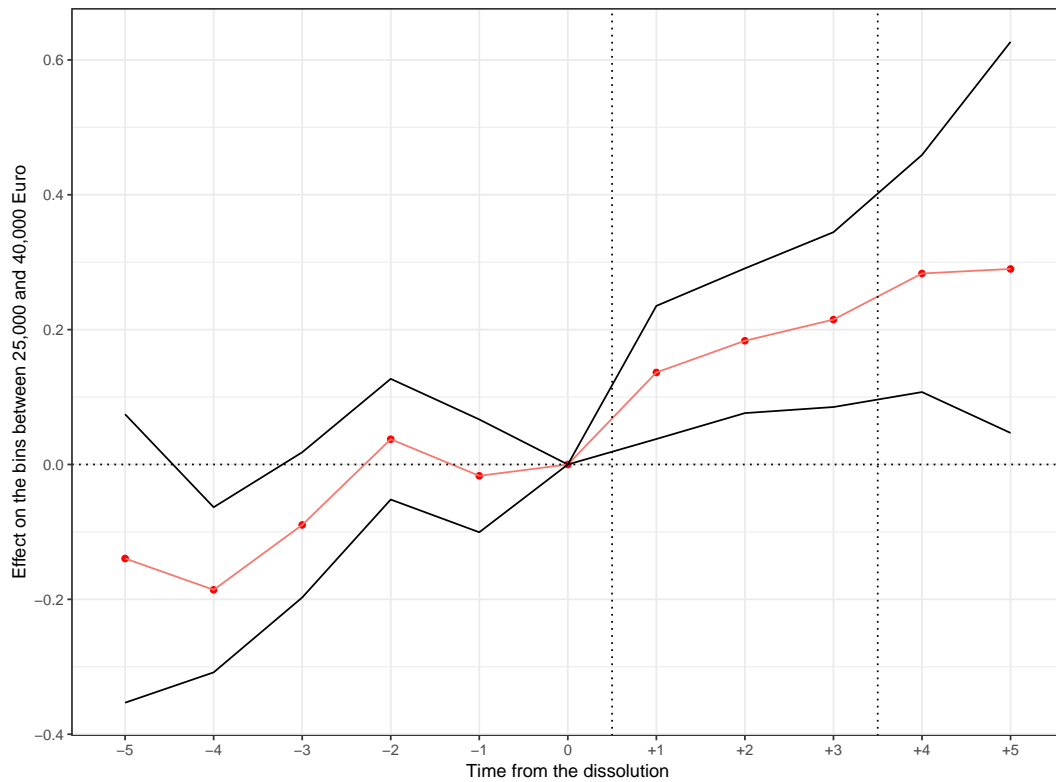


Figure 5: Average contract renegotiations by province.



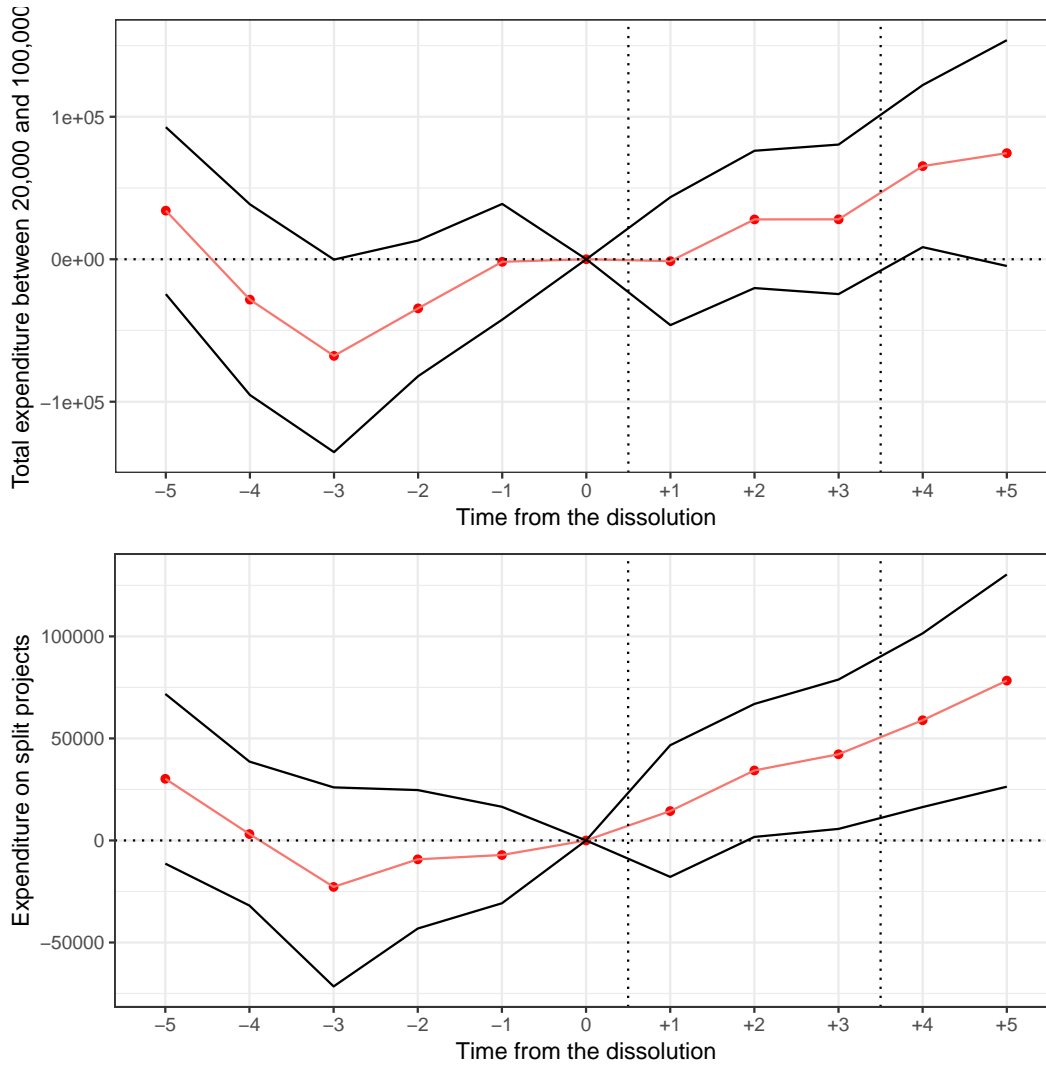
The map shows the average share of contract renegotiations for public works issued in each Italian province.

