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RESEARCH ARTICLE

Joining forces or going solo? The political and economic dynamics of intermunicipal cooperation

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Abstract
The suboptimal size of municipalities is often a challenge for service delivery due to scale limitations. Intermunicipal cooperation (IMC) has expanded as an alternative to top-down amalgamations, offering a more flexible and typically voluntary approach. Many studies have been devoted to understanding the driving factors of IMC, providing static empirical evidence on the characteristics of cooperating municipalities. This article contributes to the literature with a dynamic analysis of the drivers of cooperation, using a Cox proportional hazards model over a long period and a very large sample of municipalities in Catalonia. This dynamic analysis unravels the direction of the causal relationship in complex relationships such as fiscal restrictions or political legitimation with cooperation. Furthermore, as we have data from eight relevant local services, we improve both the theoretical and empirical analysis of cooperation dynamics based on the characteristics of the services.

Keywords: intermunicipal cooperation; local government; policy diffusion; public services

Introduction

Government reform and the adoption of policy innovations is a relevant issue in public policy analysis. Although it has received attention in national-level analysis, research at local level is much scarcer, even if political dynamism at the local level is widely documented in the literature (Shi and He 2025). Within public policy analysis, choices of the mode of public service delivery and their effects is a topic of persistent interest (e.g. Sharma 2025). In the case of government reform at local level, the suboptimal size of many municipalities has traditionally been seen as a relevant problem for local public service provision. The suboptimal size implies that a municipality is too small, and increasing production may make it possible to exploit economies of scale (Dixit 1973). Amalgamations have been a type of political reform aimed at increasing the size of local jurisdictions, thereby improving their scale of operations (Swianiewicz 2018). They have usually been imposed from the top down, and their results have been found to be well below expectations (Tavares 2024), if not negative (Blom-Hansen et al. 2016; Galizzi, Rota, and Sicilia 2023; Tavares 2024). A more selective and generally voluntary form of merger is interlocal collaboration or intermunicipal cooperation (IMC), through which two or more local governments jointly provide one or several services within their jurisdictions (Hulst and van Montfort 2012). IMC has long been suggested as a tool to address problems of local suboptimality as it allows benefiting from improved economies of scale (Ostrom, Tiebout, and Warren 1961), and potential spillovers -whether positive or negative- for other jurisdictions (Agranoff and McGuire 2003).

IMC in service provision has emerged as a significant strategy for local governments to enhance service delivery efficiency (Elston, MacCarthaigh, and Verhoest 2018), and as a tool for improving quality, equitable access, and addressing challenges posed by limited resources and increasing demands (Warner, Aldag, and Kim 2021). It is also presented as a mechanism that reconciles two fundamental principles of local government systems: on one hand, local autonomy and the quality of democracy, and on the other, efficiency and the optimal provision of services (Teles 2016; Teles and Swianiewicz 2018).[1]

In line with IMC's different dimensions, multiple factors influence its promotion and adoption. Bel and Warner's (2016) meta-regression reviewed all available multivariate empirical analyses to that point and found that fiscal constraints and spatial and organizational factors were generally influential, while economies of scale depended more on whether the study was a single service or multiservice. Almost all the studies reviewed in Bel and Warner (2016) were multi-service, USA-based, and cross-sectional. Only a few studies were single-service and for European countries (solid waste in Spain and Germany), and also cross-sectional. Several services were analyzed separately in Leroux and Carr (2007), for roads, water and sewage in Michigan (USA), and by de Mello and Lago-Peña (2013) for several services in Brazil and Spain. Both studies used cross-sectional data. More recent studies also tend to be cross-sectional, whether single service (e.g. Arntsen, Torjesen, and Karlsen 2018; Peixoto, Camões and Tavares 2024), or for several services (Szmigiel-Rawska, Łukomska, and Tavares 2020); or multi-service – i.e. aggregate level of cooperation in cities – (e.g. Rubado 2023).[2]

