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Local Public Service Provision and Delivery Economic Analysis and Policy Evaluation

Marianna Sebő



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PhD in Economics | Marianna Sebó

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Economic Analysis and Policy Evaluation

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To Lajos and Erzsébet

Acknowledgments

My path to the Ph.D. was not a straight one. I have always had a curiosity about research and enjoyed studying, but becoming an academic wasn't my plan. This changed during my Master's at the University of Barcelona when I was repeatedly expected to write essays and research notes. One of these subjects – Regulation, Privatization, and Institution – was especially interesting for me. I liked how we were pushed to form opinions and question policies. To me, a subject where we discussed privatization, corruption, incentives, and dictators was wonderful. Several months later, the lecturer, Germà, accepted to supervise my Master's thesis. I was entertained by working on it a lot. Once I realized that Germà was interested in moving traditional boundaries between disciplines, taking knowledge from and contributing to various fields, I wanted to stay. So, I saw the Ph.D. program at the University of Barcelona as a natural continuation of my Master's thesis. I haven't even applied to other Ph.D. programs. Since then, my curiosity has not been satisfied, but the number of articles and chapters of my thesis and potential research questions has steadily grown. Typically, Ph.D. candidates compare their experience to a roller-coaster with professional and personal ups and downs. For me, it was more like a cycle with episodes of letting creativity flow followed by focusing on a specific topic. I have found such switches refreshing, even addictive. I am grateful that I could devote my attention to questions that I have found personally and professionally interesting. For this experience, I am indebted to several individuals.

I am thankful to my mentor, Germà. There are many things about Germà that I could praise here, ranging from his skills as a researcher, his leadership, or that he has fun personality. One of his most interesting and valuable qualities for me was that he always understood what I lacked. When I needed it, we would spend hours talking about a methodology in his office. Other times, he would teach me about the politics behind research and publishing and the psychology of people. But mostly, I needed him to put pressure on me to meet deadlines which he happily did. Under his supervision, I have felt attention, love, appreciation, and guidance with an optimal level of humor. I couldn't have asked for more. On one hand, I am sad that his official supervision is ending, on the other hand, I am happy to know that I have gained a mentor I can always count on, in or outside of a Ph.D. program.

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always enriching to talk about our different opinions on research and our roles as researchers. Fran also has a great ability to connect people. Thanks to her I met Esteban, who has been a wonderful partner since the day I met him and the main cheerer of my thesis.

Last, I thank my family. My grandparents were very limited in their opportunities to study. Events, such as the war and deportation didn't allow them to continue in their formal education after just having learned the basic skills of reading, writing, and counting. Even though they were never to return to school again, their home looked like an open library of Hungarian and foreign literature. For my grandmother, the highest value was education. One of her most common sayings used to be – apart from “be good” – “just learn”. My parents have invested a lot of energy and resources in my brother's and my education. According to my mother, “knowledge is the only thing that cannot be taken away from you”, so she and my father have been very strict about our schooling. My brother and I haven't felt much pressure, on the contrary, we enjoyed going to private classes and having access to any useful material for studies. Some months ago my brother also inscribed in a Ph.D. program, I like thinking that seeing how I have been enjoying the program also motivated him. This thesis is dedicated to my family and the memory of my grandparents.

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1 Introduction

One of the major areas of public economics is the provision of public goods and services. Keeping costs as low as possible while maximizing welfare is a central concern of researchers, politicians, and practitioners. It is the responsibility of the government at every level to consider these issues and determine the optimal delivery. Local governments – in addition to being closer to citizens – possess more information about the values, opinions, attitudes, and judgments of the residents about inequality and redistribution. Therefore, decisions made at the local level can result in higher allocative efficiency, lower diseconomies of scale, and lower agency costs (Stiglitz, 2015). Generally, local governments play an important role in the life of the locals as they govern the delivery of local public goods and services.

At the heart of this thesis is the role of local governments, their policies, decisions, and the reactions of partner firms to them. In terms of theme, the thesis can be divided into two main parts. First, it takes a deep look at local public goods and services, while the second part offers a richer view of local public finances through its political science lens. The first part of the thesis examines deeply the idea of optimal size and economies of scale. Considering that local government boundaries are the result of historical events, they may not be correlated with the economic efficiency of public service delivery. Because of this, the question of optimal size and rescaling has been an academic concern since the work of (Tiebout, 1956). Nevertheless, to determine the optimal size of a town, many factors would need to be considered, including individual preferences, congestion costs, and economies of scale (Dixit, 1973; Mirrlees, 1972). Such trade-offs between efficiency and transaction costs, as well as the cost of governance, were key in Chapters 2, 3, and 4.

The question of efficient public service provision has become even more salient since privatization had been falling short to deliver the expected cost savings (Bel, Fageda, & Warner, 2010). One of the reforms local governments came up with is service-rescaling using cooperation, which allows them to keep more control over the production of the service as opposed to privatization. Through cooperation, the scale of the service delivery is enlarged, and potential economies of scale can lead to cost-saving. Such cooperation between municipalities, so-called “inter-municipal cooperation”

(IMC) is the subject of Chapter 2 of this thesis. There are many reasons to use IMC for public service provision, these include quality improvements and better coordination between municipalities, but the most important factor has been cost savings (Bel, Fageda, & Mur, 2013). The increase in the numbers of IMC has also led to growing scholarly interest to investigate whether these goals can be achieved by IMC. After the first empirical articles on the relationship between IMC and cost savings (Bel & Costas, 2006; Sørensen, 2007), a boom of empirical analyses has appeared from a diverse group of services and countries. What drew my attention to this topic was the fact that the empirical literature reports diverging results on the relationship between costs and IMC. At the time of writing this chapter, out of the eighteen studies finally included in the dataset, two papers reported a positive relationship, meaning IMC is related to higher cost, nine negative results, and the remaining mixed or insignificant results. Consequently, the research question that emerged was which variables are causing the divergence in the results. The suitable methodology for such questions is meta-regression analysis (Stanley & Doucouliagos, 2012). Meta-regression analyses have been used in several fields of economics and business to analyze genuine effects considering the outcomes of all the studies of a given relationship. Studies that are similar to mine have used meta-regression analyses e.g. to see the effects of privatization on costs (Bel, Fageda & Warner) or the effects of public vs. private ownership on productivity (Carvalho, Marques, & Berg, 2012).

The first contribution of this chapter is the revision of all the available empirical papers – published or not – on IMC and the creation of a database using the empirical results. Second, it was the first published paper that showed aggregated statistical evidence of factors leading to changes in costs of service delivery due to IMC. Third, it has an important contribution to the knowledge about transaction costs. The literature on asset specificity, ease of measurement, and contract management difficulty were used to better understand the nature of transaction costs.

My findings reveal that scale, transaction costs, and governance of cooperation affect whether IMC is connected to lower delivery costs. In the case of scale – usually proxied by the number of inhabitants or density – I find the IMC is particularly beneficial to smaller municipalities. Even though the optimal size might differ from service to service, empirical papers find economies of scale to be exhausted at relatively low levels (Bel & Costas, 2006; Niaounakis & Blank, 2017), consistent with the results of this chapter. The findings give

important insight into the nature of service-related and organizational transaction costs. The chapter considers asset specificity and difficulty of measurement and contract management as service-related transaction costs (Brown & Potoski, 2005; Hefetz & Warner, 2012). My results suggest that IMC can potentially alleviate service-related transaction costs, the low significance of this result nevertheless calls for cautious interpretation and further research. In the case of organizational transaction costs, it shows the importance of how IMC is coordinated. If the member municipalities of the IMC delegate their coordination to a supra-municipal entity with an elected council, additional transaction costs can be diminished.

Apart from contributing to the academic interest, this paper is of interest to policymakers, too. For them, it is essential to know what factors are needed to be considered so that their expectations of the effects of IMC can be realistic. This chapter is now published in *Urban Affairs Review*.¹

Empirical papers have also shown that instead of the strict dilemma between public and private management of service delivery, competition is key to saving costs in the production of public goods and services. In the case of traditional outsourcing, static competition is achieved at the time of contracting out. Such competition can be made more dynamic in several ways (Porter, 1998). One of them is employing fragmentation. Through fragmentation, exclusive delivery zones are created leading to a re-scaling of the service by dividing the whole market into several parts. If the number of delivery zones is optimally designed and pressure coming from the competition is present, the cost of the service delivery should converge, without harming economies of scale. Unlike fragmentation, in traditional procurement of static competition, the cost-saving effects are decreasing and can disappear (Bel & Costas, 2006). This is even more so in the case of very concentrated services such as waste collection (Massarutto, 2007). In Chapter 3, the fragmentation in the service of waste collection is analyzed in the city of Barcelona, and a policy reform is proposed. This research was published in

¹ Bel, Germà, and Marianna Sebó. 2021. "Does Inter-Municipal Cooperation Really Reduce Delivery Costs? An Empirical Evaluation of the Role of Scale Economies, Transaction Costs, and Governance Arrangements." *Urban Affairs Review* 57(1): 153–88. <https://doi.org/10.1177/1078087419839492>.

2020,² and it is the first empirical analysis of delivery costs of waste collection in different concessions within the same political jurisdiction and regulatory environment. Looking at the example of Barcelona, the creation of exclusive territories and the division into several zones of delivery in solid waste are described. In 2000, the city introduced the policy reform of fragmentation that would increase competition, and Barcelona was divided into four separate delivery zones. Each private firm was allowed to operate in up to two. Later, in 2009 competition was reinforced, and only one zone could be awarded to a firm.

There are several aspects why this research is important. Economies of scale are achieved at a relatively low level (Bel & Costas, 2006; Niaounakis & Blank, 2017), so in big cities, fragmentation can potentially lead to cost savings in various public services. Apart from Barcelona in waste collection, it has been used in several big cities e.g. in Odense, Uppsala, Valencia, and Madrid (OECD). Waste collection takes up a big part of the local government's budget in any city, so it is sensible to carefully decide how the service should be produced (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018). Another advantage fragmentation has is that it involves several smaller firms that make the delivery of the service more reliable and the time of contracting out is more competitive. Hence, fragmentation is a delivery form that calls for deeper empirical analysis. To abord this research question panel data methods have been used for the period 2015-2019.

This study has contributed to the literature in several ways. First, it provides an extensive description of possible delivery modes – privatization and its alternatives. This includes the analysis of regulation by competition via fragmentation. Second, a design for policy reform in form of mixed delivery in waste collection is developed that can be understood as an extension of fragmentation. Overall, I contribute to the literature on the regulation of public goods and services, roles of competition, and service reliability.

After analyzing fragmentation in Barcelona, a technical assessment of the workability of mixed delivery has been analyzed. Mixed delivery can be used in a fragmented jurisdiction where at least one territory is under public and the other under private production (Bel & Rosell, 2016; Miranda & Lerner, 1995;

² Bel, Germà, and Marianna Sebó. 2020. "Introducing and enhancing competition to improve delivery of local services of solid waste collection." *Waste Management* 118: 637–46. <https://doi.org/10.1016/j.wasman.2020.09.020>.

Savas, 1981). Grounded on reliability considerations, a system consisting of independent units is more reliable and robust. The public sector has different incentives and strategies than the private unit, building so-called concurrent sourcing. Apart from reliability, such systems are more flexible, adaptive, and handle better unforeseen events. The regulator obtains more information on the service, transaction costs can decrease, and monitoring gets cheaper. This could be also a useful mode when the public sector has expertise and experience with the service, but it is not capable to make the delivery for the whole locality. The results indicate that establishing an additional zone would not harm economies of scale, so a mixed delivery or an extension of fragmentation could be a possible way to improve the service.

This chapter has important implications for practitioners by providing a framework to analyze the use of competition and economies of scale so that cost savings can be made. By the introduction of a mixed delivery, some additional benefits can be reaped, and a more reliable system can be designed. In the service of waste management, this is particularly important because it is one of the most important local services in terms of spending of local governments.

As argued above, fragmentation affects the behavior of the firms due to the higher competition it leads to. If competitive pressures work – according to the expectations based on theoretical literature – lower costs should be observed. What happens to the quality of the service is on the other hand unclear. Previous literature on competition shows, that apart from its role to lower costs, it can also be used to collect information on other aspects of performance (Brown & Potoski, 2003a). Generally, it is an index of individual effort to deliver a high-quality service at low costs because the firms can be compared to each other (Sappington, 1991). This role of competition is key in public service delivery when monitoring quality because it is difficult to define and consequently to measure. Given this, supervision is needed, even though it is costly (J. Green & Laffont, 1994; Williamson, 1999). This situation of incomplete contracts can incentivize the firms to behave strategically. Knowing that the quality of the delivery is hard to observe, private companies can save costs – and increase their profits – by reducing the quality of the service (Hart, Shleifer, & Vishny, 1997).

Whereas in the empirical literature, evidence on cost- and efficiency-related outcomes is ample, quality evaluations are scarcer, due to such measurement difficulties (Shrestha & Feiock, 2011). Therefore, my aim with this paper has

been to contribute to filling this research gap. Quality of public service is important for social welfare; I find it particularly important to increase existing knowledge about it through empirical analyses. So, to contribute to the existing knowledge, I analyze the quality of waste collection service in a fragmented delivery zone in Barcelona from the citizens' point of view. Specifically, I focus on the changes in the quality of delivery when firms get closer to each other. How the quality should be measured is an important question for both private and public services. I use citizen complaints as a sign of consumer (dis)satisfaction, a form of civic participation, and a way to evaluate and monitor performance uninterruptedly. So that complaints can be used as a proxy for quality, different propensities of citizens to make a complaint had to be considered. The inclusion of several political, partisan, and socio-economic variables and the inherent interest in participation in local affairs control for such effects (James & Van Ryzin, 2017; Jilke, 2018).

Using panel data methods, I find that higher quality is delivered in the zones that are adjacent to the territory where competitors deliver the service. Lower quality is delivered in peripheral zones, where the distance between the competitors is higher and relative evaluations are much more difficult for the regulator. This paper shows that firms strategically prioritize quality in areas of their concession where due to competition the regulator can have more knowledge about the service. This result is of interest not only for scholars but also provides relevant insights for practitioners when deciding how to monitor quality. The results of this chapter show that by splitting the market of public service, more competition can be achieved that – apart from its disciplinary effects on costs – can be used to obtain more information on the service. Importantly, quality can be monitored where competitive pressures are the strongest. This chapter adds to the literature on regulation by competition, strategies of private firms in public service delivery, and the knowledge on empirical analysis of quality. Generally, it confirms the results of the theoretical literature on firms' behavior when transaction costs are high and information asymmetry allows for moral hazard (Grossman & Hart, 1983). This chapter of the thesis is now published in *Waste Management*.³

In the last chapter of the thesis, I take the discussion from economic considerations to political ones. One of the current phenomena in local

³ Bel, Germà, and Marianna Sebő. 2021. "Watch your neighbor: Strategic competition in waste collection and service quality." *Waste Management*. 127: 637–46. <https://doi.org/10.1016/j.wasman.2020.09.020>

politics is the rise of independent local parties (ILP). Such parties are hard to ideologically pinpoint, the only characteristic that holds the group of ILPs together is that they are independent (Boogers, 2008). The importance of research on ILPs stems from the notion that they are becoming important players in politics as one can observe a certain rejection and mistrust towards mainstream parties. Additionally, sometimes they are seen as competitors of extreme parties (Jankowski, Juen, & Tepe, 2020). Therefore, in this chapter, I raise the question of whether they are genuinely different from mainstream parties in terms of local public finances.

Previous literature on ILP comes from a wide range of countries, such as the Netherlands (Boogers & Voerman, 2010; Otjes, 2018, 2020), Belgium (Dodeigne, Close, & Teuber, 2021), Sweden (Åberg & Ahlberger, 2013), Germany (Jankowski et al., 2020), Austria (Ennsner-Jedenastik & Hansen, 2013) or Poland (Gendźwill & Żóltak, 2014). This literature reveals that local parties are successful in smaller (Dodeigne et al., 2021) and mostly rural municipalities (Ennsner-Jedenastik & Hansen, 2013). Surveys show that they distinguish themselves from mainstream parties (Boogers & Voerman, 2010), and can capture the votes of citizens who don't feel represented by such parties (Otjes, 2018, 2020). Nevertheless, I have found interesting the research question of how local independent parties behave once they are elected.

Not much is known about what such parties do in terms of local public finances and what 'localist' practically means. Thanks to their characteristic of not being bound by ideological positions and pressures of representing higher administrative levels, they can focus on local affairs and promote local interests. Aiming to contribute to filling this research gap, I investigate whether local parties indeed make different choices on the allocation of municipal spending. The choice of the institutional setting is in the Netherlands, where political parties have been on the rise and their relative share is in the municipal council growing (Gradus, Dijkgraaf, & Budding, 2021). In the Dutch context, there are several municipalities where the municipal council is made up of a local majority. Matching these municipalities to those where such a majority is absent, I was able to draw several causal implications. I find that independent local parties spend more on the administrative bodies of the Board of Mayor and Aldermen, the Municipal Council, and Council Committees. They also support local sports activities, playgrounds, and recreational facilities. This leads to the conclusion that they

spend more on “local-oriented” services, supporting earlier research (Boogers & Voerman, 2010).

This chapter has several contributions. I contribute to the knowledge about partisan effects on spending in local governments. Additionally, I revise the literature on ILP and describe geographical differences between them. Last, the chapter offers a deep analysis of the Dutch local political scene. This article has been a fruit of my visiting research stay at the Vrije Universiteit in Amsterdam and is currently available as a working paper. In the following Table 1.1 an overview of the dissertation is presented.

Table 1.1: Overview of the chapters of this thesis

Chapter	Research question	Sample	Methods	Dependent variable	Journal of publication
2	What are the variables that cause discrepancy in the results of empirical papers on inter-municipal cooperation and its associated costs?	Estimations in studies on the effects of inter-municipal cooperation on costs (N=111)	Meta-regression analysis	Reported differences on the effects of inter-municipal cooperation on costs	Urban Affairs Review
3	Did waste collection costs converge between different service-zones? Is it possible to increase the number of service-zones without damaging returns to scale?	Costs and outputs of waste collection in service zones 2015-2019 (N=240)	Fixed and Random effects	Costs of the service of waste collection	Waste Management
4	Do firms behave strategically when delivering quality, according to the relative strength of competition?	Count of complaints on waste collection in neighborhoods 2014-2019 (N=1,080-1,728)	Negative binomial regression, Generalized linear model	Quality of waste collection	Waste Management
5	Do local independent parties make different decisions on municipal finances compared to their national counterparts?	Data on municipal debt and spending 2010-2020 (N=3,649)	Genetic Matching	Debt- and spending categories	Not published

2 Does Inter-Municipal Cooperation Really Reduce Delivery Costs? An Empirical Evaluation of the Role of Scale Economies, Transaction Costs, and Governance Arrangements

2.1 Introduction

The growing skepticism expressed by local governments toward private-sector participation in public service provision, and the different fiscal and economic constraints these governments face in terms of efficiency and effectiveness, have led many local authorities to devise new forms of public service delivery. In recent decades, one of the alternatives most frequently adopted has been inter-municipal cooperation (IMC), within a context of increasing cooperation between governments, local councils, agencies, and political parties (Bouckaert, Peters, & Verhoest, 2016). IMC is seen as a tool that can lower costs by exploiting economies of scale while maintaining greater control over production, something that is not readily achievable with privatization (Hefetz & Warner, 2012; Levin & Tadelis, 2010).

Long-term IMC agreements can be justified on the grounds of benefits of enhanced cross-jurisdictional coordination, service quality, and inter-municipal reciprocity, which usually applies to IMC agreements based on positive past experiences regarding interpersonal trust, reputation, and sanctioning power (Aldag & Warner, 2018). Concerns over stability, equity, and universality also stimulate cooperation. This said, and as happens with other public services, obtaining cost savings is a key rationale for cooperation.

However, the empirical evidence obtained so far does not systematically confirm the cost-saving potential of IMC agreements (as can be seen in our review of results). While the context may be important in explaining the divergent results, this is not in itself an adequate explanation (Feiock, 2007). Thus, the main motivation for our research is to account for the divergence in outcomes reported for IMC agreements and to explore the factors that explain this variation. In this way, policymakers should have more realistic expectations about cooperation.

We benefit from the booming literature over the last decade and seek to reconcile results using meta-regression analysis (see for other types of service delivery, Bel & Fageda 2009; Bel, Fageda & Warner 2010; and Bel & Warner 2016). This article makes three main contributions to the literature. First, to create the database for our meta-regression analysis, we review all available (to the best of our knowledge) multivariate empirical studies that analyze the cost-saving effects of IMC. This includes both published and unpublished articles. Second, based on a prior analysis of the theoretical background underpinning IMC, we study the causes of this variation in results. To do this, we design a multivariate model to check the theoretical outcomes empirically. Specifically, we focus on the effects of economies of scale, transaction costs, and governance arrangements for IMC. Third, and by way of extension, we further analyze the role of transaction costs based on asset specificity and ease of measurability/contract management difficulty, to better understand the nature and the effects of transaction costs based on their components.

We organize the article as follows. First, we review the theoretical background and analyze theory-based outcomes or propositions. Based on this review, we then formulate our hypotheses regarding economies of scale, transaction costs, and governance arrangements. Second, we review the multivariate empirical evidence about the effects of IMC on costs.⁴ We then explain how the database was built and the choices we made to ensure homogeneity. Next, we formulate a multivariate model and present the results from our estimations, which we discuss generally, and also with special attention to the relationship with our theoretical hypotheses. Then, we offer an extension of our model to trace the effects of transaction costs, based on the nature of the specific public services under analysis. Finally, we present the results of robustness tests and draw the main conclusions and policy implications.

2.2 Theoretical Background

Efficient service provision based on IMC has been discussed essentially in terms of the theory of local public economics, within the framework of

⁴ Other empirically based evidence on shared delivery and costs exist, although it is quite scarce (Holzer & Fry, 2011). Honadle (1984) and Ruggine (2006) provide anecdotal information about savings in several cases surveyed in the United States. In contrast, several Australian case studies do not show cost savings (Dollery, Akimov, & Byrnes, 2009). Meta-regression deals solely with multivariate studies, so we do not provide specific details of these studies but concentrate on our main target.

institutional collective action, and related to the principal-agent problem in collaborative governance. Bel & Warner (2016) reviewed the evidence on IMC and costs, and classified the relevant factors into three groups: scale-related costs, organizational characteristics and service-related transaction costs, and governance arrangements. We adopt this same classification and analyze these factors. Before doing so, we should stress that it is not our objective to provide a full analysis of the theoretical factors underlying IMC. In fact, studies so far have mostly focused on studying motives and outcomes of IMC, without paying much attention to its multiple dimensions or to differences in the working of IMC (Teles & Swianiewicz, 2018a). Here, we choose to focus on the studies that are most relevant to the empirical analysis we conduct herein.

2.2.1 Economies of Scale

One of the key motives for adopting IMC is to improve the scale at which a service is delivered, given that municipalities may be of suboptimal size, reflecting the fact that they are usually the outcome of historical/cultural events and do not adhere to any obvious economic/geographic rationale. This means jurisdictional boundaries can be redefined to improve scale and internalize spillover effects. However, certain trade-off relations need to be borne in mind. Mirrlees (1972) explained optimum town size in relation to such conditions as individual preferences regarding consumption, distance from work, area occupied by the individual's residence, and population density in the immediate neighborhood. Similarly, Dixit (1973) argued that it is simply unrealistic not to include the benefits of scale economies in economic models, and proposed a model for determining the optimum size and arrangement of a monocentric city. In this model, he also considered the trade-off between economies of scale and diseconomies of congestion, for instance, in commuter transport.

Taking a different perspective, Ladd (1992) examined the effect of population growth and density on the cost and quality of public services. She found that a higher population density lowers provision costs and described a U-shaped relationship between output and population density. Her study served to confirm that there are certain optimal boundary conditions, and that while economies of scale can be achieved initially, as size increases, scale benefits become exhausted. For this reason, scale economies can be potentially advantageous—above all for smaller municipalities—since with increasing

capacity, average production costs should fall and greater efficiency should be achieved (Hulst & van Montfort, 2012).

One way to modify boundaries for the purpose of service delivery is by means of IMC (V. Ostrom, Tiebout, & Warren, 1961). As has been emphasized by many scholars (i.e., Bel & Costas 2006; Da Cruz & Marques 2012; Hefetz, Warner, & Vigoda-Gadot 2012; Warner & Bel 2008), IMC provides a market alternative, which allows a service to continue under public delivery while enjoying the advantages of scale economies. However, it should be borne in mind that the optimal scale differs for each local public service. Hence, IMC can provide a better alternative than that of amalgamation (which can be considered as generalized—and usually compulsory—cooperation) to profit from scale economies.

Most empirical papers report a negative effect of population on the frequency of cooperation (Bel, Fageda, & Mur, 2014; Hefetz, Warner & Vigoda-Gadot, 2012; Levin & Tadelis, 2010), that is, as the size of the municipalities grows, IMC tends to be less cost-advantageous for the participating municipalities. This belief that IMC is especially beneficial for smaller municipalities has been addressed from other perspectives as well. For instance, Warner & Hefetz (2002, 2003) and Mohr, Deller, & Halstead (2010) emphasize that small municipalities are less likely than larger municipalities to use competitive bidding. However, it is worth noting that the relationship between population size and cooperation can be ambiguous when multiservice cooperation is considered (Bel & Warner, 2016).

Theoretically, therefore, we expect the scale of cooperation to be a significant variable. In the empirical literature, the usual proxy employed for scale is the municipality's average population or output. As such, our first hypothesis states,

Hypothesis 1: Studies of small municipalities tend to find IMC more cost-advantageous.

2.2.2 Organizational Characteristics and Service-Related Transaction Costs

The importance of transaction costs is stressed by Williamson (1999) in accounting for inefficiencies in public bureaucracy. Moreover, he argues that the choice of service delivery method varies according to service type. Building on Williamson's insights, researchers have analyzed the characteristics and nature of transaction costs by looking at a wide range of public services.

Brown & Potoski, (2003a, 2005) revamped the analysis of service-related transaction costs in delivery choices, by focusing on asset specificity and the ease/difficulty of measurement. Levin & Tadelis (2010) not only adopted a similar approach to that of Brown & Potoski (2003a) but also included in their theoretical proposal service characteristics, which they defined as contracting difficulty and resident sensitivity, especially as related to quality. Later, Hefetz & Warner (2012) analyzed service characteristics in terms of asset specificity, contract management difficulty, citizen interest, and market competition. The indexes of asset specificity proposed by Brown & Potoski (2005) and Hefetz & Warner (2012), and of the ease/difficulty of measurement Brown & Potoski (2005) and contract management Hefetz & Warner (2012) are of key relevance to the empirical analysis we conduct herein.

According to transaction cost theory, if delivering a service requires specialized investments, and if performance measurement is difficult, that service will incur high transaction costs (Brown & Potoski, 2003a, 2005). In such a scenario, privatization is less likely. This insight is based on the idea that agents act in their own self-interest and do not cooperate (Jensen & Meckling, 1976). In partnerships, however, which are likely to be based on trust and mutual commitment between participants, these theoretical outcomes may change (Brown & Potoski, 2005). As such, IMC appears better suited to the latter scenario. Furthermore, cooperation can lead to interactive learning (Hefetz & Warner, 2012), and transaction costs can be lowered over time due to that learning process (Máñez, Pérez-López, Prior, & Zafra-Gómez, 2016).

Alternatively, it can be argued that transaction costs in the case of IMC are likely to be high, since participants will incur information and coordination costs, negotiation and division costs, enforcement and monitoring costs, and bargaining costs, as defined by Feiock (2007). We return to these potential costs in the following subsection. However, as Brown (2008) pointed out, cooperation costs do not have to be high. Municipalities tend to place greater trust in other public partners in the case of services exposed to a high risk of opportunism. By way of example, in the case of health and human services, the author concludes that this might occur because governments have similar structures and goals; hence, they are inherently perceived by each other as being more trustworthy. Moreover, although some service-related investments might be high (which usually coincides with high transaction costs), if we consider that IMC is likely to include cost sharing, the results of cooperation can be positive. However, ease of measurement might not necessarily improve

with cooperation, which in a broader sense also refers to the difficulties encountered in contract specification and monitoring (Hefetz & Warner, 2012). Likewise, inter-municipal contracting is more likely to be beneficial for those services for which competition is very low. This can also be explained in terms of transaction costs, since if a market is not competitive enough, it will require a much greater effort by the government to secure and monitor the service at an efficient and effective level (Girth, Hefetz, Johnston, & Warner, 2012).

Based on theoretical insights of the aforementioned studies, our next hypothesis states,

Hypothesis 2: Transaction costs in the context of IMC have a beneficial effect on cost savings.