Figure 6: Effect on the number of contracts below the threshold



The Figure shows the effect of neighboring dissolution on the number of procurements for goods and services issued below the 40,000 Euro by neighboring municipalities. Coefficients represent the percentage change in the number of procurement between 25,000 and 40,000 Euro issued before, during and after the neighboring dissolution. The time 0 is the year of the dissolution, while commissioners are in charge up to year 3.

Figure 7: Effect of the dissolution on expenditure

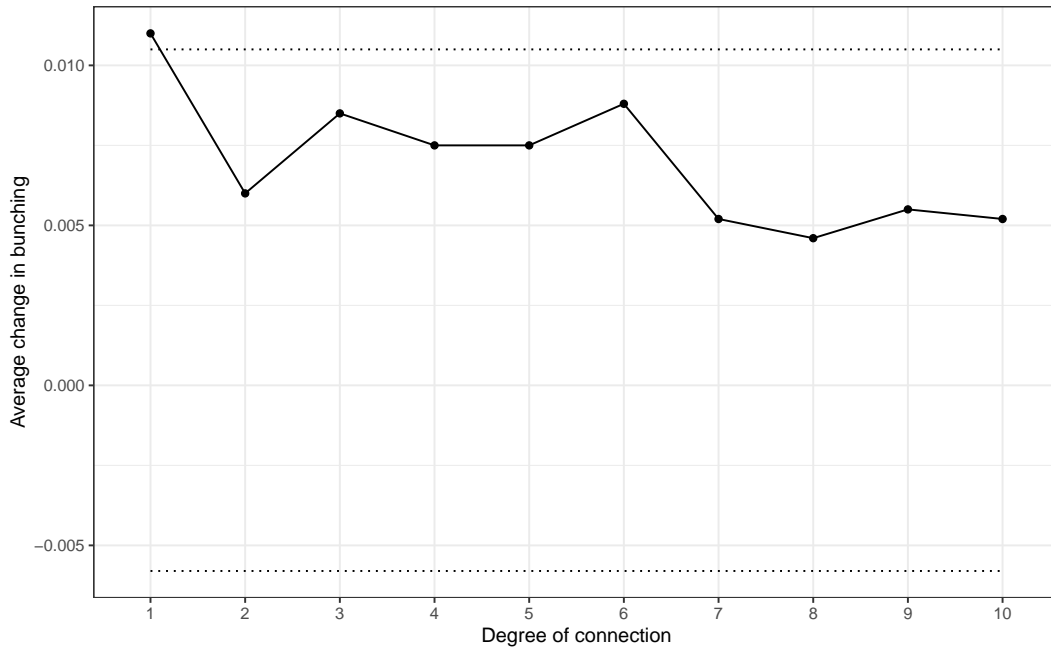


The top figure shows the effect of neighboring dissolution on the expenditure for goods and services issued between 20,000 and 100,000 Euro by neighboring municipalities. The bottom figure represents the effect of the dissolution on the expenditure for split projects for contracts of goods and services.

Coefficients represent the change in expenditure before, during and after the neighboring dissolution. The time 0 is the year of the dissolution, while commissioners are in charge up to year 3.

The increase in expenditure in split projects is not coupled with an increase in overall expenditure, therefore neighboring municipalities split projects larger than the threshold in multiple contracts below it.

Figure 8: Bunching test

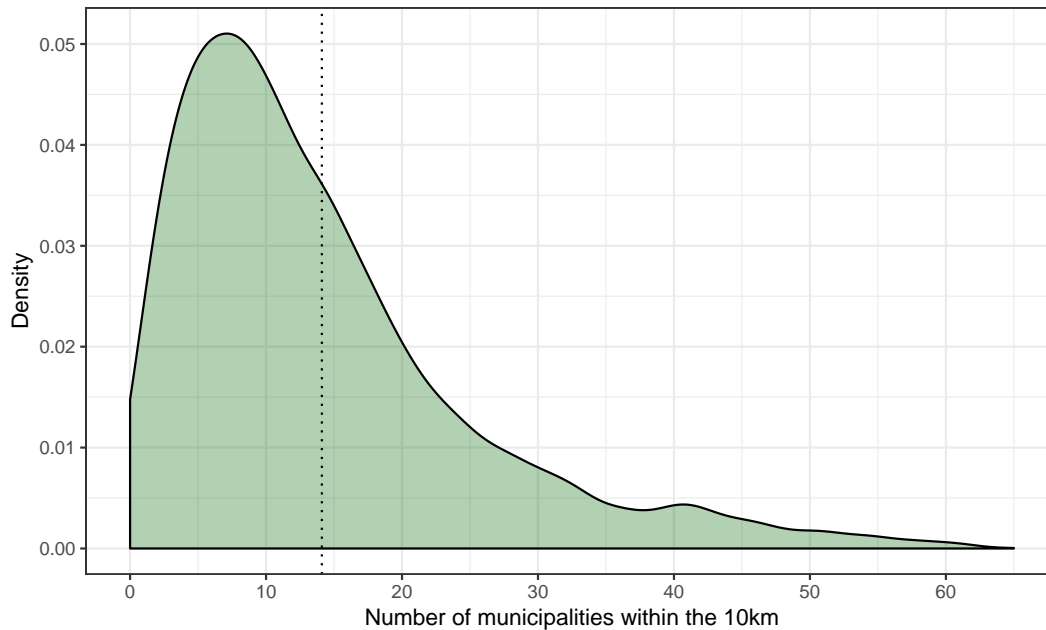


The figure represents the result from the test I describe in Section 4. The test compares the average bunching of neighboring municipalities after the dissolution with the average bunching of control municipalities. The dotted line represents the average bunching of the 5th and 95th percentiles of the distribution of the control municipalities. Instead the continued line represents the average bunching of the neighboring municipalities. The measure of bunching for neighboring municipalities is the ratio between the average number of contracts below the 40,000 Euro threshold after the dissolution and the yearly average number of contracts. The measure for control municipalities is the ratio between the average number of contracts below the 40,000 Euro threshold and the yearly number of contracts issued.