[1]As one reviewer rightly emphasized, the analysis of the relationship between IMC and service quality has expanded greatly in recent years. Quality has been explicitly considered as a relevant objective of IMC (e.g. Aldag and Warner 2018; Warner, Aldag, and Kim 2021; Zeemering 2016). Robust empirical evidence on the effects of IMC on quality is rapidly increasing, including the use of quasi-experimental techniques since 2023 (see, e.g. Elston, Bel, and Wang 2023, 2025; Sandberg 2024). Quality-related factors have not yet been explicitly considered in the empirical analysis of IMC drivers, possibly because the evidence for effects on quality is highly divergent, and also limited in terms of the variety of services analyzed. Therefore, specifying and measuring expectations about the possible future effects of the IMC on quality in the analysis of its drivers remains very challenging.

[2]Interestingly, in Elston, Rackwitz and Bel (2024), a more dynamic approach to the drivers of IMC creation and sustainability has been applied, through a comparative qualitative analysis.

Our article contributes to existing literature on drivers of IMC in several ways. First, we conduct a static explanatory analysis of factors associated with IMC in eight local public services, using data spanning a decade for the municipalities of Catalonia. Our rich database allows us to use a generalized linear mixed model (GLMM), a multilevel model particularly useful when data are clustered and both fixed and random effects are at hand. In this way, our research provides more robust results than previous literature for static analysis.

Second, and more important, we use a dynamic approach to the decision to participate in IMC, which is unprecedented in the empirical literature to our knowledge. By using the Cox proportional hazards model, we obtain a better understanding of the temporal dimension of the cooperation decision, and our dynamic analysis unravels the direction of the causal relationship in complex relationships such as fiscal restrictions or political legitimation with IMC. Furthermore, by having data available from eight relevant local services, we improve both the theoretical and empirical analysis of cooperation dynamics based on service characteristics. Therefore, we contribute to both statistical and dynamic analysis of the factors explaining IMC. Consequently, our results allow us to draw important implications for public policy.

Related literature and underlying theory

Intermunicipal cooperation

Coordination and cooperation with neighboring municipalities can mitigate spillovers and help create economies of scale (Feiock 2007). Furthermore, cooperation plays a crucial role in policy diffusion, particularly in decentralized systems (Füglister 2012). Factors influencing collaborative agreements to provide local public services and the decision to promote or be included in any kind of intermunicipal provision solution can be considered as multifaceted; they encompass economic, political, institutional and social dimensions, and have been addressed from diverse perspectives.

One of the primary drivers of IMC is the pursuit of cost savings and efficiency gains, thus achieving "collaborative efficiency" (Dixon and Elston 2020; Zeemering 2019). As local governments face fiscal and resource constraints, the potential for shared services to reduce operational costs becomes increasingly appealing. Bel and Warner (2015) highlight that the cost savings from IMC are contingent on various factors, including the cost structure of public services and the governance framework at the local level. Bel and Sebő (2021) aimed to explain the differing empirical findings regarding the impact of IMC on service delivery costs. Within this framework, they also sought to assess the extent to which theoretical expectations about IMC contribute to understanding these variations. Particular focus was placed on hypotheses related to economies of scale, service-specific transaction costs, and governance arrangements.

In this context, the relationship between promoting economies of scale and generating transaction costs has also been explored. In the case of IMC, transaction costs tend to be high due to factors such as information gathering, coordination, negotiation, enforcement, and monitoring (Feiock 2007). Hawkins (2017) highlights that the characteristics, specific activities, and nature of the collaboration significantly influence the impact of transaction costs. The number of members involved in the service delivery process is another critical factor. A higher number of members can lead to increased transaction costs, as trust becomes harder to establish (Bel and Warner 2015; Tavares and Feiock 2018). Additionally, coordination costs and challenges arising from the "multiple principal" problem also escalate (Blåka 2017; Bart, van Genugten, and van Thiel 2019). Indeed, these complex processes require not only the ability to co-ordinate decision-making, but also the ability to maintain negotiated consensus between the actors involved over time (Nelles 2013; Teles 2016).