2.2.3 Governance Arrangements

Engaging in IMC implies that decision-making is externalized, either partially or totally (Argento, Grossi, Tagesson, & Collin, 2009, pp. 45, 50), and because of this, multiple problems related to collective action are likely to arise (Feiock, 2007; Silvestre, Marques, & Gomes, 2018; Voorn, van Genugten, & van Thiel, 2017). Indeed, the transaction costs related to governance arrangements can be high in the case of cooperation, because participants must face the costs—of information and coordination, negotiation and division, enforcement and monitoring, and bargaining—identified in the previous subsection (Feiock, 2007). Moreover, as E. Ostrom (1990) pointed out, trust and norms of reciprocity are also of importance in IMC (see, in this regard, Thurmaier & Wood, 2002), and these can develop through networks (Carr, LeRoux, & Shrestha, 2009; Shrestha & Feiock, 2011). It would seem that trust and commitment are, effectively, critical for IMC to work, making IMC a viable form of public service delivery (Silvestre, Marques & Gomes, 2018).

IMC governance can take the form of informal agreements, formal contracts between the parties, joint-bodies for governance, or the delegation of power and resources to supra-municipal bodies—government or agency (Bel & Warner, 2015, 2016; Hulst, van Montfort, Haveri, Airaksinen, & Kelly, 2009). A common characteristic of all these IMC arrangements is the option available to a municipality to withdraw from the collaboration as and when it wishes. Cooperation is voluntary (unlike the situation in an amalgamation), so opting-out is a viable reaction to undesired outcomes, or to exploitation by more powerful partners.

IMC is subject to potential risks. Marvel & Marvel (2007) found that monitoring can be a central issue, if services are provided internally or by another nonprofit or governmental provider. In such cases, monitoring is either externalized along with the service or the level of monitoring falls. Also, significant problems of coordination (Feiock, 2007, 2013; Lowery, 2000; Antonio F. Tavares & Feiock, 2018) and political transaction costs (Bergholz & Bischoff, 2018; Rodrigues, Tavares, & Araújo, 2012; Tavares & Camões, 2007; Tavares & Feiock, 2018) can also arise.

By looking at IMC through the more structural lens provided by principal-agent theory, the main problem to emerge is that of multiple principals relating with one agent. As Gailmard (2009) shows theoretically, the existence of multiple principals raises a collective action problem in relation to monitoring, which can result in the level of oversight being inferior than that required to guarantee the principals' joint interests. For this reason, even if the principals have interests in common, the institutional structure of the overseeing body plays a key role in relation to accountability. Because of this Voorn, van Genugten, & van Thiel (2019) have suggested the hypothesis that delegation can entail lower transaction costs than other alternative forms of governance arrangements. The problem of multiple principals is further stressed by Da Cruz & Marques (2012) and Van Thiel (2016), among others, and has been found to be damaging for ICM outcomes by Blåka, (2017a), Garrone, Grilli, & Rousseau (2013), Sørensen (2007).

Given the multiple principal problem, the option of delegating to a supramunicipal government or agency has gained increasing attention. This course of action is frequent in Spain (*comarcas* and *mancomunidades*; see Bel, Fageda & Mur, 2014; Warner & Bel, 2008), France (*communautés*; see Frère, Leprince, & Paty, 2014), and more recently, in Italy (*Unione dei Comuni*; see Ferraresi, Migali, & Rizzo, 2018). With governance arrangements of this type, the relation is limited to one principal and one agent. The principal has incentives to consider the interests of all the municipalities involved in the IMC agreement, as each municipality can opt out and leave. Furthermore, these supramunicipal governments typically manage cooperation in different services and, because of this, economies of scale and scope in monitoring and coordination can be exploited (Bel & Costas, 2006; Bovaird, 2014). Hence, the delegation of power and resources to a supramunicipal government or agency can help minimize monitoring and coordination costs, while enabling

participants to reap benefits of cost-related economies of scale. In line with this reasoning, we formulate our next hypothesis.

Hypothesis 3: Delegation to a supramunicipal government tends to make intermunicipal cooperation more cost-advantageous.

2.3 IMC and COSTS: Empirical Evidence

The multivariate empirical literature on the effects of IMC on costs is recent, the first papers published on the topic being Bel & Costas (2006) and Sørensen, (2007). Thereafter, this literature has grown rapidly, as documented in Bel & Warner (2015). In the last few years it has undergone a veritable boom, with an expansion in the coverage of countries and services considered. While the early studies typically focused on solid waste management, subsequent studies have examined many other services.

Multivariate studies on IMC and costs have been conducted (in chronological order) for Spain, Norway, the Netherlands, Italy, France, Czech Republic, Sweden, Germany and the United States. As explained in Bel & Warner (2015, 2016), empirical literature on IMC in the United States has focused much more heavily on drivers of cooperation, because analysis of IMC in the United States is embedded in the wider debate on regionalization. In Europe, where regionalization of services is more frequent than in the United States, drivers of IMC have a singular relationship with costs; hence, empirical studies on effects of IMC on costs have been much more frequent. As usual, studies from countries outside North-America and Europe are not frequent (nonexistent in our case), mainly because of lack of data. In all, our analysis provides a complete vision of the existing empirical literature on IMC and costs, particularly comprehensive for European countries. In the following, we briefly review this literature.

2.3.1 Spain

The earliest study analyzed solid waste management in the region of Catalonia (Bel & Costas, 2006) and examined the relationship between costs and production mode. While the mode of production (public or private) did not show significant effects on the costs of refuse collection, IMC was found to reduce the costs for small municipalities. The Stevens (1978)-type cost function used in this empirical study has been followed in many subsequent studies, facilitating robust comparisons. Later articles by Bel & Mur (2009) and Bel, Fageda & Mur (2014) focused their attention on the Spanish region of Aragon and drew on data from a number of different years. In these articles,

the authors reported that cooperation reduced costs for smaller municipalities. As both these regions (Catalonia and Aragon) share the trait of having higher tiers of government to which functions and resources are transferred for IMC, the authors suggest that delegation can be an advantageous way to organize IMC governance.

Zafra-Gómez, Prior, Díaz, & López-Hernández (2013) analyzed waste management according to the forms of delivery adopted by Spain's small and medium-sized municipalities. The authors considered various forms of IMC (*mancomunidad*, consortium, *mancomunidad* under contract, and supramunicipal management via province, county, or public firms). They found that IMC reduces costs with respect to single municipal delivery. Pérez-López, Prior, & Zafra-Gómez (2015) confirmed these findings in a study that expanded the number of services considered. Further studies by Pérez-López, Prior, & Zafra-Gómez, (2018), Pérez-López, Prior, Zafra-Gómez, & Plata-Díaz (2016), Zafra-Gómez & Chica-Olmo (2019) analyze the effect of cooperation on efficiency using different techniques (order-m frontiers and data envelopment analysis (-DEA)- panel data), and find that smaller municipalities show higher efficiency in waste collection with IMC.

2.3.2 Scandinavian Countries

One of the first articles to examine this question was Sørensen (2007), who studied solid waste collection in Norwegian municipalities. The author compared two theoretical approaches to IMC in the Scandinavian context: on one hand, corporate governance theory, which holds that indirect and dispersed ownership incur high agency costs, and, on the other, standard political economy, which suggests that introducing distance between politicians and decisions might increase service delivery efficiency. Sørensen's results show that, in Norway, IMC is responsible for efficiency losses that are higher than the benefits obtained from scale economies. Remaining in Norway, Blåka (2017a) studied fire and rescue services in a comparison of hypotheses developed under institutional collective action and corporate governance theories, respectively. Her findings indicate that the cost-saving feature of cooperation depends heavily on its organizational form. Costs are

lower for IMC under contractual agreements, but cost-saving significantly decreases with the number of partners.⁵

Holmgren & Weinholt (2016) analyzed the cost of fire and rescue services in Swedish municipalities by means of stochastic frontier analysis. Because Swedish fire and rescue services are increasingly formalizing cooperation between municipalities, and also collaborating with other actors, cooperation was introduced with these two variables, that is, formalized IMC and cooperation with other actors. Both were expected to reduce inefficiency, but the outcomes were mixed: While cooperation with other actors increased efficiency, the effect of cooperation between municipalities was not significant.

2.3.3 The Netherlands

Dijkgraaf & Gradus (2013) analyzed waste collection in Dutch municipalities based on data for the period 1998–2010, using a standard cost function for a long panel dataset. They found cost savings with IMC. The same authors conducted a follow-up study with very similar characteristics, in which they controlled for provincial and municipal fixed effects and found a decreasing significance of cost savings with IMC (Dijkgraaf & Gradus, 2014). The same decreasing significance of cost savings was recorded when they controlled for the impact of various unit-based pricing systems on the quantity of waste produced by different streams.

Other articles have been published recently for the Netherlands. Niaounakis & Blank (2017) analyzed efficiency in relation to cooperation between tax departments, and found that municipalities with a threshold population of 60,000 inhabitants had already exhausted their scale economies, and that IMC stopped being advantageous above that threshold. In the case of municipalities engaged in cooperation, they conclude that, whereas costs may increase initially, IMC does reduce costs over time. Allers & de Greef (2018) have confirmed the costs savings to be gained from IMC in the case of tax collection in Dutch municipalities. However, they found no evidence of cost-saving when considering total public spending. Geertsema (2017) has looked at the interest rate levels of municipalities engaged in IMC and of those working in amalgamation as a proxy for efficiency, and finds that IMC organizations pay a higher interest rate. In contrast, the difference is not

⁵ Although its content goes beyond our main objective here, it is worth noting Blåka (2017b) on effects of cooperation on service quality, an issue for which very little empirical research is available.

significant in the case of amalgamations. Finally, Klok, Denters, Boogers, & Sanders (2018) have recently investigated perceived transaction costs, benefits, and trust attributable to IMC, and find that smaller municipalities are more positive about the perceived benefits of cooperation and that perceived results depend on the form of cooperation.

2.3.4 Italy

Garrone, Grilli & Rousseau (2013) studied joint, inter-municipal ventures in Italy, with a sample made up of multi-utility firms (providing water, electricity, gas, and waste management services). They found that coordination costs increased significantly for such firms, an expenditure that outweighed the potential cost savings from cooperation. A quite different type of IMC, that undertaken by the *Unione dei Comune* (municipal unions, with clear similarities with Spain's *mancomunidades*), is analyzed by Ferraresi, Migali & Rizzo (2018). Their empirical analysis focuses on Emilia Romagna and Toscana and employs difference-in-differences and propensity score matching methods. Their results suggest that being a member of a municipal union reduces a municipality's total per capita expenditure, and that this effect is increasing in a period of up to six years after joining the union. Finally, Giacomini, Sancino, & Simonetto (2018) have recently used survey-based data to examine perceptions in small municipalities and found significant expectations that cooperation can contribute to cost reduction, better quality, and institutional legitimacy.

2.3.5 France

French experiences with IMC and its effects on local expenditure were analyzed by Frère, Leprince & Paty (2014). They examined the effect of fiscal cooperation over the period 1994–2003 and drew two main conclusions: (1) Cooperation has no significant effect on public spending levels, and (2) no spending interactions within the cooperating organization exist.

2.3.6 Czech Republic

Soukopová & Klimovský (2016a, 2016b) analyzed solid waste management in the region of South Moravia for 2013 and 2015, respectively, again using a standard cost function, and found that IMC has cost-saving effects. Soukopová, Ochrana, Klimovský, & Mericková (2016) then extended this study of solid waste management to the whole of the Czech Republic and found that IMC increased costs, contrary to the findings of the previous study. This contradiction triggered a series of follow-up studies in the country.

Soukopová & Sládeček (2018), Soukopová & Vaceková (2018), Soukopová, Vaceková, & Klimovský (2017) undertook analyses in which they introduced variations in terms of municipality size, the time period of their databases, and the regions specifically included. Overall, these studies have found that IMC reduces costs, the most significant values being recorded for small municipalities, but they show that these savings disappear with increasing municipal population size.

2.3.7 Germany

Blaeschke & Haug (2018) examine the effects of IMC on the efficiency of the wastewater sector in Hessen. Using a two-stage data envelopment analysis, they find that IMC is related to lower levels of technical efficiency. However, smaller municipalities can benefit from scale economies through cooperation. Using a metafrontier analysis of efficiency, the authors show that cooperation gains from scale economies are probably off-set by technical inefficiencies. Furthermore, scale effects apply primarily to small municipalities.

2.3.8 The United States

The effects of cooperation in the United States have been studied by Bel, Qian, & Warner (2016) by drawing on survey-based data from a large sample of municipalities in New York State in 2013. The analysis examines a wide range of services and finds conflicting results. This indicates that the cost-saving potential of IMC depends on the characteristics of each service. The authors found that cooperation in police, library, road, and highway services reduced costs at the 1% level of significance, while it was effective in garbage and landfill management at the 10% level. For the remaining services, no significant effects were found.

2.4 Data

To create a comprehensive database that includes all studies of the effects of IMC on costs and to obtain a representative and unbiased dataset, we conducted a search of the following academic literature database services between April and July 2018: EconLit, Social Science Research Network, AgEcon, and Repec-Ideas. So as to include unpublished studies and “gray literature” too, we searched the following websites: OpenSIGLE, NBER, National Technical Information Service in the United States, U.S. GAO, E-Thesis Online Services, and European Science Research Council. We used the following keywords: “inter-municipal cooperation,” “interlocal cooperation,” “interlocal contracting,” “joint contracting,” and “shared delivery.” In

addition, we conducted a search using the same keywords on Google Scholar. Finally, we reviewed citations in all the articles we had identified that way. In all, we identified 29 multivariate empirical studies of the effects of IMC on costs, broadly considered. After completing a brief literature review (see previous section), we next defined the rules for the inclusion of studies in the meta-regression. Our main selection criterion was to ensure the homogeneity of the definition of variables included in our database.

After applying this criterion for inclusion, we then extracted the required data from the individual studies. First, the list was confined to those studies in which the costs associated with cooperation were considered as the dependent variable when compared with the costs of individual municipalities.⁶ We then checked whether IMC was defined homogeneously in the articles.⁷ After confirming the homogeneity of the studies included in the meta-regression analysis, we next sought to ensure the homogeneity of the data for our moderators and our theory-related variables. To do this, we contacted several authors to obtain data on the average population of the municipalities included in the estimations.⁸ After all these refinements, we ended up with a database comprising 18 published and unpublished studies, with a total of 111 estimations. Throughout this process, we carefully adhered to the MetaAnalysis of Economics Research Reporting Guidelines set out in Stanley et al. (2013).

Table 2.1 shows the studies included in our database for the meta-regression, with their main characteristics. We have useful information on studies

⁶ Because of this constraint to achieve homogeneity of the dependent variable, we had to exclude those studies where the dependent variable was efficiency indicator (Holmgren & Weinholt, 2016; Pérez-López et al., 2018; Pérez-López et al., 2016), interest rates (Geertsema, 2017), management costs incurred by the public utility firm (Garrone et al., 2013), volume of drinking water (Blaeschke & Haug, 2018), as well as perceptions of transaction costs and benefits (Klok et al., 2018), and overall cost perceptions (Giacomini, Sancino & Simonetto 2018).

⁷ Beyond the content of articles in our data base, we also revisited Teles & Swianiewicz (2018b) for countries that are both in our database and in that volume (Norway, France, the Netherlands, Spain and Czech Republic), to analyze homogeneity/heterogeneity of inter-municipal cooperation (IMC). In this step, we had to discard three studies that estimated more than one type of cooperation at the same time: Pérez-López et al. (2015), Zafra-Gómez et al. (2013), Zafra-Gómez & Chica-Olmo (2019).

⁸ In this way, we obtained additional data from Dijkgraaf & Gradus (2013 2014), Ferraresi, Migali & Rizzo (2018), Soukopová et al. (2016), Soukopová & Sládeček (2018), Soukopová & Vaceková (2018), Soukopová et al. (2017).

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conducted for Spain, Norway, the Netherlands, Czech Republic, France, Italy, and the United States. As for the specific services, they include a wide range of fields in which municipalities cooperate. Of the 111 estimations, 23 are drawn from either book chapters, conference papers, or other unpublished studies. In total, 20% of the estimates come from unpublished work. Moreover, two thirds of the estimates are drawn from panel data.

Our database includes information on the service(s) considered, the region and/or country for which the study was conducted, the type of collaborative governance arrangement, the year(s) for which the data were obtained (we take the average year in case that data were obtained for several years), the sample size, the type of estimation, and the overall results for the variable of interest. All these are shown in Table 2.1, in which we can see that among the 18 studies included in our study, nine obtain costs savings, seven obtain mixed or insignificant results, and two obtain cost increases.

Table 2.1: Multivariate studies included in the meta-regression analysis

Study	Service	Region/Country	Governance Arrangement	Year Data Collection	Sample Size	Nr. of estimations	Type of estimation	Effect of IMC on cost
Bel & Costas (2006)	solid waste	Catalonia-Spain	<i>Comarques</i> (counties)	2000	186	5	Cross-Section	Saves costs
Sørensen (2007)	solid waste	Norway	Intermunicipal Corporations	2005	211-311	2	Cross-Section	Increases costs
Bel & Mur (2009)	solid waste	Aragon-Spain	<i>Comarques</i> (counties)	2003	56	4	Cross-Section	Saves costs
Dijkgraaf & Gradus (2013)	solid waste	Netherlands	IM contract & IM corporation	1998-2010	5,886	2	Panel	Mixed results
Dijkgraaf & Gradus (2014)	solid waste	Netherlands	Intermunicipal Corporation	1998-2010	5,878	2	Panel	Insignificant results
Frère, Leprince, & Paty (2014)	Multi-service	France	Communautés (communities)	1994-2003	2,950	4	Panel	No significant impact
Bel, Fageda and Mur (2014)	solid waste	Aragon-Spain	<i>Comarques</i> (counties)	2008	80	2	Cross-Section	Saves costs
Soukopová & Klimovský (2016a)	solid waste	South Moravia – Czech Rep.	several forms	2013	670	2	Cross-Section	cooperation saves costs
Soukopová & Klimovský (2016b)	solid waste	South Moravia – Czech Rep.	several forms	2015	658	1	Cross-Section	cooperation saves costs
Soukopová et al. (2016)	solid waste	Czech Republic	several forms	2013	365	1	Cross-Section	Increases costs

Continued

Table 2.1: Continued

Study	Service	Region/Country	Governance Arrangement	Year Data Collection	Sample Size	Nr. of estimations	Type of estimation	Effect of IMC on cost
Niaounakis & Blank (2017)	tax collection	Netherlands	IMcooperation tax units	2005-2012	3,116	2	Panel	No significant impact
Soukopová, et al. (2017)	solid waste	Several Czech Rep.	several forms	2014	1,962	4	Cross-Section	cooperation saves costs
Bláka (2017a)	fire services	Norway	IM contracts & IM corporations	2013	428	4	Cross-Section	Insignificant effect
Soukopová & Vaceková (2018)	solid waste	South Moravia – Czech Rep.	several forms	2012-2014	205	4	Panel	cooperation saves costs
Soukopová & Sládeček (2018)	solid waste	Olomouc & Zlín-Czech R.	Several forms	2014-2016	710	6	Panel	cooperation saves costs
Ferraresi, Migali, & Rizzo (2018)	Multi-service	Emilia Rom. & Toscana-Italy	Unione dei Comuni	2001-2011	3,686	17	Panel	cooperation saves costs
Allers & de Greef (2018)	several services	Netherlands	IM corporation	2005-2013	3,331	36	Panel	Mixed results
Bel, Qian and Warner (WP)	several services	New York St.-US	Several forms	2013	293-852	13	Cross-Section	Savings for police, library, roads, solid waste. No effect for other services

Note: 'Multiservice' indicates that the study did not differentiate between services. 'Several services' indicates that different services were considered in the study, and almost all or all the estimations were made for single services. Source: Authors

2.5 Empirical Strategy

2.5.1 The Model

Because the aim of this article is to analyze the divergence in the outcomes of studies examining the effect of IMC on service costs, we opted to employ a meta-regression methodology to explain the variation in results. This methodology has been widely used, for example, in psychotherapy and in studies of expectations and different types of elasticity, and so on (Jarrell & Stanley, 1989) as well as to analyze the effects of privatization on the costs of local public service delivery (Bel, Fageda & Warner, 2010) the effects of private/public ownership on the productivity of local water services (Carvalho, Marques & Berg, 2012), the factors explaining the choice of the privatization of local public services (Bel & Fageda, 2009), and the factors that account for the choice of IMC (Bel & Warner, 2016). The standard econometric model has the following structure:

$$\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \quad (2.1)$$

In this way, we can *explain* both the determinants of an event or phenomena and their importance and magnitude. If, however, we want to explain reported *differences*, we require a model that can synthesize the various findings. The structure proposed by (Jarrell & Stanley, 1989) is as follows:

$$b_j = \beta + \sum_{k=1}^{\kappa} \alpha_k Z_{jk} + e_j, \quad (j = 1, 2, \dots, L) \quad (2.2)$$

where b_j , the observed dependent variable, is the reported coefficient of the true effect— β from the j th study out of the set of L studies. The other part of the equation includes the “meta-part,” in which α_k represents the meta-regression coefficients, Z_{jk} the meta-independent variables that capture the systematic variations between studies, and e_j is the meta-regression disturbance term. Thus, the studies’ different results cause differences in Z_{jk} , and α_k is the average biases introduced by the misspecification of the studies. From a practical point of view, instead of using the reported coefficients for b_j , it is customary to use the ratio between the reported coefficient and the standard error, that is, the t-value. The reason is that in studies using different

data sets, sample sizes, and model specifications, the variances of the coefficients are likely to be different, and so the meta-regression errors will be heteroscedastic. Here, we use the t-values for the estimations (either as reported in the studies or as calculated from the standard errors).⁹

To conduct our estimations, we formulate the following equation:

$$t - value_i = \alpha_0 + \alpha_1 SampleSize_i + \alpha_2 YearData_i + \alpha_3 US_i + \alpha_4 Multiservice_i + \alpha_5 Panel_i + \alpha_6 Population_i + \alpha_7 TransactionCosts_i + \alpha_8 Delegation_i + e_i \quad (2.3)$$

Hence, our model includes eight variables. The first five are the usual moderators related to the environmental or technical characteristics of each study. The last three are variables that reflect theoretical expectations concerning the results: *Population*, *TransactionCosts*, and *Delegation*.

As argued earlier, one of the most important drivers of IMC is the achievement of optimal boundary levels with the lowest average costs for the provision of a given service. By extending these boundaries, municipalities' scale economies can be a good way to reduce costs. In the studies included in our dataset, the variable representing output is the number of inhabitants. This figure is determined here by data availability, and the results are also readily double-checked. Thus, we examine Hypothesis 1 based on the average population of the municipalities included in the estimations. We expect this variable to be significant and to present a positive sign, reflecting the fact that the cost advantages of IMC tend to be more frequent in studies of small municipalities.

Hypothesis 2 was formulated to reflect the expected decreasing effect on costs (negative relationship) of service-related transaction costs with IMC. We have constructed *TransactionCosts* as a categorical variable, taking stock of the ratings and indicators provided by Brown & Potoski (2005) (B&P Index) and by Hefetz & Warner (2012) (H&F Index). The variable takes a value of zero if the transaction costs index of the specific service in the estimation is low (below average) according to the combined (B&P) and (H&F) indexes. A value of one corresponds to estimations that include many services (we assume this to be

⁹ Dijkgraaf & Gradus (2013, 2014) did not report any of these values, so we asked the authors to provide us these details from their estimations.

an intermediate position regarding transaction costs), and a value of two indicates relatively high transaction costs of a specific service, with respect to average values on the (B&P) and (H&F) indexes.¹⁰ In keeping with Hypothesis 2, we assume this variable to be negatively related to costs. Later, we extend our analysis and consider in greater detail the nature of transaction costs.

The dummy representing *Delegation* captures the effect of the transfer of power and resources to a supramunicipal level of government, where decisions are made about the service delivery. This variable is relevant because it can be used to test Hypothesis 3 as defined earlier. We expect this variable to be significant and to present a negative sign. Table 2.2 summarizes information on our main variables; Table 2.3 shows their descriptive statistics.

¹⁰ Other articles in the literature had taken indicators on transaction costs built by Brown & Potoski (2005) (i.e., Bel & Fageda, 2008; López-Hernández, Zafra-Gómez, Plata-Díaz, & de la Higuera-Molina, 2017). Restricting our specification to an only low-versus-high transaction cost would force us to exclude 21 observations from Ferraresi, Migali, & Rizzo (2018) and Frère, Leprince, & Paty. (2014), because these do not run separate estimations for each service, so they cannot have a low-versus-high transaction cost differentiation. Also, we believe that combining Brown and Potoski (2005) (B&P) and Hefetz & Warner (2012) (H&W) indicators provides a more comprehensive view of the literature. In practice, if we used the low-versus-high specification based only on B&P, results for transaction costs keep being insignificant, and the estimations are less robust, above all for the important reduction of the sample.

Table 2.2: Variables used in the meta-regression analysis

Variables	Description	Expectation
T-Value	T-Value from each estimation	
SampleSize	Number of observations of each estimation.	None
YearData	Year of collection of data for the dependent variables	None
US	Dummy variable with value one for studies on US, and zero otherwise	None
Multiservice	Dummy taking the value of 1 for multi-services and 0 for single-service	None
Panel	Dummy taking value of 1 if panel data is used in the study, 0 otherwise	None
Population	Average population in the municipality as reported	Positive sign
TransactionCosts	Categorical variables taking value of zero (low TC), one (intermediate TC), or 2 (high TC)	Negative sign
Delegation	Dummy variable that takes value 1 if there was delegation to a supra-municipal government, or 0 otherwise	Negative sign

Note: TC = TransactionCosts.

Table 2.3: Descriptive statistics of the variables used in the meta-regression analysis

Moderator variables	Mean	Standard Deviation	Minimum	Maximum
T-Value	-1.267	2.850	-8.38	18.89
SampleSize	2613.47	5312.20	39	28950
YearData	2008.87	4.21	1999	2015
US	0.12	0.32	0	1
Multiservice	0.23	0.45	0	1
Panel	0.66	0.48	0	1
Population	20706.67	16644.66	235.79	101167
TransactionCosts	0.51	0.64	0	2
Delegation	0.29	0.46	0	1

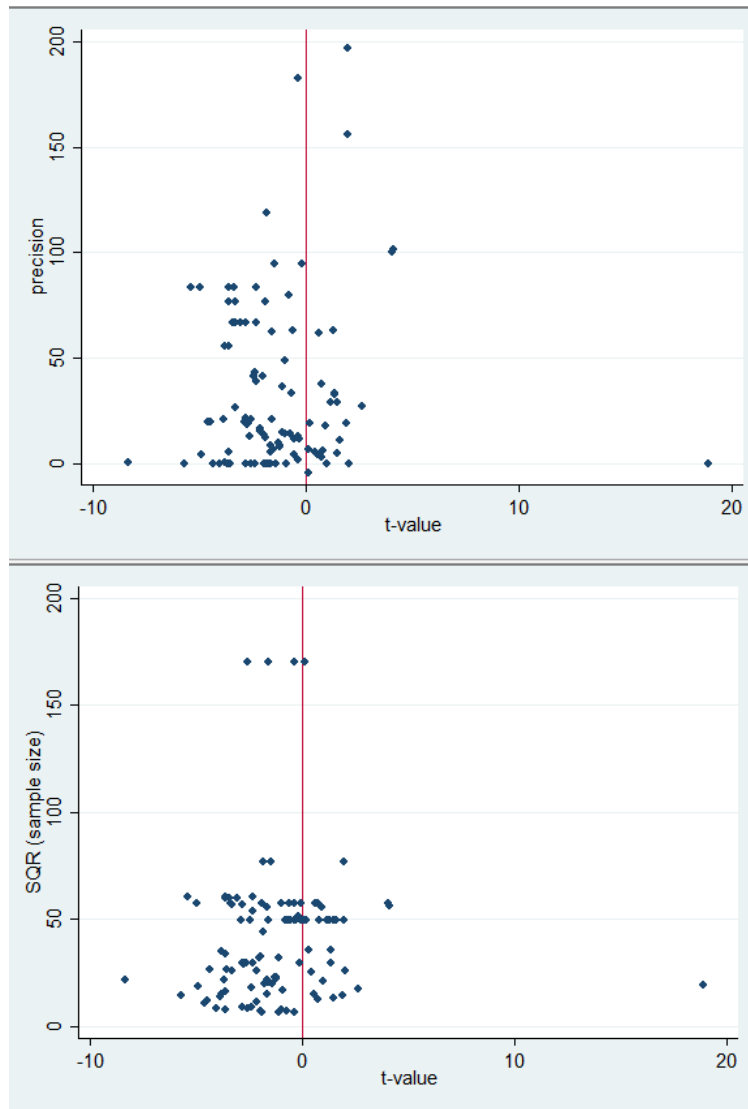
Note: Recall that the variable ‘Population’ reflects the average population size of the municipalities in the estimation.