## A General evidence

Figure A.1 shows the distribution of the number of municipalities within a ten kilometers radius. Even though the distribution is skewed towards a small number of municipalities, Italian municipalities have approximately 15 towns within a 10 kilometers radius. The figure is helpful in understanding the number of municipalities involved in the computation of the Conley standard errors.

Figure A.1: Distribution of municipalities within 10 kilometres.



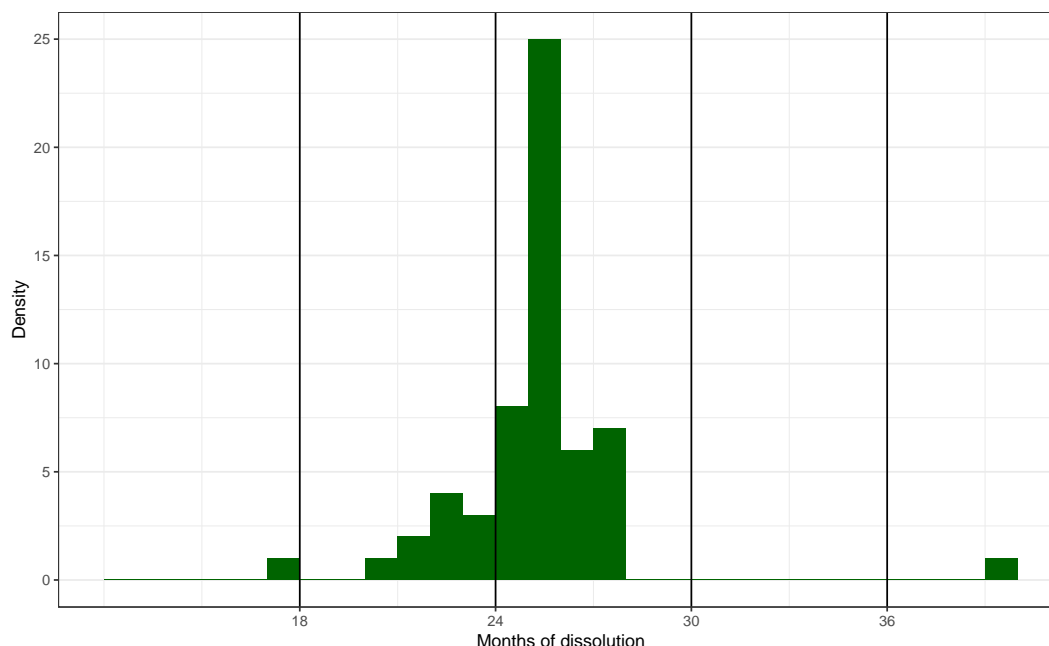
The Figure shows the distribution of municipalities within a 10 kilometres radius. The dotted line represents the average number of municipalities within a 10 kilometer radius.

## **B Additional evidence on the dissolutions**

In this section, I provide additional evidence on the dissolutions. In particular, I graphically represent the analysis of the reports of the dissolutions that the law enforcement body published to motivate their implementations. I document three findings. First, even though the law prescribes the dissolution to last at most 24 months, the vast majority of the dissolutions were concluded within 30 months from their start. Therefore, I consider in the analysis the dissolution period lasting for the first three years after the implementation of the measure.

Then, I represent graphically two additional sets of information that I collect from the dissolution reports, and I use them in the analysis. Figure B.2 shows the most common infractions that the law enforcement body used to justify the implementation of the dissolutions during the period of this study. The most common violation is that municipalities award procurement contracts to firms directly owned by criminal organizations; therefore, they cannot present any anti-mafia documentation, which is compulsory to win a procurement contract.

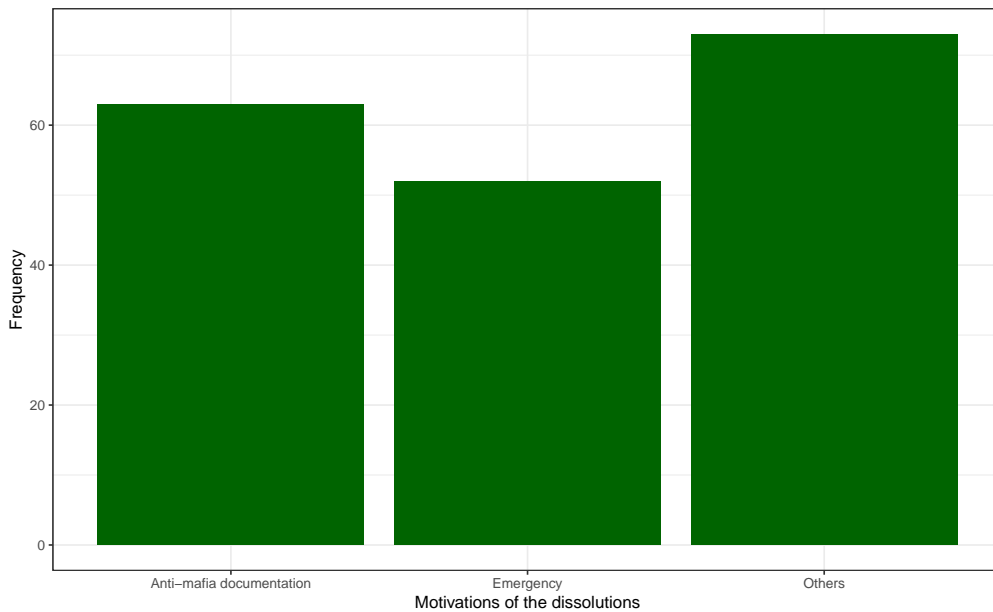
Figure B.1: Distribution of length of the dissolution



The Figure shows the length of each dissolution in the period of analysis. The vast majority of the dissolutions did not last more than 30 months.