Bel and Warner (2016) emphasize that analyzing IMC requires a theoretical framework that goes beyond cost-efficiency concerns. Using a meta-regression approach, their research underscores the importance of addressing broader policy challenges, including organizational, structural, and spatial dimensions. Their findings reveal that while fiscal pressures may incentivize cooperation, such initiatives do not always lead to efficiency gains. Furthermore, in addition to improving efficiency, scholars have highlighted other key objectives of cooperation, such as enhancing service quality, accessibility, and resilience (Aldag and Warner 2018; Aldag, Warner and Bel 2020; Warner, Aldag, and Kim 2021). This dual focus on cost efficiency and service quality underscores the complexity of motivations behind IMC. Additionally, Leroux and Carr identify local economic factors, community characteristics, and demographic variables as essential elements that affect cooperation on public works (Leroux and Carr 2007).

These findings suggest that the unique context of each municipality, including its size, resources, and demographic composition, can shape its approach to IMC. Moreover, policy-specific factors that may influence the likelihood of such cooperation are often overlooked (Strebel and Bundi 2022). However, research examining the effects of IMC in different policy areas underlines the importance of taking these differences into account at the policy level. For instance, Aldag, Warner, and Bel (2020) show that cooperation does not necessarily lead to cost savings across all domains. Similarly, other studies find that municipalities tend to cooperate more intensively in certain policy areas than in others (Aldag and Warner, 2018).

Hypotheses and their underlying theory

Economies of scale

The optimal geographic scale for local service provision depends on three key dimensions: service volume, population size, and population dispersion (e.g. Ladd 1992; Bel 2013). These dimensions have different implications for returns to scale. When average cost decreases as production increases, economies of scale exist. A typical example is that of small municipalities and solid waste collection, since one truck can serve several municipalities with small populations and volumes of waste. When the service requires a strong physical network, the reduction in average cost is due to the fact that the fixed cost of the network is distributed among a larger number of users, there are economies of density. In this case, for example, the increase in population density allows an increase in the number of users connected to an urban water network. Returns to scale allow a single entity to deliver all services at a lower cost than two or more entities would incur. The existence of these different types of returns to scale requires paying attention to the cost characteristics of the service,[3] because different services will present different delivery conditions in order to take advantage of returns to scale.

Within the literature on IMC, volume of service would be the primary issue to deal with when analyzing scale economies. However, because data on the volume of services provided are often incomplete or difficult to measure at the local level, the population served is often taken as an indicator of the volume of operations. Consequently, the empirical literature on IMC has devoted substantial attention to the effect of population as a driving factor for such collaborations (Bel and Sebő 2021; Bel and Warner 2016). The decision to enter or forgo an IMC agreement would hinger on the number of inhabitants, as cost considerations represent a key motivator for these partnerships (Arntsen, Torjesen and Karlsen 2018; Bel and Warner 2016). Smaller municipalities may be unable to capitalize on these scale benefits due to low demand, while larger municipalities may have already achieved optimal geographic scale within their own boundaries. Consequently, IMC can prove particularly advantageous for smaller municipalities (Hulst and van Montfort 2012).

Most of the empirical research on the population and IMC frequency relationship has uncovered a negative association (e.g. Hefetz, Warner, and Vigoda-Gadot 2012; Levin and Tadelis 2010). However, it must be taken into account that the optimal size varies across services, and the relationship between population and cooperation becomes more ambiguous when considering multi-service cooperation (Bel and Warner 2015, 2016). Eventually, scale economies become exhausted (Stigler 1958). Beyond this point, average costs will not decrease with increasing population. Specifically, we anticipate that as population size increases, the prevalence of IMC will decrease, although this relationship is not linear.

Furthermore, quite the opposite may happen in services for which economies of scale are not basically related to the volume of service, but to the spatial characteristics of the population and the population agglomeration. Caves, Christensen and Tretheway (1984, p. 472) suggested a crucial distinction between returns to scale (the variation in unit costs with respect to proportional changes in both network size and the provision of services), and returns to density (the variation in unit costs caused by increasing services within a network of given size). Therefore, the spatial proximity of service providers facilitates sharing physical networks for service provision, which would decrease unit costs, especially when these physical networks require relevant sunk costs.