2.5.2 Funnel Plots

One of the potential threats to meta-analyses (and other methods based on literature reviews, in general) is that published studies have a greater tendency to report positive effects. This so-called “publication bias” (D. Card, Kluve, & Weber, 2010) can greatly affect results, so in this subsection, we seek to evaluate whether it is present in our estimations. Funnel plots are a represents effect sizes (N. A. Card, 2012; Stanley, 2008). If there is no “publication bias,”

the funnel plot should give us symmetrically varying estimates around the “true effect.” At the bottom, studies with high standard errors (and, therefore, less precise) will be shown. Here, Figure 2.1 shows that there are more estimates on the negative side of the true effect; hence, it is probable that “publication bias” is present.

Figure 2.1: Funnel plots for precision and size



Note: SQR = Square Root

2.6 Results

Our results are shown in Table 2.4. We first estimated the model with ordinary least squares (OLS). After testing for heteroscedasticity (Breusch–Pagan/Cook–Weisberg test: $\text{prob} > \chi^2 = .000$), we had to reject the null hypothesis

of constant variance. Hence, we corrected the standard errors by conducting the estimation with robust OLS. The variance inflation factor (VIF) was 3.35. Hence, multicollinearity is not a relevant problem in our estimation. To avoid confusion when interpreting our results, it is important to recall that a negative coefficient means that the explanatory variable is related to lower costs with IMC and, therefore, with a substantive positive effect (cost reduction is preferred) of IMC on costs.

The results show that two moderators, *YearData* and *US*, have no significant impact on the differences in results in the relationship between IMC and costs.¹¹ In contrast, *SampleSize* shows some weak statistical significance (10% level) and presents a positive sign. Looking at the explanation for this technical variables, *Multiservice* is significant at the 1% level, and its coefficient presents a positive sign, which implies that studies that consider an aggregate set of services, in the delivery of which municipalities cooperate, tend to find IMC less advantageous in terms of costs. A likely finding is that most studies with one single service are done for solid waste collection, service for which economies of scale have been usually found in the literature. *Multiservice* estimations likely include services for which economies of scale might be not so relevant, and because of this, IMC might be not as beneficial as it is for solid waste.

¹¹ Several articles (i.e., Zafra-Gómez et al., 2013) have found effects of the Great Recession on management decisions related to costs in local public services. Following this observation, we have run our models with a dummy variable that differentiates between estimations with data taken for years later than 2008, and those with data taken for 2008 or before. This variable is never significant ($p = .855$ for ordinary least squares [OLS], $p = .784$ for OLS Robust, and $p = 0.801$ for generalized estimating equations [GEE]); all other variables keep the same sign and significance, and all estimations have lower explanatory power. This is in line with Raudla & Tavares (2018), who did not observe a direct connection between the use of IMCs and austerity.

Table 2.4: Results from meta-regression

	OLS	Robust OLS	GEE	GLS
Sample Size	6.78E-05 (6.28E-05)	6.78E-05* (4.05E-05)	7.15E-05** (3.53E-05)	1.30E-04 (2.00E-04)
Year Data	-0.152 (0.130)	-0.152 (0.103)	-0.142 (0.088)	-0.034 (0.169)
US	-1.790* (1.003)	-1.790 (1.187)	-1.831 (1.254)	-4.101 (2.870)
Multi-Service	4.185*** (1.093)	4.185*** (1.183)	4.147*** (1.203)	3.290*** (0.160)
Panel	-3.727*** (0.793)	-3.727*** (1.364)	-3.820** (1.497)	-5.377** (2.557)
Population	4.65E-06** (2.09E-06)	4.65E-06** (2.06E-06)	4.44E-06*** (1.41E-06)	3.85E-05*** (5.79E-06)
TransactionCosts	-0.777 (0.485)	-0.777 (0.484)	-0.782 (0.554)	-0.320 (0.251)
Delegation	-5.473*** (1.259)	-5.473*** (1.086)	-5.377*** (0.915)	-5.498*** (1.297)
Constant	306.799 (260.843)	306.799 (206.063)	287.147 (174.939)	70.857 (338.758)
Observations	111	111	111	111
Adjusted R-squared	0,285	0,337		
F-statistic	6.48***	14.16***		
Breusch-Pagan/Cook-Weisberg test (p>chi2)	0.000			
VIF	3.35			
Wald(Chi)2			132.45	161422.87
Prob>Chi2			0.000***	0.000***

Note: Standard errors in parenthesis.

***Significant at 1% level; **Significant at 5% level; *Significant at 10% level

Of the other technical variables, *Panel* is significant at the 1% level and presents a negative sign, which indicates that studies based on panel data, as opposed to those that rely on cross-sectional analysis, tend to find IMC more advantageous. As studies with panel data tend to provide more robust results (note also that estimations in all studies with panel data in our sample are with fixed effects), we can conclude that analytical robustness analysis is positively related with the cost advantages derived from cooperation.¹²

¹² We have also considered a differentiation between studies depending on whether they allow for causal interpretation. To do so, we have re-estimated our model with a variable that differentiates the estimations from studies using either diff-in-diff (Ferraresi, Migali & Rizzo,

In the case of the theoretically based variables, *Population* was expected to be significant with a positive sign. Our results present the expected sign, and the variable is significant at the 5% level. This confirms Hypothesis 1, according to which IMC is more advantageous for small municipalities, but as their population grows they are less likely to reap the benefits of scale economies as they may have been able to exploit them more fully without cooperation. However, these municipalities still incur coordination costs when engaging in cooperation.

Hypothesis 2 states that these service-related *TransactionCosts* are positively related with the cost advantages of cooperation, and as such, we expected a negative sign for this variable. However, we fail to find a significant relationship between service-related transaction costs and the results obtained in the studies, which would suggest a weak relationship between these costs and those of IMC. Finally, we sought to capture the effect of governance arrangements by means of our variable *Delegation*. Consistent with Hypothesis 3, we found *Delegation* to be statistically significant at the 1% level and to present a negative sign, which implies that delegating power and resources to a supramunicipal government when cooperating is associated with cost advantages for the cooperating municipalities.

Next, because our sample is formed with observations from 18 studies, each of them containing a different number of estimations, we might be exposed to problems of dependence across observations (J. Nelson & Kennedy, 2009; Ringquist, 2013). To deal with within-study autocorrelation, we follow Ringquist's (2013) suggestion and employ generalized estimating equations (GEE) to estimate a random effects meta-regression model.¹³ In this way, we obtain both consistently estimated coefficients and standard errors. The GEE results, shown in the right-hand column of Table 2.4, are very similar to those

2018) or instrumental variables (Blåka, 2017a), and one estimation in Bel et al. (2014), from the other estimations. In all cases, we have not obtained any statistical significance for this new variable ($p = .763$ for OLS, $p = .642$ for OLS Robust, $p = .668$ for GEE). In all cases, the other variables keep same sign and significance, with the exception of sample size in the GEE estimation, which becomes not significant.

¹³ J. Nelson & Kennedy (2009) and Ringquist (2013) discuss other potential sources of dependence across observations, including common data sets and research teams employed in distinct studies. Recall that in our database, no data set was used in more than one study. In the case of research teams, the studies done by the same researchers used different data sets, were undertaken in different jurisdictions, and/or used different estimation techniques. For these reasons, we believe we have no other relevant problems of dependence across observations, apart from the number of estimations in each study.

from the robust OLS estimation. The only difference was presented by *SampleSize*, which was significant at the 10% level and now is significant at the 5% level, and in the same direction, significance of *Panel* decreases from 1% to 5%. On the contrary, *Population* now increases significance, at 1% level. As a check, we estimated a random effects generalized least squares model to determine the robustness of our results. Right-hand column in Table 2.4 shows the results. All the conclusions reported earlier continue to apply with the exception that the significance of *SampleSize* disappears, which makes us to be cautious about the results for this variable.

2.7 An Extension of the Analysis of Service-Related Transaction Costs

The transaction costs associated with IMC are related to the characteristics of the collaboration activities in which the municipalities engage (Hawkins, 2017). By classifying the service-related transaction costs, we can take into account the nature of the service provided, which should help disentangle the relationship between service-related transaction costs and IMC costs. The two characteristics we can focus on are, on one hand, asset specificity, and on the other, ease of measurement. Asset specificity can be defined as the level of specific physical infrastructure or technical knowledge needed, while ease of measurement can be defined as quantifiability in contractual terms (Brown, Potoski, & Van Slyke, 2015). Based on these theoretical outcomes, we formulate the following hypotheses:

Hypothesis 2a: Asset specificity is positively related to the cost advantages of IMC.

Hypothesis 2b: Ease (difficulty) of measurement is negatively (positively) related to the cost advantages of IMC.

To analyze these two hypotheses, we checked the studies that assessed services based on more than one of their dimensions. We took the indicators for asset specificity from (Brown & Potoski, 2005) and (Hefetz & Warner, 2012): *AS_B&P* and *AS_H&W*, respectively. The ease of measurement indicator is taken from Brown & Potoski (2005), that is, *EM_B&P*, while the indicator of contract management difficulty (which embeds ease/difficulty of measurement) is taken from Hefetz & Warner (2012), that is, *CMD_H&W*.

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We run GEE estimations by introducing each of these factors sequentially.¹⁴ Table 2.5 shows the results.

It is worth noting that all significant variables, and particularly those theoretically grounded, mentioned previously keep the same sign and level of significance across all estimations. Looking at transaction costs, when we consider AS_B&P and EM_B&P measures, we find that neither helps account for differences in the IMC cost results. However, when we include in the estimation the AS_H&W and the CMD_H&W measures, a somewhat different picture emerges: Both asset specificity and contract management difficulty are significant (the first one at the 10% level and the second at the 5% level) and are associated with IMC cost advantages. Note, however, that we need to be very cautious in our interpretation of these results. Indeed, they point to the need for further research to disentangle more fully the relationship between service-related transaction costs and service costs under IMC.

¹⁴ We lost three observations when assigning transaction cost measures from Brown & Potoski, (2005) and Hefetz & Warner (2012), to services in estimations, because we could not assign precise values to youth recreation, economic development and promotion, and zoning and planning, all three from Bel, Qian, & Warner. For estimations including various services, we used the average values for the measures in Brown & Potoski (2005) and Hefetz & Warner (2012).

Table 2.5: Asset specificity and ease of measurement

Variables	AS B&P	E(D)M B&P	AS H&W	CMD H&F
Sample Size	6.04E-05* (3.33E-05)	7.04E-05* (3.62E-05)	6.80E-05* (3.51E-05)	7.72E-05* (4.01E-05)
Year Data	-0.166* (0.091)	-0.152* (0.85)	-0.156* (0.086)	-1.401 (0.089)
US_1	-2.604* (1.471)	-2.533* (1.514)	-2.211 (1.349)	-2.048 (1.373)
Multiservice	3.554*** (1.129)	3.403*** (0.783)	4.031*** (0.985)	4.039*** (0.899)
Panel	-3.641** (1.542)	-3.554*** (1.439)	-3.655** (1.425)	-3.705** (1.480)
Population	3.87E-05*** (1.49E-05)	4.44E-05*** (1.62E-05)	4.28E-05*** (1.48E-05)	4.48E-05*** (1.61E-05)
AS_B&P	-0.715 (1.582)			
EM_B&P		-0.765 (0.580)		
AS_H&W			-1.008* (0.552)	
CMD_H&W				-1.223** (0.581)
Delegation	-5.349*** (0.868)	-5.293*** (0.900)	-5.447*** (0.927)	-5.355*** (0.922)
Constant	336.025* (179.774)	308.353* (170.478)	318.172* (171.634)	285.744 (177.791)
Observations	108	108	108	108
Wald(Chi) ²	216.09	96.40	99.39	108.37
Prob>Chi ²	0.000***	0.000***	0.000***	0.000***

Note: Standard errors in parenthesis. ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level

2.8 Robustness Tests

As the funnel plot (Figure 2.1) shows, our sample might suffer from problems of “publication bias.” In this section, we test for its presence and evaluate its relevance. First, we conducted the funnel asymmetry test (FAT) to check for the presence of “publication bias” both in terms of study precision (FAT 1) and sample size (FAT 2), as recommended by Stanley (2008) and Stanley & Doucouliagos (2012). In the absence of any bias, the estimations should be randomly spread around the “true effect.” However, if the effect observed

correlates with the standard error, then we need to test whether the publication selection has a genuine effect Stanley (2008). In addition, Begg & Berlin (1988) argued that “publication bias” can also be caused by overlooking the variability in sample sizes. If the sample size is small, it is likely that the estimates’ variability will be greater. Similarly, if there is no “publication bias,” the graph depicting sample size and effect size should be symmetrical.

Table 2.6 shows the results from the FAT tests. The key issue is the significance of the intercept and its sign, which in turn reflects the sign of the bias (Stanley, 2008). Here, both in FAT (1) and FAT (2), the constant is negative and significant at the 1% level, which means “publication bias” is a relevant concern in our database. Furthermore, we can analyze the presence of a genuine empirical effect—regardless of the “publication bias.” The meta-significance test (MTS) is based on the ability of the statistical power to provide evidence of a genuine empirical effect based on the relation between the t-value and the degree of freedom. According to the MTS result shown in Table 2.6, we can see that this genuine effect is negative, that is, we find a genuine negative effect of IMC on costs. This, in turn, helps explain the results of FAT(1) and FAT(2).

Table 2.6: Funnel asymmetry (FAT) and meta-significance (MTS) tests

	FAT(1)	FAT(2)	MTS
Precision	0.001*** (4.18E-04)		
SQR_SampleSize		0.006 (0.006)	
log_df			-0.169** (0.066)
Constant	-1.386*** (0.300)	-1.491*** (0.452)	0.660*** (0.180)
Observations	111	111	111
R-squared	0.012	0.004	0.047
F	11.19***	0.79	6.65**

Note: (robust) standard errors in parenthesis;

***Significant at 1 percent level; **Significant at 5 percent level; *Significant at 10 percent level

To assess the potential effect of publication bias on our results, we have estimated two FAT meta-regressions (Stanley, 2005), replacing sample size first with study precision (the inverse of standard error) and then with the

square root of sample size. Both FAT meta-regressions, employing the two different estimation techniques, give identical results to those found in our original meta-regressions, above all in the case of the theory-related variables. Table 2.7 shows the results of the FAT meta-regressions. For the sake of simplicity, we include only the GEE estimation (OLS, Robust OLS, and generalized least squares [GLS] results are available on request). Thus, we can conclude that “publication bias” does not undermine our results.

Table 2.7: FAT meta-regressions

	FAT1 GEE	FAT2 GEE
Precision (Inverse SE)	7.40E-04*** (2.74E-04)	
SQRSampleSize		0.014 (0.009)
Year Data	-0.228*** (0.070)	-0.145 (0.096)
US	-1.629 (1.138)	-1.775 (1.237)
Multiservice	4.400*** (1.328)	3.964*** (1.121)
Panel	-3.598** (1.391)	-3.935*** (1.534)
Population	3.38E-05** (1.34E-05)	4.18E-05*** (1.27E-06)
Transaction costs	-0.695 (0.527)	-0.783 (0.554)
Delegation	-5.949*** (1.120)	-5.280*** (0.858)
Constant	460.247*** (140.210)	291.514* (192.855)
Observations	111	111
Wald(Chi) ²	908.43	423.39
Prob>(Chi) ²	0.000***	0.000***

Note: (robust) standard errors in parenthesis. ***Significant at 1% level; **Significant at 5% level; *Significant at 10% level

2.9 Discussion and Conclusion

This study has sought to provide an explanation for the diverging empirical results of the effects of IMC on service delivery costs, and within this framework, to determine whether theoretical expectations about IMC play a relevant role in explaining these results. We have paid particular attention to

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hypotheses concerning economies of scale, service-related transaction costs, and governance arrangements.

After carefully building a database of all homogeneous multivariate studies that have addressed the issue, we employed a meta-regression methodology. Our data base is comprehensive—to our knowledge—of all available multivariate empirical studies on IMC and costs. Among the 18 studies included in our meta-regression, nine obtain costs savings, seven obtain mixed or insignificant results, and two obtain cost increases. While inter-local contracting has little presence in our study because of scarcity of studies on the United States, where it is most frequent, our analysis is extremely representative of other types of IMC, and of European practices of IMC.

We obtained interesting insights into the role played by the environmental and technical variables; thus, studies that focus on single services and those that employ panel data tend to find greater cost advantages of IMC. More importantly, we found that studies conducted in municipalities with small population sizes tend to find IMC more cost advantageous, which is consistent with the hypothesis we formulate in relation to scale economies. We also found that the studies in which the governance of cooperation is delegated to supramunicipal governments tend to find IMC more cost advantageous.

We did not find any significant overall relationship between service-related transaction costs and the cost advantages of IMC. When decomposing transaction costs into asset specificity and contract management difficulty, we found a slightly significant positive effect of transaction costs on the cost advantages of IMC. These results, though, should be treated as preliminary findings because they are neither systematic across estimations, nor statistically strong. Indeed, more empirical research on transaction costs and IMC is needed.

We have not been able to consider here questions of service quality, given that the empirical evidence is extremely scarce. Also, scarcity of studies on the United States and lack of studies on developing countries prevent us from claiming full generalization of our results. These are limitations of our analysis, and also issues that deserve further research.

In all, our research provides interesting results with considerable implications for the effects of IMC on costs. We believe the main implication that can be drawn by policy makers from our results is that “one size does not fit all”:

IMC can be cost advantageous for some services, but not for others. The possibility of exploiting scale economies, particularly in the case of small municipalities, seems to be robustly associated with cost savings. Moreover, just how the governance of the cooperation is arranged matters, highlighting the need to carefully consider the coordination and supervision costs involved.

3 Introducing and Enhancing Competition to Improve Delivery of Local Services of Solid Waste Collection

3.1 Introduction

This study aims to evaluate waste collection reforms that can successfully contribute to enhance competition. The waste service in the city of Barcelona is evaluated, where regulation by competition has been in operation for several decades, as four exclusive waste collection zones have been awarded by means of a ‘split auction’. The empirical analysis studies the cost determinants of solid waste services in Barcelona and investigates whether there are any differences in the cost and scale economies of the four existing waste collection zones.

The first research question is: Did waste collection costs converge between the different service-zones (as competition would make to expect)? To the best of our knowledge, this is the first analysis comparing waste collection costs for different concessions in different zones within the same political jurisdiction, which means all studied management units are under exactly the same regulation [see Bel & Rosell (2016) for such type of analysis for bus transportation].

Based on these results, a reform aimed at improving the efficiency of solid waste collection is proposed. To do so, the results on returns to scale must be analyzed, because it is a prerequisite to understand whether increasing the number of collection zones, while potentially good for competition, could negatively affect costs because of scale reasons. Hence, the second research question is: Is it possible to increase the number of service-zones to increase competition without damaging returns to scale? We are not aware of any technical analysis of this type previously conducted in order to inform a proposal of policy reform to improve waste collection in a city. In this way, the study further contributes to the literature by developing a design for the reform of a waste collection system. Given that it serves a large urban area (Barcelona), it could eventually be applied to similar urban contexts. According to the existing knowledge on economies of scale in waste collection, returns to scale tend to be fully exhausted at volumes corresponding to between 25,000 and 50,000 inhabitants, and even smaller (Abrate, Erbetta, Fraquelli, & Vannoni, 2014; Bel & Costas, 2006; Chifari,

Piano, Matsumoto, & Tasaki, 2017; Di Foggia & Beccarello, 2020; Dijkgraaf & Gradus, 2003; Dubin & Navarro, 1988; Greco, Allegrini, Del Lungo, Gori Savellini, & Gabellini, 2015; Simões, Carvalho, & Marques, 2012, 2013; Stevens, 1978). Therefore, many cities operate at scales that are large enough to consider splitting waste collection without damaging the economies of scale.

3.2 Privatization and its Alternatives

3.2.1 Regulation by Competition

Since the cost-saving effects of privatization appear to be neither systematic nor sustainable (Bel, Fageda & Warner, 2010), cost-saving competition has emerged as a key concern in management reform for delivering positive economic effects. One of the most frequently used methods for promoting such competition has traditionally been public procurement through auctions. Yet, when bidders only compete *for* the market in a static fashion, as opposed to competing *in* the market in a more dynamic fashion, the positive cost-saving effects of competition are decreasing over time and may even disappear (Bel & Costas, 2006; Gradus, Schoute, & Dijkgraaf, 2018; Hefetz & Warner, 2012). Even if at the time of bidding *rivalry* exists, a more dynamic form of competition – which can be defined as *extended rivalry* (Porter, 1998) – is missing. Indeed, specifically in waste management as local service delivery the appropriateness of competitive tendering has been questioned (Massarutto, 2007). Given that the European market of municipal waste management is concentrated (the top 15 companies achieving 1/3 of the total industries turnover) and country-wise the market is usually divided between the top-5 operators (Antonioni & Massarutto, 2012), local governments have been incentivized to come up with new delivery strategies.

If the (local) government chooses to divide production among several bidders through a ‘split auction’ or ‘dual sourcing’, it also motivates competition in later auctions (Laffont, Tirole, & Idei, 1993). The duplication of fixed costs is justified by the yardstick competition effect (Auriol & Laffont, 1992). Early research had already predicted the cost-reducing effects of yardstick competition due to the presence of comparable firms (Shleifer, 1985). Since then the efficiency gains from yardstick competition have been widely reported as regulatory tool. Examples include port reforms in Mexico (Estache, González, & Trujillo, 2002), efficiency patterns of local governments in Norway (Revelli & Tovmo, 2007), welfare spending of 93 departments in

France (Elhorst & Fréret, 2009), public education (Terra & Mattos, 2017) or electricity distribution (Kumbhakar & Lien, 2017).

The approach of exclusive territories as a tool to achieve yardstick competition lies somewhere between the two polar models of perfect competition and pure monopoly (Rey & Stiglitz, 1995). The entry of new players may be socially desirable if players can be compared and even when they cannot be, if allowing for differentiated output. However, the strategy can induce inefficiency as a result of the duplication of fixed costs and by being detrimental to the exploitation of economies of scale. As for the monitoring of private actors, group incentive mechanisms are likely to arise in which the actions of one agent provide information about the actions of other agents, and the principal is able to monitor ‘agents with other agents’ (Varian, 1990).

3.2.2 Inter-municipal Cooperation

Unlike privatization, inter-municipal cooperation (IMC) is based on strategic collaboration rather than on competition, the aim being to achieve economies of scale (and, hence, improve the cost conditions of the service) and to enhance coordination so as to better tackle externalities (Bel & Sebó, 2021; Pérez-López et al., 2016). The advantages of IMC include the possibility of retaining greater control over production and, hence, of incurring lower transaction costs than those incurred under privatization (Hefetz & Warner, 2012; Levin & Tadelis, 2010). Such a situation is particularly desirable when enhanced service quality and cross-jurisdictional coordination are also sought (Aldag & Warner, 2018).

Indeed, IMC affords policy-makers with the possibility of ‘finding equilibrium’ and avoiding extreme ideological positions in relation to public or private provisions (Voorn, Van Genugten, & Van Thiel, 2020). It should, however, be noted that service provision by means of IMC is compatible with both private production (i.e. as illustrated by cases in Spain and France) and limited public production (i.e. as illustrated by cases in the Netherlands and Norway). Since service delivery by IMC means the participants use ‘functional consolidation’ (as opposed to the full amalgamation of municipalities), a potential efficiency gain can be made.

3.2.3 Re-municipalization

Reforms in the form of contract reversal have shown the existence of a ‘two-way street’, that is, from the privatization of management toward contracting back in (or reverse privatization) (Warner & Hefetz, 2012). Indeed, processes

of re-municipalization have become the subject of considerable political debate in recent decades, although they are by no means a new phenomenon. However, there has been a resurgence in these contract reversals for reasons of managerial pragmatism, disappointment with the outcomes achieved with service delivery privatization and the failure of governments to monitor and manage the contract; hence, re-municipalization may be grounded in market failure, government failure or in both (Hefetz & Warner, 2004). To a lesser extent, political context and ideological motivation have also been identified as factors in some cases (Gradus & Budding, 2020).

Service characteristics are an important factor determining the likelihood (or otherwise) of contracting back in. Overall, if monitoring is costly and there are measurement difficulties, and competition is absent, a government is more likely to consider contracting back in (M. A. Nelson, 1997). According to (Hefetz & Warner, 2004) examples of such services include utility billing, building maintenance, heavy equipment and emergency vehicles, street repair, traffic signs, recreation facilities, tree trimming, legal services, street cleaning and sanitary inspection. Moreover, re-municipalization can be a useful tool for local governments seeking to correct dynamic inefficiencies and so satisfy a broader range of public values (Lindholm, 2019).

3.2.4 Mixed Delivery

Between the extremes of fully contracting out and re-municipalization, an intermediate solution is offered by mixed delivery. This involves the fragmentation of a jurisdiction into several territories, of which at least one is subject to public production and another to private production (Bel & Rosell, 2016; Miranda & Lerner, 1995; Savas, 1981; Warner & Bel, 2008; M. Warner & Hebdon, 2001).

In theory, the primary argument in support of a mixed system of production is derived from reliability considerations (Bendor, 1985), which requires the units of the system – in our case public and private companies – to be independent. Combining governance modes in case of private sector (which is often referred as concurrent sourcing) is seen as a way to manage technological volatility (Krzeminska, Hoetker, & Mellewigt, 2013). Institutions that provide reliability are adaptive, flexible and can handle better unanticipated conflicts (J. Bendor & Moe, 1985). Indeed, it has been found that concurrent sourcing decreases the negative effects of both technological and performance uncertainty (Mols, Hansen, & Villadsen, 2012). In addition, it increases the internal agent's monitoring power and reduces the

opportunism of the external supplier (Mols, 2017). It mitigates agency costs, signals quality and gives bargaining power the internal agent or franchisor (Hefetz, Warner, & Vigoda-Gadot, 2014).

Apart from the alleviation of uncertainty, the efficiency and knowledge effect are also important, it is a flexible delivery mode which gives opportunities to experiment and test shifts in the delivery (Hefetz 2016). Besides its role to improve competition, mixed systems are associated with higher tendency of exploration of new contracts (Warner & Hefetz, 2020). Usually, local governments use this type of delivery when they have prior contracting experience but their capabilities are low (Porcher, 2016). The role of the local government in this setting can be diverse. Apart from sharing the production, it acts as organizing hub, oversees the whole production and regulates it (Brown, Potoski, & Van Slyke, 2015). Mixed delivery arrangements can bring together the benefits of both contracting-out and in-house production. In the US municipalities, one-fifth of all services are delivered this way, either through bilateral or multilateral arrangements based on the number of partners splitting the delivery it (Brown, Potoski, & Van Slyke, 2015).

3.3 Institutional Context: Waste Collection in the City of Barcelona

Solid waste collection has historically been delivered by private firms in the city of Barcelona. By the end of the past century, two private concessions were managing solid waste collection, held by *Fomento de Construcciones y Contratas* (FCC) and *Concesionaria y Contratas de Usuarios de Servicios de Limpieza Pública* (CLD), both due to expire in 2000 (Bel & Warner, 2009).¹⁵

In 2000 the city was divided into four zones, with four separate solid waste collection contracts being awarded to private firms, with none being allowed to obtain more than two zones.¹⁶ The city believed that its policy would create

¹⁵ English names for these organizations are: (FCC): Promotion of Construction and Contracts; (CLD): Concessionaire and Contracts of Users of Public Cleaning Services. The first direct contract between CLD and the city for waste collection dates to 1964. FCC, established initially in 1900 as *Fomento de Obras y Construcciones* (FOCSA: Promotion of Works and Concessions), had a long history of cooperation with Barcelona, starting with a contract in 1911 for street cleaning and conservation.

¹⁶ The service reform involved the joint awarding of solid waste collection and street cleaning in each zone to the same private firm. This has been maintained in all subsequent contracting processes. It should be stressed, however, that all contracts, supervision and payments clearly

redundancy in public service delivery and lead to improvements in efficiency, innovation and quality and to a more reliable system to react to the city's unexpected or novel needs (Bel & Warner, 2009). Fragmentation would allow private firms to address the specific characteristics of each territory, which could differ markedly with the season of the year.