Since municipalities are in charge of verifying the firm's documentation, if the municipality does not collect anti-mafia documentation, it is considered a voluntary omission of the law. It is enough to justify the dissolution of a municipal government. Unfortunately, I do not have any information on the firms winning the procurement contracts; therefore, I cannot use this violation of the law in the analysis. Instead, the second most common evidence used by the law enforcement bodies is the direct award of contracts larger than 40,000 Euros avoiding the public tender. Municipalities can award procurement contracts of goods and services larger than 40,000 Euros only in case of emergency. Then, given the need to have a quick and effective response, the municipality can award a contract directly to a firm to avoid the red tape costs associated with public tenders. Unfortunately, the emergency clause is extensively exploited for corruption purposes as well; indeed, a municipality can claim the existence of an emergency to distort competition and award procurement contracts to a specific firm. Nevertheless, the use of the emergency clause without a real need can be risky for the municipality; if the law enforcement body has a closer look at the municipal activity, it will not take long be-

Figure B.2: Motivations of the dissolutions

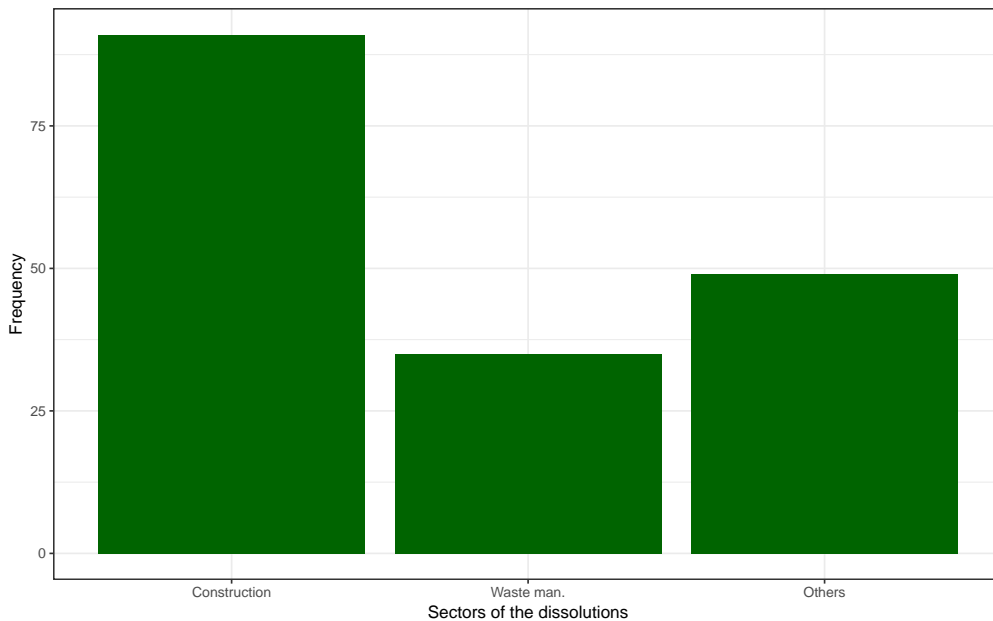


The histogram shows the motivations that the law enforcement bodies use most frequently to justify the dissolutions. Approximately 60 percent of the motivations were one of the following: first, municipality did not verify whether the firm was owned by a mafia related individual, or the municipality verified and decided to award the contract to the firm anyway (33 percent), or municipalities exploited the emergency clause to award a procurement contract to a specific firm even when there was no emergency (28 percent).

fore realizing that the municipality uses the emergency clause for other purposes. Therefore, when municipalities perceive a higher level of attention from the law enforcement body, they split the projects larger than 40,000 Euros into multiple contracts smaller than the threshold. In this case, even without using an emergency clause, the municipality can legitimately award the contracts directly to a specific firm and, the law enforcement has to provide some other criminally relevant evidence for proving the existence of irregularities. Finally, the remaining category includes all the other violations that the law enforcement body used as evidence for proving organized crime's infiltration, such as the extensive use of the renegotiations.

Figure B.3 shows the municipal sectors that criminal organizations infiltrated in the dissolution cases. Since the same criminal organization can infiltrate multiple sectors of the municipal activity simultaneously, the number of infiltrated sectors is higher than the number of dissolutions. Organized crime infiltrated mainly two sectors of municipal activity: construction and waste management sectors. Instead, the Others column represents the remaining over 40 sectors of the municipal activity.

Figure B.3: Infiltrated sectors in the dissolved municipalities



The histogram shows in which sectors criminal organizations infiltrated in the dissolved municipalities. In 72 percent of the cases, organized crime infiltrated either the construction sector (52 percent) or the waste management (20 percent). The waste management category includes also cleaning and sewage services.

## C Qualitative evidence from judicial cases

This section reports some of the sizeable qualitative evidence referring to how organized crime exploited the 40,000 Euro threshold for corruption purposes. Since smaller contracts could be legally awarded to specific firms without justification, they were the perfect tool for criminal organizations to receive public funds. Since public resources are always attractive for organized crime and the proliferation of organized crime is a serious concern in Italy, different sources have extensively discussed it. Therefore, it is possible to gather qualitative evidence from either newspaper articles, or reports of the dissolutions, books on the technical details of the procurement law or simply talking with the employees of the Italian Monitoring Authority (ANAC). For simplicity, I include here some citations from only a particular type of source: judicial verdicts. Indeed, I believe that it can help interpret these findings to provide tangible evidence of how the judicial system evaluates this phenomenon. Unfortunately, in order to be concise, I do not report all the judicial cases in which the 40,000 Euro threshold has been exploited since I have found more than 30 cases (and still counting) up to now. Therefore, the



following is a "small" portion of the qualitative evidence that anyone can find on this topic.

*T.A.R. Campania Napoli Sez. I, (ud. 30-07-2006) 11-09-2006, n. 8037*

"[...] Additional evidence to prove the connection between the criminal organization and the municipal administration is the award of numerous contracts smaller than 40,000 Euros to firms owned by the XXXXX brothers, who are members of the XXXXX clan".

*Consiglio di Stato N. 04578/2017 Sez. III*

"[...] Even though a municipality should not be considered infiltrated by organized crime simply for its geographical location, it can be relevant if the law enforcement body proves the existence of behaviours signaling potential irregularities. [...] The direct award of numerous contracts to the same firm is a signal of the lack of autonomy of the municipal administration and the presence of the criminal organization in the municipality's business."

