Sweeping the Dirt Under the Rug: Measuring Spillovers from an Anti-Corruption Measure [*]

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Abstract

Using data on Italian public procurement, I show that the implementation of a law enforcement measure on a municipal government has two effects on neighbouring municipalities. First, they increase the number of contracts under a threshold below which evidentiary requirements become less stringent, making it more difficult to prove any infraction. This response accounts for 1 percent of the yearly expenditure on large contracts. Second, they renegotiate fewer contracts, a practice that is often associated with corruption. The results suggest that, in response to law enforcement, local administrators exploit less monitored margins of the procurement process and engage less in activities that are signals of potential corruption so as to minimise scrutiny by law enforcement bodies. I provide evidence that this is indeed the case. Using a technique from natural language processing, I show that municipalities split large projects into contracts smaller than the threshold and the response occurs only in sectors that are more vulnerable to corruption (i.e. construction and waste management).

1 Introduction

Holding public officials accountable helps to prevent illegal activities such as corruption (United Nations (2004)). However, the implementation of measures to prosecute public officials who do not comply with the law can also influence the behaviour of other public bodies. Anti-corruption policies deter irregularities in neighbouring public bodies (Colonnelli and Prem (2017) , Galletta (2017), Avis *et al.* (2018) and Chabrost and Saussier (2018)), but deterrence is not the only possible consequence. If the measure triggers further investigations, non-targeted public bodies can strategically react to the anti-corruption measure to avoid future screening, especially if they have some type of connection with the target. I show that this is indeed the case, focussing on the behaviour of Italian municipalities.

I study the spillover effects of a national anti-corruption policy in Italy that targets municipalities colluding with organized crime. If there is evidence of collusion between elected officials and criminal organisations, the national government can dissolve a local administration. Under the policy, all elected public officials are replaced by three high-ranking members of the law enforcement body, nominated by the national government. I exploit the dissolutions of Italian municipal governments from 2011 to 2016 to analyse the response of the neighbouring municipalities. I use an event study strategy and observe the reaction of the municipalities that share a border with a dissolved municipality and compare it to the reaction of all Italian municipalities that do not share a border with it.

I focus on procurement contracts, using a novel dataset containing information on all the procurement contracts of all Italian municipalities. Public procurement involves a large segment of the Italian economy, representing approximately 10 percent of Italian GDP (Government (2013)). It is a sector vulnerable to corruption: all the cases of dissolution in this study were motivated by irregularities in the procurement sector.[1]

I focus the analysis on two relevant outcomes of procurement behaviour of the municipalities. First, I study the change in the number of contracts issued around a relevant threshold

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[1] The vulnerability of the procurement sector to corruption is not a peculiarity of Italy. The OECD estimates that 57 percent of the corruption cases in OECD countries happened in the procurement sector (OECD (2014)).

for the Italian procurement law (i.e. 40,000 Euros). Different rules apply for contracts smaller than the threshold, which decrease the paperwork required, the reporting requirements, and, for contracts of services and furniture only, increase the discretion of the public official in the choice of the winning firm. Therefore, contracts smaller than the threshold are less transparent and with fewer evidentiary requirements that law enforcement bodies can use to prove an illicit behaviour. Then I focus the analysis on renegotiations of contracts for public works. Renegotiating a contract implies awarding additional funds to the firm for the completion of the public work, due to unforeseen costs or complications. Excessive renegotiations of contracts are considered a signal of potential corruption by the Italian monitoring authority, since cases of corruption related to the renegotiations are common (Di Cristina (2012)).[2]

Municipalities react to the neighbouring dissolution by issuing a higher number of contracts smaller than 40,000 Euros. In particular, municipalities shift contracts of services and furniture from above to below the 40,000 Euro threshold, without changing the overall expenditure around it. The effect lasts on average longer than the dissolution itself. On average, municipalities increase the number of contracts smaller than 40,000 Euro by approximately 12 percent per year, during the years of the dissolution, and 26 percent afterwards.The effect corresponds to an annual shift below the threshold of approximately 1 percent of the expenditure above the threshold.[3] The neighbouring dissolution also deters municipalities from renegotiating contracts for public works during their execution. The probability of renegotiating an existent contract decreases on average by 4 percent and the value decreases approximately by 70 percent. The response on the renegotiations accounts for 9 percent of the yearly expenditure for public works.[4]

Municipalities respond to the neighbouring dissolution exploiting margins of the procurement process with fewer evidentiary requirements and engaging less in activities with higher

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[2]Ferraz and Finan (2011) and Coviello and Gagliarducci (2017) show how renegotiations are more likely when mayors have no re-election incentives.

[3]I consider the average annual expenditure in contracts larger than 40,000 Euro. The effect would consist in 18 percent of the yearly expenditure in contracts between 40,000 Euro and 100,000 Euro, and it would be approximately 6 percent of the average expenditure for contracts between 40,000 Euro and 250,000 Euro.

[4]I have considered only the public works larger than 150,000 Euro, since the information on renegotiations is compulsory only for those contracts.

risk of corruption. These responses are consistent with the hypothesis that municipalities attempt to minimise the scrutiny by law enforcement bodies, when a neighbouring municipality is dissolved. I provide two pieces of evidence to support this interpretation.

First, using a language modelling technique and approximate string matching, I show that municipalities increase the number of contracts below 40,000 Euro by splitting a single project worth more than 40,000 Euro into multiple contracts smaller than the threshold. I identify whether projects have been split in smaller parts in the following way. First, I compare the text describing the characteristics of the procured good in each contract using word embeddings, which is a language modelling technique used to capture the semantic meaning of the words, and approximate string matching.[5] If the municipality issues two contracts in the same year with a similarity of at least 95 percent under these critieria and the sum of the contracts' values is larger than 40,000 Euro, then I consider them to be part of the same project. A back-of-the-envelope calculation shows that the increasing in expenditure below 40,000 Euro is entirely due to the increase in split projects.

Finally, I show that the municipalities move contracts below the threshold in sectors in which the infiltration of criminal organisations is more likely, namely construction and waste management.[6] More than 70 percent of the dissolution cases were the results of infiltration in those two sectors.[7]

Therefore, establishing legal thresholds that change the procurement law might have unfortunate consequences. In 2018, the Italian legislator acknowledged that criminal organisations exploited the 40,000 Euro threshold to complicate the investigations of law enforcement bodies. The legislator ruled that, from 2019 onwards, awarding multiple contracts under the 40,000 Euro threshold to the same firm is an evidence of illicit behaviour that can justify a

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[5]Computing the similarity with an approximate string matching technique implies computing the similarity between two descriptions with four different string matching measures (i.e. the Levenshtein measure, the Demerau-Levenshtein, the Jaro and the Jaro-Winkler). Appendix A.3 describes the methodologies in details.

[6]It is not a contradiction that the contracts shifted below the 40,000 Euros are those of furniture and services but the response comes from construction and waste management. Indeed, both these sectors can have both public works, services and furniture.

[7] Infiltration in specific sectors is common for criminal organisation: organised crime seeks legal activities that can cover for money laundering (Transcrime (2017)).

dissolution.[8]

This paper relates to multiple strands of literature. First, it contributes to the literature on spillovers from monitoring. The most closely related papers by Colonnelli and Prem (2017), Galletta (2017), Avis *et al.* (2018) and Chabrost and Saussier (2018) find that law enforcement acts as a deterrent for misconduct in neighbouring municipalities. Conversely, Lichand and Fernandes (2019) show how anti-corruption audits can have negative effects, whereby other unmonitored municipalities engage with corrupt vendors by moving their activities from the audited municipality. My paper contributes to this literature by showing how law enforcement measures can encourage other public bodies to commit irregularities in a less inferable way for reducing the chance of scrutiny by law enforcement bodies.

Second, this paper contributes to a growing literature showing that, when under scrutiny, agents substitute activities to less well-monitored margins. There are examples of this type of response in the literatures on procurement (Gerardino *et al.* (2017)); taxation and subsidies (Asatryan and Peichl (2016), Carillo *et al.* (2017), Almunia and Lopez-Rodriguez (2018) and Daniele and Dipoppa (2018)) and corruption and crime (Yang (2008), Knight (2013), Niehaus and Sukhtankar (2013) and Dell (2015)). My paper contributes to this literature by showing that agents not monitored directly can have similar responses as well. When law enforcement bodies scrutinise the behaviour of a public administration, they may inadvertently incentivise unexpected responses from other institutions. Furthermore, my results also indicate the response of public bodies can be complex and involve multiple variables at the same time. Municipalities engage less in activities with higher risk of irregularities, but also increase the number of contracts with fewer evidentiary requirements.

Third, the project relates to the broad literature studying corruption in the procurement sector. The evidence shows that corruption acts as "grease in the wheel" for least productive firms to operate in the procurement sector (Colonnelli and Prem (2017)). In particular, this literature shows how more corrupt public officials exploit the higher discretion of some awarding procedures for awarding contracts to investigated (or politically connected) firms

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[8]Ruling of *Consiglio di Stato, Sez. III, Sent. 26/09/2019, n.6435*.

(Baltruinate *et al.* (2018) and Decarolis *et al.* (2019)). This paper contributes to this literature by showing an unexplored mechanism of how public bodies can enforce an high level of discretion. Municipalities split larger projects into multiple smaller contracts to award contracts without the use of public tender.

Fourth, this project contributes to the literature that shows why public bodies change contracts' values so that they are below legal thresholds (Palguta and Pertold (2017) and Szucs (2017) and Baltruinate *et al.* (2018)). This literature suggests that public bodies exploit changes in the procurement law in order to award contracts to a specific firm. The contribution of my paper is twofold. First, I show that public bodies could exploit legal thresholds for different purposes as well. The results of my paper are consistent with the hypothesis that municipalities change contract values in order to limit the availability of circumstantial evidence of a potential irregularity. I also show a potential mechanism behind the shift towards contracts below the threshold. Municipalities split a large project in multiple smaller contracts without changing the size of the total project. This is consistent with municipalities strategically exploiting the legal threshold without impacting real variables such as quality of the good, which would be more likely to be affected with a change in the project size.

Finally, this paper relates to the literature that show the determinants of renegotiations of a contract. Renegotiations are more likely either if the mayor is more tenured or does not face any re-election incentive (Ferraz and Finan (2011) and Coviello and Gagliarducci (2017)), or if the project is smaller or more complex or it is awarded with private negotiation or a first price auction (Decarolis (2014), D'Alpaos *et al.* (2013) and Decarolis and Palumbo (2015)). I show how renegotiations can be a relevant outcome to study when focussing on the response to anti-corruption measures. In this case, the municipalities can use the renegotiations of a contract for the award of additional resources to the winner firm.

The remainder of the paper proceeds as follows. Section 2 provides the institutional background to the law enforcement measures and public procurement in Italy. Section 3 describes the data. Section 4 illustrates the empirical strategy. Section 5 shows the results on the number of contracts below the 40,000 Euro. Section 6 analyses the mechanisms behind the shift of

contracts from above to below the threshold. Section 7 shows the results on the renegotiation of contracts for public works and Section 8 discusses the robustness checks. Finally, Section 9 concludes.

2 Institutional Setting

In this section, I discuss the main features of the institutional setting. First, I describe the law enforcement measure, which limits the influence of organised crime on municipal governments. Then, I describe the procurement outcomes that I use in this study, in particular, how contracts change around the 40,000 Euro threshold. I discuss why the 40,000 Euro threshold is relevant and how changes in the procurement law affect the probability of detection of irregularities. Finally, I discuss why studying the municipalities' response to the probability of renegotiating an existing project is relevant for my study.

2.1 The law enforcement measure

During the 1980s, the infiltration of mafia clans into local administrations became increasingly common. In the 1990s, the national government introduced stricter regulations for tackling collusion among public officials and criminal organisations. In particular, the law 164/1991 introduced the dissolution of a municipal government for mafia infiltration. The national government can decree the dissolution of a municipal government, when the law enforcement bodies provide evidence of direct (or indirect) links between members of the local government and the mafia.

When a municipal government is dissolved, the elected officers are replaced by three high-ranking members of the law enforcement bodies (the *Commissioners*). The commissioners replace the elected officials in all of their duties, and they only deal with the ordinary business of the municipality. Their objective is to reduce the influence of the criminal organisation on the municipal government. Acconcia *et al.* (2014) and Galletta (2017) show how dissolved municipalities reduce the level of investment in the municipality substantially during

Figure 1: Map of the dissolutions
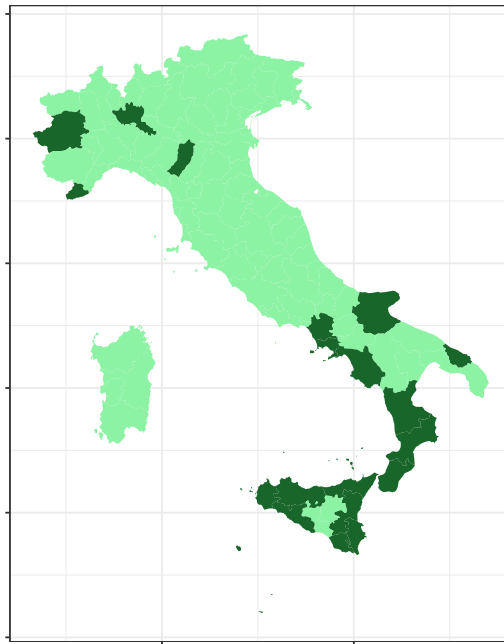
The map shows the Italian provinces where there has been at least a dissolution in the period of my analysis (2011-2016).

the dissolution, keeping constant the amount of current expenditure.[9] The law prescribes the dissolution to last between 12 and 24 months, although they usually last between 24 and 36 months.[10] After the dissolution, the municipality holds new elections for the municipal government.