The contracts awarded in 2000 had an initial duration of seven years; yet, before termination, they were extended for an additional two years. In 2009, after a new bidding process, the city kept the number of zones the same, but modified their structure by making some changes in the districts included within each. In this bidding process, firms were obliged to bid for all four zones, even though it was now dictated that only one contract would be awarded per firm. As a result of the bidding process, the award of contracts in each zone (comprising city districts) was as follows: North (Horta-Guinardó and Nou Barris) was awarded to CLD Urbaser; Center (Ciutat Vella, Eixample and Gràcia) was awarded to FCC; East (Sant Andreu and Sant Martí) was awarded to Urbaser; and West (Sants-Montjuic, Les Corts and Sarrià-Sant Gervasi) was awarded to CESPÀ.¹⁷

3.4 Empirical Strategy

3.4.1 Methodology

Empirical analyses of the factors impacting solid waste collection – starting with Hirsch (1965) – have sought to model refuse collection costs taking into account factors related primarily to scale economies, break-even points and price determination. Following Hirsch's pioneering study, Stevens (1978) introduced significant improvements by considering the market structure, differentiating between (1) market provision under a competitive system, and (2) public provision with either (2a) a public monopoly or (2b) private monopoly. Stevens reported of economies of scale up to 50,000 inhabitants, while beyond this population size he found constant returns to scale. She showed market provision to be between 26 and 48% more costly than

distinguish between the two services in each zone. Thus, all data used in our empirical strategy refer solely to the solid waste collection service.

¹⁷ In the upcoming concession for the period 2019-2027, the fragmentation into four zones has been maintained, and each bidder has to make a bid for at least two zones, although – as in the previous process – only one contract can be awarded per firm (Ajuntament de Barcelona, 2018). The bidding process is still undergoing, and the current contract has been prolonged till 31 August 2021, or until the new contracts come into force.

monopolies under public provision, indicating that the gains from competition were lower than the transaction costs incurred, since there was no sign of additional inefficiency due to competition. In the case of public provision, he reported no significant cost difference between public and private production below a population of 50,000, while private production was less costly above that population threshold.

Another major advance was made in empirical studies by Dubin & Navarro (1988). Here, the authors also analyzed solid waste collection costs under market and public provisions (with either a public or private monopoly), but prior to this they controlled for the form of production, so that any potential endogeneity of the latter and costs was dealt with. As in Stevens (1978), market provision was found to be the least efficient system; while, within public provision, private production was less costly than public.

Following on from these empirical analyses of solid waste collection, an increasing number of studies have appeared, especially after 2000 (see Bel, Fageda & Warner, 2010, for a review). Most papers failed to find a significant difference in the outcomes of public and private production (Allesch & Brunner, 2014). Indeed, similar conclusions have been obtained in more recent studies (e.g. Abrate et al., 2014; Jacobsen, Buysse, & Gellynck, 2013; Romano, Ferreira, Marques, & Carosi, 2020).

When modelling the costs of waste collection parametrically, the relationship between outputs and inputs has usually been represented by a cost or production function. Both can include several variables and may be either linear or non-linear. Similarly, and in line with Stevens (1978) and Dubin & Navarro (1988), many previous studies base their empirical analysis on a cost function. In this paper this type of modelling is followed, as usual in studies of costs of waste collection (see Bel, Fageda & Warner, 2010). However, our study is unique as it analyzes the cost of the waste collection lots following the divisions made in the city of Barcelona, which provides us with a jurisdictionally but also politically (in the sense of the governing party, see Benito-López, Moreno-Enguix, & Solana-Ibañez, 2011) homogeneous context. As in Bel & Costas (2006), and omitting the variables that these authors found not to cause additional variability in our framework – namely, salaries and frequency of collection, which are equivalent in all four of the city's concessions – our cost function can be expressed as:

$$TC = F(\text{Quantity}_{disposal}, \text{Quantity}_{select}, \text{Firm}, \text{Density}, \text{Prod}, \text{Tourism}) \quad (3.1)$$

We initially estimated the following model for the delivery zones for the period of five years:

$$\begin{aligned} TotalCosts_{it} = & \beta_0 + \beta_1 DisposalWaste_{it} \\ & + \beta_2 OrganicWaste_{it} + \beta_3 PaperWaste_{it} + \beta_4 PackagingWaste_{it} \\ & \beta_5 VoluminousWaste_{it} + \beta_6 GlassWaste_{it} + \beta_7 Surface_{it} \\ & + \beta_8 Population_{it} + \beta_9 Density_{it} + \beta_{10} Tourism_{it} + \varepsilon_{it} \end{aligned} \quad (3.2)$$

When evaluating the relevance of collinearity between the regressors (see Table A.1 and Table A.2 in Appendix to Chapter 3), the model had to be modified accordingly, and to control for seasonality a dummy variable of *August* was introduced to the estimations.

$$\begin{aligned} TotalCosts_{it} = & \beta_0 + \beta_1 DisposalWaste_{it} \\ & + \beta_2 OrganicWaste_{it} + \beta_3 PaperWaste_{it} + \beta_4 PackagingWaste_{it} \\ & \beta_5 VoluminousWaste_{it} + \beta_6 GlassWaste_{it} + \beta_7 August_t + \varepsilon_{it} \end{aligned} \quad (3.3)$$

3.5 Data

The variables are described in Table 3.1. Data for the variables used in our estimations refer to the period 2015–2019 and were provided by the city agency that supervises the solid waste service. Monthly observations for the costs incurred by the municipality and solid waste quantities of each type are available. Data regarding inhabitants in each district are annual.

The variance inflation factor (VIF) was computed to check the potential relevance of multicollinearity and found an average value equivalent to 559.84. For this reason, the variables with the highest individual VIF values (that is, density, surface, and population) were excluded. Moreover, given that the various categories of waste are correlated, the variable *Disposal waste* was expressed in absolute terms, while for the other categories the relative weight

of the waste as a percentage of total waste was used. After doing this, a new VIF check was conducted and individual value for tourism was 23.56; hence this variable was excluded from the analysis. As a result, the remaining equation presented an average $VIF = 6.41$, with all variables presenting low individual VIF values, with the relative exception of Disposal waste, which value of 10.33 was slightly above the comfort threshold of 10. Therefore, while we keep in mind this result for Disposal waste, we believe that no relevant multicollinearity problems subsist in our final specification.

Table 3.1: Description of the variables used in the estimations

Dependent Var	Description	Periodicity	Source
Total Cost	Total costs incurred by the municipality for the service of waste collection by zones	Monthly data 2015-2019	city agency supervising waste collection service
Independent Var	Description		
Disposal waste	volume of disposal waste collected by zone	Monthly data 2015-2019	city agency supervising waste collection service
Organic waste	volume of organic waste collected by zone	Monthly data 2015-2019	city agency supervising waste collection service
Paper waste	volume of paper waste collected by zone	Monthly data 2015-2019	city agency supervising waste collection service
Packaging waste	volume of packaging & plastic waste collected by zone	Monthly data 2015-2019	city agency supervising waste collection service
Voluminous waste	volume of voluminous waste collected by zone	Monthly data 2015-2019	city agency supervising waste collection service
Glass waste	volume of glass waste collected by zone	Monthly data 2015-2019	city agency supervising waste collection service
Surface	Area of the zones in km ²	Yearly data 2015-2019	bcn.cat
Population	Number of inhabitants in the zone	Yearly data 2015-2019	ides.cat
Density	Inhabitants per km ²	Yearly data 2015-2019	bcn.cat
Tourism	Number of touristic establishments in the zone	Yearly data 2015-2019	bcn.cat
August	Dummy variable taking the value of 1 in the month of August		Own elaboration
FCC	Dummy variable taking the value of 1 for the zone of FCC		Own elaboration
CESPA	Dummy variable taking the value of 1 for the zone of CESP		Own elaboration
URBASER	Dummy variable taking the value of 1 for the zone of Urbaser		Own elaboration
CLD	Dummy variable taking the value of 1 for the zone of CLD		Own elaboration

3.6 Estimations and Results of the Empirical Analysis

Our basic estimations are shown in Table 3.2. Exploiting the panel structure of our data, both the fixed and random effects models were tested. Since it was not possible to reject the null hypothesis of no systematic difference in coefficients (the Hausman test resulted in $p=0.3759$), the random effects model is the preferred choice. All estimations were conducted using Stata v. 14.2 software.

Next, differences between zones/firms were analyzed. Recall that differences in a given area's productivity from that of the specific conditions of a zone cannot be disentangled. Results are shown in Table 3.3. In every regression the association between one chosen firm and outcome variable – total costs of waste collection – was estimated. In the first column FCC was introduced but the variable is not statistically significant meaning that FCC is not different from the average firm of waste collection. The same applies to CLD. In the case of CESPAs the coefficient is positive, and the statistically significant result suggests that in CESPAs zone the total costs of waste collection are significantly higher than in the average zone in Barcelona. In Urbaser, in contrast, the negative coefficient and statistical significance imply that the total costs of the zone are significantly lower than average.

Additionally, the costs of each firm with the costs incurred by the other three firms were compared (see Table 3.4). FCC's costs are not statistically different from those of any other firm except Urbaser, which with lower statistical significance appears to have lower costs; CESPAs is more expensive than Urbaser, which is also cheaper than CLD, although the statistical significance of this last relationship is also weaker. Overall, CESPAs appears as the most expensive firm, whereas Urbaser seems to be the most cost advantageous. The following random effects model was estimated including a_i and u_{it} for the unobserved disturbances for firm i at time t .

$$\begin{aligned}
 TotalCosts_{it} = & \beta_0 + \beta_1 DisposalWaste_{it} \\
 & + \beta_2 OrganicWaste\%_{it} + \beta_3 PaperWaste\%_{it} + \beta_4 PackagingWaste\%_{it} \\
 & + \beta_5 VoluminousWaste\%_{it} + \beta_6 GlassWaste\%_{it} \\
 & + \beta_7 Firm_i + \beta_8 August_t + \varepsilon_{it}
 \end{aligned} \tag{3.4}$$

Table 3.2: Empirical results of the estimation of the determinants of the cost of waste collection

Ind. Variables	Fixed effects	Random effects
Disposal waste	261.08*** (40.63)	196.30*** (21.98)
Organic%	4,795,423 (4,763,969)	3,888,061 (2,602,580)
Paper%	1.09e+07*** (3,725,651)	1.23e+07*** (3,318,121)
Packaging%	-1.49e+07 (1.19e+07)	-1.01e+07 (1.00e+07)
Glass%	1.21e+07 (7,792,125)	2,343,534 (6,333,890)
Voluminous%	3,243,387 (4,528,310)	-1,857,780 (3,438,226)
August	308,742*** (96,501)	215,702*** (75,911)
Constant	-2,280,851** (1,007,228)	-1,000,587*** (354,150)
R-sq	within=0.2458 between= 0.9914 total=0.8337	within= 0.2332 between = 0.9995 total= 0.8402
Observations	240	240
Groups	4	4
F	10.66***	
Prob>F	0.0000	
Wald chi2		1219.93***
prob>chi2		0.0000

Note: *** indicates significance at 1% level; indicates significance at 5% level; * indicates significance at 10%. In parenthesis standard errors.

Table 3.3: Empirical results of the estimation of the determinants with a random effects model of the cost of waste collection

Ind. Variables	FCC	CESPA	Urbaser	CLD
Disposal waste	152.32*** (28.95)	128.76*** (28.17)	138.55*** (25.84)	159.63*** (36.35)
Organic%	1,892,309 (3,759,927)	6,517,393 (3,988,697)	4,937,039* (2,591,423)	-200,534 (2,830,707)
Paper%	9,302,254 (6,310,569)	7,456,300 (6,249,613)	1.33e+07** (6,091,118)	1.11e+07* (6,595,291)
Packaging%	-6,385,313 (7,557,839)	-1,442,768 (8,002,792)	5,259,720 (8,267,561)	-6,783,580 (7,587,547)
Glass%	1.92e+07** (8,605,673)	2.09e+07** (8,375,855)	2.42e+07*** (8,321,548)	1.90e+07** (8,437,642)
Voluminous%	-7,627,461** (3,385,846)	-9,129,601*** (3,280,312)	3,980,872 (4,658,556)	-4,754,840 (5,618,711)
August	597,901*** (163,047)	610,077*** (147,956)	314,224** (165,325)	534,585*** (163,195)
FCC	-84,799 (204,227)			
CESPA		175,034* (98,495)		
Urbaser			-491,742*** (158,419)	
CLD				83,500 (170,379)
Constant	-1,214,511 (610,540)	-1,790,527*** (911,428)	-2,668,209 (641,827)	-1,204,636** (537,661)
Time effects	YES	YES	YES	YES
R-sq	within: 0.7977 between: 0.9999 total: 0.9582	within: 0.8009 between: 1.0000 total: 0.9589	within: 0.8078 between: 1.0000 total: 0.9604	within: 0.7978 between:0.9999 total: 0.9582
Observations	240	240	240	240
Groups	4	4	4	4
Wald chi2	3,965.64***	4,036.99***	4,191.79***	3,967.26***
Prob > chi2	0.0000	0.0000	0.0000	0.0000

Note: *** indicates significance at 1% level; indicates significance at 5% level; * indicates significance at 10%. In parenthesis standard errors.

Table 3.4: Direct comparison of the firm dummies with the chosen reference group

	FCC	CESPA	Urbaser
CESPA	37,644 (243,135)		
Urbaser	-483,778+ (328,086)	-521,422*** (173,771)	
CLD	-50,830 (407,126)	-88,474 (216,201)	432,947** (216,336)

Note: Firms in the first row indicate the reference category in each estimation. *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10%, +indicates significance at 15%. In parenthesis standard errors.

3.6.1 Economies of Scale

Following the theoretical outcome regarding the importance of enhancing competition via split auctions, the next step in our research involved analyzing the convenience of increasing the number of solid waste collection zones in Barcelona, so as to increase competition. Thus, this section studies whether the creation of more zones and, hence, a reduction in the size of the current zones, leads to a loss of economies to scale. Preserving the current cost functions, if the firms already produce with constant returns to scale, a loss in size would not result in an increase in average costs. Notice, however, that an increase in the level of fragmentation would be more advisable in the case of diseconomies of scale, since reducing the size of the zones would lead to lower average costs.

Some of the earlier studies of waste collection costs undertook analyses of scale economies. The first to incorporate a systematic and robust analysis was Stevens (1978), who reported the presence of economies of scale for US municipalities with between 20,000 and 50,000 inhabitants and constant returns to scale above that threshold. Likewise, Dubin & Navarro (1988) found increasing returns to scale for US municipalities with up to 20,000 inhabitants; Dijkgraaf & Gradus, (2003) reported scale economies in Dutch municipalities with a population of fewer than 40,000 inhabitants; and Bel & Costas (2006) found increasing economies of scale in the smaller municipalities of Catalonia, and full exploitation of economies of scale in municipalities with between 20,000 and 50,000 inhabitants. A notable exception is Bohm, Folz, Kinnaman, & Podolsky (2010), who observed

increasing returns to scale across all quantities of disposal waste in their sample of US municipalities. However, increasing returns to scale were soon exhausted in recycling waste, and diseconomies of scale appeared thereafter. Most of the evidence reported up to 2010 was analyzed by Gomez-Reino (2010) by means of meta-regression. The author concluded that there were only slight economies of scale in waste collection.

More recent studies typically provide additional information. For example, Simões, Carvalho, & Marques (2012) show that the optimal scale in Portuguese municipalities depends on the producer and mode of production, but that, generally, the service delivery fully exploits scale economies with a population of between 25,000 and 50,000 inhabitants. Increasing returns to scale limited to smaller Portuguese municipalities are also found in a study by Simões, Carvalho, & Marques (2013). In a study of Japanese municipalities, (Chifari et al., 2017) report economies of scale, but find that they are much less relevant in the case of waste collection than they are for waste processing and waste disposal. In a study of Italian municipalities, Abrate et al. (2014) report constant returns to scale for the average municipality in their sample of 42,500 inhabitants. In the case of larger municipalities, the authors find diseconomies of scale in waste collection. Finally, Greco et al. (2015) disentangled undifferentiated versus separate waste collection, finding the former to be cheaper and capable of achieving higher rates of economies of scale than the more expensive and specialized separate waste collection.

In the case of Barcelona, all the zones have populations above 300,000; based on previous studies (Abrate et al., 2014; Bel & Costas, 2006; Chifari et al., 2017; Dijkgraaf & Gradus, 2003; Dubin & Navarro, 1988; Greco et al., 2015; Simões, Carvalho, & Marques, 2012, 2013; Stevens, 1978), that would imply that their volumes of waste are well above the threshold at which of economies of scale can be fully exploited. As such, the expectation is to find either constant returns to scale or diseconomies of scale. In neither case, however, would the policy recommendation of creating an additional zone to enhance competition eliminate gains of increasing returns to scale, given that all existing zones are already well above that size.

Many of the empirical studies that analyze solid waste use Hirsch's (1965) definition, which states that the optimal scale is the level of operation at which average costs are lowest. This coincides with a scale elasticity of a unit value, and many empirical papers use the inverse of scale elasticity to define economies of scale (Baumol, Panzar, & Willig, 1988), reflecting the

proportional increase in total costs due to a proportional increase in output, *ceteris paribus* (Farsi, Filippini, & Lunati, 2008). Hence, if this relation is lower than 1, it means that average costs increase (decrease) as output increases (decreases) and that a situation of diseconomies (economies) of scale exists. This paper, however, is concerned with describing the current situation and of determining the effect of a one-unit increase in output on average costs, rather than on finding the optimal size. Broadly speaking, similar empirical studies either make use of the relationship identified by Baumol, Panzar, & Willig (1988) using a logarithmic function or explain average costs with a linear (e.g. Dubin & Navarro, 1988) or quadratic function (e.g. Hirsch, 1965).

Here, the average cost explanation is followed and both the linear and quadratic structures are estimated, as specified in Table 3.5. These estimations do not include the quadratic component since it was found not to be statistically significant in any of the estimations except one with low statistical significance and the coefficient close to zero (see Table A.3 in Appendix to Chapter 3). This implies that the relationship between the unit cost and output is similar to that reported in Stigler (1958), in the sense that scale economies are exhausted at relatively small sizes. After that, average costs are found until increasing marginal costs are achieved following a highly significant growth in population. Hence, our preferred specification is the linear model shown in the first column in Table 3.5. According to our estimation, 10,000 additional tons of waste would lead, on average, to an increase in average costs of 1.15 euros. This specification, however, is unable to capture any possible differences between zones; hence, it can only be concluded that the average zone in Barcelona is already in a state of diseconomies of scale at 1%, which is also called “technically post-optimal region with respect to scale” (Frisch, 1965, p.123).

To see zone-specific effects, interaction models as described in Brambor, Clark, & Golder (2006) are used. Multiplicative models of this type are common in quantitative analyses in political science because they can capture the relationship between (political) inputs and (political) outputs depending on the institutional context (Brambor, Clark & Golder, 2006).¹⁸ The following equation was estimated:

¹⁸ For example, Frère, Hammadou, & Paty (2011) interact a dummy variable representing urban areas with population size to see the effect on the range of public services provided; Andrews & Boyne (2014) use an interaction term between task complexity and size to determine a change in administrative intensity in UK universities; Sundell & Lapuente (2012)

$$\begin{aligned}
 \text{AverageCosts}_{it} = & \beta_0 + \beta_1 \text{VolumeOfWaste}_{it} \\
 & + \beta_2 \text{Firm}_i + \beta_3 \text{VolxFirm}_{it} + \beta_4 \text{OrganicWaste\%}_{it} \\
 & + \beta_5 \text{PaperWaste\%}_{it} + \beta_6 \text{PackagingWaste\%}_{it} + \beta_7 \text{VoluminousWaste\%}_{it} \\
 & + \beta_8 \text{GlassWaste\%}_{it} + \beta_9 \text{August}_t + a_i + u_{it} \quad (3.5)
 \end{aligned}$$

This “context conditionality” suggests that the relationship between two variables depends on the values of other variable(s). This study is concerned with whether the relationship between output and average costs is modified (increases or decreases) when the dummy variables of the firms are equal to 1. When including the interaction term between the firm and the volume of production (e.g. FCCxVolume), all the constitutive terms must be included in the estimation (both the dummy of FCC and Volume). Our results in Table 3.5 show that the average effect of one additional ton of waste has a positive and significant effect on the average costs, hence the zones, on average, produce diseconomies of scale. Also, evidence that none of the firms is producing under increasing returns to scale is obtained. Similarly, the fact that none of the dummies for zones (nor the interactions) has a significant coefficient implies that they do not have any additional effect, whether decreasing or increasing, with respect to the average level of costs.

examine political incentives to contract out when both political competition and government ideology interact; and Baccini (2014) interacts country traits to estimate transaction costs in negotiating.

Table 3.5: Random effects models with average costs as dependent variable

Ind. variables	Baseline Model	FCC	CESPA	CLD	URBASER
Volume of Waste	0.0001146*** (0.00004)	0.0001578*** (0.0000462)	0.0000764* (.0000421)	0.0001271** (0.0000549)	0.0000998** (0.0000396)
FCC		0.6751835 (1.083312)			
VolxFCC		-0.0000632 (0.0000482)			
CESPA			-0.0440294 (0.9160006)		
VolxCESPA			0.0000368 (0.0000542)		
CLD				-0.0636076 (0.9686429)	
VolxCLD				0.0000189 (0.0000974)	
URBASER					-1.590688 (1.121753)
VolxURBASER					0.0000244 (0.0000779)
Organic%	-10.72443** (4.604285)	-0.3742947 (7.947679)	7.49011 (9.399558)	-12.23164* (6.732878)	1.125449 (5.70768)
Glass%	37.117000* (18.99537)	37.07115* (19.90401)	45.3512** (18.98156)	37.74618* (19.43697)	52.04941*** (19.11558)
Paper%	12.05251 (13.97826)	6.85513 (14.48616)	5.533799 (13.99599)	14.05125 (15.25925)	21.11603 (13.92194)
Packaging%	-11.07958 (16.67308)	-8.869408 (16.6694)	2.007219 (18.61685)	-11.76851 (16.91852)	19.50666 (18.38975)
Voluminous%	-24.59843*** (6.881505)	-29.57171*** (7.65964)	-29.23682*** (7.439307)	-21.45513* (12.01539)	4.770295 (10.83903)
August	1.174488*** (0.3302451)	1.388899*** (0.3650669)	1.328958*** (0.331738)	1.11969*** (0.3685213)	0.5165666 (0.3700132)
Constant	2.281632 (0.7770934)	0.7220327 (1.251622)	-0.2151134 (1.410389)	2.055045** (1.014099)	-2.158094 (1.465268)
R-squared					
within	0.8140	0.8174	0.8209	0.8142	0.8263
between	0.9996	0.9998	0.9999	0.9995	0.9999
total	0.9266	0.9281	0.9295	0.9267	0.9316
Time effects	YES	YES	YES	YES	YES
Observations	240	240	240	240	240
Groups	4	4	4	4	4
Wald chi2	2196.88***	2218.87***	2268.11***	2268.11***	1748.33***
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10%. In parenthesis standard error.

3.7 Discussion and Policy Implications

This research has empirically addressed two main research questions. The first one is whether awarding different contracts after splitting in four zones the waste collection service in the city of Barcelona had caused a convergence in costs, as competition for contracts would make to expect. Our results show that costs have not converged between concessions. Therefore, introducing more competition for the contracts could be advisable.

Our second main research question is whether current conditions of returns to scale in the four existing service zones pose any potential problem to increase the number of zones, hence increasing potential competition. Our results show that none of the four existing zones is operating under increasing returns to scales. Therefore, increasing the number of zones would not imply scale-related damages.

When interpreting our results, it should be borne in mind that it has often proved difficult to determine whether the service differences are attributable to the local conditions of each zone or to the firms' production and cost function. Having said that, the analysis of whether any firm/zone-related differences between the lots was undertaken, which allowed determining that the four zones are indeed different from each other. Subsequently, the study determined which is the most expensive and which the least. Thus, it is apparent that the current level of competition created by the local government through market fragmentation is insufficient to achieve the outcome of perfect competition (i.e., no differences in the firms' relative costs).

One way to enhance competition would be to increase fragmentation by introducing more lots, a solution that means bidders would have to compete both statically and dynamically: First, because now, in the auction phase, the zones are not so big, firms with lower capacities would also be able to participate and bid for the market(s) (Pavel & Slavík, 2018); and, second, in the phase of regulation by competition with one more participant, the local regulator would have more information and the incentives of the participants would change. In addition, potential collusion would be less likely with more participants.

One of the potential disadvantages of a higher level of fragmentation, however, is the possible elimination of economies of scale. To address this risk, as mentioned, whether the firms are producing with increasing returns to scale was examined. Since evidence – on average – of the absence of

economies of scale in every zone was obtained, one of the policy recommendations is the creation of one additional zone. An example resulting from the creation of a new zone comprising the city districts of Sarrià-Sant Gervasi and Gràcia is shown in Table 3.6.¹⁹ Figure 3.1 and Figure 3.2 compare the map of the existing division of zones with the one that would correspond to the proposal formulated.

Apart from fulfilling the goal of avoiding decreasing returns to scale, this reform could facilitate entry for smaller firms. Recall that the private contractors that initiated the service provision in the early stages (2000–2009) held onto the service and successfully won subsequent contracts. Hence, even though the market was divided into lots, competition was still quite weak. Increasing the number of zones and maintaining the one-concession-per-firm criteria would surely increase the possibilities for smaller firms, because the solid waste market in Catalonia –relevant market– has only three big players (Bel & Fageda, 2011). Hence, smaller firms would have more chances of having one zone awarded.

As outlined earlier, other than privatization and the management of competition, present-day local delivery options include IMC, contract reversal or re-municipalization and mixed delivery. However, IMC is not recommendable for big markets like the city zones of Barcelona, being better suited to small municipalities where scale economies have yet to be fully exploited (Bel & Sebó, 2021). The other two reforms can, though, be considered similar in the sense that they would involve the partial or full re-municipalization of waste collection services in Barcelona. Moreover, if the newly created zone were to be public (or failing that if one of the original four zones were to be re-municipalized), information asymmetry could be improved, insofar as the possibilities for benchmarking by local government would be enhanced (Mols, 2010a, 2010b) and a form of yardstick competition could be created (Girth et al., 2012; Warner & Hefetz, 2012). Regarding comparative performance of public and private delivery in the region of Catalonia, available evidence (Bel & Costas, 2006) indicates that no systematic difference exists in costs paid for municipalities.

¹⁹ In making this suggestion it is considered the existing constraint that solid waste collection zones must include entire city districts and that they cannot be split between different waste management zones. Ideally, the analysis should be conducted at the neighborhood (73 neighborhoods in the city) or even at the street level rather than at the district level (10 districts). However, the information available only permits a district level analysis.

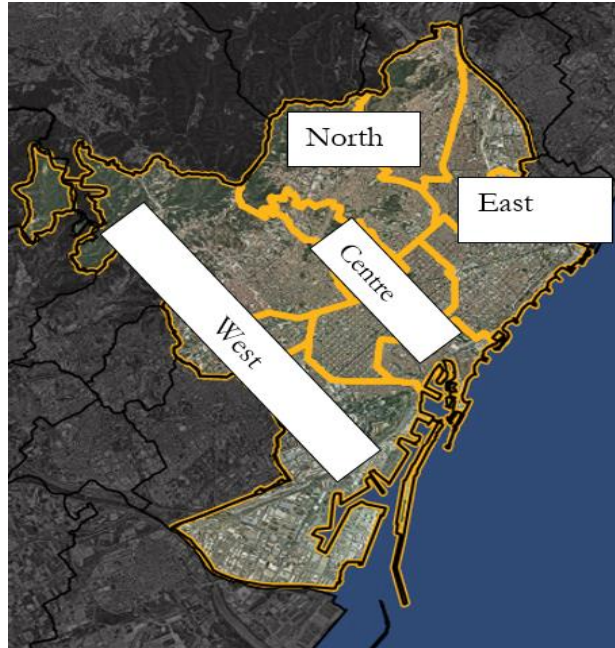
Table 3.6: Possible fragmentation considering economies of scale and mixed delivery

Zone	District	Population	%	Firm	%	Population	District	Zone
North	Horta-Guinardó	342,164	20.9%	A	20.9%	342,164	Horta-Guinardó	North
Centre	Nou Barris	491,137	30.0%	B	22.6%	369,339	Nou Barris	Centre
	Ciutat Vella						Ciutat Vella	
	Eixample Gràcia						Eixample	
East	Sant Andreu	388,136	23.7%	C	23.7%	388,136	Sant Andreu	East
	Sant Martí						Sant Martí	
West	Sants-Montjuic	415,325	25.4%	D	16.3%	266,065	Sants-Montjuic	West
	Les Corts						Les Corts	
	Sarrià-Sant Gervasi							
				New	16.6%	271,058	Gràcia Sarrià-Sant Gervasi	New Zone
Total		1,636,762	100%		100%	1,636,762		Total

Note: The service of pneumatics belongs to the zone of Center and beaches belong to the zone of East. The number of inhabitants refers to the year of 2019. Source: idescat.cat

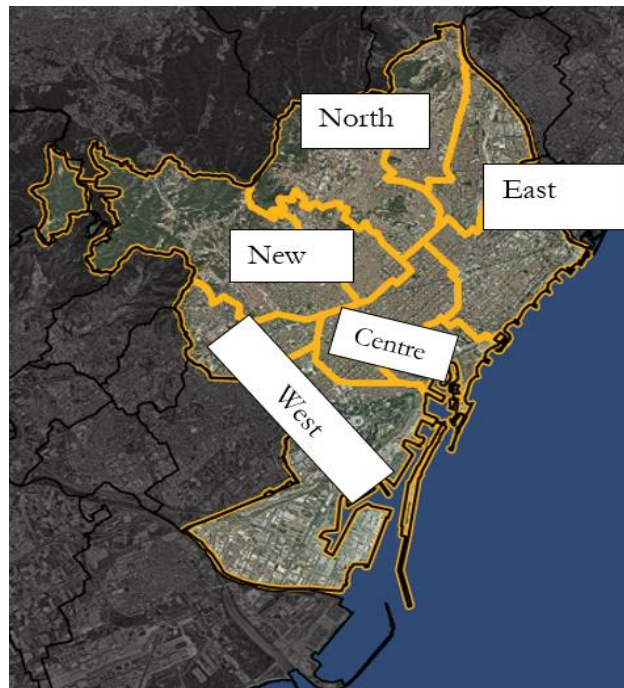
Furthermore, creating a mixed system ensures that the public unit gains more knowledge about the service and is in a better position to assess the performance of the private agents. It also ensures that creative responses are given to specific problems and that knowledge is shared (Parmigiani, 2007). Additionally, the emergence of new technological opportunities calls for a flexible organization to ensure their full exploitation, something that is particularly relevant in waste collection, because this is one of the main public services in terms of budget consumption and because the links between the environment and waste generation are a pressing concern in these times of climate change.