*T.A.R. Lazio Roma Sez. I, Sent., (ud. 18-07-2018) 24-09-2018, n. 9544*

"[...] The municipality exploited the 40,000 Euro threshold extensively to award contracts to the firms owned by members of the criminal organization. Even though the phenomenon does not seem relevant since it relates to small contracts, it is extremely relevant if we consider the high frequency of the awards of these contracts to corrupted firms."

*T.A.R. Lazio sez. I - Roma, 28/09/2019, n. 11396*

"[...] From August 2016 to July 2017, the firm XXXX won 11 contracts smaller than 40,000 Euro threshold."

"[...] Even though the direct awards to firms owned by criminal organizations are only for small values, they are evidence of the infiltration of organized crime into the municipality's business. The criminal organization exploited the change in the law at the 40,000 Euros to directly award public funds to its firms, avoiding public tenders."

"[...] The frequent use of the direct awards for contracts smaller than 40,000 Euro (and the absence of any formal requirement) made it very hard for the law enforcement body to verify whether the municipality committed any irregularity."

"[...] The evidence collected by the law enforcement body shows how often the crimi-

nal organization exploited the 40,000 Euro threshold during its activity. They split different projects into multiple smaller contracts to award the contracts directly to firm XXXX without any justification, violating publicity requirements and distorting competition."

"[...] The direct awards of contracts to firm XXXX are clear evidence of the illicit behaviour of the municipal administration, which behaved in the interest of the criminal organization and harmed the municipality's budget."

"[...]From June 2015 to July 2017, company XXXX won 21 contracts of 35,000 Euro without ever participating in a public tender. The wife of the owner is the aunt of one of the bosses of the XXXXX clan."

*Consiglio di Stato sez. III - 26/09/2019, n. 6435*

"[...] The infiltration of 'Ndrangheta clans on the municipality's business resulted in a chaotic organization of the municipality's procurement activity. Evidence of this is a large number of direct award of contracts (smaller than 40,000 Euros) to the firms owned by the criminal organization."

*T.A.R. Lazio sez. I - Roma, 28/05/2019, n. 6647*

"[...] The law enforcement body gathered evidence on the direct award of contracts (smaller than 40,000 Euros) to firm owned by criminal organizations".

"[...] The municipal administration exploited the 40,000 Euro threshold to award directly public contracts to firm XXXX, owned by the XXXXX family, who belongs to the organized crime."

*Consiglio di Stato sez. III - 28/06/2017, n. 3170*

"[...] The infiltration of criminal organizations in the municipality's activity is evident if we focus on: the direct award of numerous contracts smaller than 40,000 Euro to firms owned by clan members, the problematic situation of the waste management in the municipality. "

*T.A.R. Lazio sez. I - Roma, 05/10/2016, n. 10049*

"[...] The municipality awarded contracts (smaller than the threshold) to firms owned by the criminal organization for a total value of 450,000 Euro from September 2009 to May

2013. This sum is considerable if we consider that the municipality has a population of 3,000 inhabitants."

"[...] In several cases, the criminal organization firms won contracts through a direct award even if they have never won another contract with the same municipality before."

*T.A.R. Lazio sez. I - Roma, 03/12/2020, n. 12935*

"[...] From June 2015 to July 2017, the municipality awarded 21 contracts for 35,000 Euros each to the firm XXXX owned by the grandfather of the wife of a member of the city council, whose relatives are members of the criminal organization."

*T.A.R. Lazio sez. I - Roma, 16/11/2020, n. 11940*

"[...] The frequent use of direct awards is legitimate since the contracts are small, but they demonstrate the influence that the criminal organization has on municipal behaviour. Indeed, they are used to distort competition and to choose the winner of the contract arbitrarily."

*Consiglio di Stato sez. III - 24/06/2020, n. 4074*

"[...] The municipality awarded multiple contracts directly to firms owned by members of the criminal organization. The municipality split larger projects into smaller contracts to award them directly to the predetermined firms."

"[...] In a year, the municipality awarded 11 contracts directly to the firm owned by the criminal organization without issuing any public tender."

## **D Additional robustness checks bunching results**

In this section, I show the additional robustness checks that I compute on the results of Equation 1. I compute several robustness checks to verify that the results hold even with differences in the estimation. For example, Table D.1 shows the effect of the dissolution keeping contracts of different sizes in the analysis. The analysis of Table 2 is reported in the fourth column; instead, from columns 1 to 3, I show the results using respectively contracts up to 60,000 Euros, 70,000 Euros, and 80,000 Euros. Results do not change irrespective of focussing only on contracts closer to the threshold. It seems that the effect gets greater the larger is the maxi-

Table D.1: Effect on the number of contracts below 40,000

	(1)	(2)	(3)	(4)
	Num. Proc.	Num. Proc.	Num. Proc.	Num. Proc.
$Treat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.150*** (0.030)	0.167*** (0.027)	0.179*** (0.033)	0.209*** (0.031)
Contracts $\leq$ 60,000	X			
Contracts $\leq$ 70,000		X		
Contracts $\leq$ 80,000			X	
Contracts $\leq$ 100,000				X
Observations	503,538	589,630	675,722	893,107

The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

num size of contracts we include, but the difference between the two coefficients is likely not statistically significant. A possible interpretation of the slight increase in the effect can be the relative greater stability in the number of larger contracts that municipalities issue every year.

Instead, Table D.2 shows the effect of bunching at different numbers of bins below the 40,000 Euro threshold. The results are stable irrespective of the number of neighboring bins below the 40,000 Euros that I consider. These results should not surprise. Indeed there is no reason why municipalities should split projects in contracts extremely close to the 40,000 Euro threshold. For example, if a municipality wants to split a project of 60,000 Euros, it could split it into two contracts of 30,000 Euros each or in three contracts of 20,000 Euros.