Figure 1 shows the geographical distribution of the dissolutions in the period of my analysis. Most of the dissolutions are in the south of Italy, in particular in Sicily, Calabria and Campania.

The dissolution has several steps. In some cases, the process starts with a police investigation that identifies connections between municipal officials and organised crime[11]. The investigation may begin for reasons which are extraneous to the direct involvement of the mafia in the municipal government.[12]

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[9]In Appendix A.2 I show the change in procurement behaviour of the dissolved municipalities. There is no change around the 40,000 Euro threshold, but results are consistent with findings from Galletta (2017) who studies the total level of expenditure.

[10]As shown in the Appendix A.2

[11]As shown in Figure 11, the process for the dissolution started with an arrest on in 36 percent of the cases

[12]*Commissione parlamentare d'inchiesta sul fenomeno delle mafie e su altre associazioni criminali, anche*

Then, the provincial[13] prefect establishes a commission in charge of evaluating the municipality's activities for three months. The goal of the commission is to provide both evidence of the existence of a connection between the municipality and organised crime, and circumstantial evidence of the influence of the criminal organisation on the municipality's behaviour. The evidence may also not constitute a crime, since the dissolution is a precautionary measure to limit the influence of the criminal organisation, but it has to prove objectively the influence of organised crime on the municipality. Therefore, the national state considers as objective evidence behaviours like awarding contracts to firms owned by mafia members or the illicit use of the emergency clause. Awarding contracts smaller than 40,000 Euro directly to a firm is not considered objective evidence of the influence of organised crime. Interestingly, on September 2018 a verdict also included the direct award of multiple contracts smaller than 40,000 Euro to the same firm as an objective circumstantial evidence that justifies dissolution (*Consiglio di Stato, Sez III, 10/01/2018, n.96*). This verdict acknowledges how vulnerable small contracts are to corruption and it also highlights how the 40,000 Euro threshold is relevant for this topic in the Italian case.

At the end of the three months, the commission produces a report for the Italian *Ministry of Interior* within 45 days. Finally, the national government and the President of the Republic validate the decision. What is relevant for this study is that municipalities have no prior information on the dissolution of a neighbouring municipality in the years prior to its implementation and the entire process that concludes with the dissolution lasts at most 10 months.[14]

When implementing a dissolution, the law enforcement body publishes a detailed report describing the motivations for the dissolution. I use those reports to collect information on the irregularities in the procurement sector that the law enforcement bodies found during the investigation, and what sector organised crime infiltrated in the dissolved municipality.[15] The

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straniere (2005).

[13]Italian provinces are the smallest institutions after the municipality. There are 110 provinces in Italy.

[14]The national law n.410/1991 states explicitly the steps and the timing of the dissolution.

[15]Figure 12 and 13 shows respectively the irregularities that the law enforcement bodies found in the procurement activity of the dissolved municipalities and the sectors in which organised crime infiltrated.

most frequent reason for the dissolution is the failure to verify the identity of the owner of the winning firm as a mafia member. Unfortunately, I have no information on the identify of the winning firm of the procurement contracts in the data.

The second most frequent motivation is the one that I exploit in this study. That is, the municipality exploited the emergency clause to award a procurement contract larger than 40,000 Euro directly to a firm even in the absence of any emergency. In this way, the municipality could award the contract directly to firms owned by criminal organisations without the use of the public tender. In Section 5, I show that, after a dissolution, neighbouring municipalities increase the number of procurement contracts smaller than 40,000 Euro rather than using the emergency clause to award larger contracts directly.

Criminal organisations infiltrated more frequently in two sectors of the dissolved municipalities. Some sectors are more vulnerable to the infiltration of organised crime. They share common features that make them particularly suitable for infiltration. First, the quality of the good is difficult to assess, so criminal organisations can earn additional profit providing goods of lower quality. Second, their activities are difficult to monitor, so these business can also become a legal cover for money laundering of illegal activities.[16] In approximately 70 percent of the dissolution cases, the criminal organisations infiltrated in two sectors: construction and waste management. In the remaining 30 percent of cases, they infiltrated in one of the other 44 sectors of the municipal activity. In Section 6, I show that the response comes only from contracts related to construction and waste management, in which criminal organisations are particularly likely to infiltrate.

Finally, I focus my attention on the reaction of neighbouring municipalities after a dissolution for two reasons. First, criminal organisations often influence the economy of large areas. There are many examples of criminal organisations influencing multiple neighbouring municipalities at the same time (DIA (2016)). Second, municipalities can react to a neighbouring dissolution because they perceive that it is more likely to be scrutinised next. Many cases of dissolution had provided enough evidence of illicit regarding other public bodies that

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[16]The Italian Law n. 190/2012 states all the sectors of the economy more vulnerable to infiltration of criminal organisations. The waste management and construction sectors are the two most classical examples.

justified the dissolution of nearby municipalities as well.[17]

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 from that for services and furniture. Similarly, Italian procurement law changes depending on the value of the contract: larger contracts have stricter regulation.

There is a relevant threshold at 40,000 Euro. The law n.163/2006 prescribes three changes in the law for contracts smaller than the threshold. First, contracts under 40,000 Euro are less transparent, since the municipality does not have to publish any documentation for awarding the contract. Second, municipalities have to incur lower administration and compliance costs (i.e. red tape costs). For example, municipalities do not have to supply as much information about contracts smaller than 40,000 to the Italian monitoring authority (*ANAC*).

Finally, municipalities can legally award a procurement contract smaller than 40,000 Euro directly to a firm, avoiding the public tender. The procedure for contracts larger than 40,000 Euro is different depending on the type of good procured. Contracts for public works can be awarded without public tender regardless of size, but a public tender must be used for larger contracts of services and furniture. 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.

Figure 2 shows the distribution of the procurement contracts by face value. Municipalities have strong incentives to design contracts just below the 40,000 Euro threshold. Municipalities issue approximately ten times more procurement contracts every year just below 40,000 Euro than just above.[18]

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[17]An example is the dissolution of Giugliano in 2013 that provided enough evidence of collusion between other municipalities and the clan of *Casalesi* to motivate other four dissolutions in the same province (DIA (2013)).

[18] The average number of contracts between 35,000 and 40,000 issued in a year is 2.16, while it is 0.22 for contracts between 40,000 and 45,000 Euro.

Figure 2: Distribution of contracts by face value
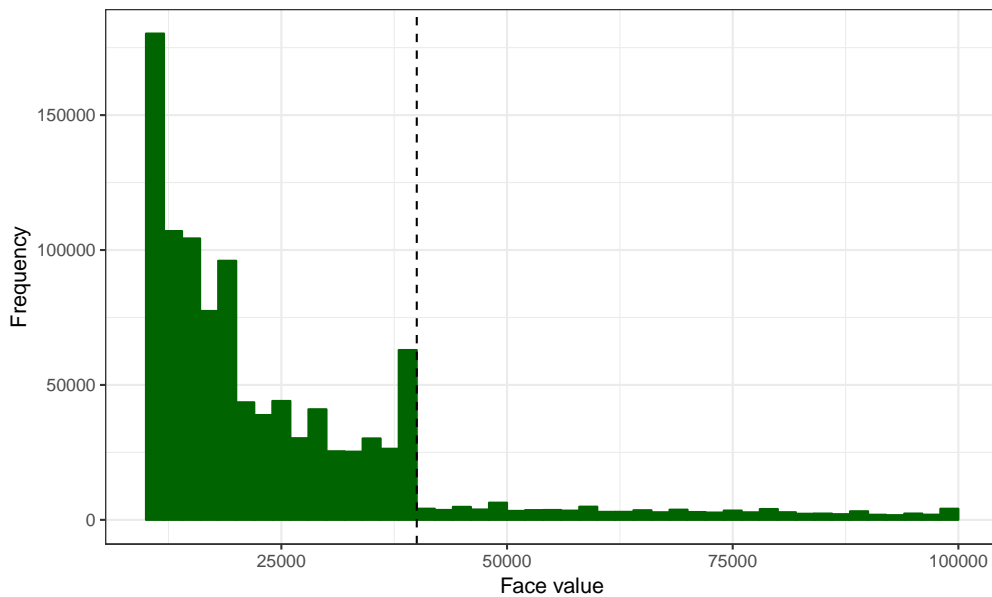
The figure shows the distribution of the procurement contracts by face value. There is a substantial bunching at the 40,000 Euro threshold (dashed line). The figure does not include contracts larger than 100,000 Euros. Figure 8 shows the distribution with all the procurement smaller than 1,000,000 Euros.

It is easier to detect irregularities for contracts of services and furniture larger than 40,000 Euro for two reasons (Corradino *et al.* (2017)). First, the municipality must use a public tender. This involves a larger number of economic agents and, therefore, there is a higher probability that one of them detects (and reports) an irregularity. The municipality can try to avoid issuing public tender by misusing the emergency clause. Even though the overexploitation of the emergency clause is common in the Italian procurement sector (ANAC (2018)), it is risky. The law enforcement body can verify whether there was an emergency and investigate if there was not.[19]

On the other hand, detecting irregularities in contracts smaller than 40,000 Euro is more complicated since the municipality can award the contract, without a public tender. The law enforcement body has to find other sources of evidence to trigger a formal investigation.

Several steps of the procurement process are particularly vulnerable to illicit behaviours.

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[19]Figure 12 shows how often the law enforcement body exploits the wrong use of the emergency clause to motivate a dissolution. In fact, the overexploitation of the emergency clause is the second most frequent motivation for the dissolutions in my period of analysis.

Every year ANAC publishes a report describing the phases of the procurement process that the law enforcement bodies should monitor more closely and the common signs of illicit behaviours (ANAC (2015)).[20] In particular, I focus on the renegotiations of the contracts of public works.[21]

In a renegotiation the winning firm requests additional funds to complete the contract, due to unforeseen costs or complications. The firm can seek additional resources up to one fifth of the original contract's value. The renegotiation is not meant to change the quality of the good procured: it should only allow the winning firm to complete the original contract.

Figure 3 shows the average share of public works that had a renegotiation in the different Italian provinces. There is a lot of heterogeneity, since firms use renegotiation in many situations, not necessary related to corruption. Nevertheless, renegotiating a contract for public works is also a common practice in areas where organised crime is widespread, like Sicily.

3 Data and descriptive statistics

The primary source of data is the universe of procurement contracts issued by all Italian municipalities from 2011 to 2016. The data contains 7,965,123 contracts, and a large share of them are tiny: the average size of a contract is 18,453 Euro, and the median is 1,230 Euro. ANAC collects the data, and it is also in charge of monitoring the procurement sector. For each contract, the data contains information on: its value, the purchasing municipality, the awarding mechanism (e.g. public tender or discretionary procedure), date of the purchase and a description of each item. For contracts of public works larger than 150,000 Euro, the data also contains information on the renegotiations from 2007 to 2016, the date of the renegotiation and its value. The data details additional information on the good procured for contracts

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[20]In Appendix A.7, I list all the parts of the procurement process that the monitoring authority suggests to monitor more closely since they are more vulnerable to corruption.

[21]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.

Figure 3: Map of the share of renegotiation in the Italian provinces.
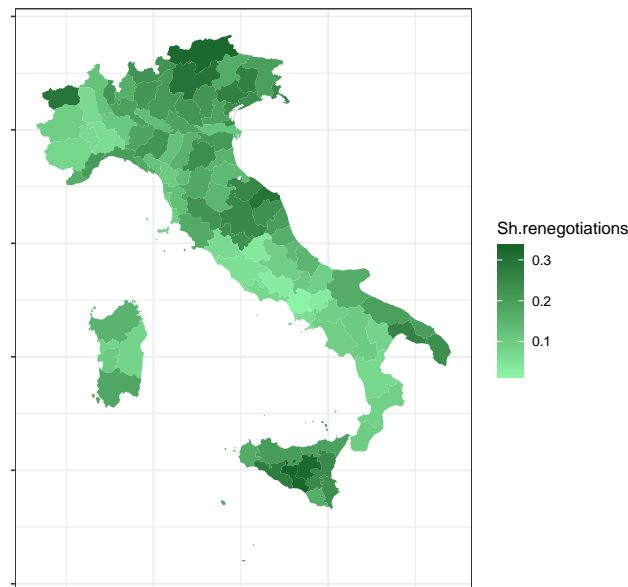
The map shows the average share of renegotiations in the contracts for public works issued in each Italian province. In the Appendix A.7, I show the geographical distribution of the average value of the amendments.

larger than 40,000 Euro. In particular, each contract larger than 40,000 Euros is associated with a 9 digit code (i.e. the *CPV*) that categorises the type of good in detail.[22]

I also include municipal characteristics (i.e. population) from the Italian national bureau of statistics (*ISTAT*) and mayors' characteristics (i.e. place of birth and the number of years until the next election) from the Home Department.

Table 1 shows descriptive statistics of the variables of interest. I highlight four different facts: municipalities issue more contracts immediately below the 40,000 Euro threshold; the expenditure around 40,000 Euro accounts for approximately 10 percent of average yearly expenditure of the municipalities; approximately one-third of public works are subject to renegotiations, and municipalities often avoid the use of public tender when awarding contracts between 40,000 Euro and 100,000 Euro. Public tenders are used in approximately one-fifth of contracts for services and furniture. This suggests that municipalities often exploit the emergency clause to award larger contracts.

Figure 4 shows that municipalities exploit the conditions in the procurement law at 40,000

[22]The CPV establishes a single classification system for public procurement used to describe the subject of the contract. More info at https://simap.ted.europa.eu/cpv .