Figure 3.1: Actual division of Barcelona into four zones



Source: Ajuntament de Barcelona (2018)

Figure 3.2: Proposed division into five zones



Source: Table 3.6, right column

3.8 Conclusion

This study has analyzed the current situation and performance of the solid waste collection service in the city of Barcelona. Based on the empirical findings, a series of reforms that should help to improve the service by lowering costs and by improving system reliability have been recommended. Consistent with findings of the absence of increasing returns to scale in the city service with the current configuration of zones, our first policy recommendation is for the city to create – at least – one additional zone. Second, it is our belief that further improvements can be achieved in terms of system reliability, public values and symmetric information if one of the zones (either the newly created one or one of the original four zones) were to be subject to public production. Whereas in this paper the possibilities of designing new reforms have focused on economies of scale, other management scenario analyses in the literature have examined improving the combinations of energy and materials recovery (Massarutto, De Carli, & Graffi, 2010) or distinct recycling programs (Lavee & Khatib, 2010; Lavee & Nardiya, 2013).

The type of analysis and design for a reform proposal of waste collection services could be conducted for similar urban contexts. Existing empirical evidence is consensual in the conclusion that returns to scale in waste collection tend to be fully exhausted in all large cities and most medium cities (above 50,000 inhabitants) Therefore, many cities operate at scales that are large enough to consider zoning waste collection services, without damaging returns to scale. In that regard, the potential relevance of our study goes well beyond the specific case of the city of Barcelona, here empirically analyzed.

One of the limitations of this paper is the impossibility to distinguish the characteristics of a given firm from those of the zone it is managing. Furthermore, the information available on costs and output is measured at the zone level (including full city-districts). Hence, it was not possible to examine other market design possibilities at a more micro-level. This is due to lack of data below the zone level, which hinders effective monitoring by the local government. Future research would benefit from the additional availability of observations at district or neighborhood levels, since this would allow a more refined analysis and service reform design.

4 Watch your Neighbor: Strategic Competition in Waste Collection and Service Quality

4.1 Introduction

Empirical evidence on costs and efficiency in waste management services is abundant in the literature, with particular emphasis on public-private comparisons (see reviews in Bel, Fageda & Warner, 2010; Bel & Warner, 2008). However, evidence available on service quality is much scarcer, most likely because measuring and monitoring quality is difficult and costly (Shrestha & Feiock, 2011). Lack of knowledge on service quality under different delivery regimes is a relevant issue, because it is not only costs, but also quality what matters for social welfare. This public-policy related concern is reinforced by the solidly grounded theoretical insight that private producers have the incentive to use quality reduction as a cost reduction device, in order to increase financial profits (Hart et al., 1997; Levin & Tadelis, 2010).

The primary objective of this research is to increase the existing knowledge on quality under private delivery of the waste collection service. To do so, we explore the influence of competition by comparison on the quality of service in the city of Barcelona, where regulation by competition was introduced in the last few decades by means of a ‘split auction’ (Auriol & Laffont, 1992; Grimm, Pacini, Spagnolo, & Zanza, 2006). The market is divided into four exclusive waste collection zones. Although contracts are awarded for several years, the local authority monitors performance throughout the whole contract.

There is no evidence available in the literature to date as to whether firms strategically prioritize quality of waste collection services in certain areas of their concessions, due to competitive pressures. Furthermore, this research explores quality performance in waste collection from the citizens' perspective, based on data on citizen complaints at a neighborhood level, which is another new development within the field of waste management studies.

The main research question is: Do firms behave strategically when delivering quality, according to the relative strength of competition? The easiest parts of the city to make relative performance evaluations are those where firms operate closer to each other. As firms can anticipate where competition

by comparison is stronger, they may behave strategically in terms of quality delivery. Two hypotheses are formulated regarding our main research question: 1) Firms deliver higher quality in areas in their service zone that are closest to competitors' delivery zones; 2) firms deliver lower quality in the peripheral areas of their delivery zone, that are further from their competitors' zones.

This research offers a fresh perspective for policymakers. The results show that market fragmentation can be a useful policy in large cities, not only for increasing competition in the bidding process, but also dynamically fostering competition in quality delivery. As competition by comparison makes it easier to evaluate relative performance, it alleviates the problem of asymmetric information that regulators face when contracting external firms. Moreover, an important practical lesson is drawn as well: the regulator should pay special attention to monitoring service quality in peripheral zones. In these areas, because of the distance from competitors, firms may neglect quality if monitoring is not effective enough.

Before addressing the details of our empirical modelling and implementation, in the next we provide a review of existing theoretical and empirical evidence that provides the framework within which the empirical work is conducted, and the results obtained are interpreted.

4.2 Theoretical and Empirical Background

Two strands of the literature are particularly useful to frame our research, so that we can formulate hypothesis that we later empirically test and interpret according to the relevant theoretical insights. First, competition for contracts and incentives for service quality; second, measurement of quality in public services.

4.2.1 Competition for Contracts, Firms' Incentives and Service Quality

Growing dissatisfaction with purely public production of local services during the 1970s and 1980s paved the way to an increase in privatization and contracting out of public services in the final quarter of the last century. Although other alternative delivery modes have gained traction more recently (Bel, Hebdon, & Warner, 2018), the level of new contracting out is still very high (Gradus, Schoute, & Budding, 2021; Warner & Hefetz, 2020). One major area of interest for scholarly research has been the discussion on its cost-

saving potential. While the key argument for privatization in waste collection management has been cost savings, extensive review studies show that this goal has not been systematically reached (Bel, Fageda & Warner, 2010). Cost savings due to competitive bidding do not seem sustainable and potential costs savings gains are not sustained overtime (Bel & Costas, 2006; Gradus et al., 2018). Therefore, the appropriateness of competitive tendering has been questioned (Massarutto, 2007), and an increasing number of studies consider ownership as less relevant when cost savings need to be achieved, while emphasizing the role of competition.

Besides issues related to competition, contracting out creates a principal-agent relation characterized by uncertainty and asymmetric information that leads to a surge in transaction costs. Such additional costs arise at every stage of the contract, from negotiation through to the implementation, supervision and enforcement phases (Green & Laffont, 1992, 1994; Williamson, 1999). Furthermore, private managers' incentives to use reduce quality reduction to increase profits (Hart et al., 1997; Levin & Tadelis, 2010) are particularly strong with incomplete contracts, for which transactions costs are higher, as quality performance indicators are difficult to define and measure (Dilger, Moffett, & Struyk, 1997), and the contract is harder to manage (Brown & Potoski, 2003a; Hefetz & Warner, 2012). Therefore, it is more difficult for the regulator to both punish and reward quality performance, as opposed to cost-related indicators (Holmstrom & Milgrom, 1991).

The most important concerns for local authorities when contracting out are the issues resulting from monitoring, information asymmetry and service quality (Warner & Hebdon, 2001). Therefore, apart from effective supervision, local governments are motivated to use other methods to obtain more information on performance. One such tool is competition (Brown & Potoski, 2003b), which can be used as a key monitoring device for gathering information (Holmstrom, 1982). It makes it possible to evaluate relative performance by comparison, which gives an indicator of individual effort (Sappington, 1991). This disciplinary role of competition, therefore, acts as an incentive not to increase costs or decrease quality.

Competition by comparison can be even more valuable if all the actors are influenced by common parameters, such as operating in the same jurisdictional context (Holmstrom & Tirole, 1989). In practice, this type of regulation by competition can be organized through 'split auctions' or 'dual sourcing' (see (Auriol & Laffont, 1992; Grimm et al., 2006; Krzeminska et al., 2013; Mols,

2010b; Poulsen, 2019). In such cases, several producers operate within the same jurisdiction. Consequently, firms are exposed to higher levels of competition by comparison. As well as the benefit of reduced dependence on a single provider (Alcalde & Dahm, 2019), firms' behavior might also change due to competitive pressure resulting from the split (Grimm et al., 2006).

However, competitive pressures are highest where comparison by the regulator and the users is easiest – where firms are operating close to each other. Conversely, by the same reasoning, the lowest competitive pressures are in areas that are far from competitors' zones, where it is more difficult for the regulator and users to make any relative evaluation by observing performance. As private firms can anticipate where it is easier and more difficult for the regulator and users to assess service quality, they have the incentive to deliver better quality where competition by comparison is harder. Therefore, we formulate the following two hypotheses.

Hypothesis 1: Firms will deliver higher quality in their service areas that are closer to areas served by competitors.

Hypothesis 2: Firms will deliver lower quality in their service areas that are further from areas served by competitors.

4.2.2 Measuring Quality in Public Service Delivery

In a competitive market, price and competition can give information on the possible relations between cost and quality. However, this is not common in the case of local public services as most of them have quasi-market characteristics (Boyne, 1998; Lowery, 1998). Therefore, local governments regulate and monitor the quality of outsourced services, using tools such as citizen complaints, citizen satisfaction surveys, performance data and activity audits in the field (Brown & Potoski, 2003a).

Most empirical studies evaluating quality refer to the effects of ownership on the public-private dichotomy or competition (see Comondore et al., 2009; Estrin, Hanousek, Kocenda, & Svejnar, 2009). A recent study on economic and quality effects of contracting out by Petersen, Hjelm, & Vrangbæk (2018) reviews 49 studies on local public services published between 2000 and 2014, of which 19 include quality as dependent variable. However, most of these studies do not include a measure of quality; only categorical variables of improvement, deterioration or no effect (e.g., Zafra-Gómez, Plata-Díaz,

Pérez-López, & López-Hernández, 2016 for a recent example on waste collection).

Measuring quality is difficult and monitoring is costly (Shrestha & Feiock, 2011). Citizen complaints and consumer satisfaction can be considered to reflect quality (Devereux & Weisbrod, 2006; Harvey & Green, 1993). Local governments and public managers use citizen complaints to monitor and evaluate the quality of public services (Deichmann & Lall, 2007) and to assess the performance of public service managers (Brown & Potoski, 2004). Furthermore, citizen complaints constitute a form of continuous civic participation (White & Trump, 2018), which makes them a suitable source of information for identifying ways to improve public services (Okamoto, 2016).

Based on all these considerations, the quality of the solid waste collection service is assessed by means of the number of complaints. While there are studies on the quality of solid waste collection services based on citizen surveys and, in particular, service satisfaction surveys, (e.g., Puche Regaliza, Alvear González, Aparicio Castillo, Arranz Val, & Lara Ortega, 2018; Purcell & Magette, 2010),²⁰ no quality assessment based on citizen complaints has been published to date, to the best of the authors' knowledge. In this respect, this article provides an additional contribution to the literature.

4.3 Institutional and Geographical Context of Solid Waste Collection in Barcelona

Private firms have managed the solid waste collection services in the city of Barcelona since the late nineteenth century. Beyond public procurement, at the beginning of the twenty-first century, regulation by competition was introduced by dividing the city into four concessional areas, each including either two or three city districts (see Bel & Sebó, 2020 for a detailed analysis). In large cities, such as Barcelona, this method²¹ can improve competition for

²⁰ Studies of quality in public services based on user satisfaction surveys have also been conducted for health services (Barber, Gertler, & Harimurti, 2007; Nolan et al., 2001) and bus services (Stradling, Carreno, Rye, & Noble, 2007).

²¹ Other examples include Odense in Denmark (split into four regions), Uppsala in Sweden (divided into regions where one tender is renewed each year), Phoenix in the USA, and Valencia and Madrid in Spain (OECD, 1999).

the contract without damaging the scale of operations.²² The current division of the city into zones is as follows (city districts included in parentheses): 1) West zone (Sants–Montjuïc, Les Corts, and Sarrià-Sant Gervasi); 2) North zone (Horta–Guinardó and Nou Barris); 3) Center zone (Ciutat Vella, Eixample, and Gràcia); 4) East zone (Sant Andreu and Sant Martí).

The contract now in place started in 2009. For the corresponding bidding process, firms were required to bid for each zone, even though it was pre-established that no firm would be awarded more than one service zone. As a result of the process, the contract for the West zone was awarded to CESPÀ, for the North zone to CLD, for the Center zone to FCC, and for the East zone to Urbaser. The contracts were initially intended to last until 2017, but they were extended until 2019, and have since been extended again, until August 31, 2021.

A new bidding process is underway, in which the division of the city into service zones has not been modified. As before, the contract for waste collection is bundled with the contract for street cleaning. Even though each firm can be awarded a maximum of one contract, they were required to bid for at least for two zones. Besides the four incumbent firms, two other firms have submitted bids. The final award of the contracts is expected to take place in December 2020. The criteria for evaluation established by the City Council combine price-related categories with environmental requirements. Interestingly, given the research conducted here, the evaluation does not include any significant user-related component.

4.4 Empirical Strategy

4.4.1 Methodology

Our empirical strategy aims to analyze the differences in quality delivered in neighborhoods by firms due to pressure from competitors. Quality is (negatively) measured by complaints, with more complaints indicating lower quality. To answer our research question, we look at the types of borders of a given neighborhood. In this section, we explain how the two types of borders

²² Most empirical studies on economies of scale in solid waste collection have found such economies to be fully exploited in jurisdictions of a population between 25,000 and 50,000 (Abrate et al., 2014; Bel & Costas, 2006; Chifari et al., 2017; Di Foggia & Beccarello, 2020; Dijkgraaf, Gradus, & Melenberg, 2003; Dubin & Navarro, 1988; Greco et al., 2015; Simões et al., 2012, 2013; Stevens, 1978).

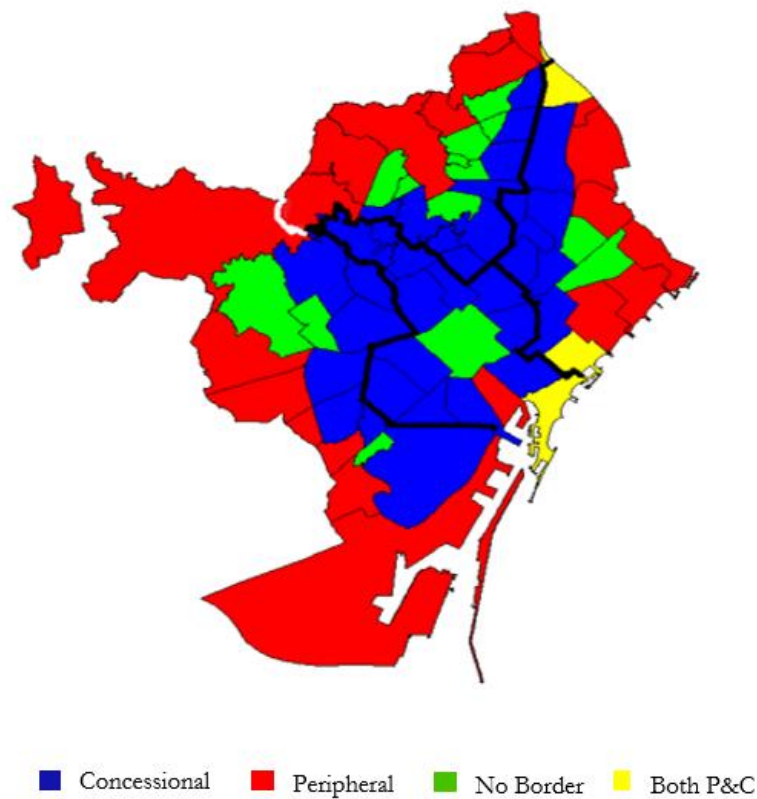
are divided and coded, then a description of the main variables is presented. Last, we construct our main models. Data collection and model estimations are explained in the subsequent sections.

Neighborhoods that share a border with other neighborhoods in which a different firm holds the contract to collect waste are categorized as neighborhoods with a *Concessional Border*. In this type of neighborhood, two (or more) firms operate directly next to each other, so this is where the maximum competitive pressures on quality exists. Firms can anticipate that, in terms of the regulator's monitoring, it is easy to compare complaints in these neighborhoods to assess comparative quality. Therefore, there will be incentives for the firms to deliver a higher quality of service in the neighborhoods where comparability with other firms is high. A negative relationship between the number of complaints and the *Concessional Borders* variable is expected.

The opposite effect is expected for complaints in the neighborhoods where quality comparisons with other firms are more difficult. With this in mind, the variable *Peripheral Borders* is defined to refer to neighborhoods that have borders with other municipalities or with the sea (given the geography of the city of Barcelona). As opposed to concessional borders, firms have incentives to provide lower service quality in peripheral neighborhoods, because the regulator has far lower capacity to compare quality with other firms' neighborhoods. Therefore, a positive association between the number of complaints and the *Peripheral Border* variable is expected.

Figure 4.1 shows the 73 neighborhoods of Barcelona and indicates whether a neighborhood has a concessional border, peripheral border, neither or both. There are five neighborhoods that have both types of border: Barceloneta (Ciutat Vella district); Vila Olímpica (Sant Martí district); Trinitat Vella (Sant Andreu district), Sant Genís dels Agudells (Horta-Guinardó District), and Tibidabo, Vallvidrera i les Planes (Sarrià-Sant Gervasi district). Note, however, that the last two cases (neighborhoods separated by a white line in top-left area of Figure 4.1) are adjacent and border no residential areas (as shown in Figure B.1 retrieved from city council's official street map (barcelona.cat, 2021), in Appendix to Chapter 4). Therefore, both neighborhoods are coded only as peripheral.

Figure 4.1: Neighborhoods and type of borders in Barcelona



Source: Authors, based on city council information

As quality is assessed based on complaints, it is crucial to take into account different socio-economic and political factors that affect people's predisposition for making complaints. First, wealthy citizens tend to demand higher service quality, and a higher level of education allows greater awareness of quality, which is a precondition for initiating a complaint (Thomas, 1982). Therefore, citizens who give more feedback on service delivery, whether positive or negative, tend to come from the wealthier and more educated population sectors (Loeffler & Bovaird, 2016). While data on income at neighborhood level in Barcelona is only available up to 2017, data on educational attainment is up to date and available for the whole period covered by our analysis, and it is well known that educational attainment tends to have a strong correlation with income. The level of educational attainment in the neighborhood is assessed by means of the *Higher Education* variable. This variable is expected to have a positive correlation with the number of complaints.

Turning now to socio-political factors, it is firstly considered that governments are seen as liable for the quality of service delivery, even if services are delivered by external firms. If citizens' expectations have not been met, local politicians are liable for sanctions, and citizens can punish governments by voting against the incumbent (James, Jilke, Petersen, & Van de Walle, 2016). However, not all citizens are equally empowered to punish local governments by voting; only those who have the legal right to vote. Spanish and the other EU citizens have the unconditional right to vote in local elections in Spain.²³ Therefore, given that their potential level of political participation and punishment for low quality is higher, both firms and local regulators have incentives to pay more attention to quality delivered in neighborhoods where political participation can be higher. The resulting expectation is that neighborhoods with a higher share of citizens with the right to vote (*Political Participation*) receive a better service quality, which results in fewer complaints.

Furthermore, it is worth taking into account that identifying with political parties can strongly bias perceptions on the quality of the service (James & Van Ryzin, 2017; Jilke, 2018); supporters of the local government tend to be more satisfied with service delivery, whereas supporters of parties in opposition tend to be less satisfied. It should be noted, however, that when actual performance is evaluated -as it is in in this research, through the number of complaints- partisan biases can be less relevant (Tilley & Hobolt, 2011). Hence, no clear expectation exists regarding this variable (*Votes*).

Additionally, scale-related control variables were included. Firstly, *Population*, for which a positive effect on the number of complaints is expected. Secondly, *Net Density* (which measures the population density in the area allocated for residential use only), for which no precise expectation exists. The basic structure of our count model is as follows:

²³ Other than European Union members, a few countries have signed treaties with Spain that reciprocally allow their respective citizens residing in the other country to vote in the local elections. However, in such cases, the right to vote is subject to strong procedural limitations and requirements of years of residence. As a result, electoral participation is much lower. In the last local election in Spain (June 2019), 466,181 foreigners entered the electoral census (10% of total foreign adult population in Spain). Only 16,648 of these were citizens of non-EU countries with a reciprocal agreement, according to data from the Spanish Statistical Institute (INE; see https://www.eldiario.es/desalambre/voto-inmigrante-extranjeros-legalmente-espana_1_1636823.html).

$$\begin{aligned}
 & \textit{Quality} \\
 & = F(\textit{BorderStatus}, \textit{Higher Education}, \textit{Political Participation}, \\
 & \quad \textit{Vote for Governing Party}, \textit{Population}, \textit{Net Density}) \quad (4.1)
 \end{aligned}$$

As stated, several neighborhoods meet the conditions of having both a *Concessional Border* and a *Peripheral Border*. Therefore, two different specifications are considered:

$$\begin{aligned}
 \textit{Complaints}_{it} = & \beta_0 + \beta_1 \textit{Concessional Border}_i + \\
 & \beta_2 \textit{Higher Education}_{it} + \beta_3 \textit{Political Participation}_{it} + \beta_4 \textit{Votes}_{it} \\
 & + \beta_5 \textit{Population}_{it} + \beta_6 \textit{NetDensity}_{it} + \varepsilon_{it} \quad (4.2)
 \end{aligned}$$

$$\begin{aligned}
 \textit{Complaints}_{it} = & \beta_0 + \beta_1 \textit{Peripheral Border}_i + \\
 & \beta_2 \textit{Higher Education}_{it} + \beta_3 \textit{Political Participation}_{it} + \beta_4 \textit{Votes}_{it} \\
 & + \beta_5 \textit{Population}_{it} + \beta_6 \textit{NetDensity}_{it} + \varepsilon_{it} \quad (4.3)
 \end{aligned}$$

4.5 Data

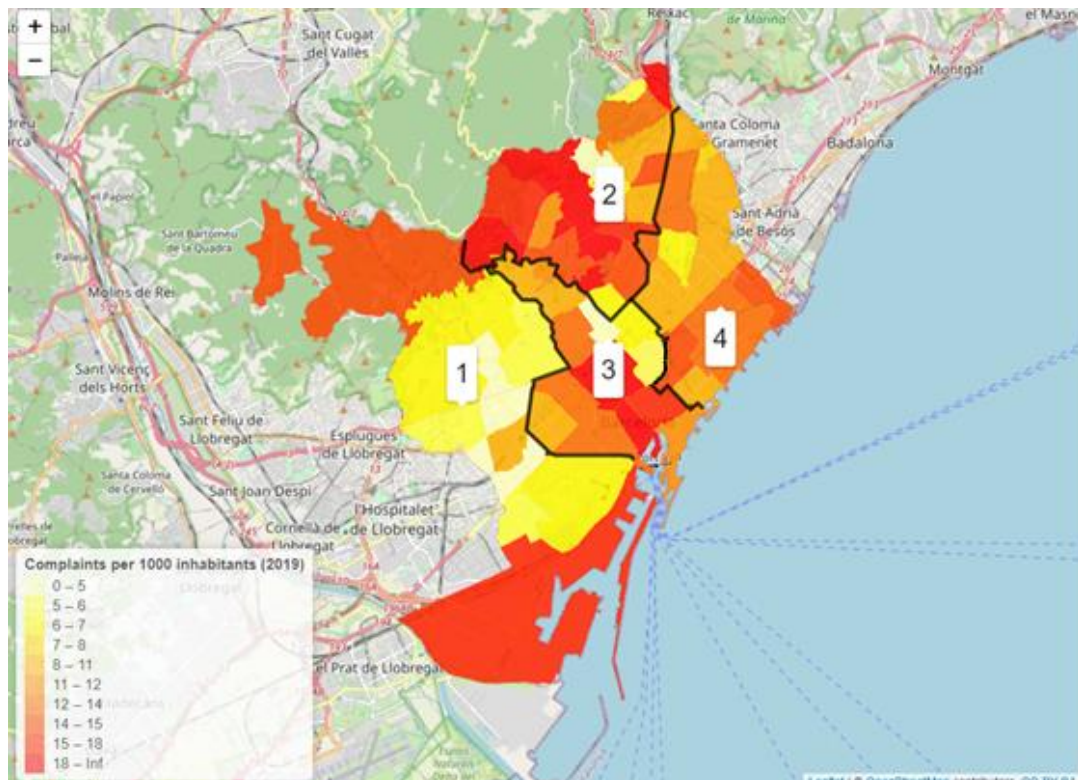
The Open Data BCN portal makes many datasets of different types accessible online. The collection of complaints in Barcelona resembles the *NYC 311 online* complaint program in New York, which was originally a non-emergency phone number available to citizens for reporting problems. Similar platforms were later developed, such as *Cambridge iReports* in the USA; *FixMyStreet* in the UK, and *SeeClickFix* and *CitySourced* – both location-independent – among others (Offenhuber, 2015). These platforms can be seen as tools for co-production of local services (Brudney & England, 1982; O'Brien, 2016), as is the Open Data BCN dataset on queries and complaints.

Complaints in the city of Barcelona have been recorded since 2013, and the registry is up to date. The database is formed of 31 categories, each of which is divided into subgroups. This research was interested in subgroups related to waste collection in the city. This data contains detailed information on date, time, and location of the calls (district, neighborhood and ward, mostly geolocated). Therefore, it has been possible to aggregate the number of complaints made about the waste collection service at a neighborhood level.

Figure 4.2 shows the number of complaints made in each neighborhood (per 1,000 inhabitants) in the year 2019, the last for which information is available for the whole year.

The period under analysis is 2014-2019, the first and last year with information available for the whole year. For this period, monthly observations of complaints are available for each neighborhood. For socio-economic, socio-political, and demographic variables, the data is yearly from 2014 to 2019. In the case of voting for the party in government, three election years were included in the data: 2011, 2015 and 2019. In the years in which elections were held, the outcomes starting from July of that year were considered (as newly elected local governments take office in June). The variables and their sources are described in Table 4.1. All sources are publicly available online: Open Data BCN, Official city statistics (bcn.cat), and Regional statistics (idescat.cat). Table 4.2 displays the descriptive statistics.

Figure 4.2: Complaints on the waste collection service in each neighborhood of Barcelona, year 2019



Note: (1) indicates Western zone; (2) Northern zone; (3) Center zone; and (4) East zone.

Source: Authors based on Open Data BCN

To check the potential relevance of multicollinearity issues, the variance inflation factor (VIF) was computed for each of the two specifications, and for all four concessional areas, each managed by a different firm. The highest mean VIF was 2.56 (Center zone-FCC, estimation for concessional borders). The maximum individual VIFs were 4.76 and 4.39, both for *Higher Education* in Center zone-FCC, concessional and peripheral estimations respectively. All other individual VIFs were well below 4. Thus, no relevant multicollinearity problems exist in the estimations. Results for mean and individual VIFs are displayed in Table B.1, in the Appendix to Chapter 4.