Table D.3 shows the results of Equation 1 using bins of different sizes. The results do not change based on the bins' size, and they get larger if I focus on analysis with larger bins as in columns 3 and 4. Instead, Table D.4 compares the effect of Equation 1 between the OLS estimation (column 1) and the using Poisson conditional fixed-effects quasi-maximum likelihood (QML) in column 2. This estimator has several desirable properties, including consistency of the coefficient estimates independently on any assumption on the conditional variance as long as the mean is correctly specified (Wooldridge (1997)). Results are very

Table D.2: Effect on the number of contracts below 40,000

	(1)	(2)	(3)	(4)
	Num. Proc. .	Num. Proc.	Num. Proc.	Num. Proc.
$Treat_{m,t} \times Bunching\ Bins$	0.209*** (0.031)	0.204*** (0.038)	0.220*** (0.032)	0.223*** (0.041)
<hr/>				
Bin size:				
Bunching bins: $25,000 \leq X \leq 40,000$	X			
Bunching bins: $10,000 \leq X \leq 40,000$		X		
Bunching bins: $20,000 \leq X \leq 40,000$			X	
Bunching bins: $X \leq 40,000$				X
Observations	893,107	893,107	893,107	893,107

The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities. *Bunching Bins* represents bins between 25,000 Euros and 40,000 Euros for the first column, 24,000 and 40,000 for the second one, 20,000 and 40,000 for the third and fourth one.

similar in both types of estimations.

Then, I address the recent concern on the econometric literature on the staggered adoption of a difference-in-difference design estimating the results of Equation 1 with the estimator proposed by De Chaisemartin and D’Haultfoeuille (2020). It consistently estimates the ATE of the dissolution, even when the treatment effect is heterogeneous over time and across groups. Figure D.1 shows how results are not different from the one shown in Figure 6. The x-axis represents the time both before (i.e., the negative value) and after the neighboring dissolution. After the dissolution (i.e., year 0), there is an increase in the number of procurement contracts issued below the 40,000 Euro threshold. The results are also similar in magnitude to the one estimated in Figure 6. Since there are very few neighboring municipalities in the first year of the data, the confidence interval of the fourth coefficient is particularly large. So I exclude it for clarity from the figure.

Finally, Table D.5 shows the results of Table 5 focusing on similar characteristics for mayors only. I verify whether the mayor’s characteristics are more relevant in the awarding process of procurement contracts rather than the features of the public employees who award

Table D.3: Effect on the number of contracts below 40,000

	(1)	(2)	(3)	(4)
	Num. Proc.	Num. Proc.	Num. Proc.	Num. Proc.
$Treat_{m,t} \times Bunching\ Bins$	0.209*** (0.031)	0.194*** (0.028)	0.314*** (0.044)	0.384*** (0.055)
Bin size:				
5,000 Euros	X			
4,000 Euros		X		
10,000 Euros			X	
20,000 Euros				X
Observations	893,107	1,076,150	430,460	215,230

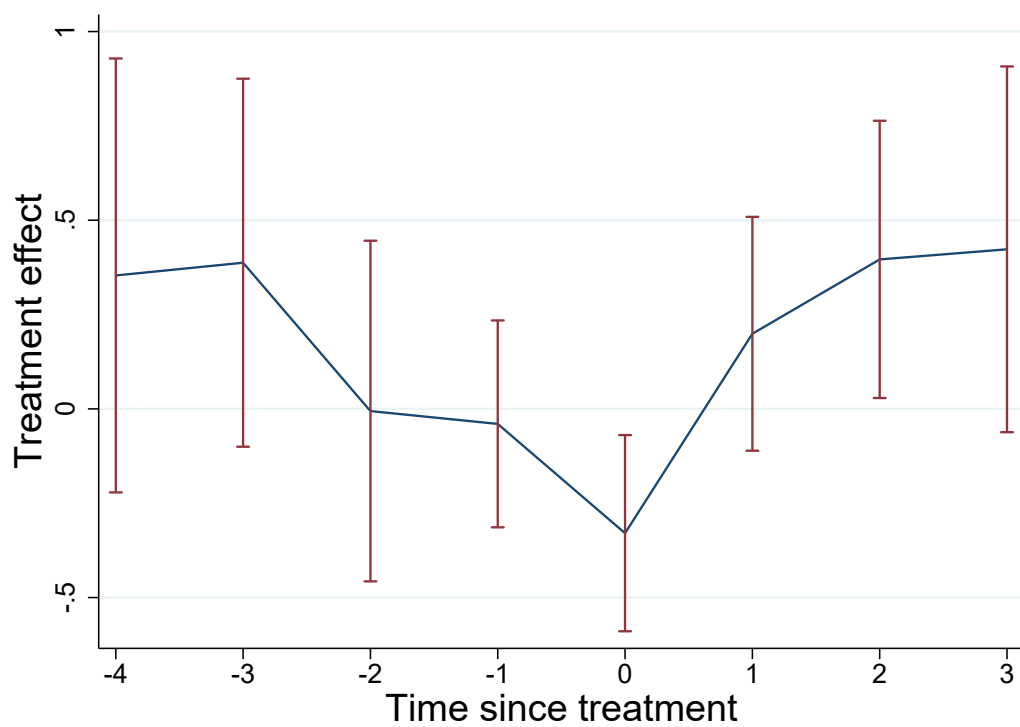
The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities. *Bunching Bins* represents bins between 25,000 Euros and 40,000 Euros for the first column, 24,000 and 40,000 for the second one, 20,000 and 40,000 for the third and fourth one.

Table D.4: Effect of the treatment with OLS and Poisson estimation

	(1)	(2)
	Num. Proc.	Num. Proc.
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000)$	0.209*** (0.031)	0.257*** (0.008)
Observations	893,107	893,107

The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

Figure D.1: Results using De Chaisemartin and D'Haultfoeuille (2020)



The Figure shows the effect of neighboring dissolution on the number of procurements for goods and services issued below the 40,000 Euro by neighboring municipalities. Coefficients represent the percentage change in the number of procurement between 25,000 and 40,000 Euro issued before, during and after the neighboring dissolution. 95 percent confidence intervals are displayed.