Table 1: Descriptive statistics

	All municipalities	
	Mean	Standard deviation
Procurement		
N. contracts	171	(229)
N. contracts btw. 10,000 and 40,000 Euro	19	(38)
N. contracts btw. 40,000 and 100,000 Euro	2	(10)
Expenditure (in thousands Euro)	3,204	(50,386)
Exp. btw. 10,000 and 40,000 Euro (in th. Euro)	181	(434)
Exp. btw. 40,000 and 100,000 Euro (in th. Euro)	139	(695)
Sh. public works	0.185	(0.141)
Sh. services	0.476	(0.138)
Sh. furniture	0.338	(0.125)
Sh. renegotiations	0.282	(0.400)
Sh. pub. tender btw. 10,000 and 40,000 Euro	0.035	(0.103)
Sh. pub. tender btw. 40,000 and 100,000 Euro	0.147	(0.297)
Sh. pub. tender btw. 40,000 and 100,000 Euro for services and furniture	0.197	(0.344)
Sh. pub. tender btw. 40,000 and 100,000 Euro for public works	0.098	(0.278)
Municipalities characteristics		
Population	7,277	(40,297)
Local mayor	0.39	(0.48)
N. neighbours	5.89	(2.12)
N. mun. within 10km	14.1	(11.1)
N. of contracts	7,965,123	
N. of municipalities	7,753	
N. of treated municipalities	176	

The table summarises the following yearly variables: *N. contracts* is the average number of contracts issued. *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 share of contracts that are about public goods, *Sh. services* is the average share of services, while Sh. furniture is the average share of furniture. *Sh. renegotiations* is the average share of contracts for public works larger than 150,000 Euro that have been renegotiated. *Sh. pub. tender btw. 10,000 and 40,000 Euro* is the average share of contracts between 10,000 and 40,000 Euro awarded with public tender. *Sh. pub. tender btw. 40,000 and 100,000 Euro* is for contracts between 40,000 and 100,000 Euro. Finally, the municipality's characteristics are: average population, average share of mayors who are born in the municipality, average number of neighbour municipalities, average number of neighbouring municipalities and average number of municipalities within a 10 km radius. The treated municipalities are the municipalities sharing a border with the dissolved municipality.

Euro when a neighbouring municipal government is dissolved. The number of contracts just below the 40,000 Euro for services and furniture increases substantially, after the dissolution. There is no change in the distribution of contracts for public works.

Figure 4: Bunching pre (and post) a neighbour's dissolution by procurement type
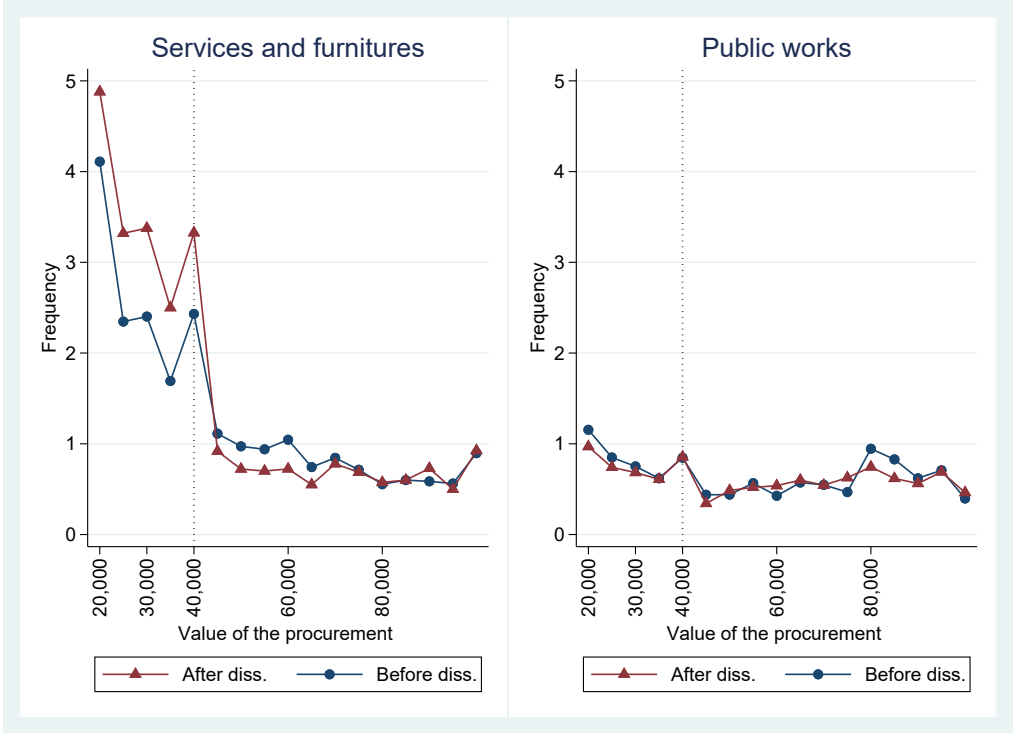
The figure shows the bunching for the neighbour municipalities before and after the dissolution for the different types of procured good. The bin size is 5,000 Euro. The contracts for services and furnitures are the only one bunching at 40,000 Euro. This suggests that the relevant change in the law that neighbour municipalities exploit is the possibility of awarding the contracts smaller than 40,000 Euro without public tender. This is the only change in the law at 40,000 Euro that affects only services and furnitures.

4 Empirical strategy

The identification strategy relies on the exogeneity of the treatment, that is the exact timing of the dissolution of a municipality being as good as random. The exogeneity assumption would be compromised if the neighbouring municipalities have information on the start of the process resulting in the dissolution. For example, the neighbouring municipalities could infer that a dissolution will be implemented soon if an arrest of a public official systematically anticipates it. This does not seem to be the case since, between 2011 and 2016, only 26

out of 73 dissolutions had any arrested public official before their implementations.[23] The exogeneity assumption would be compromised if the municipalities knew in advance about the start of the dissolution. Law n.410/1991 describes the process of the dissolution in all its steps and it specifies how there should be no information disclosure on the dissolution before its implementation.

Therefore, the empirical strategy is based on multiple dissolution shocks happening at different times in different areas of Italy. I estimate both a triple difference-in-difference and a difference-in-difference, comparing municipalities with a neighbouring 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, they are computed from Equation (1). The contracts issued by each municipality in every year are split into bins of 5,000 Euro each. Therefore, the resulting estimation strategy is a triple difference-in-difference in which the outcome variable is the number of contracts for services and furniture 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 treated and control municipalities, before and after the implementation of the dissolution and 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 Treat_{-m,t} + \delta_1 AfterTreat_{-m,t} \\
&+ \beta_0 Treat_{-m,t} \times \mathbb{1}\{25,000 \leq b \leq 40,000\} + \\
&+ \beta_1 AfterTreat_{-m,t} \times \mathbb{1}\{25,000 \leq b \leq 40,000\} + \gamma_0' X_{m,t} + \gamma_1' \overline{X}_{-m,t} + \epsilon_{b,m,t}
\end{aligned}
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(1)

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[23]Information on arrested public officials has been collected from newspapers articles collected on Factiva. I would like to thank Gianmarco Daniele and Tommaso Giommoni who allowed me to double-check my findings on the arrests with their data. Figure 11 shows the geographical distributions of the arrests and dissolutions between 2011 and 2016. There were 171 arrests of public officials and 73 dissolutions.

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 α terms are respectively bin, municipality and year fixed effects. $Treat_{-m,t}$ is a dummy taking a value one if it is the first, second or third year since commissioners are in charge of a neighbouring dissolved municipality. The variable $AfterTreat_{-m,t}$ takes value one if it is one or two years since the commissioners left a neighbouring dissolved municipality. $X_{m,t}$ are municipality controls, and $\overline{X}_{-m,t}$ 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 and the number of years remaining before the next election to account for political cycles. All the standard errors account for spatial heteroskedasticity and autocorrelation for all municipalities within a ten kilometres radius (Conley (2008)).[24] The main coefficients of interest are β_0 and β_1. β_0 shows the differential effect of nearby dissolution on the number of contracts between 25,000 Euros and 40,000 Euros. β_1 shows whether the effect persists for contracts between 25,000 Euros and 40,000 Euros in the years after the dissolution as well.

In order to provide evidence on the mechanisms of Section 6.2 I use Equation 2, which is a specification at the municipality-year level:

$$
\begin{aligned}
Y_{m,t} = \alpha_m + \alpha_t + \beta_0 Treat_{-m,t} + \beta_1 AfterTreat_{-m,t} \\
+ \gamma_0' X_{m,t} + \gamma_1' \overline{X}_{-m,t} + \epsilon_{m,t}
\end{aligned}
\tag{2}
$$

I use Equation 2 for two different outcomes: first, the outcome in Section 6.1 is yearly expenditure on contracts issued for split projects. In particular, two contracts are considered to be split if the same municipality issues them in the same year, the similarity of their descriptions is above 95 percent for one of the two similarity measures that I use and the sum of the contracts size is larger than 40,000 Euro. Second, in Section 6.2, $Y_{m,t}$ corresponds to the number of contracts issued above the 40,000 Euro threshold for two different sectors:

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[24]I would like to thank Thiemo Fetzer and Solomon Hsiang for sharing online their codes for running the Conley standard errors. http://www.trfetzer.com/conley-spatial-hac-errors-with-fixed-effects/ and http://www.fight-entropy.com/2010/06/standard-error-adjustment-ols-for.html .

those in which the infiltration of organised crime is more likely (i.e. construction and waste management), and all others combined.

Finally, I use a contract-level specification for Section 7. I exploit the information on the type of object procured, [25] to compare changes in the likelihood of having a renegotiation and its average value, controlling for time-invariant characteristics of the good. Therefore, Equation 3 is the regression equation for Section 7:

$$
\begin{aligned}
\mathbb{1}\{Amendment_{g,m,t} = 1\} = \alpha_g + \alpha_m + \alpha_t + \beta_0 Treat_{-m,t} + \beta_1 AfterTreat_{-m,t} + \\
+ \gamma_0' X_{m,t} + \gamma_1' \overline{X}_{-m,t} + \epsilon_{g,m,t}
\end{aligned}
\tag{3}
$$

The notation of Equation 3 and controls do not change with respect to Equations 1 and 2. Since it is a contract-level regression, I also control for a type of good fixed effect (i.e. α_g). In the following sections, I show results of the above-mentioned regression equations.

5 Results on contracts below the 40,000 Euro threshold

In this section, I show the effect of a neighbouring dissolution on the number of contracts smaller than 40,000 Euro. Table 2 shows the results of Equation 1 using all the contracts for services and furniture smaller than 70,000 Euro. The number of contracts below 40,000 Euro increases on average by approximately 12 percent during the neighbouring dissolution and 26 percent afterwards. The coefficients are all stable to the inclusion of province-specific linear trends and controls.

Figure 5 shows the effect of a neighbouring dissolution on the number of contracts smaller than 40,000 Euro from Equation 1 for all the years before, during and after the dissolution. There is no anticipation effect of the neighbouring dissolution. During the dissolution, neighbouring municipalities increase the number of procurements between 25,000 and 40,000 Euro from 8 to 24 percent on average. The effects of the implementation of a law enforcement mea-

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[25] I use the first four digits of the *CPV* as fixed effects. The first four digits of the CPV allows me to categorise the contracts in 949 different categories of good.

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

	(1) Num. Proc.	(2) Num. Proc.	(3) Num. Proc.
$Treat_{m,t} \times (25{,}000 \leq \text{Bin} \leq 40{,}000)$	0.1234***	0.1212***	0.1215***
	(0.0270)	(0.0272)	(0.0272)
$AfterTreat_{m,t} \times (25{,}000 \leq \text{Bin} \leq 40{,}000)$	0.2770***	0.2661***	0.2660***
	(0.0664)	(0.0648)	(0.0648)
Bin Fe.	Y	Y	Y
Controls	N	Y	Y
Province linear trends	N	N	Y
Observations	507,204	507,204	507,204
Baseline Mean	5.65	5.65	5.65

The outcome variable is the inverse hyperbolic sine of the number of procurements for services and furniture 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

sure in a neighbouring municipality are long lasting: they persist longer than the duration of the dissolution. A simple back-of-the-envelope calculation shows that the effect corresponds to an annual shift of 18 percent of the yearly expenditure on contracts between 40,000 and 100,000 Euros.

There might be different mechanisms explaining the municipalities' responses, hence it is difficult to interpret the results of the section without further analysis. In Section 6, I provide evidence to corroborate the hypothesis that the increase in the number of smaller contracts is an attempt to minimise scrutiny by law enforcement bodies exploiting less monitored margins of the procurement process.

6 Mechanisms

I discuss two results that help to interpret the findings in Section 5. In Section 6.1 I show that municipalities increase the number of contracts below the threshold by splitting a large project in multiple (smaller) contracts. In this way, the size of the project would not change, but the municipality could issue contracts smaller than 40,000 Euro.