Table 4.1: Description of the variables used in the estimations

Variable	Description	Periodicity	Source
Complaints	Total number of complaints per month in a neighborhood	Monthly data 2014-2019	OpenData BCN
Concessional Border	Dummy standing for neighborhoods where two firms meet, with residents near both neighborhood borders		Own elaboration
Peripheral Border	Dummy standing for peripheral neighborhoods, either bordering with another municipality or with the sea		Own elaboration
Higher Education	Number of inhabitants having finished at least pre-university as the share of population who entered the educational system	Yearly data 2014-2019	OpenData BCN
Political Participation	Number of Spaniard or EU citizens as the share of total inhabitants in the neighborhood	Yearly data 2014-2019	bcn.cat
Votes	Pro-mayor list votes in the local elections as the share of total votes	Data for last election held	bcn.cat
Population	Total number of inhabitants in the neighborhood	Yearly data 2014-2019	idescat.cat
Net Density	Net density (inhabitants/residential hectares)	Yearly data 2014-2019	bcn.cat

Table 4.2: Descriptive Statistics

Variable	West-CESPA				North-CLD			
	Max	Min	Std. Dev.	Mean	Max	Min	Std. Dev.	Mean
Complaints	78	0	11.23	12.63	166	0	13.32	9.97
Concessional Border	1	0	0.49	0.41	1	0	0.48	0.37
Peripheral Border	1	0	0.49	0.41	1	0	0.45	0.29
Votes	51.90	4.80	12.19	23.42	40.30	8.50	8.66	28.05
Higher Education	0.82	0.15	0.18	0.62	0.61	0.20	0.12	0.39
Political Participation	0.97	0.78	0.04	0.91	0.97	0.71	0.05	0.89
Population	47,928	1,145	13,407	24,305	37,216	529	10,204	37,216
Net Density	1,121	19	316	570	1,181	85	282	619
Variable	Center-FCC				East-Urbaser			
	Max	Min	Std. Dev.	Mean	Max	Min	Std. Dev.	Mean
Complaints	444	0	23.07	26.11	132	0	12.88	13.65
Concessional Border	1	0	0.34	0.87	1	0	0.50	0.53
Peripheral Border	1	0	0.34	0.13	1	0	0.50	0.47
Votes	39.70	17	6.41	26.74	37.80	10.70	6.14	27.10
Higher Education	0.77	0.39	0.09	0.63	0.78	0.19	0.14	0.48
Political Participation	0.94	0.61	0.08	0.86	0.95	0.73	0.05	0.90
Population	58,642	7,307	15,903	32,649	57,961	2,482	12,662	22,585
Net Density	1,155	328	231	741	1,511	380	238	827

4.6 Estimations and Results

Given that the number of complaints made on the service in each neighborhood was used to analyze quality variations related to competition by comparison, the outcome variable is discrete: the count of the event – complaint made (W. H. Green, 2018). To estimate the count model, negative binomial regression was used. Negative binomial regression generalizes the Poisson model by loosening the assumption that the variance is equal to the mean, an assumption that is rarely satisfied. The outcome variable has a

variance higher than its mean, which indicates an issue of overdispersion, which can be dealt with by using negative binomial regression (Hilbe, 2014). The maximum likelihood method was used to estimate the regression coefficients. In all estimations time controls are used.

The results of the first set of estimations, for the models for each concessional area/firm analyzing concessional borders, are displayed in Table 4.3. In all four estimations, alpha is higher than zero, thus confirming that overdispersion is present. The p-value for the chi-square ($p < 0.0000$ in all cases) shows that the overall model is robust for every regression.

The key variable is *Concessional Border*, which allows us to check Hypothesis 1. In three concessional areas (North (CLD), Centre (FCC) and East (Urbaser)), neighborhoods that border other concessional areas show negative signs (they have less complaints), and all coefficients are significant at the 1% level. The Western concessional area (CESPA) is the only exception, as the coefficient for its neighborhoods with concessional borders has a negative sign, as expected, but the coefficient does not significantly differ from zero.

Table 4.4 displays the results for the estimations of the models with neighborhoods with a peripheral border, which is the key variable in these estimations as it allows us to check Hypothesis 2. The North (CLD), Centre (FCC) and East (Urbaser) concessional areas have a higher number of complaints (positive sign) in peripheral borders, and coefficients are strongly significant, as in the previous case: at the 1% level for FCC and for Urbaser, and at 5% for CLD. As before, once again, West (CESPA) is the only exception: a positive sign (as expected) for the neighborhoods with peripheral borders is found, but its coefficient does not significantly differ from zero.

Table 4.3: Results of the estimation of the influence of concessional borders on the count of complaints

DV: Count of Complaints	West-CESPA	North-CLD	Center-FCC	East-Urbaser
Concessional Border	-0.03399 (0.04541)	-0.14351*** (0.03909)	-0.52823*** (0.05534)	-0.40212*** (0.02927)
Higher Education	1.16754*** (1.14437)	1.60189*** (0.19791)	1.41065*** (0.45433)	2.85124*** (0.17563)
Political Participation	-3.19041*** (0.61271)	-1.92718*** (0.43374)	-3.57416*** (0.39154)	-4.51974*** (0.40552)
Votes	0.00311** (0.00145)	-0.00470 (0.00337)	0.00639** (0.00250)	0.01213*** (0.00391)
Population	0.00005*** (1.81e-06)	0.00007*** (1.98e-06)	0.00003*** (1.18e-06)	0.00004*** (1.02e-06)
Net Density	-0.00034*** (0.00010)	-0.00021*** (0.00007)	-0.00020* (0.00010)	0.00028*** (0.00005)
Constant	3.08090*** (0.70739)	1.85752*** (0.39272)	4.45095*** (0.23204)	3.15011*** (0.34204)
Alpha	0.12691 (0.01334)	0.22230 (0.01343)	0.12360 (0.01395)	0.08132 (0.00795)
Time effects	YES	YES	YES	YES
Observations	1,224	1,728	1,080	1,224
Wald chi	2,694.82	3,582.70	2,761.03	4,021.81
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1726	0.1792	0.1481	0.1924
Log pseudolikelihood	-3,589.22	-4,746.71	-3,858.46	-3,572.03

Note: *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10%. In parenthesis robust standard errors.

Regarding the control variable included in the estimations, results are almost identical for both specifications. In all estimations in Table 4.3 and Table 4.4, *Higher Education* and *Population* show a stable and significant positive association with complains, whereas it is negative in the case of *Political Participation*. Results for these three variables in all eight estimations are according to expectations. In the case of *Votes for the Mayor's Party*, results are less systematic, but *Votes* tend to be associated with more complaints, when statistically significant. Results for *Net Density* show a random pattern regarding sign and significance, so no clear and stable effect can be concluded.

Table 4.4: Results of the estimation of the influence of peripheral borders on the count of complaints

DV: Count of Complaints	West- CESPA	North- CLD	Center- FCC	East- Urbaser
Peripheral Border	0.04259 (0.04255)	0.11541** (0.04465)	0.57992*** (0.06623)	0.28565*** (0.03776)
Higher Education	1.21592*** (0.15663)	1.68717*** (0.19628)	2.59359*** (0.37558)	2.32295*** (0.17365)
Political Participation	-3.22445*** (0.58569)	-1.91162*** (0.44378)	-4.42607*** (0.33990)	-2.58081*** (0.41050)
Votes	0.00314** (0.00146)	-0.00478 (0.00342)	0.00419 (0.00259)	0.01743*** (0.00401)
Population	0.00005*** (1.43e-06)	0.00007*** (1.72e-06)	0.00003*** (1.26e-06)	0.00004*** (1.07e-06)
Net Density	-0.00033*** (0.00009)	-0.00015 (0.00009)	-0.00065*** (0.00009)	0.00072*** (0.00006)
Constant	3.05356*** (0.53319)	1.74684*** (0.41728)	4.19191*** (0.22822)	0.85919** (0.35968)
Alpha	0.12747 (0.01343)	0.22591 (0.01334)	0.12413 (0.01248)	0.10069 (0.00887)
Time effects	YES	YES	YES	YES
Observations	1,224	1,728	1,080	1,224
Wald chi	2,752.13	3,571.30	2,991.85	3,648.68
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1726	0.1786	0.1514	0.1794
Log pseudolikelihood	-3,588.99	-4,749.99	-3,850.27	-3,629.58

Note: *** indicates significance at 1% level; **: indicates significance at 5% level; * indicates significance at 10%. In parentheses robust standard errors.

4.7 Robustness Check

The robustness of our results can be checked with another technique that can be used to estimate an over-dispersed Poisson distribution, such as the Generalized Linear Model (GLM). Using this approach, the value of k is identified for which the deviance-based dispersion equals 1 (Hardin & Hilbe, 2007). Table 4.5 and Table 4.6 present the results for the GLM estimation of models for *Concessional Border* and for *Peripheral Border*, respectively. The results

obtained are almost identical to those obtained with negative binomial regressions, which suggests that the results obtained are robust to the estimation technique. The only relevant difference is found in the estimation for the peripheral borders specification for West-CESPA. Precisely, the coefficient for the *Peripheral Border* variable is now positive and statistically significant at the 1% level (while it was not significant with negative binomial regression). With GLM, all four estimations for peripheral borders are consistent with H2, as more complaints (indicating lower quality of the service) are made in the neighborhoods where comparison with other concessions is more difficult.

Table 4.5: Results of the estimations for concessional borders. Generalized Linear Model

DV: Count of Complaints	West- CESPA	North- CLD	Center- FCC	East- Urbaser
Concessional Border	-0.05113 (0.04512)	-0.10099*** (0.03845)	-0.56122*** (0.04986)	-0.40050*** (0.03161)
Higher Education	1.52882*** (0.16860)	1.90457*** (0.21930)	1.64525*** (0.45226)	3.21657*** (0.21946)
Political Participation	-2.97407*** (0.63239)	-2.40828*** (0.47475)	-3.95644*** (0.39164)	-5.26783*** (0.50601)
Votes	0.00400** (0.00165)	-0.00539 (0.00354)	0.00576** (0.00251)	0.01341*** (0.00456)
Population	0.00005*** (1.85e-06)	0.00007*** (2.00e-06)	0.00003*** (1.21e-06)	0.00004*** (1.22e-06)
Net Density	-0.00020** (0.00010)	-0.00019** (0.00008)	-0.00005 (0.00010)	0.00035*** (0.00006)
Constant	2.54848*** (0.58100)	2.11644*** (0.42693)	4.59085*** (0.25562)	3.5233*** (0.40267)
Time effects	YES	YES	YES	YES
Observations	1,224	1,728	1,080	1,224
AIC	6.76444	6.01866	8.30163	6.90479
BIC	-7,793.40	-11,532.37	-6,789.33	-7,826.83
Log pseudolikelihood	-4,061.84	-5,122.13	-4,404.88	-4,147.73

Note: *** indicates significance at 1% level; ** indicates significance at 5% level; * indicates significance at 10%. In parentheses robust standard errors.

Table 4.6: Results of the estimations for peripheral borders. Generalized Linear Model

DV: Count of Complaints	West-CESPA	North-CLD	Center-FCC	East-Urbaser
Peripheral Border	0.11983*** (0.04571)	0.11106** (0.04722)	0.65302*** (0.06031)	0.25066*** (0.03730)
Higher Education	1.70153*** (0.18526)	1.98792*** (0.21578)	3.04677*** (0.38733)	2.64540*** (0.21395)
Political Participation	-3.36134*** (0.62838)	-2.30952*** (0.49579)	-4.88924*** (0.34925)	-3.24471*** (0.48779)
Votes	0.00416** (0.00168)	-0.00524 (0.00358)	0.00367 (0.00255)	0.01815*** (0.00459)
Population	0.00005*** (1.55e-06)	0.00007*** (1.78e-06)	0.00003*** (1.27e-06)	0.00004*** (1.23e-06)
Net Density	-0.00022** (0.00009)	-0.00012 (0.00010)	-0.00053*** (0.00009)	0.00076*** (0.00007)
Constant	2.72006*** (0.55945)	1.91821*** (0.46733)	4.23713*** (0.25064)	1.25800*** (0.39473)
Time effects	YES	YES	YES	YES
Observations	1,224	1,728	1,080	1,224
AIC	6.76311	6.01867	8.29181	6.92195
BIC	-7,795.03	-1,1523.36	-6,799.92	-7,805.84
Log pseudolikelihood	-4,061.02	-5,122.13	-4,399.57	-4,158.23

Note: *** indicates significance at 1% level; indicates significance at 5% level; * indicates significance at 10%. In parentheses robust standard errors.

4.8 Discussion and Policy Implication

This research has empirically addressed a main research question: how firms managing the waste collection system in a jurisdiction with fragmented service areas will deliver quality depending on competition by comparison posed by other firms in the city. Our results show strategic behavior of the firm in response to competitive pressures. Those neighborhoods that share a border with another neighborhood that belongs to a different delivery zone tend to have a lower number of complaints, reflecting a higher quality of service provided by the firm, which is consistent with our Hypothesis 1. This is due to the fact that comparing performance is easier for regulators and citizens in this type of neighborhood. While there can be no price competition in the concessional borders, firms can compete on quality.

Conversely, the opposite effect is found in peripheral neighborhoods that share borders with neighboring municipalities or with the sea, where the

number of complaints related to quality is higher, thus reflecting a lower quality of the service, consistent with our Hypothesis 2. In peripheral neighborhoods, firms do not face significant competition by comparison. They can only be compared with concessionaires in neighboring municipalities, and even this is only possible in a limited number of peripheral neighborhoods. Most peripheral neighborhoods have borders with the sea (south-east of the city), with mountainous areas (north and north-west of the city) or with the Besòs River (east of the city).

The only concessional area that has many neighborhoods bordering neighborhoods in other municipalities with a significant population (thus forming an urban continuum) is the West zone (CESPA). Interestingly, this is the only zone in which the peripheral neighborhoods do not show a significantly higher number of complaints in our preferred estimation (negative binomial regression). It should be noted, however, that, even in this zone, Hypothesis 2 (more complaints in peripheral neighborhoods) holds when a General Linear Model is estimated, as shown in Table 4.6.

Although the importance of quality is widely acknowledged, the reform of local public service management in the last few decades has emphasized cost considerations, as has academic research on solid waste collection. One of the main reasons for lagging quality is that its measurement can be very costly, if at all feasible. Additionally, private firms may have the incentive to decrease quality in order to save costs. Hence, moral hazard issues can arise (Grossman & Hart, 1983).

This increases uncertainty and information asymmetry between firms and governments, which makes contracts more incomplete. Thus, effective monitoring and supervision are strongly required (Hart et al., 1997; Levin & Tadelis, 2010; Simon, 1991). Due to the principal-agent conflict of interests, agency costs arise if the firm is not guided by the principle of loyalty and equity (Frydinger & Hart, 2020). New approaches in this line of research investigate the possibility of establishing a partnership mentality and relationship-building (Frydinger, Hart, & Vitasek, 2019). Nevertheless, empirical research seems to confirm that mainly measurable quality indicators are positively correlated with privatization; otherwise, public delivery is of higher quality thus reinforcing the notion of incomplete contracts (Alonso & Andrews, 2016).

Enhancing competition by means of fragmentation of zones and their corresponding contracts within a jurisdiction is a management tool that several cities have used. This is particularly suitable for larger cities, where fragmentation does not damage economies of scale, as shown for the case of Barcelona in Bel & Sebó (2020), and a dynamic form of competition is beneficial (Porter, 1998). Fragmentation increases the opportunities for firms other than the major players to compete (Pavel & Slavík, 2018), thus contributing to alleviating the significant problem of the trend towards concentration in the waste management market (see Antonioli & Massarutto, 2012; Bel & Fageda, 2011).

While split auctions (Auriol & Laffont, 1992; Grimm et al., 2006) in solid waste collection have mainly been used for cost containment, this research has shown that they can also be useful for quality monitoring and supervision. As well as price comparisons in the bids for the contracts, quality comparison can be undertaken as an ongoing task. In that regard, local governments can benefit from information provided by users, such as complaints made for quality-related reason, to compare relative performance in the quality of the service delivered. This enables the regulator to monitor ‘agents with other agents’ (Varian, 1990).

The most straightforward place to compare agents is bordering areas that they share with each other. In this regard, the empirical results obtained in this article have significant policy implications. Firms behave strategically and provide better quality of service in the areas where comparison with other competitors is easier. In other words, firms prioritize the quality of service where they can be compared by the regulator with another supplier on the market (for which users' complaints can be used). However, firms pay much less attention to areas where comparison is more difficult, which have been classified here as peripheral neighborhoods. Consequently, if local governments want to achieve similar levels of quality across the city, they must devote more efforts to monitoring performance in quality directly in neighborhoods where firms face lower competition by comparison.

This article adds to the existing literature in several ways. Firstly, quality of the waste collection service is evaluated by locating feedback data and aggregating it at a micro level. Moreover, strategic behaviors of firms are explored, looking at the divergence in the quality that they deliver. While the quality of the service has been evaluated here based on citizen complaints, other dimensions of quality in waste service collection, and waste management overall, have not

been considered, particularly indicators related to environmental improvement and the fight against climate change, such as different recycling programs (Lavee & Khatib, 2010; Lavee & Nardiya, 2013), or improving the combinations of energy and material recovery (Massarutto et al., 2010). With advancing knowledge in the different dimensions of service quality in waste management, future research will be better equipped to undertake a more comprehensive approach to this issue.

4.9 Conclusion

This study has analyzed the effects of competition by comparison on the behavior of firms with respect to quality in the waste collection services that they provide in the city of Barcelona. More specifically, this research illustrates the incentive to decide quality levels strategically in service delivery based on the distance from competitors, taken as a proxy for competitive pressure. The results from the empirical analysis show that firms offer different quality levels according to the level of competition they face, this depending on whether relative performance evaluations are easier or difficult to make.

Our results suggest that waste companies devote more effort to provide service quality in the areas closer to areas served by competitors, where quality is more directly comparable with that of competitors, because this could influence valuations in future tendering processes. Insufficient or badly planned supervision by local authorities might be allowing companies to reduce efforts in neighborhoods that are more distant to competitors' zones, containing in this way overall costs in the own concessional area, but creating a persistent lag in service quality.

These findings are particularly relevant to both practitioners and policymakers. Local authorities can improve information asymmetry on service delivery by splitting the market, reducing the need to introduce costly monitoring tools. In addition, competition can be managed to promote service quality and direct monitoring by regulators must be emphasized in peripheral areas of the city where citizens have less opportunity to compare quality between different private providers.

Lack of information on other dimensions of quality, other than complaints received, have limited the possibility of conducting a more comprehensive study of spatial variations in the quality of waste collection services. In this regard, having additional data available on other important quality variables

would allow a higher level of generalizability of the results to be achieved. In particular, future research on the strategic behavior of firms should be conducted using data on the environmental impacts of waste collection and waste management, given the relevance of this urban service in terms of tackling the challenge of fighting climate change.

5 The Influence of Independent Local Parties on Debt and Spending: Evidence from Dutch Municipalities

5.1 Introduction

In the Netherlands, independent local parties (ILP) are increasingly becoming an important political player in the (executive) board at the municipal level (Gradus, Dijkgraaf, et al., 2021). Their relative size in terms of seats in the council rose from 24.6% in 1998 to 36.7% in 2018. Therefore, it has also received substantial scholarly attention including studies on the Netherlands (Boogers & Voerman, 2010; Otjes, 2018), Belgium (Dodeigne et al., 2021), Sweden (Åberg & Ahlberger, 2013) Germany (Jankowski et al., 2020), Poland (Gendźwill & Żóltak, 2014) and Austria (Ennser-Jedenastik & Hansen, 2013). Whereas in all of the aforementioned countries ILPs have been emerging as important players in municipal politics, their country-specific context differs and they merit focused attention. In Sweden, even though ILPs are emerging, they are less widespread than Dutch ILPs. In Austria, although local parties hold 15% of the seats, support for ILPs is quite heterogeneous, e.g. in Tyrol and Vorarlberg more localization can be observed, while in the region of Vienna almost no independent local list exists (see Ennser-Jedenastik & Hansen, 2013). This spatial differentiation is observable in other countries as well. For the Belgian case, Dodeigne et al. (2021) highlight that the smaller the size of a municipality the larger the size of local parties. In Germany, Jankowski et al. (2020) show that in municipalities of Lower Saxony Independent Local Lists received in 2016 15.6% of the votes. Moreover, they have raised the question of whether ILPs could be considered a rejection of mainstream parties. Indeed, when the establishment party AfD contested the election in 2016, the vote share of ILL decreased by more than three percentage points. Interestingly, the Dutch anti-establishment party PVV contested the election in 2018 in the Netherlands, which, nevertheless, did not substantially affect the ILPs (Gradus, Dijkgraaf, et al., 2021). This indicates that Dutch local parties are becoming more established and make them interesting to study.

The literature studying public finances has been of scholarly interest on both local and national levels. In early papers in this field, fragmentation has received a lot of attention since the seminal work of Weingast, Shepsle, &

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Johnsen (1981). Higher fragmentation is shown to affect spending categories and debt due to the policymakers' disagreement about how and where to provide higher levels of public goods and services (Alesina & Tabellini, 1990). Another line of literature investigates the effects of ideology which is of high importance in redistributive politics (Dixit & Londregan, 1998). Indeed, a motivated candidate is interested in policy outcomes and not only winning *per se* (Wittman, 1983). Whereas the aforementioned first papers on the connection of political factors with economic outcomes provided theoretical results, more recent papers provide empirical evidence for these considerations. Based on information on West German states, Potrafke (2011) has shown that government ideology influences the allocation of public expenditures on education and cultural affairs. The results indicate that leftist governments increase public spending on schooling, whereas right-wing governments are associated with more expenditure on universities and cultural affairs.

Additionally, there is growing literature studying the impact of political partisanship on debt and spending composition (see for example Lee, Moretti, & Butler, 2004). Existing studies on partisan elects are, however, mostly restricted to state and national governments. For the US and using regression discontinuity design (RDD) methods, Ferreira & Gyourko (2009) present evidence suggesting that partisan effects are absent at the level of US municipalities. However, for some European countries, local partisan effects are found. For example, using data for Swedish local governments and the regression discontinuity method Pettersson-Lidbom (2008) shows that there is an economically significant party effect: left-wing governments spend 2-3 percent more than right-wing governments. Left-wing governments also have 7 percent lower unemployment rates, which is partly due to left-wing governments employing 4 percent more workers than right-wing governments. Moreover, the composition and representation of the Spanish council may influence how local governments finance public services (Bel & Miralles, 2010) and local spending (Bel, Raudla, Rodrigues, & Tavares, 2018). For the Netherlands, Allers, de Haan, & Sterks (2001) analyze the role of partisan politics in determining the local tax burden. Property taxes are the most important revenue source which municipalities in the Netherlands can decide upon themselves. Using a data set on Dutch local property taxes in 1996, Allers et al., (2001) conclude that municipalities with a council dominated by left-wing parties have a higher tax burden and higher spending.

Interestingly, Riedel, Simmler, & Wittrock (2021) did not find that political partisanship affects the overall spending of German municipalities but did find significant partisan effects on spending composition. Specifically, a council seat majority of the main left-wing party SPD is associated with more social service spending and less spending for infrastructure and public goods relative to councils dominated by the main conservative party CDU/CSU. Quantitatively, the share of spending assigned to social services increases by 3.6 percentage points and the spending assigned to infrastructure goods drops by 7.2 percentage points respectively, which is quantitatively significant. Importantly, the German results show that the use of fine-grained spending data is essential. Similarly, Bischoff & Hauschildt (2021) found that counties with the larger political power of the Cristian Democrats spend more on vocational education in West Germany. According to François & Magni-Berton (2015), the annual changes in spending on French public education are also affected by partisan and bureaucratic factors. Veiga & Veiga (2007) investigated political business cycles in Portugal and found that left-wing oriented incumbents tend to be more opportunistic in investment expenditures than right-wing ones. For the Spanish Region of Murcia, Benito, Bastida, & Vicente (2013) observed that left-wing governments spend more on cultural expenditure than right-wing ones.

In this paper, we use annual data on local finances to analyze the influence of independent local parties on the debt and spending composition of Dutch municipalities. Independent local parties are a diverse group of organizations that makes it hard to pinpoint them ideologically. Because of their ideological and organizational characteristics, Boogers & Voerman (2010) stress that local parties are in a better position to organize citizens' political involvement based on their local interests. Moreover, independent local party councilors are more able to promote local interests than representatives of party branches, who are assumed to be more responsive to pressures from fellow party members at higher administrative levels. We use annual data on the debt position of Dutch municipalities as well as on actual municipal spending on the nine main categories collected by Statistics Netherlands. Using a matching strategy we analyze whether municipalities have different behavior in terms of local public finances. Given that our findings show that municipalities with local public majorities differ in several categories, our objective was to see in what specific policies such municipalities are different. Hence, for the categories that show differences in spending between the two groups (i.e., those having a majority of local parties and those that do not have that) we also delve deeper into the

data and show which activities are especially relevant for explaining differences in spending behavior. Specifically, we look at the underlying categories of the main nine categories using several models to ensure the robustness of our results.

The paper is structured as follows. Section 5.2 describes the institutional setting of Dutch municipalities, and we pay special attention to the definition of independent local parties. In section 5.3 we describe the data from the main spending categories and underlying spending categories. In section 5.4 our empirical strategy based on a matching procedure is given and in section 5.5 the empirical model is specified. In section 5.6 our results are elaborated. Some concluding remarks and topics for future research are offered in section 5.7.

5.2 Institutional Setting: Dutch Municipal Elections

The public sector in the Netherlands consists of three layers: central government, 12 provinces, and 352 municipalities (in 2021). In addition, independent water authorities (in 2021: 21), which are active in the fields of water safety, water quality, and water quantity, also belong to the public sector. Almost fifty percent of employees in the Dutch public sector are working for municipalities (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2019). Municipalities are considered the most important and visible level of sub-national government because of the broad range of physical services they provide for citizens, such as issuing driver's licenses, maintenance of roads, waste collection, maintaining the sewage system, and social services, such as social assistance (providing a minimum income) as well as employment promotion facilities and measures. Since the 1990s, the importance of these social services has grown to a great extent because of large decentralization measures in which tasks were transferred from the central government to municipalities (i.e., in the domains of transport and facility care, domestic care, and youth care). Moreover, municipalities perform land development activities, including the purchase of land and making it ready for building. Whereas the central government has prescribed many tasks that have to be performed by municipalities, municipalities have wide discretion over how they perform these tasks. This so-called municipal autonomy is laid down in article 124 of the Constitution. Municipalities are mainly funded by the central government which gives them about 70% of their funding. Besides the funds

provided by the central government, municipalities have their own taxes (e.g., real estate tax) and charge tariffs for their services. Finally, other activities, including land development activities, provide an important – but varying – source of income.

Municipal councils are elected every 4 years. In principle, elections in all municipalities are held on the same day in March (with exceptions for municipalities that have recently been merged or are expected to be merged soon). The electoral system is based on list proportional representation with no threshold other than the natural threshold due to council size. Political parties are responsible for these lists. For new political parties, it is easy to participate in an election as they only have to be supported by some voters (in this municipality) and a deposit should be secured. As Otjes (2018) points out this makes the Dutch system relatively open to the formation of new and independent local parties. The minimum number of votes necessary for the first seat is equal to the total number of votes divided by the number of seats. The number of seats varies between 9 (for municipalities with less than 3,001 inhabitants) and 45 (for municipalities with more than 200,001 inhabitants). Therefore, the threshold due to council size is ranging from 2% for large cities with 45 seats (Amsterdam, Rotterdam, The Hague, Utrecht, and since 2018 Almere and Groningen) and 11% for small municipalities.

Independent local parties (ILP) run in municipal elections but do not participate in elections at the national level. National parties are defined as parties that are represented in the National Parliament.²⁴ After the 2017 National Election, there were 13 parties: Social Democrats (PvdA), Conservative Liberals (VVD), Christian Democrats (CDA), Progressive Liberals (D66), Green Left (GL), Socialist Party (SP), Christian Union (CU), Reformed Political Party (SGP), Freedom Party (PVV), Party for Animals (PvdD), Party for Elderly (50+), Party for Allochthones (DENK) and Forum for Democracy (FvD).²⁵

5.3 Data

For the empirical analysis, we have merged various datasets as shown in Table 5.1. Since we are interested in the absence or presence of an absolute majority

²⁴ Some local parties ran under the banner 'Leefbaar' (Liveable), but without forming a national organization. In 2002 Leefbaar Nederland had two seats in the National Parliament. However, this party did not have formal ties to the independent local parties (Otjes, 2018).

²⁵ After the 2021 national elections there are 19 National Parties.

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consisting of only local parties, hence a local party majority, we have constructed a dummy of *Local majority*, based on municipal electoral data from kiesraad.nl. Using the number of seats achieved by every party in a given municipality, we have summed up the seats of local parties and calculated their share of the total number of seats. If this seat share resulted in a number higher or equal to 50% (hence, a simple majority was achieved), we coded the variable *Local majority* as 1, otherwise 0. Data about these political characteristics (seats and aldermen) were collected from Kiesraad, which is published on their website.²⁶ The other main variables included are the outcome variables connected to municipal finances, such as debt or spending. We use annual data on municipal spending of different categories from the annual reports, published by the ministry of the Interior and Kingdom Relations on findo.nl. Additionally, several variables collected by Statistics Netherlands (CBS) were used in the matching procedure and the estimations as control variables. In most cases, we have observations for the period 2010-2020 except for the debt categories, which were not yet available for 2020 at the time of our analysis.