Table D.5: Heterogeneous effect based on mayor’s characteristics

	(1)	(2)	(3)	(4)
	Num. Proc.	Num. Proc.	Num. Proc.	Num. Proc.
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000)$	0.209*** (0.031)	0.196*** (0.031)	0.198*** (0.032)	0.186*** (0.056)
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times Degree_{m,t}$		-0.038 (0.024)		
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times Woman_{m,t}$			-0.045 (0.144)	
$Treat_{m,t} \times (25,000 \leq Bin \leq 40,000) \times High\_skill_{m,t}$				-0.006 (0.064)
Observations	847,846	847,846	847,846	847,846

The outcome variable is the inverse hyperbolic sine of the number of procurements in each bin for contracts of goods and services. The following controls are included: population, indicator whether the mayor is born in the municipality, the average of the controls for neighboring municipalities, year fixed effects and province-specific linear trends. I use the Conley standard errors to account for spatial HAC errors. Conley standard errors are computed for all the municipalities within a ten kilometre radius. Figure A.1 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

the contract in practice. Not surprisingly, I document how the mayor’s characteristics do not influence the bunching response after a neighboring dissolution. These results suggest how the infiltration of organized crime often involves multiple agents within the public body and that simply dismissing the elected officials might not be enough to reduce the influence of the criminal organization on the municipal activity.

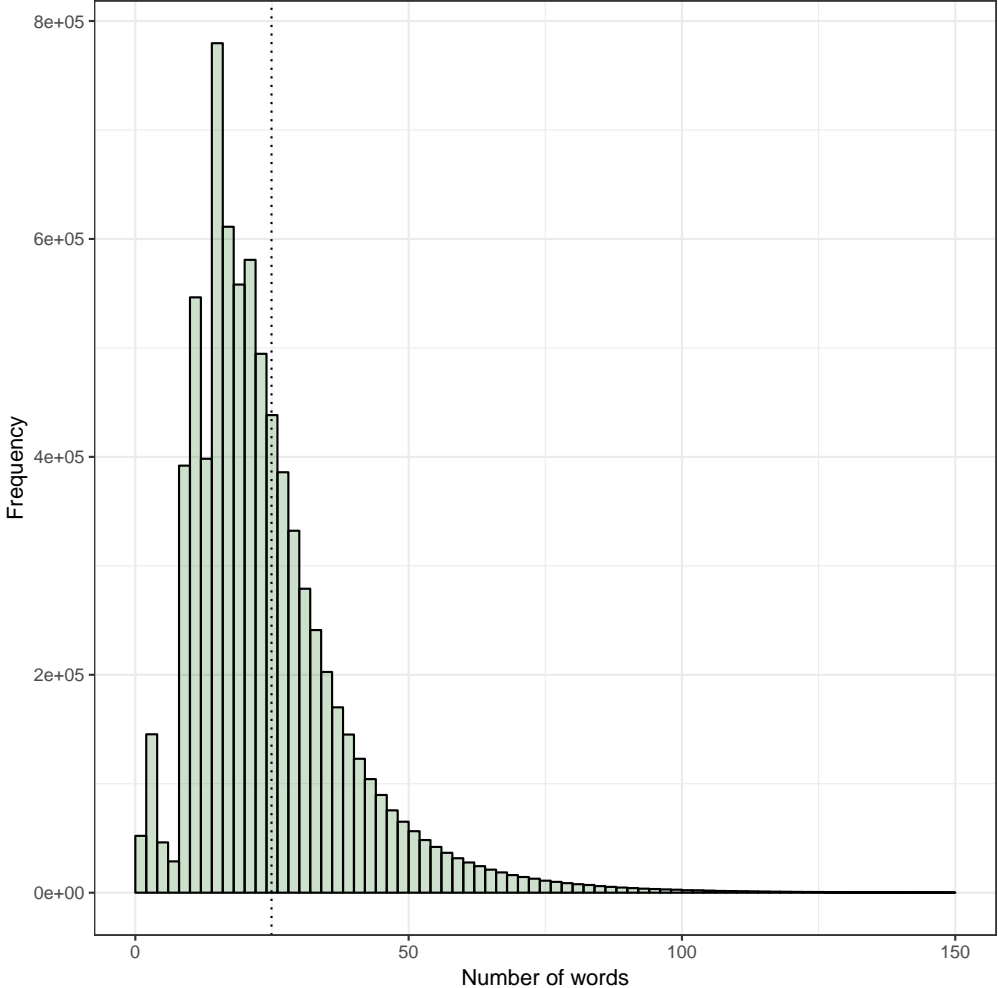
## E Description of Word Embedding

In this section, I illustrate in detail how I identify split projects. I show how text analysis can determine whether two contracts are related to the same object and belong to the same project. Since splitting a project in multiple contracts is illegal, the data reported to ANAC does not contain this information. I have to identify these cases indirectly. In particular, I exploit the description of the contract that municipalities have to provide regardless of the contract size. Indeed, municipalities have to describe the object of the contract to ANAC to justify the use of public resources. Unfortunately, there is no standard minimum requirement that municipalities have to satisfy in how detailed the description should be. Figure E.1 shows the distribution of the number of words used by the municipalities to describe their contracts



smaller than 40,000 Euro. After cleaning, municipalities provide descriptions of 25 words on average, but the vast majority of the descriptions contain less than 50 words.

Figure E.1: Distribution of the number of words in descriptions of the contracts



The Figure shows the distribution of the number of words in the descriptions of the contracts smaller than 40,000 Euro. The dotted line represents the average number of words used in the description.

Since the objective is to understand whether municipalities made their expenditure less transparent by splitting larger projects in multiple contracts smaller than the threshold, I focus only on contracts smaller than 40,000 Euros. Therefore, I compare the descriptions of contracts smaller than the threshold issued by the same municipality in the same year. I focus only on those pairs of contracts that summed together would make a contract larger than 40,000 Euros. Then, I compare the descriptions using a common text analysis technique, Word Embedding. Word Embedding is a language modeling technique from natural language

processing based on the co-occurrence of words. This technique represents the meaning of the words in a low-dimensional Euclidean space and specifies their meanings based on the words co-occurring with them. This implies that synonyms (which often do not appear in the same sentence) have a similar vector representation since they occur in similar contexts. Second, the direction of the difference between two words also conveys meaning. For example, going from the vector representing a country to the vector representing its capital city means taking a step in the 'capital city' direction. Taking the same step for vectors related to other countries brings us close to the 'capital city' vector as well.