Figure 5: Effect of the dissolution on bunching at 40,000 Euro
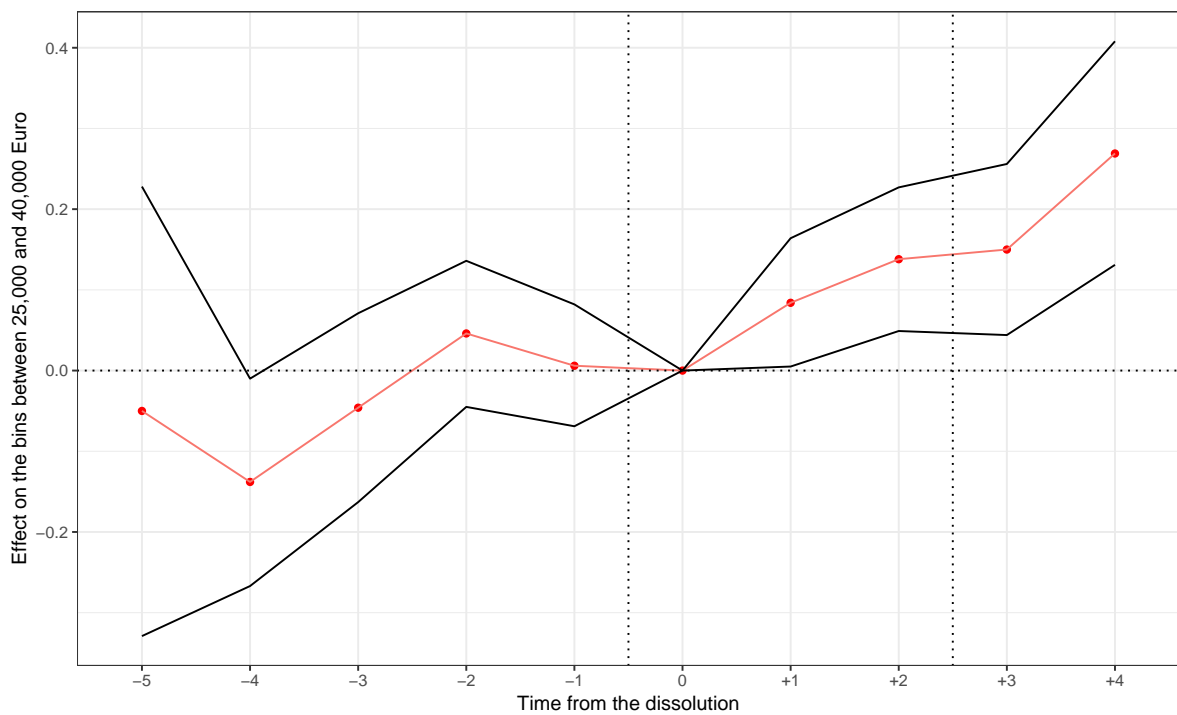
The Figure shows the effect of neighbouring dissolution on the number of procurements for services and furniture issued below the 40,000 Euro by treated municipalities. Coefficients represent the percentage increase in the number of procurement between 25,000 and 40,000 Euro issued before, during and after the neighbouring dissolution. The time 0 is the year of the dissolution, while commissioners are in charge up to year 3.

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In Section 6.2, I show that contracts moved from above the 40,000 Euro threshold are those related to the sectors that organised crime is more likely to infiltrate. These sectors are construction and waste management and they are identified from the dissolutions reports. They show that criminal organisation infiltrated those sectors in 70 percent of the dissolutions.

6.1 Splitting a single project in multiple contracts

A municipality can keep contracts below the 40,000 Euro threshold by deciding to invest less resources in the project, this would imply issuing a smaller contract and impacting variables such as quality of the good, efficiency or corruption. Alternatively, the municipality can break a larger contract into multiple smaller contracts. Splitting would make the award of the overall project less transparent and would provide fewer circumstantial evidence for the law enforcement bodies to prove any potential irregularity without necessarily affecting real variables such as quality of the good.

I exploit the description of the procured good in each contract to determine whether two contracts are related to the same object and therefore could have been issued in a single (larger) contract. In particular, I compare the descriptions of all contracts smaller than 40,000 Euro, but jointly larger than the threshold, issued in the same year by the same municipality.

I compare the descriptions of the contracts using two different methods.[26] First I measure the similarity of the descriptions between two contracts with four different similarity measures: the Levenshtein measure, the Demerau-Levenshtein measure, the Jaro, and Jaro-Winkler measures. These are different ways to compute the similarity (i.e. the distance) between two matched descriptions for approximate string matching. For example, the Demerau-Levenshtein measure defines the distance between two strings by counting the minimum number of operations needed to transform one string into the other, where an operation is defined as an insertion, deletion or substitution of a single character, or a transposition of two adjacent characters. The main weakness of this method is in the way of computing similarity. These four measures do not capture the meaning of the words, but they only count the number of

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[26]In Appendix A.3, I describe the two methods in details.

changes needed to make the two descriptions identical. Therefore, a use of different words to describe the same object (e.g. synonyms) could invalidate the results.[27]

Therefore, I complement these findings with a further analysis using word embeddings, a language modelling technique from natural language processing based on the co-occurrence of words to preserve their semantic meaning. In particular, the specific model I rely on is Word2Vec (Mikolov *et al.* (2013)). Word embeddings allows me to compare the meanings of the descriptions, allowing changes like synonyms and different ordering of the words. Appendix A.3 shows the similarity scores with both methods for a sample of descriptions from the data. Word2vec performs better in capturing the differences in meanings between the contracts' descriptions.

Table 3 shows the results of Equation 2, using as outcome variable the yearly expenditure on split projects of services and furniture. In Table 3, two contracts are considered part of the same project if they are issued by the same municipality, in the same year, the joint value of the two projects is larger than 40,000 Euro and the similarity between the descriptions is at least 95 percent.[28]

The use of two different methods for computing the similarity of the contracts' descriptions does not change the interpretation of the results. The main results are in column 2, in which Word2Vec is used to compute the similarity between the descriptions. After the dissolution of a municipal government, neighbouring municipalities increase the average expenditure on split projects by approximately 27 thousand Euro on a baseline of 45 thousand. The effect persists both during the presence of the commissioners and after they leave the dissolved municipality.

I complement the results in Table 3 with an analysis of the total yearly expenditure in contracts around the 40,000 Euro threshold. Table 4 shows the results of Equation 2, where the outcome variable is the yearly total expenditure on contracts for services and furniture of different sizes. In this way I show that municipalities are only making their public expenditure

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[27]For example, the maximum similarity between the word *street* and *road* using the four above-mentioned measures is 0.472, on a maximum of 1, even thoug they are synonyms.

[28]Appendix A.5 shows the results with different thresholds of similarity for both techniques.

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

	Word2Vec		Appr. string matching	
	(1)	(2)	(3)	(4)
	Exp.	Exp.	Exp.	Exp.
$Treat_{m,t}$	42,831***	27,645**	19,720***	14,362**
	(11,923)	(12,092)	(7,029)	(7,196)
$AfterTreat_{m,t}$	57,483***	39,286*	30,755***	25,738**
	(21,254)	(20,993)	(11,651)	(11,751)
Province linear trends	N	Y	N	Y
Observations	37,973	37,973	37,973	37,973
Baseline mean	45,148	45,148	24,000	24,000

The outcome variable is the expenditure on split projects of services and furniture (i.e. contracts smaller than 40,000 Euro which are about the same object and pooled together would be a contract larger than 40,000 Euro) identified using Word2Vec and approximate string matching to compare the objects' descriptions. Two contracts are considered to be part of the same project if the similarity is 95 percent or higher. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

less transparent, with no change in the total amount spent around the threshold.[29]

Therefore, results of Table 3 and 4 show that municipalities do not change the level of expenditure during a neighbouring dissolution, but they increase the share of the expenditure on less transparent contracts, that are more difficult for the law enforcement to monitor.

6.2   Results by types of good

In this section, I analyse what contracts municipalities move below the 40,000 Euro threshold during a neighbouring dissolution. I focus on what sectors the objects of the contracts are. As described in the dissolution reports, criminal organisations infiltrated dissolved municipalities in particular in two sectors of the municipalities activity: construction and waste management. Therefore, I exploit the detailed information for contracts larger than 40,000 Euro to analyse whether municipalities moved construction and waste management contracts below

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[29]Appendix A.5 shows the results on the yearly expenditure considering contracts of different sizes.

Table 4: Effect of the dissolution on the expenditure around the threshold.

	(1) Expenditure	(2) Expenditure	(3) Expenditure
$Treat_{m,t}$	20,853	17,673	6,747
	(15,174)	(13,751)	(8,577)
$AfterTreat_{m,t}$	62,112***	62,992***	58,378***
	(23,831)	(23,508)	(17,333)
20,000 Euro $\leq$ Contract Size $\leq$ 100,000 Euro	Y	N	N
20,000 Euro $\leq$ Contract Size $\leq$ 80,000 Euro	N	Y	N
30,000 Euro $\leq$ Contract Size $\leq$ 60,000 Euro	N	N	Y
Observations	46,327	46,327	46,327

The outcome variable is the yearly expenditure on contracts of services and furniture around the 40,000 Euro threshold. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

the 40,000 Euro threshold.

Table 5 shows the results of Equation 2 using as outcome variable the number of contracts issued above 40,000 Euro for the two of sectors[30]. The first two columns show that treated municipalities only reduce the number of contracts above 40,000 Euro for goods in the construction and waste management sectors; the third and fourth columns show that there is no effect for contracts in all the other sectors.

The results of Table 5 shows that municipalities respond to a neighbouring dissolution by moving contracts which are more likely to suffer the influence of criminal organisations below the 40,000 Euro threshold. The results of this section and of Section 6.1 show that municipalities react to the neighbouring dissolution by splitting large projects in vulnerable sectors into multiple smaller and less transparent contracts. The law enforcement body then has to prove the maladministration in other ways, since the direct award for smaller contracts is considered a legitimate procedure.

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[30]Appendix 21 shows additional robustness on the results of Table 5.

Table 5: Effect on the number of contracts for services and furniture above 40,000 Euro by sectors.

	Construction and waste man.		Others	
	(1)	(2)	(3)	(4)
	N	N	N	N
$Treat_{m,t}$	-0.120*	-0.202***	0.055	0.137
	(0.062)	(0.071)	(0.175)	(0.172)
$AfterTreat_{m,t}$	-0.007	-0.116	0.279	0.237
	(0.109)	(0.126)	(0.268)	(0.289)
Province linear trends	N	Y	N	Y
Observations	11,178	11,178	11,178	11,178
Baseline mean	0.21	0.21	1.49	1.49

The outcome variable is the number of contracts for services and furniture 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, number of years until the next election, the average of the controls for neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

7 Results on renegotiations

Renegotiation of a contract for public works is a phase of procurement that is vulnerable to corruption (Di Cristina (2012)). The municipality can award additional resources directly to the winning firm without a public tender. This creates incentive for collusion between the public official and the firm, winner of the contract. A contract should be renegotiated only when the firm incurs in an unexpected inconvenience that does not allow it to complete the object of the contract. In practice, contracts of public works are renegotiated in 30 percent of the cases.

Table 6 shows the results of Equation 3. The outcome is a dummy taking value one if the contract has been renegotiated, zero otherwise. The probability of renegotiating the contract during a neighbouring dissolution decreases by approximately four percent.

Assuming that the renegotiation does not change the quality of the procured good, the municipalities engage less in activities that are often associated with corruption, when a neigh-

Table 6: Effect of the dissolution on the probability of having a renegotiation.

	(1) Renegotiation=1	(2) Renegotiation=1	(3) Renegotiation=1
$Treat_{m,t}$	-0.061***	-0.064***	-0.038**
	(0.016)	(0.017)	(0.019)
$AfterTreat_{m,t}$	-0.039	-0.039	0.011
	(0.025)	(0.027)	(0.033)
Province linear trends	N	N	Y
Controls	N	Y	Y
Year Fe	Y	Y	Y
Observations	77,338	73,087	73,087
Baseline mean	0.297	0.297	0.297

The outcome variable is a dummy taking value 1 if the public works contract had been renegotiated. All the specifications have good fixed effect (i.e. based on the first four digits of the *CPV*.) The following controls are included (when specified): population, indicator whether the mayor is born in the municipality, number of years until the next election, the average of the controls for neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities. These results are based on all the public works larger than 150,000 Euro, the only contracts for which information about renegotiations is available.

bouring municipality is dissolved. Nevertheless it is possible that municipalities assign the resources previously awarded during the renegotiation to other phases of the procurement process. Therefore, in Table 7 I look at the effect of the neighbouring dissolution on the amount of resources spent on public works projects.

First, I compute the rebate for each contract. The rebate is a measure of relative saving that the public administration achieved in awarding the contract. Indeed, the Rebate$_{g,m,t,}$ is defined as follows:

$$\text{Rebate}_{g,m,t} = \frac{\text{Reservation Price}_{g,m,t} - \text{Final Price}_{g,m,t}}{\text{Reservation Price}_{g,m,t}}$$

I estimate Equation 3 using three different outcomes. The first outcome is the logarithm of the value of the renegotiations, since the municipalities could agree to fewer renegotiations but increase the size of each of them. The second column uses the rebate of each contract, column three considers the total project size.

Table 7: Effect of the dissolution on values of the contracts of public works

	(1) Renegotiation Value	(2) Rebate	(3) Tot. Project value
$Treat_{m,t}$	-0.704**	-0.005	0.011
	(0.337)	(0.008)	(0.062)
$AfterTreat_{m,t}$	-0.362	-0.010	-0.005
	(-0.378)	(0.013)	(0.087)
Observations	18,541	52,515	52,515
Baseline Mean	13,419	0.089	337,348

The outcome variable are respectively the logarithm of value of renegotiations, the rebate and the logarithm of the total value of the projects. All specifications have good fixed effect (i.e. 206 different fixed effects coming from the *CPV*.) 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities. These results are based on all the public works larger than 150,000 Euro, the only contracts for which information about renegotiations is available.

Table 7 shows that municipalities also decrease the size of renegotiations during the neighbouring dissolution, and they do not redistribute the decrease in resource spent during the renegotiation to other phases of the procurement process. Therefore, I conclude that the dissolution has a deterrent effect on the behaviour of neighbouring municipalities with respect to outcomes that the law enforcement body knows are particularly vulnerable to corruption, like the renegotiations. A back-of-the-envelope calculation shows that the decrease correspond to 9 percent of the yearly expenditure for public works larger than 150,000 Euro.

8 Robustness

In this section, I show the main robustness checks to confirm the validity of my results and their interpretation[31]. First, I analyse in detail why municipalities exploit the 40,000 Euro threshold. In Section 2.1, I argue that the relevant difference between contracts above and below the threshold is the greater discretion to award smaller contracts without a public tender.

[31]Appendix A.4 shows additional robustness checks.

By issuing a smaller contract, municipalities can have higher discretion in the choice of the winner firm and reduce the evidence that law enforcement bodies can use to prove potential illicit behaviours. I can test whether this is the provision that municipalities exploit, since it applies to services and furniture, but not to public works.