²⁶ This site was accessed on 01.09.2021.

Table 5.1: Description of the main variables and sources of data

Variable name	Description	Source
Main Variables		
Local majority	Dummy variable coded as 1 if local parties have more than 50% of the seats in the municipal council, 0 otherwise.	Authors based on kiesraad.nl
Municipal debt	Municipal debt divided into long-term and short-term debt.	findo.nl
Municipal spending	Municipal spending on services on categories of Local Public Administration; Public Order and Safety; Infrastructure; Economic affairs; Education; Culture and Recreation; Social Services; Public Health and Environmental Affairs; Spatial Planning and Housing.	findo.nl
Control Variables		
Demographic pressure	The ratio between the number of people aged 0 to 20 and aged 65 or older compared to the people in the so-called 'productive' age group of 20 to 65 years in a municipality	CBS
Dutch background	Persons of whom both parents were born in the Netherlands as a percentage in a municipality.	CBS
Female inhabitants	Female inhabitants as a percentage in a municipality	CBS
Household wealth	Median household wealth of private household of a municipality	CBS
Male inhabitants	Male inhabitants as a percentage in a municipality	CBS
Population	Number of inhabitants in a municipality.	CBS
Population density	Population density in a municipality	CBS
Population growth	Changes in the number of individuals in a municipality in a particular year stated in per thousand term of the initial population on January 1.	CBS
Provinces	Categorical variable of the 12 Dutch provinces of the municipality	CBS
Unemployment	Inhabitants who receive benefits under the Unemployment Insurance Act as a percentage in a municipality.	CBS

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In Table 5.2 the descriptive statistics of the main variables can be found. In our raw unmatched data, there were 3,649 observations included, out of which 16% of the municipal council had a local independent majority in the period from 2010-2020. The average debt position of a Dutch municipality is 1,818.4 Euros *per capita* for long-term debt, whereas this is 375.0 Euros for short-term debt. The table also reveals that there is a great variation between the spending categories we distinguish. By far the most important spending category is Social Services, with on average 925.7 Euros of spending *per capita*, followed by Local Public Administration with 463.6 Euros of spending. The least important category is Economic Affairs with just 38.3 Euros of spending *per capita*. The table also shows that the number of observations in our analysis is not evenly distributed among the provinces, but this is to be expected as the number of municipalities in provinces varies extensively. An overview of the individual shares of the main categories in the total spending *per capita* can also be found in Table 5.2.

Apart from the nine aggregate spending categories we had access to expenditures at a more disaggregated level, however, because of changes in the reporting structure, these data were only available for 2017-2020. Spending on Local Public Administration is important in the sense that it takes up a big part, more than 17%, of the total expenditure of the municipalities. It contains expenditure on administrative bodies such as the Board of Mayor and Aldermen, local audit offices, and the Ombudsman. Civil matters like official registers, administration of official documents, passports, and driving licenses also belong here. Several types of taxes are additionally accounted for here. More than one-third of the spending of Local Public Administration is dedicated to Overhead costs, which are the costs associated with the management and support of all employees of the municipality.

Table 5.2: Descriptive statistics of variables

Main Variables	Number of observations	Mean	Standard Deviation	Min	Max
Long-term debt	3,334	1.8184	1.2901	-0.3462	8.7738
Short-term debt	3,334	0.3750	0.3808	-0.5883	7.9731
Spending categories:					
Local Public Administration	3,649	0.4636 (17.36%)	0.3146	-4.9498	3.8131
Public Order and Safety	3,649	0.1060 (3.97%)	0.1023	-0.0398	3.1056
Infrastructure	3,649	0.1815 (6.80%)	0.1005	0.0000	1.4097
Economic Affairs	3,649	0.0383 (1.42%)	0.0604	0.0000	1.0541
Education	3,649	0.1486 (4.59%)	0.1227	-0.2526	2.1659
Culture and Recreation	3,649	0.2467 (9.24%)	0.1055	0.0000	1.4451
Social Services	3,649	0.9257 (34.66%)	0.4258	0.0000	3.3368
Public Health and Environmental Affairs	3,649	0.2628 (9.84%)	0.0758	0.0000	0.9760
Spatial Planning and Housing	3,649	0.3233 (12.11%)	0.3063	0.0000	3.6558
Control variables					
Demographic pressure	3,649	73	8	44	13
Dutch background	3,649	85	8	44	97
Female population	3,649	50.30	0.81	46.52	53.36
Household wealth	2,981	82	58	1	404
Male population	3,649	49.70	0.81	46.64	53.48
Population	3,649	47,594	71,454	919	872,757
Population Density	3,649	908	1,041	21	6,620
Population growth	3,649	4	7	-42	63
Unemployment	3,300	1.80	0.55	0.24	4.54

Note: Spending categories are provided in per capita terms and per 1000 Euros.

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Tasks related to land traffic and the associated infrastructure, the development and management of parking facilities, recreational and economic ports, and waterways are included in the next category of Infrastructure. Additionally, Public transport is included here with its associated infrastructural facilities, such as the costs of operating buses, trams, and metros. The most important underlying category is Traffic and Transport which includes traffic policy, traffic control installations, maintenance of pavements, road lightning, or winter maintenance. It accounts for more than 85% of the spending in the whole area.

The general function of Economic Affairs includes Economic Development, Physical business infrastructures such as business parks, and investments in shopping areas or agricultural land. Here are tasks such as the attraction of new businesses and start-ups, and financial support for businesses including agriculture, horticulture, livestock, and fisheries included. The last field, Economic promotion, includes activities that are aimed at making the municipality more visible. Here, we encounter tasks such as attracting new employees and institutions, investing in economic networks, and promoting tourism and fairs or tourist and commuter tax. The most important field is Physical Business and Infrastructure.

The category of Education is concentrated on public primary education for municipalities that self-govern such tasks, educational housing for public and special education. Local educational policy and student facilities further include toddler care, adult care, and prevention of early school leaving. Administrative costs for municipalities that are responsible for secondary education are also listed here. Nevertheless, Education as a whole accounts for less than 5% of the overall spending of a municipality.

The field of Culture and Recreation refers to the encouragement of both professional and recreational sports. This area is relatively important for municipalities because almost 10% of the total expenditure is spent on it. More than a third of the whole category is spent on Public Green Spaces and Open-Air recreation. The related tasks include the maintenance of forests, public waters, and small waterways. Additionally, playgrounds, hobby clubs, and recreational facilities are accounted for in this specific function. The task of Sports Accommodations is also relatively important, and they refer to facilities such as sports halls, swimming pools, and skating rinks.

In the area of Social Services, Income Schemes are the most important function. It includes wage subsidies, support for older or disabled citizens, or benefits for the living expenses of starting entrepreneurs. The amount of spending here also depends on the municipal poverty policy. Another important task in this category is youth care which consists of parenting aid, youth mental healthcare, or youth facilities for short-term stays. As we have stated above, this category is where the municipality spends most of its revenue.

In the field of Public Health and Environmental Affairs, the main tasks are Sewerage and Waste Management which together consist of almost 70% of the spending in this area. Examples of the specific activities in these fields include the collection and transport of waste and wastewater, waste separation and recycling, and the prevention of water pollution and groundwater issues. The less important tasks are Cemeteries and crematoria and Public Health. Overall, this category accounts for around 10% of the municipal expenditure.

The last field is Spatial Planning and Housing which accounts for more than 12% of the total municipal spending. Here, the most important task is Land development which includes land acquisition, preparation for construction, and housing. Other tasks involve several permits connected to the housing and the preparation of structural or zoning plans. A detailed overview of the underlying categories and their shares is presented in Table 5.3.

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Table 5.3: Underlying spending categories and their share of the main group

Main Spending Category	Underlying Category	Mean spending	Spending Share
0) Local Public Administration			100%
	Governance	0.0778	8.48%
	Civil Affairs	0.0338	3.68%
	Maintenance of buildings	0.0243	2.65%
	Overhead	0.3665	39.93%
	Treasury	0.0209	2.28%
	Real estate tax on residential properties	0.0089	0.97%
	Real estate tax on non-residential properties	0.0022	0.24%
	Parking Tax	0.0007	0.08%
	Other Taxes	0.0070	0.76%
	General Benefit	0.0010	0.11%
	Other Incomes and Expenses	0.0199	2.17%
	Corporate Tax	0.0016	0.17%
	Changes in Reserves	0.2885	31.43%
	Surplus	0.0647	7.05%
1) Public Order and Safety	Crisis management and fire department	0.0664	70.86%
	Public Order and Safety	0.0273	29.13%
2) Infrastructure			100%
	Traffic and Transport	0.1435	85.26%
	Parking	0.0119	7.07%
	Recreational Ports	0.0031	1.84%
	Economic Ports and Waterways	0.0056	3.33%
	Public Transport	0.0042	2.50%
3) Economic Affairs			100%
	Economic Development	0.0126	17.82%
	Physical Business Infrastructure	0.0422	59.69%
	Firms' subsidies	0.0054	7.64%
4) Education	Economic Promotion	0.0105	14.85%
	Public Primary Education	0.0084	6.61%
	Educational Housing	0.0634	49.88%
	Education Policy and Student Affairs	0.0553	43.51%

Continued

Table 5.3: Continued

Main Spending Category	Underlying Category	Mean spending	Spending Share
5) Culture and Recreation	Sports Policy and Activation	0.0167	6.93%
	Sports Accommodations	0.0649	26.92%
	Cultural Presentation, Production, and Participation	0.0329	13.65%
	Museums	0.0101	4.19%
	Cultural Heritage	0.0057	2.36%
	Media	0.0223	9.25%
	Public Green Spaces and Open-Air Recreation	0.0885	36.71%
6) Social Services	Citizen Participation	0.1005	8.56%
	Neighborhoods	0.0491	4.18%
	Income Schemes	0.3562	30.33%
	Supported Participation	0.1372	11.68%
	Labor Participation	0.0330	2.81%
	Customized Facilities (WMO)	0.0399	3.40%
	Customized Services 18+	0.1570	13.37%
	Customized Services 18-	0.2199	18.72%
	Escalated Care 18+	0.0488	4.16%
	Escalated Care 18-	0.0328	2.79%
7) Public Health and Environmental Affairs	Public Health	0.0396	14.61%
	Sewerage	0.0839	30.95%
	Waste management	0.1028	37.92%
	Environmental management	0.0352	12.98%
	Cemeteries and crematoria	0.0096	3.54%
8) Spatial Planning and Housing	Spatial Planning	0.0361	13.94%
	Land Development	0.1587	61.27%
	Housing and Building	0.0642	24.79%

Note: average in per capita terms for 1,000 based on information from 2017-2020

5.4 Empirical Strategy

5.4.1 Matching Procedure

Due to the so-called fundamental problem of casual inference, we are not able to observe both the presence and absence of local majorities in the same municipality at the same time, therefore casual effects are impossible to directly quantify (Gelman, Hill, & Vehtari, 2020). To estimate the average treatment effect, nevertheless, an ideal research design would choose pairs of similar municipalities and randomly assign to one of them a council with a local party majority. Nevertheless, in our setting we cannot construct such experiments, nor do natural experiments come close to such design. Hence, we chose to apply matching methods before regression adjustments. We take advantage of our institutional setting, where local parties are a common phenomenon and in 16% of our dataset, we can observe local parties be the majority in the municipal councils. In randomized experiments with correct balance, we could compare the outcome in the treated and the control group—using simple difference-in-means would be possible. In our case, nevertheless, municipalities in which citizens choose to vote for local parties are inherently different. As shown in Table 5.4 several variables that are significantly different for the two groups.

To see the differences between the control and the treated group we have analyzed several characteristics. Nevertheless, *Demographic pressure* (calculated as the ratio between people below 20 and above 65 and the so-called productive age group of 20 to 65 years) doesn't appear to be significantly different in these groups. Further, we have looked at the migratory background of the inhabitants using data on the share of people with both parents born in the Netherlands. In this characteristic, we do find a significant difference of 1.3% between the treated and the control group. Other demographic variables we have looked at are *Population*, *Population density*, *Population growth*, *Female population*, and *Male population*. *Population* has a mean of 52,038 inhabitants for the municipalities that don't have a local party majority in the council. For the municipalities with a local party majority in the council this mean is 24,740 (this is a statistically significant difference at $p < 0.001$). This is in line with Gradus, Dijkgraaf, et al. (2021), who shows that smaller municipalities have more local parties. The same applies for *Population density*, which has a mean in the control group of 978 and 547 in the treated group.

Table 5.4: Unmatched sample difference in means in the variables used in the matching

	Unmatched Sample		Difference ¹
	Control	Treated	
Matching Variables	N = 3,055	N = 594	
Demographic pressure	73.32	73.88	-0.55
Dutch background	84.64	85.94	-1.3***
Female population	50.36	50.01	0.35 ***
Household wealth	76.04	110.11	-34***
Male population	49.64	49.99	-0.35***
Population	52,037.97	24,740.33	27,298***
Population Density	977.67	546.61	431***
Population growth	3.94	2.82	1.1**
Unemployment	1.80	1.78	0.02
Years	2015.05	2015.311	-0.26
Province			0.54***
Drenthe	125 (4.1%)	7 (1.2%)	
Flevoland	66 (2.2%)	0 (0%)	
Friesland	143 (4.7%)	27 (4.5%)	
Gelderland	486 (16%)	57 (9.6%)	
Groningen	59 (1.9%)	0 (0%)	
Limburg	163 (5.3%)	151 (25%)	
Noord-Brabant	422 (14%)	231 (39%)	
Noord-Holland	462 (15%)	32 (5.4%)	
Overijssel	261 (8.5%)	14 (2.4%)	
Utrecht	264 (8.6%)	11 (1.9%)	
Zeeland	128 (4.2%)	15 (2.5%)	
Zuid-Holland	476 (16%)	49 (8.2%)	

¹ Welch Two Sample t-test; Standardized Mean Difference

*** Denotes significance at $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

In the case of *Population growth* we have also found a significant difference of 1.1. The same applies to the variables *Female population* and *Male population* where the difference between the treatment and the treated group is 0.35%. For the variables *Unemployment* we don't find a significant difference between the two groups. Nevertheless, in the case of *Household wealth*, we can observe that in the treated group the median household wealth of private households are on average significantly higher.

Hence, overall, municipalities with local majorities are usually much smaller, roughly speaking have half of the population compared to their counterparts

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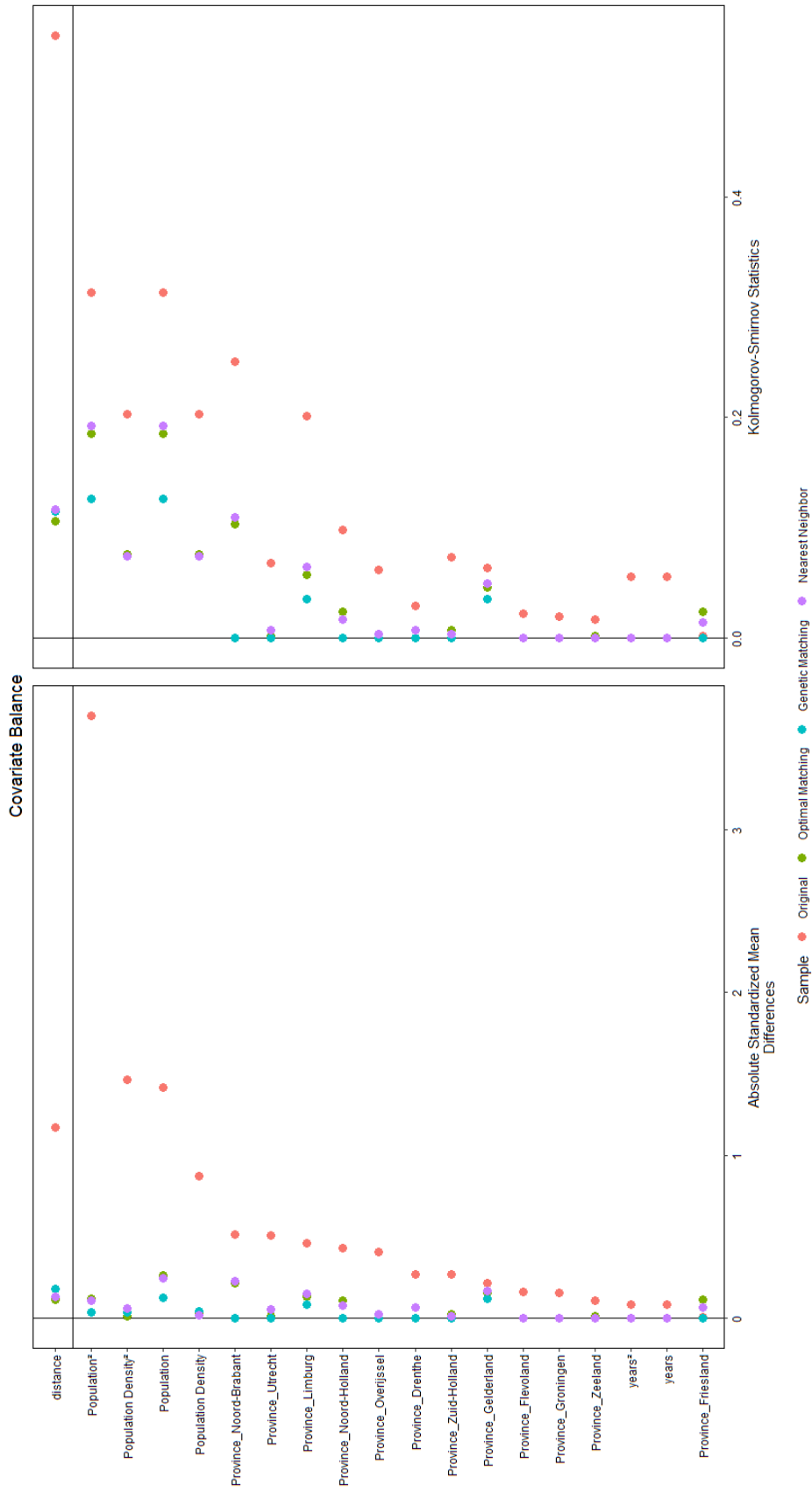
and are less densely populated with a higher median household wealth. Additionally, there is a geographical component also observable, given that there are provinces where none of the municipalities have a local majority such as Flevoland or Groningen, whereas in Noord-Brabant or Limburg it appears to be a common phenomenon.

Thus, the main empirical challenge arises from the fact that municipalities that choose local parties over national ones and vote for them have different characteristics compared to municipalities where national parties have a simple majority in the council. We solve this issue by applying a matching procedure. Matching is a popular method in fields such as statistics (Rosenbaum, 2002), economics (Abadie & Imbens, 2006), political science (Sekhon, 2009), and medicine (Imbens, 2000). It is a method of balancing the distribution of covariates of the treated and the control groups (Stuart, 2010), hence it is a conditioning strategy to identify some causal effects (Cunningham, 2021).

In our case, through the matching procedure municipalities are selected that have similar observable characteristics, the only observable difference between them is the majority type in the municipal council. This way we can consider having local parties in the majority in the council as random and we can identify its effects on debt and spending outcomes. In the matching procedure, we matched the municipalities based on four variables: *Population*, *Population density*, *Province* and *Years*. Hence we don't choose every variable available to us so that we can assess the matching procedure on the unused covariates.

To achieve a very good balance for our dataset we compared the performance of several matching procedures before choosing one. We can assess the quality of the matches in Figure 5.1. The red dots show the imbalance of the variables before the matching. The absolute standardized mean differences have become lower in every matching procedure which means that better balance is achieved, and the estimated effects are more robust to misspecifications (King & Nielsen, 2019). The values of the Kolmogorov-Smirnov statistic got lower also, as it would be in the case of a randomized experiment.

Figure 5.1: Comparison of several matching procedures



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After carefully comparing optimal, genetic, and nearest neighbor matching methods due to its best balance for our data and smallest difference, we chose the procedure of genetic matching (Diamond & Sekhon, 2013) where the variable of *Years* was exactly matched. In genetic matching, an evolutionary search algorithm is used that establishes the weights which is a generalization of propensity score and Mahalanobis distance matching. Genetic matching is preferable to propensity score matching because it eliminates the necessity of iteratively checking the propensity score. It has been employed in several fields of social sciences, e.g., to study the relationship between social media and political behavior (Bode, 2016) hospital efficiency health economics (Büchner, Hinz, & Schreyögg, 2016) or political science (Handlin, 2016).

From the original unmatched database, the number of observations of 3,649 municipalities the matched database contains 1,188 municipalities while keeping in the database all the “treated” municipalities. In Table 5.5 we can see that most variables are not significant anymore, hence we could eliminate most of the differences across every variable using just four in the matching procedure. Nevertheless, the variable *Population* is still significant to some extent, however, the significance is smaller as in the unmatched sample and the mean difference between the two groups decreased from 27,298 to 3,544. If we look at the provinces, we can observe that the spatial dependence is now corrected, for example, we don’t have any observations from Flevoland or Groningen, where local majorities are not common. During this matching procedure none of the treated units were eliminated, hence, the regression analysis will let us estimate the average treatment effect on the treated units.

Table 5.5: Matched sample difference in means in the variables used in the matching

	Matched Sample		Difference ¹
	Control	Treated	
Matched Variables	N = 594	N = 594	
Demographic pressure	73.66	73.88	-0.21
Dutch background	86.56	85.94	0.62
Female population	50.04	50.01	0.03
Household wealth	106.37	110.11	-3.7
Male population	49.96	49.99	-0.03
Population	28,284.41	24,740.33	3,544**
Population Density	539.86	546.61	-6.8
Population growth	3.32	2.82	0.51
Unemployment	1.79	1.78	0.01
Years	2,015.31	2,015.31	0.00
Province			0.12
Drenthe	7 (1.2%)	7 (1.2%)	
Flevoland	0 (0%)	0 (0%)	
Friesland	27 (4.5%)	27 (4.5%)	
Gelderland	60 (10%)	57 (9.6%)	
Groningen	2 (0.3%)	0 (0%)	
Limburg	139 (23%)	151 (25%)	
Noord-Brabant	231 (39%)	231 (39%)	
Noord-Holland	32 (5.4%)	32 (5.4%)	
Overijssel	14 (2.4%)	14 (2.4%)	
Utrecht	18 (3.0%)	11 (1.9%)	
Zeeland	15 (2.5%)	15 (2.5%)	
Zuid-Holland	49 (8.2%)	49 (8.2%)	

¹ Welch Two Sample t-test; Standardized Mean Difference

*** Denotes significance at $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

5.5 The Model

Whereas matching methods are not supposed to substitute model adjustments, they work best in combination with them, leading to “double robustness” (Stuart, 2010). After the matching procedure using ordinary least square (OLS), we can estimate the following specifications:

$$Debt_{i,t} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.1)$$

$$Spending_{i,t} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.2)$$

Where *Debt* and *Spending* are the dependent variables describing the local financial outcomes in the municipalities. Specifically, in the case of *Debt* we differentiate between long-term and short-term debt. In the case of *Spending* we have information on several spending groups as shown in Table 5.2 and Table 5.3 Information on these categories helps us distinguish the effects of local majorities on spending groups with varying discretion. Hence, overall, we estimate several specifications:

$$Long - term\ debt_{PerCap_{i,t}} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.3)$$

$$Short - term\ debt_{PerCap_{i,t}} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.4)$$

$$\begin{aligned} Public\ Administration\ \&\ Support_{PerCap_{i,t}} = \\ & \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \end{aligned} \quad (5.5)$$

$$Public\ Education_{PerCap_{i,t}} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.6)$$

$$Economic\ Issues_{PerCap_{i,t}} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.7)$$

$$Social\ Issues_{PerCap_{i,t}} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.8)$$

$$\begin{aligned} Sports,\ Culture\ \&\ Recreation_{PerCap_{i,t}} = \\ & \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \end{aligned} \quad (5.9)$$

$$Public\ Safety_{PerCap_{i,t}} = \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \quad (5.10)$$

$$\begin{aligned} Traffic,\ Transport\ \&\ Ports_{PerCap_{i,t}} = \\ & \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \end{aligned} \quad (5.11)$$

$$\begin{aligned} Public\ Health\ \&\ Environment_{PerCap_{i,t}} = \\ & \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \end{aligned} \quad (5.12)$$

$$\begin{aligned} Public\ Housing\ \&\ Spatial\ Planning_{PerCap_{i,t}} = \\ & \alpha + \beta LocalMajority_{i,t} + \gamma X_{i,t} + \epsilon_{i,t} \end{aligned} \quad (5.13)$$

In all these specifications i stands for municipality and t is the year of observation. Our main variable of interest is *Local Majority* that equals to 1 if in a given year t and a given municipality i at least 50% of the seats in the municipal council belonged to local parties. Additionally, X stands for the vector of control variables, and the error term is denoted by ϵ .

5.6 Results

Our estimations suggest that there are differences in local finances in municipalities with local majorities both in terms of local public finances. The outcome variable was used first in per capita and also in log per capita terms to correct for the skewness of the distribution. Transforming the outcome variable allows us to use the OLS estimation. Importantly, the main conclusions are the same for both specifications indicating that the findings are robust.

In Table 5.6 the OLS estimation was carried out to see the effect of *Local Majority* on *Long-term Debt* and *Short-term Debt*. Using time and province fixed-effects, including the variables used in the matching and control variables, our results indicate that the debt level, both short-term and long-term, is not lower in municipalities with local party majorities. Hence, we don't find evidence for municipalities with local majorities being less willing to go into debt to finance investments, as Dutch law does not allow to use of this debt to finance deficits. Additionally, we don't find that municipalities with a local party majority are less prone to use short-term debt to finance shortages in liquidity in the short run. Nevertheless, the use of short-term debt would imply more dependence on operational treasury issues than on policy decisions. Long-term debt on the other hand is used to fund investments in fixed assets, such as land and buildings.

Table 5.6: Municipal debt

	Debt in p.c.	Debt in p.c. with controls	Debt in log (p.c.)	Debt in log (p.c.) with controls
Short-term debt	0.014 (0.027)	0.011 (0.030)	0.120* (0.050)	0.133* (0.053)
Long-term debt	0.168* (0.074)	0.169* (0.074)	0.109 (0.107)	0.085 (0.115)
Observations	1,031	931	1,029	929
Province dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Matching variables	YES	YES	YES	YES
Control variables	NO	YES	NO	YES

Notes: (i) The dependent variable was always used in per capita terms. (ii) Clustered robust standard errors in parenthesis. (iii) *** Denotes significance at $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

As shown in Table 5.7, we find that local party majorities imply higher expenditure in several main spending categories. In the case of Local Public Administration, we find that local majorities on average spend around 4.8% more Euros *per capita* in this group which corresponds to roughly 47 Euros higher spending per capita a year. In the case of Culture and Recreation, the expenditure on average is higher in municipalities with a local party majority by 20 Euros *per capita*, whereas in the case of Public Health and Environmental Affairs such municipalities spend *per capita* 48 Euros per year corresponding to around 4.8% higher spending. In the other categories, we haven't found any significant difference between the expenditure of the municipalities of the control and the treated group. To see which specific tasks might potentially cause this divergence between the two groups of municipalities we have explored the underlying categories of these three main categories. Importantly, in the following estimations, our database is smaller because this type of classification has been in use only since 2017 whereas we had information on the main groups from 2010, therefore with the interpretation of the following estimations we have even been more cautious.

Table 5.7: Main spending groups

	Spending group in p.c. terms	Spending group in p.c. terms with controls	Spending group in log(p.c.) terms	Spending group in log(p.c.) terms with controls
Local Public Administration	0.045** (0.014)	0.047** (0.015)	0.038+ (0.022)	0.047+ (0.024)
Public Order and Safety	-0.002 (0.005)	-0.004 (0.006)	0.020 (0.025)	0.019 (0.029)
Infrastructure	0.003 (0.004)	0.003 (0.005)	0.035+ (0.019)	0.031 (0.021)
Economic Affairs	0.007* (0.003)	0.004 (0.003)	-0.015 (0.053)	-0.040 (0.056)
Education	0.011 (0.009)	0.012 (0.009)	0.007 (0.023)	0.015 (0.025)
Culture and Recreation	0.017** (0.006)	0.020** (0.007)	0.021 (0.019)	0.026 (0.021)
Social Services	0.006 (0.012)	0.014 (0.011)	0.008 (0.013)	0.018 (0.013)
Public Health and Environmental Affairs	0.016*** (0.004)	0.018*** (0.004)	0.040*** (0.011)	0.047*** (0.011)
Spatial Planning and Housing	0.001 (0.016)	0.005 (0.015)	0.008 (0.044)	-0.000 (0.044)
Nr. Observations	1,188	956	1,188	956
Province dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Matching variables	YES	YES	YES	YES
Control variables	YES	NO	YES	NO

Notes: (i) The dependent variable was always used in *per capita* or log of *per capita* terms. (ii) Clustered robust standard errors in parenthesis. (iii) *** Denotes significance at $p < 0.001$, ** $p < 0.01$, * $p < 0.05$ and + $p < 0.1$.