The specific model I use is Word2Vec (Mikolov *et al.* (2013a)). The training objective is to find word representations useful for predicting the surrounding words in a sentence or document. Given a sequence of training words  $w_1, \dots, w_T$ , the objective of Word2Vec is maximising the following average log probability.

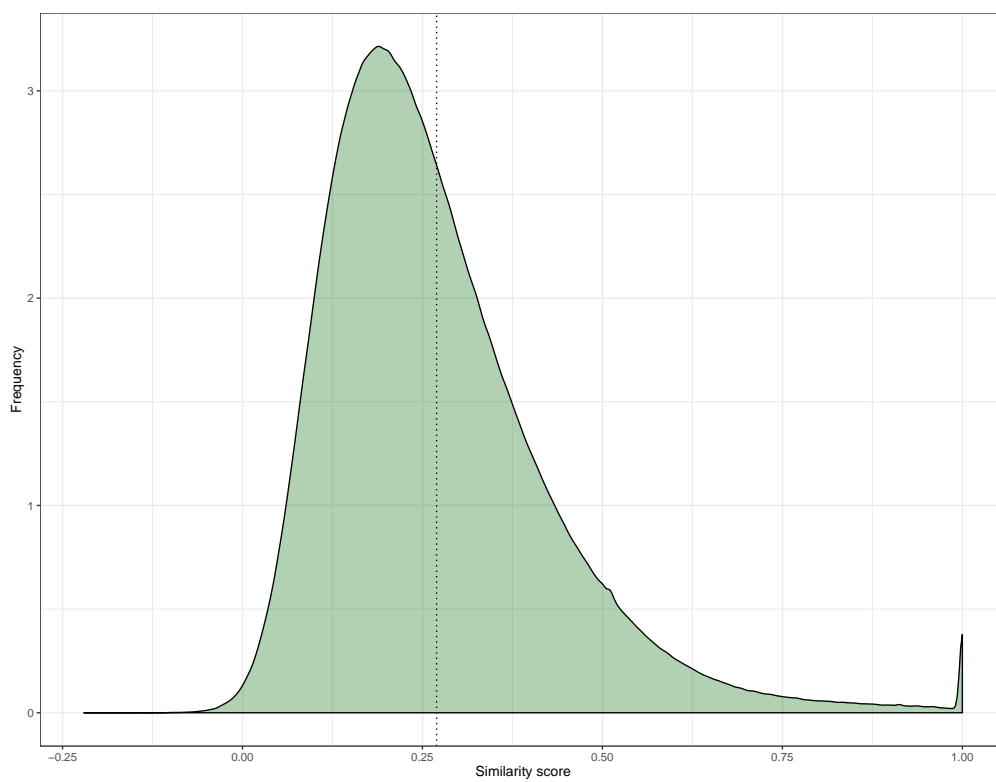
$$\frac{1}{T} \sum_{t=1}^T \sum_{-c \leq j \leq c, j \neq 0} \log[p(w_{t+j}|w_t)]$$

where  $c$  is the size of the training context. I train 300-dimensional vectors for 20 iterations and set a learning rate of 0.05.

Figure E.2 shows the distribution of similarities using Word2Vec. A negative value of similarity represents an opposite meaning of the descriptions; therefore, if two descriptions have a similarity score of -1, they have opposite meanings. On the other hand, the similarity of 1 implies that the two descriptions represent the same object. Word2Vec provides a stringent comparison between descriptions since the distribution is skewed towards the left and the average similarity between pairs of contracts is about 0.25. Some of the projects have descriptions with identical meanings since there is a discrete increase in the similarity distribution around 1. Therefore, there is evidence that municipalities issue pairs of contracts in the same year that could be part of a single contract larger than the threshold. In the results of Table 3, I consider part of the same projects the pairs of contracts with a similarity greater than 90 percent.

Finally, I verify whether Word2Vec provides reliable results. Table E.1 shows the sim-

Figure E.2: Distribution of the similarities with Word2Vec



The Figure shows the distribution of the similarity of the contracts using Word2Vec. The dotted line represents the average similarity between two contracts.

ilarity scores of four couples of contracts in the sample. The first two examples show how Word2Vec can recognise whether two contracts relate to a similar (but not identical) project. Indeed, it recognises that the contracts are for the same projects but two different locations (i.e., two different gyms or schools). Correctly, the similarity scores are close to 1 in both cases, but they are smaller than 0.9, and they are not counted as split projects. Instead, Word2Vec can also detect whether two contracts are related to the same object, but the descriptions use different words (or ordering). For example, the last two couples of the contract represent the same object and have a similarity above 0.9. In both cases, they are considered split projects.

Table E.1: Sample of similarity scores

Word2Vec Score	Description 1	Description 2
0.70	<i>Management of gym XXX Sep 2009-Aug2014</i>	<i>Management of gym YYY Sep 2009-Aug2014</i>
0.68	<i>Meals for school XXX academic year 2014-2015</i>	<i>Meals for school YYY academic year 2014-2015</i>
0.96	<i>Shelter for the elderly year 2011</i>	<i>Service for shelter for the elderly</i>
0.97	<i>Snow clearing</i>	<i>Service of snow clearing 2011/2012</i>

## F Signal of potential irregularities

Since public procurement is a long and complex process, irregularities can happen at different stages of the process. Therefore, ANAC lists the procurement process features to consider as indicators of potential irregularities (ANAC 2015). This report is published annually, and it should guide the law enforcement body in evaluating the procurement contracts. For the monitoring authority, the public body can pursue some illicit activities if the contract has the following features:

- Emergency clause.
- Same winner firm of many other contracts awarded by the same institution.
- Discriminatory requirements for bidding.

- A single bid auction.
- A subcontract.
- A contract renegotiation.
- The object of other contracts issued in a close period of time is the same (i.e. splitted projects).
- No advertisement of the tender.

The contract renegotiation is the only feature of the list that I have in the data; therefore, I study the reaction of the municipalities to a neighboring dissolution according to this dimension, considering it as one of the first outcomes that the law enforcement body would look at and it is also easy to monitor.