Therefore, Figure 6 shows the results of equation 1 for all the years before, during and after the neighbouring dissolution, replicating the analysis in Section 5 for public works only (top panel). Results for services and furniture (i.e. Figure 5) are replicated in the bottom panel. Since the effect comes exclusively from contracts for furniture and services, it confirms that municipalities increased the number of contracts smaller than 40,000 Euro for goods in construction and waste management to avoid the public tender without perpetrating any illicit behaviours (like the erroneous use of the emergency clause).

Second, Table 8 shows the results of Equation 1 using different sets of control groups. A possible concern is that using all the Italian municipalities that do not share a border with a dissolved municipality may be too broad as control group. There might be time-varying differences between municipalities that are not captured by the province-specific linear trends. Column 2 computes the results of Equation 1 limiting the control group to those municipalities in provinces with at least a dissolved municipality, but that do not share any border with it. Finally, column 3 exploits the different timing of the dissolutions to constrain the control group to those municipalities that will share (or had shared) a border with a dissolved municipality over the period. Results are stable to different control groups. Results are robust to the inclusion of different control groups.

I next examine whether alternative hypotheses can explain the results of Equation 5. Other motivations can generate results similar to those of Section 5. For example, the dissolution is likely to create a shock in the procurement market of the area, since the dissolved municipality is likely not to operate at full capacity during its dissolution. In fact, Acconcia *et al.* (2014) and Galletta (2017) show how commissioners substantially reduce the spending of the municipality during the dissolution, since they have to eliminate the influence of organised crime in the municipality's business. Therefore, the commissioners' activity might reduce the size of

Figure 6: Effect of the dissolution on the bunching by procurement types
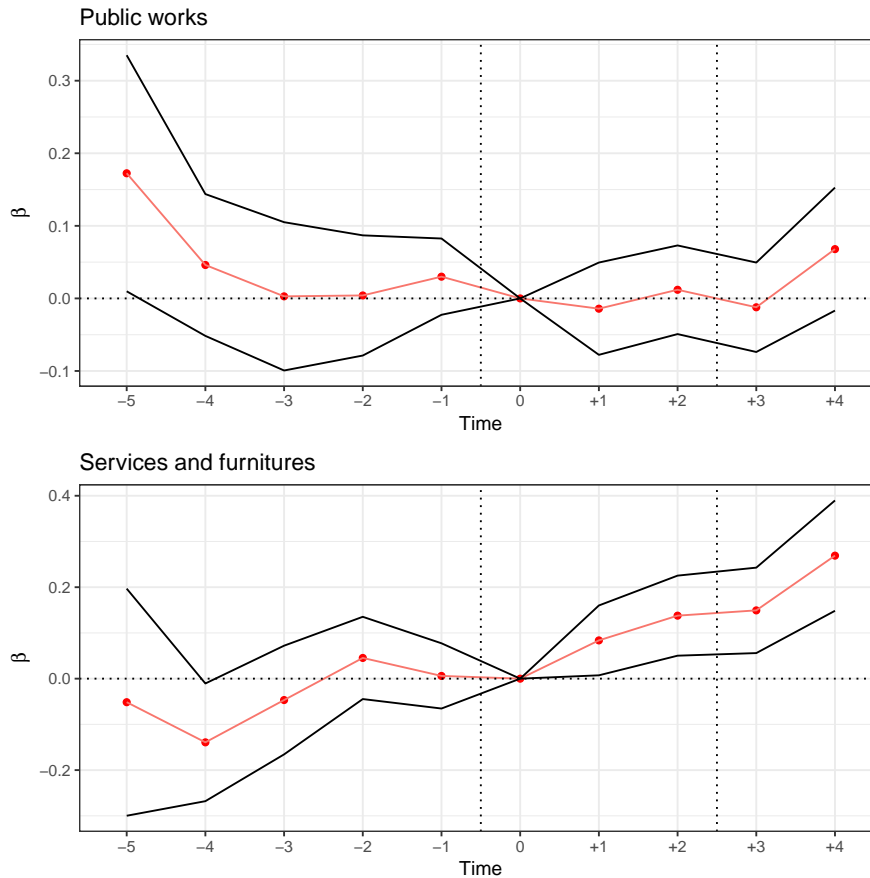
The Figure shows the effect of the neighbouring dissolution on the number of procurements issued below the 40,000 Euro by the treated municipalities by procurement types. The top graph shows the effect for public works, whereas the bottom graph is for services and furniture. The coefficients represent the percentage increase in the number of procurements between 25,000 and 40,000 Euro issued before, during and after the dissolution of a neighbouring municipality. The time 0 is the year of the dissolution, while the commissioners are in charge of the neighbouring municipality up to year 3.

Table 8: Effect of the dissolution using different control groups

	(1) Num. Proc.	(2) Num. Proc.	(3) Num. Proc.
$Treat_{m,t} \times (25{,}000 \leq \text{Bin} \leq 40{,}000)$	0.122***	0.081**	0.103***
	(0.027)	(0.033)	(0.037)
$AfterTreat_{m,t} \times (25{,}000 \leq \text{Bin} \leq 40{,}000)$	0.266***	0.212***	0.246***
	(0.065)	(0.059)	(0.062)
All mun.	Y	N	N
Same Province	N	Y	N
Neighbour only	N	N	Y
Observations	507,20	111,649	11,650
Baseline Mean	5.65	5.60	6.03

The Table studies the effect of the neighbouring dissolution considering different control groups. The first column estimates Equation 1 on the full sample, the second one restricts it to those provinces with at least a dissolution over the period. Finally, the third column estimates the results based only on the treated municipalities. I exploit the different timing of the dissolution to compare municipalities that are affected by the treatment at different points over the period. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

the market for firms operating in the area. Neighbouring municipalities have more bargaining power following the dissolution. Neighbouring municipalities could issue more contracts below 40,000 Euro to avoid the public tender and exploit the increase in bargaining power in a one-to-one negotiation with firms. Coviello *et al.* (2018) show that higher discretion can be a condition that municipalities might exploit in order to improve the quality of the procured good.

Table 9 shows the results of the analysis of this alternative hypothesis. First, I compute the reduction in the procurement activity that each dissolved municipality faces during the dissolution, in the following way:

$$RelativeChange_{-m} = \frac{\text{N. of Contracts}_{-m,during} - \text{N. of Contracts}_{-m,pre}}{\text{N. of Contracts}_{-m,pre}}$$

N. of Contracts$_{d,during}$ is the average number of procurement contracts issued during the dissolution by the dissolved municipality. N. of Contracts$_{d,pre}$ is the average number of con-

tracts issued in the years prior to the dissolution. Relative Change shows the average change in the procurement activity of the dissolved municipality, which captures the change in the bargaining power of the neighbouring municipalities. In fact, the more the dissolved municipality reduces its business (i.e. Relative Change is negative), the higher is the likely increase in the bargaining power of the neighbouring municipalities, since firms have lost more business opportunities.

Therefore, I estimate the following regression:

$$
\begin{aligned}
N_{b,m,t} = &\ \alpha_b + \alpha_m + \alpha_t + \delta_0 Treat_{-m,t} + \delta_1 AfterTreat_{-m,t} \\
&+ + \delta_2 Treat_{-m,t} \times RelativeChange_{-m} + \delta_3 AfterTreat_{-m,t} \times RelativeChange_{-m} \\
&+ \beta_0 Treat_{-m,t} \times \mathbb{1}\{25,000 \le b \le 40,000\} + \beta_1 AfterTreat_{-m,t} \times \mathbb{1}\{25,000 \le b \le 40,000\} \\
&+ \beta_2 Treat_{-m,t} \times RelativeChange_{-m} \times \mathbb{1}\{25,000 \le b \le 40,000\}+ \\
&+ \beta_3 AfterTreat_{-m,t} \times RelativeChange_{-m} \times \mathbb{1}\{25,000 \le b \le 40,000\} \\
&+ \gamma_0' X_{m,t} + \gamma_1' \overline{X}_{-m,t} + \epsilon_{b,m,t}
\end{aligned}
$$

$$(4)$$

Equation 4 is similar to Equatin 1 with an additional interaction. I observe the differential effect of the neighbouring dissolution for municipalities with a different bargaining power. Table 9 shows the results of the estimation. The first column shows the results of Equation 1, and Column 2 those of Equation 4. The data shows that neighbouring municipalities increase the number of contracts below 40,000 Euro when the dissolved municipality reduces its business, since the coefficients of the interactions are negative and statistically significant. However, even though bargaining power may matter, its change cannot explain all the main effect.

Finally, Table 10 shows the results of Equation 1 with different definitions of treated group. The first column shows the results of Table 2, in which the treated group is only the neighbouring municipalities. In column 2, I extend the treated group to all those municipalities sharing

Table 9: Effect of the dissolution on municipalities with different bargainig power

	(1) Num. Proc.	(2) Num. Proc. .
$Treat_{m,t} \times$ (25,000 $\leq$ Bin $\leq$ 40,000)	0.103***	0.122***
	(0.037)	(0.039)
$AfterTreat_{m,t} \times$ (25,000 $\leq$ Bin $\leq$ 40,000)	0.246***	0.311***
	(0.062)	(0.096)
$Treat_{m,t} \times$ (25,000 $\leq$ Bin $\leq$ 40,000) $\times$ Relative Change$_{-m}$		-0.0004**
		(0.0000)
$AfterTreat_{m,t} \times$ (25,000 $\leq$ Bin $\leq$ 40,000) $\times$ Relative Change$_{-m}$		-0.0004*
		(0.0000)
Observations	11,650	11,650
Baseline	6,03	6,03

The table examines whether the effect of the dissolution is driven by an increase in the bargaining power of the neighbouring municipalities. A change of one unit in Relative Change$_{-m}$ corresponds to a change of ten units of procurement contracts compared to before the dissolution. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

a border with a neighbouring municipality. Finally, in column 3 I extend the definition of the treatment group to all the neighbours up to the third degree of connection. Results are similar if I broaden the definition of neighbouring municipalities.

9 Conclusion

I show that anti-corruption measures are not only an effective way to make public officials accountable and prevent illegal activities, but they also impact the behaviour of other unmonitored institutions. I focus on the behaviour of Italian municipalities and I show that they react to the dissolution of a neighbouring municipal government for mafia infiltration. I show that neighbouring municipalities attempt to minimise scrutiny by the law enforcement body exploiting less monitored margin of the procurement process and engaging less in activities with higher risk of corruption.

I focus on two particular dimensions of procurement by Italian municipalities. First, I show the municipalities' behaviour in issuing procurement contracts for services and furni-

Table 10: Effect of the dissolution on farther municipalities

	(1) Neigh.	(2) Neigh.[2] .	(3) Neigh.[3]
$Treat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.122***	0.186***	0.123***
	(0.027)	(0.028)	(0.028)
$AfterTreat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.266***	0.048	0.154***
	(0.066)	(0.060)	(0.050)
Observations	507,204	503,140	503,140

The first column shows the result of Table 2, the second one includes in the treatment group the neighbours of the municipalities sharing a border with a dissolved one. Finally, the last column also includes the third degree of conection (i.e. the neighbours of the neighbours of the neighbours). 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

ture around a relevant threshold (i.e. 40,000 Euro). Contracts for services and furniture below 40,000 Euros have fewer evidentiary requirements, since municipalities can award them directly to a firm without committing any irregularity. Furthermore, contracts smaller than 40,000 Euro are also less transparent, since the municipality does not have to publish any documentation prior to awarding the contract and has to provide a lower level of information to the monitoring authority.

Finally, I study whether neighbouring municipalities renegotiate public works contracts. Renegotiations are considered one of the most delicate phases of the procurement process in terms of corruption, since they are top up payments from the municipality to the winning firm, without the use of a public tender.

I show that when the national government dissolves a municipal government, neighbouring municipalities increase the number of procurement contracts smaller than 40,000 Euro, without changing the total amount spent around the threshold. In particular, municipalities split larger contracts in those sectors that are more likely to be infiltrated by organised crime into multiple contracts smaller than 40,000 Euro.

After a dissolution, neighbouring municipalities do not reduce the amount of resources

spent on contracts around the 40,000 Euro threshold. They make the expenditure in these vulnerable sectors less transparent and with fewer evidentiary requirements.

This paper has important policy implications. I show that the dissolution of a municipal government has unfortunate consequences on unmonitored public bodies as well, since it induces neighbouring municipalities to make part of their (more vulnerable) procurement activity less transparent and more discretionary.

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A   Appendix

A.1   General graphs

In this section, I show all the figures and tables that clarify the context and explain the details of the analysis.

Figure 7 shows the distribution of the number of municipalities that each Italian municipality has in a 10 kilometre radius (i.e. the radius chosen for the Conley standard errors). Every municipality has on average other 14 municipalities within a distance of 10 kilometres.