5 The Influence of Independent Local Parties on Debt and Spending

Table 5.8: Underlying categories of Local Public Administration

	Spending group in p.c. terms	Spending group in p.c. terms with controls	Spending group in log(p.c.)	Spending group in log(p.c.) with controls
Governance	0.029*** (0.006)	0.025*** (0.006)	0.137*** (0.031)	0.124*** (0.034)
Civil Affairs	0.004*** (0.001)	0.004** (0.001)	0.112** (0.034)	0.113** (0.037)
Maintenance of buildings	0.150 (0.155)	0.151 (0.198)	0.150 (0.155)	0.151 (0.198)
Overhead	0.029 (0.016)	0.026 (0.019)	0.005 (0.038)	0.006 (0.047)
Treasury	0.007* (0.004)	0.008 (0.005)	0.407* (0.183)	0.463* (0.218)
Real estate tax on residential properties	0.002 * (0.001)	0.001 * (0.001)	0.119 (0.076)	0.105 (0.088)
Real estate tax on non-residential properties	0.000 (0.000)	0.000 (0.000)	0.132 (0.122)	0.115 (0.147)
Parking Tax	-0.000 (0.000)	-0.000 (0.000)	-0.869 * (0.421)	-1.069* (0.479)
Other Taxes	-0.000 (0.001)	-0.001 (0.001)	-0.162 (0.159)	-0.213 (0.201)
General Benefit	0.000 (0.001)	0.001 (0.001)	-0.093 (0.310)	0.304 (0.363)
Other Incomes and Expenses	0.008 (0.007)	0.007 (0.008)	0.175 (0.203)	0.105 (0.250)
Corporate Tax	-0.000 (0.001)	0.001 (0.001)	-0.087 (0.283)	-0.055 (0.341)
Changes in Reserves	-0.018 (0.033)	-0.028 (0.037)	0.023 (0.105)	0.001 (0.122)
Surplus	0.036** (0.012)	0.032** (0.012)	0.170 (0.116)	0.241 (0.145)
Nr. Observations	492	360	492	360
Province dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Matching variables	YES	YES	YES	YES
Control variables	YES	NO	YES	NO

Notes: (i) The dependent variable was always used in *per capita* or log of *per capita* terms. (ii) Clustered robust standard errors in parenthesis. (iii) *** Denotes significance at $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

In Table 5.8 the results for the underlying categories of Local Public Administration are shown. We found a positive effect of the local majority on the spending on the services of Governance and Civil Affairs. These results imply that municipalities with a local party majority spend more on tasks that are connected with administrative bodies. These include wage costs, travel, and accommodation costs of the Board of Mayor and Aldermen or local councils, and the local audit office. On average, such municipalities spend 25 Euros more *per capita* for these tasks each year which corresponds to roughly 13% higher spending. In the case of Civil Affairs, we find that municipalities with local majorities spend on average 12% more leads to 4 Euros higher spending *per capita*. This field involves tasks such as issuing passports and driving licenses, population registering, or the organization of elections and referendums. Whereas this result is statistically significant, it concerns less than 4% of the spending of Local Public Administration as a whole.

Considering the main category of Culture and Recreation, we find that municipalities with local majorities have higher expenditure on Sports Policy and Activation and Public Green Spaces and Open-Air Recreation as shown in Table 5.9. Specifically, this might be connected in the former area to tasks such as support for recreational and professional sports and spending on organizations involved in sports. In the former, the presence of local party majorities is connected to higher spending by 9 Euros which according to the model with the logarithmic transformation means around 49% higher spending. In the latter, higher spending implies the support of nature conservation, maintenance of forests and other nature reserves, or public green spaces. Additionally, it can involve the construction and maintenance of playgrounds, hobby clubs, and other recreational facilities. In this category, the average expenditure is by 15 Euros -or by around 14% - higher in municipalities with a local party majority. On the other hand, we find that such municipalities spend by 2 Euros less on Cultural Heritage which corresponds to around 37% lower spending. The relative importance of this task is nevertheless not so high, given that on average only 2.36% of the overall spending on Culture and Recreation is devoted to it.

Table 5.9: Underlying categories of Culture and recreation

	Spending group in p.c. terms	Spending group in p.c. terms with controls	Spending group in log(p.c.) terms	Spending group in log(p.c.) terms with controls
Sports policy and activation	0.010*** (0.003)	0.009*** (0.002)	0.401*** (0.087)	0.402*** (0.095)
Sports accommodations	0.001 (0.004)	0.001 (0.004)	0.006 (0.050)	0.011 (0.058)
Cultural presentation, production, and participation	-0.001 (0.002)	-0.000 (0.002)	-0.050 (0.082)	-0.008 (0.095)
Museum	0.000 (0.002)	0.000 (0.002)	0.066 (0.143)	0.093 (0.169)
Cultural Heritage	-0.003*** (0.001)	-0.002** (0.001)	-0.265* (0.104)	-0.313* (0.128)
Media	0.001 (0.001)	0.001 (0.001)	0.062 (0.053)	0.083 (0.062)
Public green spaces and open-air recreation	0.019*** (0.005)	0.015*** (0.004)	0.147*** (0.031)	0.132 *** (0.032)
Observations	492	360	492	360
Province dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Matching variables	YES	YES	YES	YES
Control variables	YES	NO	YES	NO

Notes: (i) The dependent variable was always used in *per capita* or log of *per capita* terms. (ii) Clustered robust standard errors in parenthesis. (iii) *** Denotes significance at $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

Last, in Table 5.10 the underlying categories of the area of Public Health and Environmental Affairs are shown. Here our results indicate that municipalities with local majorities spend 9% Euros less per capita on the category of Public Health and around 6% more Euros per capita on Sewerage. The tasks of Public Health involve measures that protect the health of the whole population, but also it is connected to the protection of specific risk groups of young and elderly people. Such tasks are related to monitoring health, implementing preventive programs, or providing health information and guidance. Overall, our results of the main categories show that spending on Public Health and Environmental Affairs is higher in municipalities with local majorities, which, as mentioned above, might be caused by higher spending on Sewerage which involves more than 30% of the expenditure of this category.

Specifically, this includes tasks connected to wastewater and water management, the prevention of groundwater problems, and water pollution.

Table 5.10: Underlying categories of Public Health and Environmental Affairs

	Spending group in p.c. terms	Spending group in p.c. terms with controls	Spending group in log(p.c.) terms	Spending group in log(p.c.) terms with controls
Public Health	-0.003* (0.001)	-0.002 (0.001)	-0.094** (0.029)	-0.092** (0.032)
Sewerage	0.007* (0.003)	0.005 (0.003)	0.071** (0.027)	0.062* (0.028)
Waste	0.008 (0.004)	0.006 (0.004)	0.049* (0.023)	0.046 (0.025)
Environmental management	0.006 (0.003)	0.002 (0.003)	0.047 (0.062)	0.010 (0.077)
Cemeteries and crematoria	-0.001 (0.001)	-0.000 (0.001)	-0.035 (0.120)	0.056 (0.132)
Observations	492	360	492	360
Province dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Matching variables	YES	YES	YES	YES
Control variables	YES	NO	YES	NO

Notes: (i) The dependent variable was always used in *per capita* or log of *per capita* terms. (ii) Clustered robust standard errors in parenthesis. (iii) *** Denotes significance at $p < 0.001$, ** $p < 0.01$ and * $p < 0.05$.

5.7 Conclusion

The Netherlands is one of the countries where local parties are relatively successful, the rejection of the mainstream parties is a current phenomenon observed in many countries therefore we expect the future local parties to be even more represented in municipal elections. Our estimations suggest that there are differences in local finances in municipalities with local majorities in different spending categories. First, for Local Public Administration, we find that local majorities on average spend per capita around 4.8% more in this group. In addition, municipalities with local majorities spend significantly more on the tasks of Governance and Civil Affairs. Hence, they spend more on the administrative bodies of the Board of Mayor and Aldermen, the Municipal Council, and council committees. The civil matters that the expenditure is higher might include the issuing of passports and driving licenses, elections, or referendums among others.

Second, for Culture and Recreation, the expenditure on average is higher in municipalities with a local party majority by 20 Euros *per capita*. If we investigate underlying spending categories, we find higher spending in the field of Sports Policy and Activation and Public Green Spaces and Open-Air Recreations, whereas we find a negative effect on the spending on Cultural Heritage. Thus, municipalities with local majorities encourage both recreational and professional sports. Also, they give higher importance to the conservation of nature and maintenance of forests. Additionally, they spend more on hobby clubs, playgrounds, and recreational facilities. It seems that local majorities spend more on “local-oriented” services and goods, which is in line with Boogers & Voerman, (2010).

Third, for Public Health and Environmental Affairs, the expenditure on average is 4.8% higher in municipalities with a local party majority in *per capita terms*. We find higher spending on the task of Sewerage and lower on Public Health, although it is hard to draw any specific conclusions. Nevertheless, since municipalities spend more than double on Sewerage than on Public Health, probably the overall effects are driven by this higher share given that Public Health on a local level in the Netherlands is limited.

Finally, one of the limitations of our analysis is that we don't know what higher spending implies in terms of quality and efficiency. We encourage future research to take this discussion further and explore whether higher spending is due to higher quality in the service delivery or lower efficiency.

6 Conclusions

Local governments are facing nowadays several challenges. The topics of the chapters of my dissertation can be summarized into two concerns. First, the increasing skepticism toward privatization and dissatisfaction with private production in terms of both costs and quality have led local governments to experiment with other forms of provision and delivery. Second, dissatisfaction with government and mistrust of mainstream parties have affected local politics and local governance as well. Most of these challenges are tackled through experimentation, innovation, and learning, where inter-jurisdictional competition and cooperation can enable such processes (Oates, 1972).

As presented in Chapter 2, I had the exceptional opportunity to analyze the booming literature on inter-municipal cooperation as a way to escape stand-alone provision. IMC is used as a tool to enlarge the scale of the delivery, potentially leading to economies of scale. Another advantage that IMC has is that municipalities can preserve larger control over the service, which would involve higher transaction costs in the case of privatization (Hefetz & Warner, 2012; Levin & Tadelis, 2010). IMC uses cooperation to achieve a more reliable service and higher stability and it enables the participants to learn from each other. It is based on trust and mutual commitment, which stems from the fact that municipalities have very similar incentives. Nevertheless, it involves transaction costs that can increase through negotiation and coordination (Feiock, 2007; Williamson, 1999). Given these trade-offs, empirical papers fail to give a consistent answer on the relationship between costs and IMC. Chapter 2 is aimed at explaining the diverging results in the empirical literature. Through a meta-regression analysis (Jarrell & Stanley, 1989; Stanley, 2005, 2008; Stanley & Doucouliagos, 2012; Stanley et al., 2013) the study has looked at whether the divergence can be explained based on economies of scale, transaction costs, and governance. I show that IMC is advantageous for mostly small municipalities, economies of scale are exploited with smaller levels of population. In the case of delegated governance to a supra-municipal entity, costs related to collective action issues can also be lowered. Furthermore, the contribution of this chapter encourages a more in the deep analysis of the role of transaction costs and the effects of IMC on service quality. The main policy implication to be drawn is that one size doesn't fit all. When entering into an IMC agreement policymakers should carefully consider the factors that are found that influence the cost-saving outcomes of IMC.

The limitations of studies using meta-regression analysis involve the limitations of the papers used for the dataset. Importantly, most articles I have used for this chapter didn't aim at investigating the implication of IMC on the quality of the delivery. Nevertheless, every time more research on IMC includes quality-related indicators. Recent literature has found several factors that affect the quality of the delivery in IMC. These include the effect of the asymmetrical relationship due to municipal size (Arntsen, Torjesen, & Karlsen, 2021) or the number of members in the IMC (Blåka, Jacobsen, & Morken, 2021). The quality of IMC can also be measured via a citizen satisfaction survey (Holum & Jakobsen, 2016). I expect a growing number of quality-related studies on IMC. Apart from quality, research on coordination and service resilience in IMC is an exciting research avenue. In case of unforeseen events, IMC might appear less flexible, although it can enhance available resources (Elston & Bel, 2022). Other questions that were outside of the scope of Chapter 2 include the discussion on concerns related to accountability and transparency of such agreements (Spicer, 2017).

In the next chapter, several alternatives to privatization as delivery choices are described. Following the description, I pay special attention to regulation by competition and mixed delivery. These approaches are similar in the sense that they all work in a fragmented market – several suppliers under the same jurisdiction and regulatory frame. Hence, they improve the regulatory tools through competition. In the city of Barcelona, regulation by competition has been in place for several decades for the service of waste collection. The benefits of exclusive territories include increased dynamic competition, making the companies compete not just for the market – as in the case of a single contracting out – but in the market throughout the whole contracting time (Porter, 1998). This is advantageous, given that cost-saving effects of privatization tend to decrease and even disappear over time (Bel & Costas, 2006). My results show that this level of competition has not yet led to converging costs. This may imply that more competition, e.g. more fragmentation, is required. Looking at scale-related issues, I have found that none of the zones is operating under increasing returns to scale. Keeping regulation by competition but enhancing the number of zones would lead to higher competition without damaging economies of scale. If the regulator has the objective to make the service of waste collection more stable, reliable, and less predisposed to fail, an additional measure could be the introduction of mixed delivery. A mixed delivery consists of zones of both public and private production in a fragmented jurisdiction (Bel & Rosell, 2016; Miranda &

Lerner, 1995; Savas, 1981; Warner & Bel, 2008; M. Warner & Hebdon, 2001). Given that the public and private units have different incentives, and risks and are more independent a mixed delivery can be more reliable (J. B. Bendor, 1985; J. Bendor & Moe, 1985). In the case of Barcelona, this would mean that at least one of the zones is subject to public delivery.

This chapter has empirically analyzed the benefits of fragmentation and the workability of a mixed delivery. Typically, in the literature, the benefits of both are argued, but empirical evaluations lag. Cost-related empirical papers raise the question of whether a mixed delivery is genuinely cost-minimizing (Bel & Rosell, 2016). Recent articles have pointed to the fact that mixed delivery is useful in the case of capacities limitations, e.g. in schooling (Destler & Page, 2018), but less is known about its consequences. It would be interesting to see empirical analyses involving factor issues such as reliability, information asymmetry, or transaction costs despite their measurement difficulties. I would like to see future empirical research to shed more light on the effects of mixed deliveries.

Competition by comparison makes possible – apart from exploiting economies of scale – relative performance assessments (Varian, 1990). In Chapter 4, I have used this notion to analyze the strategic behavior of firms in terms of the quality of their delivery. Theoretically, private firms have the incentives to save costs by offering lower quality in the delivery if contracts are incomplete (Grossman & Hart, 1983). Empirical papers also confirm that private firms deliver based on measurable quality indicators, if contracts are incomplete public delivery can typically achieve higher quality (Alonso & Andrews, 2016). In Barcelona, all the firms operate in the same jurisdiction and are close to each other, which makes it possible to evaluate individual efforts (Sappington, 1991). I show that the smaller the distance between the firms, in adjacent neighborhoods, the quality is the highest. Consequently, the quality is lowest in peripheral areas where relative assessments are more difficult to make. In this chapter, I benefit from citizen complaints made through the city's feedback system. Analyzing their characteristics while controlling for socio-economic and political variables allows them to be used as a valuable monitoring tool for performance assessment for very low costs. My suggestion for policy makers includes the usage and promotion of such system, and to keep in mind the strategic behaviors that firms can make.

The absence of other performance- and quality indicators has limited my research in this chapter. Possibly, in the future, more microdata will be

available and studies aiming at investigating quality will allow for higher generalizability of the results. Another way to extend this research would be to look at the effects of competition on additional non-contractual items. This can include environmental impact, air pollution, or noise. A different research question that arises is to see what happens with the complaints after they have been reported. Tracking them would allow researchers to analyze how responsive the system is and whether the firms can be held accountable by the local government.

After analyzing several different options of public service provision and production in Chapters 2, 3, and 4, in Chapter 5 I take the question of local governance from firms and regulators to voters and political parties. In today's globalized world several social and political changes in norms and values have been taking place. Such changes have led to a critical perspective on democracy and mistrust in governments (Chatterjee, 2007). In response to such democratic crises, the ability of societies to self-organize and maintain the diversity of local forms has gained importance and scholarly attention (Gould, 2006). The subject to which I devoted Chapter 5 is the Dutch local independent parties. In the Netherlands, local parties are on the rise, their seat share in the council rose from 24.6% in 1998 to 36.7% in 2018 (Gradus, Dijkgraaf, et al., 2021). Independent local parties distance themselves from ideologies, most of them consider themselves localists. They consider local political affairs important and promote local interests (Boogers & Voerman, 2010). I find that Dutch local parties indeed focus on local-oriented policies in terms of spending which makes them significantly different from mainstream parties.

One of the main limitations of this chapter includes that it cannot be observed what changes in spending mean. It is far from obvious that higher spending leads to higher quality or an increase in welfare for the citizens. Future research should look more deeply into this limitation. Using surveys, it would be advisable to analyze how citizens see the work of local parties. Apart from quality, I would be interested to analyze how the success of local parties affects local democracy, accountability, and transparency. The literature shows that local parties are connected to higher levels of citizen involvement, which would imply a more direct democracy (Boogers, 2008; Boogers & Voerman, 2010). Nevertheless, empirical evaluations are scarce, and a broader geographic context would be needed to generalize results.

Despite its limitations, I see this thesis as a beginning of my journey as a researcher. There are many exciting avenues for further research. Structural re-design of service delivery is an evolving topic and several phenomena have gained traction. For instance, municipal consolidation or amalgamations are an interesting subject in this area. The need for amalgamation used to be explained by cost considerations. There have been cases of financial rewards in case of amalgamation, e.g., in France, financial withdrawal in case of rejection, e.g. Ontario, Canada (McMillan, 2006; Prud'Homme, 2006), or even forced amalgamation, e.g. in Queensland (Dollery, Kortt, & Grant, 2011). Nevertheless, the idea of readily attainable economies of scale due to amalgamation is not systematically confirmed by empirical papers. Current literature seems to corroborate that the optimal scale depends on the service. In amalgamations, scale-related gains can offset the costs, raising questions about the rationale behind it (Allers & Geertsema, 2016; Blom-Hansen, Houlberg, Serritzlew, & Treisman, 2016). Currently, in some cases, researchers and practitioners are even exploring the “de-amalgamation” (Dollery et al., 2011). Apart from cost-related evaluations, democracy gaps have been a debated topic as a disadvantage of amalgamation as it can reduce voter turnout (M. Allers, de Natris, Rienks, & de Greef, 2021).

Another form of structural re-design is private neighborhoods and homeowner's associations. They are examples of citizen self-organization when the option of “exit” is chosen (Hirschman, 1970). Therefore, homeowner organizations are sometimes termed “private government” (Callaway, 2018). Indeed, the citizens who choose this option are usually more affluent and come from a segmented region (Clarke & Freedman, 2019). Such “clubs” (Buchanan, 1965; Sandler & Tschirhart, 1997) represent an exciting research area for several reasons. Given their flexibility, they can potentially be an interesting place to experiment, and a source of innovation, since they can lead to sharing activities in an organized form. Nevertheless, the research question on the effects of such associations arises. Potential concerns include costs related to collective governance and many-principal issues (Chen & Webster, 2005). They might reinforce inequality and segregation, which can be worrying. Empirical research of the causes and consequences of such associations would allow policymakers to understand better the dynamics of demand for local public goods and services. Similar to these examples, the chapters of this thesis illustrated several economic and political phenomena that were all responses to certain dissatisfaction of the locals.

6 *Conclusions*

Additional challenges, that local governments will have to tackle include environmental, demographic, and political changes. It has already been argued that when solving environmental challenges, local governments can be more active than their national counterparts, even though they depend on national politics (Fredriksson & Wollscheid, 2014). Local governance can transform communities from within, supporting green local businesses and civil society groups and help achieve sustainable development (Amundsen, Hovelsrud, Aall, Karlsson, & Westskog, 2018). Decentralization allows local governments to tailor the services to their preferences, leading to a greater inter-jurisdictional variation in pollution (Sigman, 2014). Interestingly, one can observe several countries giving more power to local governments in environmental regulation, whereas in the European Union the harmonization of environmental policies are common. These two paths can be interesting to empirically analyze contributing to the environmental decentralization debate.

As for the demographic changes, aging is an issue of growing importance. Aging might changes local decisions as the elderly are more prone to vote and feel connected to the local community (de Mello, 2021). Considering this, they can influence local politics more. Aging is likely to put new expectations on local governments and the mix of public services will have to change (Andrews & Dollery, 2021). Local governments when facing a decrease in local labor markets might organize more cross-agency collaborations so that such needs are met (Warner & Zhang, 2021). Aging nevertheless can be a debatable issue given that financing these new services involves questions on distribution. If there is a smaller percentage of poor who is elderly compared to other age groups such as in Canada, considerations of economic efficiency and political pressure will have to be investigated (Kitchen, 2021).

Last, I would like to mention the phenomena of illiberal democracies. Theoretically, dictatorships can survive the most, when the elite is kept small and can rule over the majority (Bueno de Mesquita, Smith, Siverson, & Morrow, 2003). Such elite has to be given more political and economic power by the dictator (Bel, 2010). Implementing illiberal policies to enable power-sharing is particularly easy in very centralized governments (Zakaria, 1997). One way to look at such policies is to investigate how much power is left to local municipalities. In a setting with relatively powerful governance and higher level of decentralization, local politics might have the tools to resist or even retaliate non-democratic measures. How much political power and economic importance is needed for the local governments so that they are

capable to hold the national government accountable from below appears to me as interesting research question. Empirically, countries of Central and Eastern Europe might be an interesting context to study. Their socialist past with municipal consolidations was followed by political interest to give power back to local governments and municipal, and the recent phenomena of illiberal democracies can be of concern (Dobos, 2021). Interestingly, current populist politicians often have an anti-elitist rhetoric. As in the case of Hungary, populists give importance to the common people, leading them to believe that improvements in local public goods are yet to come. Typically, on the other hand, lower levels of democracies are connected lower spending on local public goods, such as roads, water, or sanitation (Deacon, 2009). Less is known about how present illiberal democracies work.

These are just a few examples of topics I find interesting and would like to contribute to in the future. Nonetheless, there is neither a perfect provision nor a perfect delivery mode for all local goods and services, certain slack will be continually produced. Any institution of any society is bound to fail in terms of a certain loss of efficiency and democracy (Hirschman, 1970). Research is key to analyzing how even small improvements can be made and which systems fit best the local conditions of a community.

A. Appendix to Chapter 3

Table A.1: VIF results of the models considered

	Inclusion of the variables			
	Model1	Model2	Model3	Final Model
Disposal waste	105.63	29.59	17.70	10.33
Organic waste	110.60	62.29	✘	✘
Paper waste	12.73	6.96	✘	✘
Packaging waste	26.48	20.46	✘	✘
Voluminous waste	7.67	6.12	✘	✘
Glass waste	94.69	82.41	✘	✘
Organic waste %	✘	✘	4.05	2.36
Paper waste %	✘	✘	2.02	1.96
Packaging waste %	✘	✘	10.35	9.73
Voluminous waste %	✘	✘	5.78	5.77
Glass waste %	✘	✘	9.04	8.29
Surface	1814.99	✘	✘	✘
Population	908.14	✘	✘	✘
Density	2423.75	✘	✘	✘
Tourism	93.69	33.39	23.56	✘
Mean VIF	559.84	34.46	10.36	6.41

Table A.2: Sequential exclusion of independent variables due to VIF reporting multicollinearity based on intercorrelation between the regressors

Ind. Variables	Model1	Model2	Model3
Disposal waste	152.73** (67.44)	114.51*** (35.80)	164.10*** (27.86)
Organic waste	-61.24 (264.96)	89.00 (199.44)	
Paper waste	793.99*** (254.69)	701.65*** (188.94)	
Packaging waste	-1,920.34** (890.32)	-1654.91** (784.93)	
Glass waste	774.88 (520.46)	801.18 (487.03)	
Voluminous waste	216.60 (279.41)	68.54 (250.38)	
Organic waste %			1,940,976 (3,461,225)
Paper waste %			1.20e+07*** (3,422,387)
Packaging waste %			-1.48e+07 (1.02e+07)
Glass waste %			5,772,885 (6,476,342)
Voluminous waste %			-111,575 (3,445,397)
Population	20.32* (10.89)		
Surface	-1,244.16** (623.61)		
Density	-23,729.26* (12,104.10)		
Tourism	-940.56 (939.71)	-300.94 (562.65)	351.05 (475.58)
Constant	-235,312 (915,189)	158,867 (224,957)	-529,135 (570,612)
R-sq	0.8401	0.8370	0.8350
Observations	240	240	240
F	120.34***	170.24***	167.77***
Prob>F	0 .0000	0 .0000	0 .0000

Note: *** indicates significance at 1% level; indicates significance at 5% level; * indicates significance at 10%. In parenthesis standard errors.

Table A.3: Inclusion of the term Volume squared

Ind. variables	Baseline Model	FCC	CESPA	CLD	URBASER
Volume of Waste	0.0002111** (0.0000956)	-0.0002062 (0.0002628)	0.0000505 (0.0001156)	0.0003895** (0.0001598)	0.0001918** (0.0000939)
Volume Squared	-2.91e-09 (2.62e-09)	1.36e-08 (9.66e-09)	7.21e-10 (3.00e-09)	-6.42e-09* (3.68e-09)	-2.82e-09 (2.61e-09)
FCC		5.020607 (3.27218)			
VolxFCC		-0.0002999* (0.000175)			
CESPA			-0.0548285 (0.9196158)		
VolxCESPA			0.0000393 (0.0000553)		
CLD				1.141653 (1.184573)	
VolxCLD				-0.0000487 (0.0001043)	
URBASER					-1.326445 (1.147551)
VolxURBASER					5.22e-06 (0.0000798)
Organic	-6.91397 (5.737698)	-4.247512 (8.389724)	7.462829 (9.426089)	-11.17307* (6.720451)	4.418035 (6.467309)
Glass	32.48059* (19.43535)	41.42359** (20.08726)	46.93635** (20.14197)	33.68481* (19.46142)	48.1269** (19.44786)
Paper	11.61517 (13.97435)	5.232103 (14.49109)	5.300813 (14.06786)	15.73343 (15.19958)	21.06087 (13.91523)
Packaging	-9.481973 (16.72367)	-8.89808 (16.62216)	2.233438 (18.69172)	-11.74343 (16.81851)	20.4257 (18.40042)
Voluminous	-26.71203*** (7.13487)	-24.92699*** (8.320915)	-28.93427*** (7.565025)	-11.98505 (13.11697)	1.952774 (11.14295)
August	1.230166*** (0.333801)	1.307763*** (0.3685719)	1.323546*** (0.3334098)	1.045915*** (0.3687688)	0.5764213** (0.3739556)
Constant	1.289817 (1.182853)	3.283899 (2.207632)	-0.0942076 (1.50091)	-0.8216596 (1.930794)	-3.045731* (1.6791)
R-squared					
within	0.8152	0.8194	0.8210	0.8173	0.8274
between	0.9997	0.9998	0.9999	0.9996	1.0000
total	0.9271	0.9289	0.9295	0.9279	0.9321
Time effects	YES	YES	YES	YES	YES
Observations	240	240	240	240	240
Groups	4	4	4	4	4
chi2	708.58***	721.86***	730.13***	710.28***	764.32***
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *** indicates significance at 1% level; indicates significance at 5% level; * indicates significance at 10%. In parenthesis standard errors.

B. Appendix to Chapter 4

Table B.1: Variance inflation factor analysis

Variable	West-CESPA	North-CLD	Center-FCC	East-Urbaser
Concessional Border	2.43	1.63	1.74	1.48
Higher Education	1.96	1.54	4.76	2.00
Political Participation	3.57	1.53	3.22	1.78
Votes	1.14	1.04	1.21	1.03
Population	2.90	2.25	1.92	1.23
Net Density	3.31	1.76	2.49	1.16
Mean VIF	2.55	1.62	2.56	1.45

Variable	West-CESPA	North-CLD	Center-FCC	East-Urbaser
Peripheral Border	1.73	1.40	1.49	2.07
Superior Studies	2.35	1.61	4.39	1.71
Political Participation	3.16	1.53	2.87	1.53
Vote	1.14	1.05	1.21	1.02
Population	1.83	1.76	2.32	1.26
Net Density	2.81	2.05	2.29	1.77
Mean VIF	2.17	1.57	2.43	1.56

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