Figure 7: Distribution of the number of municipalities in a 10 kilometre radium.
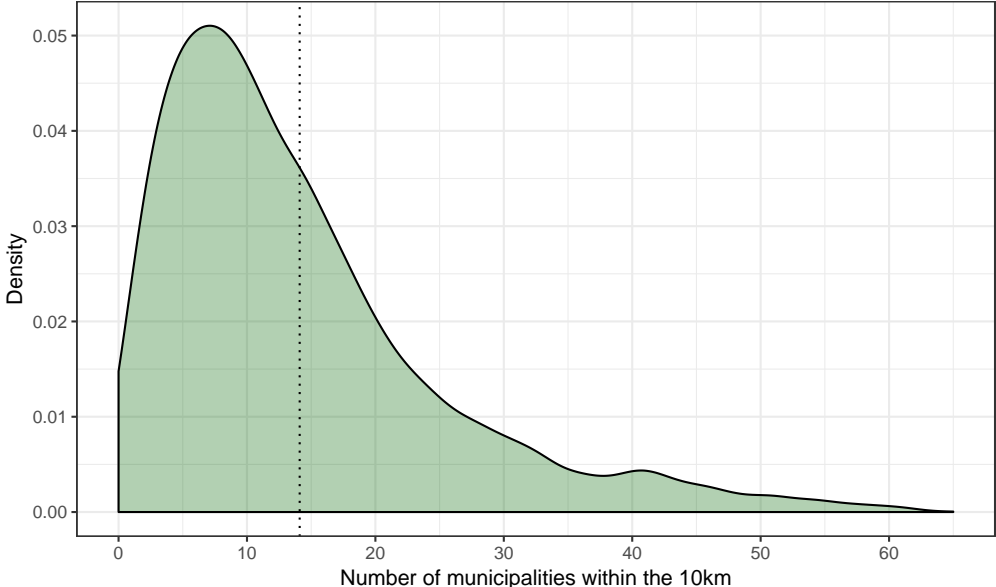
The figure shows the distribution of the number of municipalities in a 10 kilometre radium. Municipalities have on average other 14 municipalities within 10 kilometres.

Figure 8 shows the distribution of the size of the procurement contracts in the data, without dropping the contracts larger than 100,000 Euros.

Figure 8: Distribution of contracts by face value
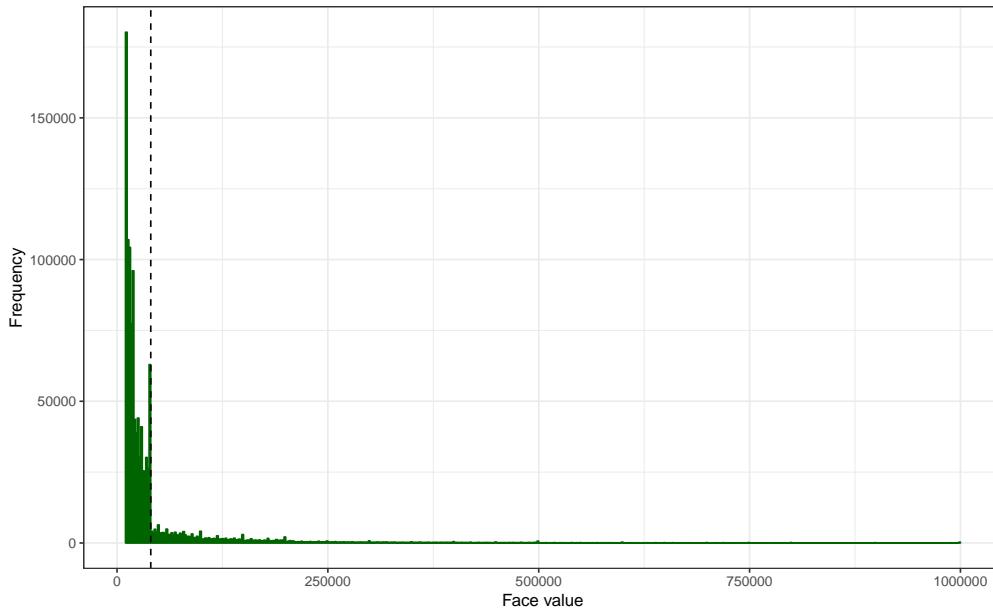
The figure shows the distribution of the procurement contracts by face value. There is a substantial bunching at the 40,000 Euro threshold (dashed line). The figure does not include contracts larger than 1,000,000 Euros.

Figure 9 shows the most frequent words used to describe the object of the contracts. This figure can be helpful in understanding why the municipalities issued the contracts, since there is no additional information specifying the type of good procured for contracts smaller than 40,000 Euros.

A.2   Analysis on the dissolved municipalities

In this Section, I show all the additional analysis on the dissolved municipalities. First, Figure 10 shows how long the commissioners ruled dissolved municipalities during the period of my analysis. Most of the dissolutions lasted between two and three years.

Figure 11 shows the geographical distribution of the arrests of public officials between 2011 and 2016 (left panel) and compares it to the one of the dissolutions in the same period (right one). Some dissolutions followed an arrest (26 out of 73), but many arrests of public officials did not conclude with a dissolution. Therefore, I argue that the arrest of a public official is not a good signal anticipating the future dissolution.

Figure 12 shows the most common evidence that law enforcement used to prove the infil-

Figure 9: Wordcloud using the good descriptions of the contracts

The wordcloud graphically shows the most frequent words used for describing the good in each contract. Since I cannot use the above-mentioned CPV, I exploit the description that municipality has to provide to ANAC when issuing each contract. The biggest and darkest words are the most commonly used in the descriptions.

Figure 10: Length of the dissolution
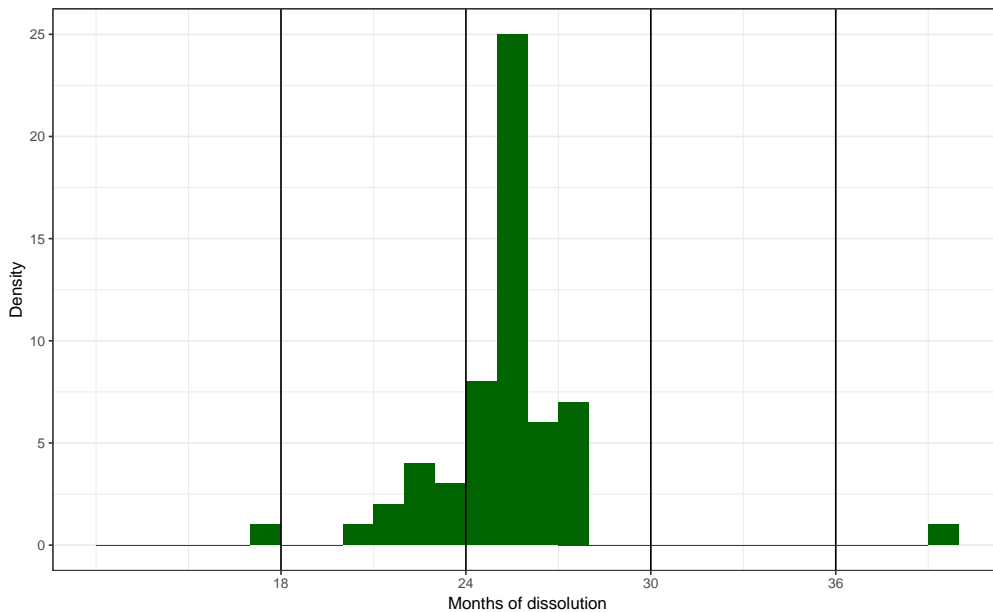
The figure shows the lengths (in months) of the dissolutions in the period of my analysis (2011-2016). The duration of the dissolution is computed from when the commissioners begin their duties in the dissolved municipality to the day of the next election.

Figure 11: Geographical distribution of the arrests and dissolution by Italian province

Number of arrests in each province   Number of dissolutions in each province
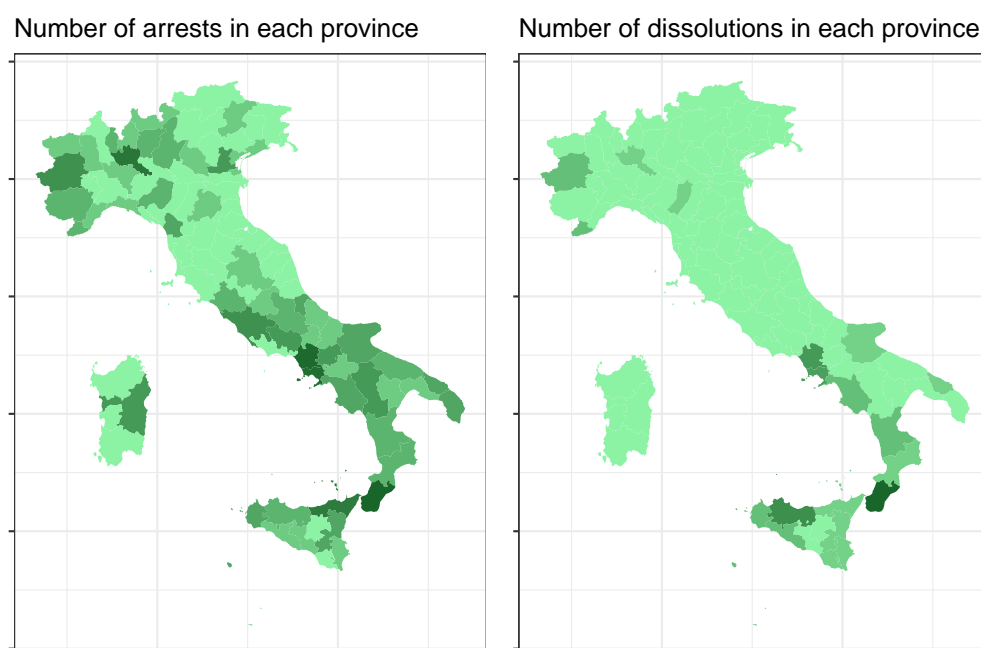
The figure compares the number of arrests of public officials and dissolutions implemented between 2011 and 2016 in the Italian provinces. The left-hand side figure shows the Log(Number of arrests $+$ 1) in the Italian provinces, the right-hand side shows the Log(Number of dissolutions $+$ 1). There are a total of 171 arrests of public officials in the period, whereas the dissolutions are 73. Furthermore, 47 out of 73 (64 percent) dissolutions did not have any arrested public official before the implementation.

tration of organised crime into the dissolved municipality. There are two extremely common motivations: either the municipality awarded a contract to a firm owned by a mafia member or the municipality used inappropriately the emergency clause to directly award a procurement contract.

Figure 13 shows the sectors in which criminal organisations infiltrated more often in the dissolved municipalities. In more than 70 percent of the dissolution cases, organised crime infiltrated in construction and waste management.

Figure 12: Motivations of the dissolutions
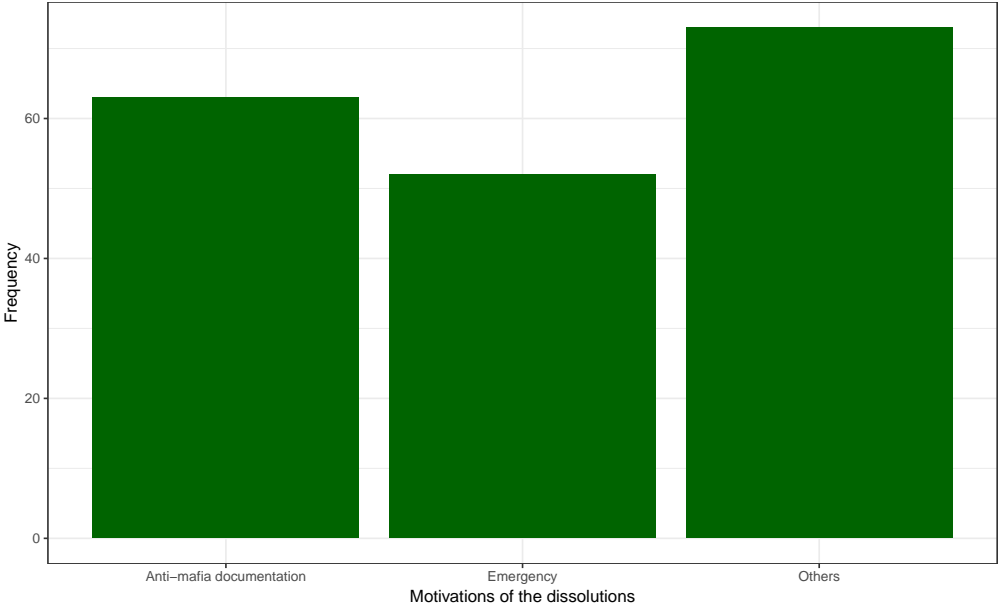
The histogram shows the motivations that the law enforcement bodies use most frequently to justify the dissolutions. Approximately 60 percent of the motivations were one of the following: first, municipality did not verify whether the firm was owned by a mafia related individual, or the municipality 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).

Figure 13: Infiltrated sectors in the dissolved municipalities
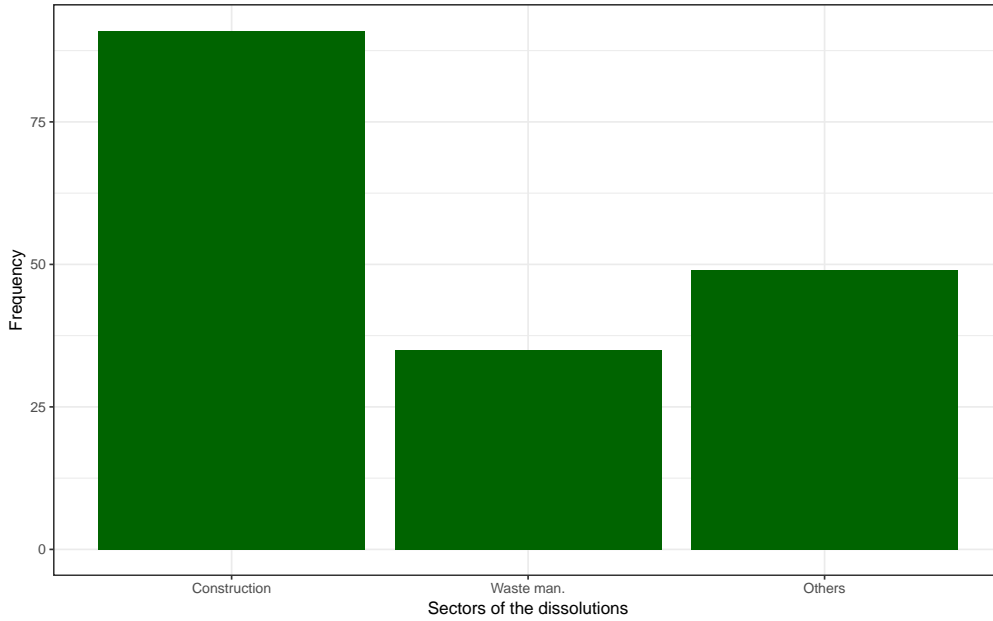
The histogram shows in which sectors criminal organisations infiltrated in the dissolved municipalities. In 72 percent of the cases, organised crime infiltrated either the construction sector (52 percent) or the waste management (20 percent). The waste management category includes also cleaning and sewage services.

I also study what are the consequences of the dissolution on the procurement behaviour of the dissolved municipalities. I estimate the following equation at municipality-year level.

$$
\begin{aligned}
Y_{m,t} = & \alpha_m + \alpha_t + \\
& + \beta_0 Diss_{m,t} + \beta_1 AfterDiss_{m,t} + \\
& + \gamma_0' X_{m,t} + \epsilon_{m,t}
\end{aligned}
\tag{5}
$$

$Y_{m,t}$ is a dummy taking value one if the municipality issued in a year at least a contract of the following size: larger than 300,000 Euro, between 20,000 Euro and 60,000 Euro, between 20,000 and 40,000 Euro and between 40,000 and 60,000 Euro. First, Table 11 show the results of estimating Equation 5 on the different outcomes. I restrict the sample of municipalities to only the one in the South of Italy (as in Galletta (2017) to have more comparable results.

In line with results from Galletta (2017), dissolved municipalities reduce the number of larger projects during the dissolution. Afterwards, the probability of having a larger project

Table 11: Effect of the dissolution on the dissolved municipalities.

|	(1) Y	(2) Y	(3) Y	(4) Y
$Treat_{m,t}$	-0.106*	-0.054	-0.050	-0.070
	(0.068)	(0.064)	(0.054)	(0.067)
$AfterTreat_{m,t}$	0.252**	-0.026	0.068	-0.028
	(0.125)	(0.144)	(0.123)	(0.138)
Contract size $\geq$ 300,000 Euro	Y	N	N	N
20,000 Euro $\leq$ Contract size $\leq$ 60,000 Euro	N	Y	N	N
20,000 Euro $\leq$ Contract size $\leq$ 40,000 Euro	N	N	Y	N
40,000 Euro $\leq$ Contract size $\leq$ 60,000 Euro	N	N	N	Y
Observations	10,440	10,440	10,440	10,440

From the first column, the outcome variables is a dummy taking value one if respectively there is at least a contract issued in the year larger than 300,000 Euro, between 20,000 and 100,000 Euro, between 20,000 and 40,000 Euro and between 40,000 and 100,000 Euro. All the regressions include the following controls: population, indicator whether the mayor is born in the municipality, the number of years until the next election, year fixed effects and province specific linear trends.

increases again.

A.3 Methods to compute the similarities between two descriptions

In this section, I illustrate more in details the two methodologies that I use to determine whether two contracts are about the same object. Since, the data does not contain information on whether a project is split in multiple contracts, I have to identify these cases in an indirect way. Therefore, I compare the descriptions of the good that the municipality has to provide to ANAC every time that it issues a contract. Figure 14 shows the distribution of the number of words used by the municipalities to describe their contracts smaller than 40,000 Euro.

Figure 14: Distribution of the number of words in descriptions of the contracts
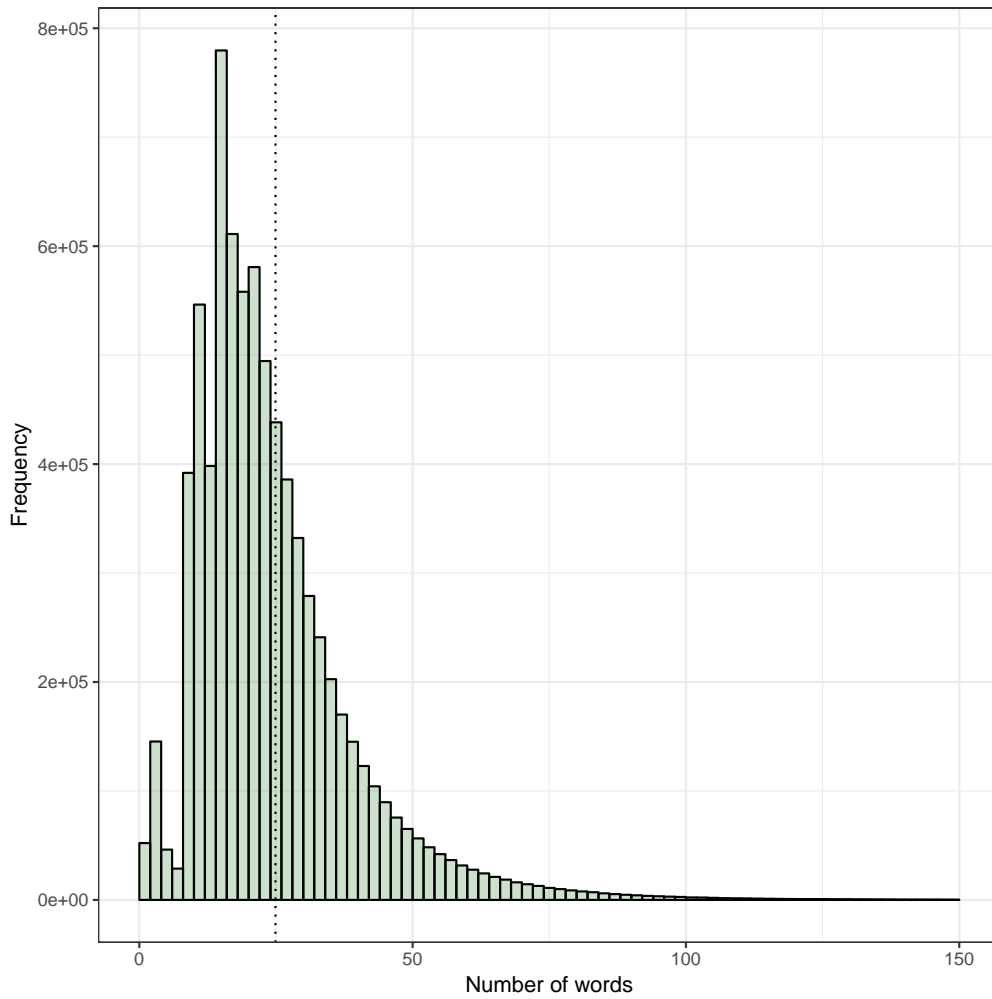
The Figure shows the distribution of the number of words in the descriptions of the contracts smaller than 40,000 Euro. The dotted line represents the average number of words used in the description.

First, I cleaned all the descriptions of those words that do not provide a specific meaning to the sentence such as articles and propositions (i.e. the stopwords). I also transform all the words in lower case to avoid a mismatch due to wrong typing and consider only those words with at least two letters. Finally, I tokenise the words. In this way I try to minimise the possibility to incur in spelling and common mistakes.

When the descriptions are cleaned, I exploit two different strategies for identifying the split projects. First, I compare the descriptions of the contracts with four different measures to assess the approximate string matching. This technique measures in different ways how many changes are required to make a description of a contract identical to the other one. The

four measures are the following:

- The **Levenshtein distance** is the minimum number of single-character edits (i.e. insertions, deletions and substitutions) between two strings (Levenshtein (1966)).

- The **Demerau-Levenshtein distance** is the minimum number of operations between two strings. In this case the possible edits are: insertions, deletions and substitutions of a single character or permutation of two adjacent one (Demerau (1964)).

- The **Jaro distance** between two strings of lengths s_1 and s_2 is computed in the following way (Jaro (1989)):

$$d_w = \begin{cases} 0 & \text{if } m = 0 \\ \frac{1}{3}\left(\frac{m}{|s_1|} + \frac{m}{|s_2|} + \frac{m-t}{m}\right) & \text{otherwise} \end{cases}$$

Where m is the number of matching characters and t is half the number of the transpositions.

- The **Jaro-WInkler distance** starts from the Jaro distance and uses a prefix scale p (i.e. 0.1) which gives more favorable ratings to strings that match from the beginning for a set of prefix length l. Therefore the Jaro-Winkler measure is the following:

$$d_{jw} = d_j + lp(1 - d_j)$$

Figure 15 shows the distribution of the similarity score for all the couples of contracts below 40,000 Euro issued by the same municipality in the same year using approximate string matching. A similarity of 1 implies that the two contracts are described in the same way.

The drawback of using approximate string matching for identifying split projects is that it heavily relies on exactly what words the municipality uses in the descriptions. Synonyms, spelling mistakes or different order of the words would affect the similarity score between two

Figure 15: Distribution of similarities with approximate string matching
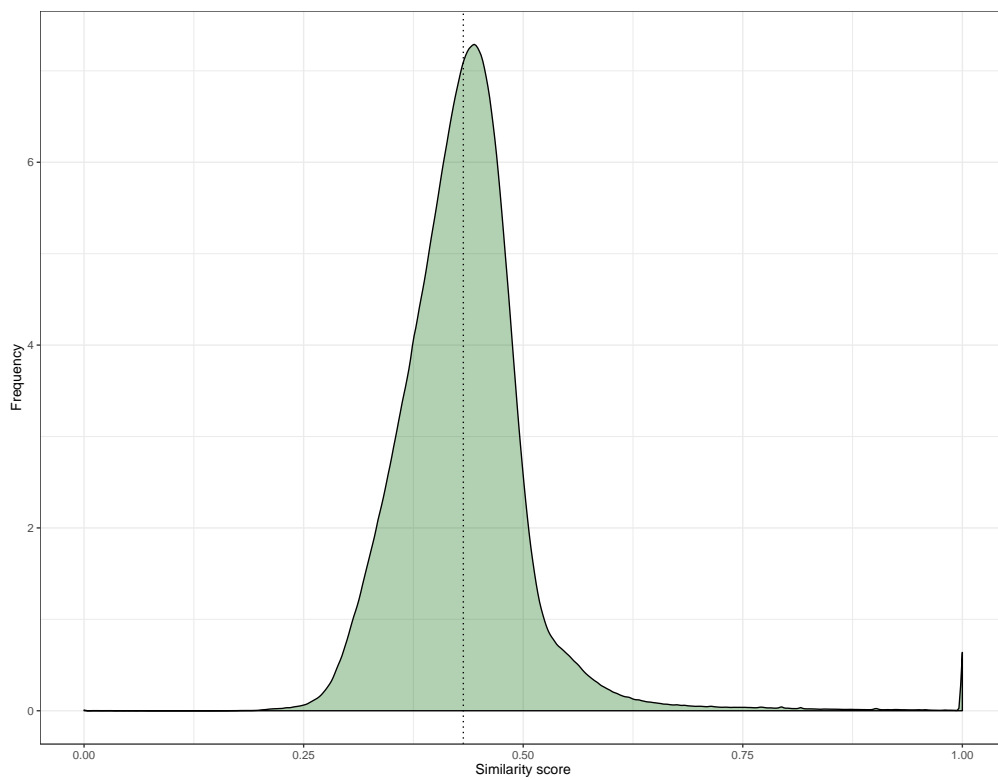
The Figure shows the distribution of the similarity of the contracts using approximate string matching. The dotted line represents the average similarity between two contracts.

contracts' descriptions. Therefore, I also rely on word embedding, which is a more sophisticated technique.

Word Embeddings is a language modelling technique from natural language processing which is based on the co-occurrence of words. This technique represents in a low dimensional euclidean space the meaning of the words and it 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, and 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.* (2013)). The training objective is to find word representations that are useful for predicting the surrounding words in a sentence or document. Given a sequence of training words $w_1, \ldots, w_T$, 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 16 shows the distribution of similarities using Word2Vec. Comparing it to Figure 15, Word2Vec provides a more stringent comparison between descriptions, since the distribution is more skewed towards left. The difference is partially mechanical, since a limited number of changes in the letters are required to make a description identical to the other, but similar words can still provide different meanings.

Finally, I verify whether Word2Vec provides reliable results and how different they are from the results derived with approximate string matching. In particular, I show the similarity scores of a sample of contracts in the dataset.

Figure 16: Distribution of the similarities with Word2Vec
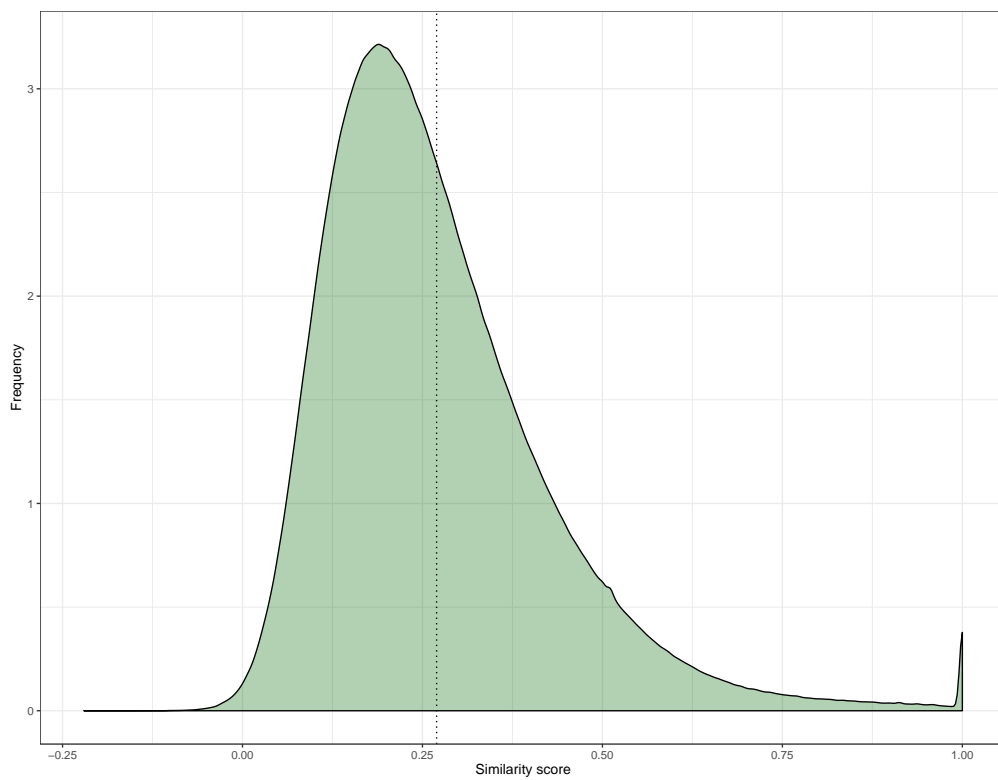
The Figure shows the distribution of the similarity of the contracts using Word2Vec. The dotted line represents the average similarity between two contracts.

Table 12: Sample of similarity scores

Word2Vec Score	App. String Matching	Description 1	Description 2
0.70	0.92	*Management of gym XXX Sep 2009-Aug2014*	*Management of gym YYY Sep 2009-Aug2014*
0.68	0.92	*Meals for school XXX academic year 2014-2015*	*Meals for school YYY academic year 2014-2015*
0.96	0.52	*Shelter for the elderly year 2011*	*Service for shelter for the elderly*
0.97	0.40	*Snow clearing*	*Service of snow clearing 2011/2012*

Table 12 shows two differences between approximate string matching and Word2Vec. The first two examples show how Word2Vec detect whether the same service is provided in two different places. Therefore, the similarity score of Word2Vec correctly award a lower score two the similarity of the two example of contracts, even though the words used in the description are basically the same. Word2Vec also scores high two contracts describing the same good with different words.

A.4   Additional Robustness checks of the main results

In this section, I show other robustness checks of the main results of Section 5. In particular, I show the results including procurement of different sizes from the one used in the main analysis.

Table 13 shows the results of Equation 1 using different sets of bins around the 40,000 Euro threshold. Column 1 shows the results of Table 2, whereas column 2 and 3 extend it to all the procurement contracts up to 80,000 Euro and 90,000 Euro respectively. Finally, Column 4 computes Equation 1 without on all the contracts smaller than 100,000 Euro but those between 40,000 Euro and 70,000 Euro.

Table 14 shows the differential effect of the neighbouring dissolution on a different set of bins below the 40,000 Euro. Results are stable irrespective of whether I study the differential effect on all the contracts between 15,000 Euro and 40,000 Euro or only those between 35,000 Euro and 40,000 Euro.

Finally, Table 15 shows the results of estimating Equation 1 using Poisson conditional fixed-effects quasi-maximum likelihood (QML). This estimator has several desirable proper-

Table 13: Effect on the number of contracts below 40,000 with contracts of different size.

	(1) 0 to 70,000 €	(2) 0 to 80,000 €	(3) 0 to 90,000 €
$Treat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.141***	0.157***	0.167***
	(0.029)	(0.030)	(0.032)
$AfterTreat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.273***	0.278***	0.282
	(0.071)	(0.075)	(0.079)
Observations	593,926	680,648	637,288

The table shows the results of Equation 1 including procurement contracts for furniture and services of different sizes. The first column reports the results with all contracts smaller than 70,000 Euro, the second column includes procurement up to 80,000 Euro, 90,000 Euro the third one. Finally, column four shows the same results excluding the contracts just above the 40,000 Euro threshold (i.e. between 40,000 Euro and 70,000 Euro). 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

Table 14: Effect on the number of contracts below 40,000

	(1) Num. Proc.	(2) Num. Proc.	(3) Num. Proc.	(4) Num. Proc.
$Treat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.122***			
	(0.027)			
$AfterTreat_{m,t} \times (25,000 \leq \text{Bin} \leq 40,000)$	0.266***			
	(0.065)			
$Treat_{m,t} \times (20,000 \leq \text{Bin} \leq 40,000)$		0.157***		
		(0.030)		
$AfterTreat_{m,t} \times (20,000 \leq \text{Bin} \leq 40,000)$		0.175***		
		(0.069)		
$Treat_{m,t} \times (30,000 \leq \text{Bin} \leq 40,000)$			0.104***	
			(0.030)	
$AfterTreat_{m,t} \times (30,000 \leq \text{Bin} \leq 40,000)$			0.305***	
			(0.069)	
$Treat_{m,t} \times (35,000 \leq \text{Bin} \leq 40,000)$				0.126***
				(0.038)
$AfterTreat_{m,t} \times (35,000 \leq \text{Bin} \leq 40,000)$				0.442***
				(0.087)
Observations	507,204	507,204	507,204	507,204

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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

Table 15: Effect on the number of contracts below 40,000

	(1) OLS	(2) OLS	(3) Poisson	(4) Poisson
$Treat_{m,t} \times (25{,}000 \leq \text{Bin} \leq 40{,}000)$	0.121***	0.122***	0.246***	0.260***
	(0.027)	(0.027)	(0.071)	(0.046)
$AfterTreat_{m,t} \times (25{,}000 \leq \text{Bin} \leq 40{,}000)$	0.266***	0.266***	0.492***	0.502***
	(0.065)	(0.065)	(0.121)	(0.057)
Province Linear Trends	N	Y	N	Y
Observations	507,204	507,204	359,875	359,875

The table shows the results of Equation 1 estimated with the OLS (column 1 and 2) and Poisson QML (third and fourth columns). The outcome variable of the OLS 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

ties, including consistency of the coefficient estimates independently on any assumption on the conditional variance as long as the mean is correctly specified (Wooldridge (1997)).

A.5 Robustness checks on similarity results

In this section, I show the robustness checks of the results in Section 6.1. First, I show the results of equation 2, using different thresholds of similarity between contracts' descriptions to classify two contracts as part of the same project. Table 16 shows the results using Word2Vec for comparing the descriptions. Column 1 shows the results of Section 6.1, whereas in the other column I consider the yearly expenditure on contracts with similarities higher than 90, 85 and 80 percent respectively. Results are very stable irrespective of what level of similarity two contracts need to have to be considered part of the same project.

Similar results apply when I use approximate string matching as method to compare contracts' descriptions. Table 17 shows the results of Equation 2, using different thresholds of the string approximate matching to establish when two contracts are part of the same project.

Second, Table 18 shows the results of Section 6.1 but focussing only on contracts of public works. As shown in Figure 4, municipalities do not change the number of contracts below the

Table 16: Effect on the expenditure for split projects using different similarity scores.

	(1) 95 % sim.	(2) 90 % sim.	(3) 85 % sim.	(4) 80 % sim.
$Treat_{m,t}$	27,645**	36,222***	36,997**	39,549***
	(12,092)	(14,312)	(15,376)	(16,597)
$AfterTreat_{m,t}$	39,286*	45,573*	50,175*	54,844*
	(20,993)	(26,637)	(27,486)	(29,111)
Observations	37,973	37,973	37,973	37,973

The outcome variable is the expenditure on split projects for furniture and services identified using Word2Vec to compare the objects' descriptions. Two contracts are considered to be part of the same project if the similarity is respectively 95, 90, 85, 80 percent or higher. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

Table 17: Effect on the expenditure for split projects using different similarity scores.

	(1) 95 % sim.	(2) 99 % sim.	(3) 90 % sim.	(4) 80 % sim.
$Treat_{m,t}$	14,362**	11,687*	16,169*	27,776**
	(7,196)	(6,233)	(8,790)	(11,964)
$AfterTreat_{m,t}$	25,738**	20,458*	26,417*	40,629*
	(11,751)	(11,861)	(14,460)	(21,029)
Observations	37,973	37,793	37,793	37,793

The outcome variable is the expenditure on split projects for furniture and services identified using string matching to compare the objects' descriptions. Two contracts are considered to be part of the same project if the similarity is respectively 95, 90, 85 and 80 percent or higher. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

Table 18: Effect of the dissolution on the expenditure for split projects of public works.

	(1) Word2Vec	(2) Word2Vec	(3) String Matching	(4) String Matching
	80 %	90%	95 %	99 %
$Treat_{m,t}$	-5,384	-1,318	1,383	626
	(4,437)	(2,872)	(1,304)	(1,114)
$AfterTreat_{m,t}$	8,162	4,681	-4,260	-3,622
	(9,886)	(6,687)	(2,274)	(1,929)
Observations	37,973	37,973	37,973	37,973

The outcome variable is the expenditure on split projects for public works identified using Word2Vec and approximate string matching to compare the objects' descriptions. Two contracts are considered to be part of the same project if the similarity is respectively 80, 90, 95 and 99 percent or higher. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

40,000 Euro. Therefore, if the mechanism through which municipalities move contracts of services and furniture below the 40,000 Euro is through splitting a single project in multiple (smaller) contracts, we should not observe any response on the expenditure on split projects for public works. Results of Table 18 confirms this hypothesis, since there is not a statistically significant difference in the expenditure on split projects of public works, during and after a neighbouring dissolution.

Finally, I show that results of Table 4 are stable to the inclusion of larger projects. Table 19 shows the results of Equation 2 with the yearly expenditure on contracts for furniture and services as outcome.

A.6   Robustness checks on results by type of good

Table 21 shows the results of Equation 2 and use as outcome variable the number of contracts issued by sectors (i.e. construction and waste management or others) and types of good (i.e. furniture and services or public works). Since the relevant change in the 40,000 Euro threshold applies only for services and furniture, it is not surprising to observe a response only for

Table 19: Effect of the dissolution on total expenditure, including larger contracts.

	(1) Expenditure	(2) Expenditure	(3) Expenditure
$Treat_{m,t}$	23,026	10,995	14,238
	(23,765)	(20,966)	(17,957)
$AfterTreat_{m,t}$	55,685	59,549*	64,003**
	(34,079)	(32,927)	(29,335)
20,000 Euro $\leq$ Contract Size $\leq$ 200,000 Euro	Y	N	N
20,000 Euro $\leq$ Contract Size $\leq$ 300,000 Euro	N	Y	N
20,000 Euro $\leq$ Contract Size $\leq$ 100,000 Euro	N	N	Y
Observations	46,327	46,327	46,327
Baseline mean	401,639	355,649	246,792

The outcome variable is the yearly expenditure on contracts for services and furniture around the 40,000 Euro threshold. 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 neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

contracts of services and furniture in waste management and construction sectors.

Finally, Table shows the results of Equation 2 focussing on contracts for services and furniture of different sizes.

A.7   Additional informations on the renegotiations

Since public procurement is a long and complex process, irregularities can happen at different stages of the process. Therefore, the Italian monitoring authority (ANAC) lists the features of the procurement process to consider as indicators of potential irregularities. This report is published annually and it should guide the law enforcement body in the evaluation of 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.

Table 20: Effect on number of contracts larger than 40,000 Euros by type of good and sector

	Services and Furniture				Public Works			
	Construction and waste man.		Others		Construction and waste man.		Others	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	N	N	N	N	N	N	N	N
$Treat_{m,t}$	-0.120*	-0.202***	0.055	0.138	0.014	-0.095	0.078*	0.098**
	(0.062)	(0.071)	(0.175)	(0.173)	(0.105)	(0.104)	(0.044)	(0.046)
$AfterTreat_{m,t}$	-0.008	-0.116	0.279	0.238	-0.154	-0.344**	0.086	0.124
	(0.110)	(0.126)	(0.268)	(0.289)	(0.167)	(0.168)	(0.078)	(0.089)
Province linear trends	N	Y	N	Y	N	Y	N	Y
Observations	11,178	11,178	11,178	11,178	11,178	11,178	11,178	11,178

The outcome variable in the first four columns is the number of contracts for services and furniture in the two categories of sectors. The following four columns show the results for the contracts of public works larger than 40,000 Euros respectively for construction and waste management and other 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, number of years until the next election, the average of the controls for neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

Table 21: Effect on number of contracts larger than 40,000 Euros by type of good and sector

	Contracts smaller than 60,000 Euro		Contracts smaller than 80,000 Euro	
	Construction and Waste man.	Others	Construction and Waste man.	Others
	(1)	(2)	(3)	(4)
	N	N	N	N
$Treat_{m,t}$	-0.157**	0.043	-0.202***	0.138
	(0.065)	(0.141)	(0.071)	(0.173)
$AfterTreat_{m,t}$	-0.217**	0.209	-0.116	0.238
	(0.100)	(0.232)	(0.126)	(0.289)
Observations	11,178	11,178	11,178	11,178

The outcome variable is the number of contracts for services and furniture in the construction and waste management sectors. Contract size is between 40,000 Euro and 60,000 Euro in the first two columns, and contracts between 40,000 Euro and 80,000 Euro in the last two columns. 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, number of years until the next election, the average of the controls for neighbouring 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 7 shows the distribution of the number of municipalities within ten kilometres for all Italian municipalities.

- A single bid auction.

- A subcontract.

- A 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 renegotiation is the only feature of the list that I have in the data, therefore I study the reaction of the municipalities to a neighbouring dissolution on 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. The law enforcement body faces more difficulties in detecting whether two contracts are related to the same object, since it would need to compare all the contracts issued by the municipality in a specific time frame (e.g. in the same year like in Section 6.1).

Figure 3 shows how amendments are common in areas where organised crime is infiltrated the most (e.g. Sicily). Figure 17 shows the average size of the amendments in each Italian province as share of the value of the corresponding contracts. Renegotiations should not be larger than 20 percent of the contract value. Some provinces where criminal organisations have historically infiltrated (as the Province of Naple) show an average size of the renegotiations above the 15 percent of the contract value, that is very close to the legal threshold.

Figure 17: Value of the renegotiations as share of the contract values.