In our context, that of local public services, economies of density may exist when municipalities have a high population in small areas, because urban settlements may be close enough (i.e. conurbations), allowing for the sharing of physical networks,

[3]A third type of returns to scale can arise when economies of scope exist. That is, when the average cost decreases as the number of services produced by a production unit increases. We do not give a more detailed consideration to economies of scope, because these would ultimately depend on whether the cooperative organizational arrangement is limited to a single service or whether several services are managed through the cooperative organizational arrangement (in our context, mancommunities or county councils, respectively). This issue has recently begun to receive attention in the analysis of the effects of cooperation on costs, where it has more practical relevance.

thus sharing high fixed costs. This type of situation is often overlooked in empirical analysis, but we must take it into account in our analysis, due to the variety of services we analyze. Among them, urban water and sewage, which are characterized by significant fixed costs derived from strong physical networks. Therefore, we need to consider the potential relationship between IMC and population density.

While population size or density may effectively explain the existence of IMC, their role as explanatory factors for IMC *adoption by a municipality* -the dynamic aspect of cooperation- is less straightforward. The formation of an IMC arrangement requires not only an interested municipality but also the identification of a suitable partner who shares this interest in collaboration (Bischoff and Wolfschütz 2021), and the easy movement of key actors between jurisdictions can also lead to the diffusion of policy innovation (Mistur and Matisoff 2024). Current empirical research emphasizes the significance of population dynamics among neighboring municipalities and the potential for mutual benefits. When such mutual benefits are absent, institutional arrangements tend to favor mergers over IMC (Seta 2024). The potential for mutual benefits fundamentally depends on complementarities and service characteristics. For instance, in the domain of administrative tasks, municipalities situated within clusters of declining populations demonstrate higher rates of IMC initiation (Bischoff and Wolfschütz 2021).

Given the existing theoretical insights and existing empirical evidence, we formulate our first hypothesis as follows:

H1: Returns to scale are positively associated with IMC.

Fiscal constraints

The theoretical approaches present compelling arguments for a positive relationship between fiscal constraints and IMC adoption. Given that municipalities typically operate under strict budget and debt constraints, policymakers are required to develop innovative solutions for efficient service delivery. IMC has emerged as a cost-saving tool, with empirical research demonstrating that fiscal constraints drive the formation of such arrangements (Warner and Hefetz 2002). Politicians representing highly indebted municipalities show greater propensity to support IMC initiatives (Bergholz and Bischoff 2018). Fiscal constraints, operationalized through various measures (most usually debt per capita or local wealth), have been consistently identified as a primary driver of IMC (Bel and Warner 2016).

However, despite strong theoretical foundations and widespread empirical support, correlational studies may fail to capture this relationship accurately. In practice, municipalities with high debt levels might face barriers to IMC participation, either due to their inability to make necessary investment commitments or their low attractiveness as potential partners (Dixon and Elston 2020). Indeed, poorer municipalities may be considered by their neighbors as non-desirable partners (Kwon and Feiock 2010; Rubado 2023). Therefore, supplementing a static analysis with a dynamic one appears sensible, particularly as theoretical literature suggests a positive relationship wherein higher debt accelerates cooperation. The ambiguity interpreting correlational findings underscores the importance of examining both static and dynamic aspects of the fiscal constraints-IMC relationship. All in all, we follow the most common theoretical insight on fiscal constraints to specify our second hypothesis:

H2: Fiscal constraints are positively associated with joining IMC.

Political incentives

IMC is politically challenging (Krueger, Walker, and Bernick 2011). While city administrators may be more inclined to improve service efficiency, policymakers may fear losing political control with IMC and may therefore be less willing to engage in IMC (Leroux and Pandey 2011). Intermunicipal collaboration blurs traditional lines of authority by weakening the direct link between residents and service providers. While the conventional model facilitated clarity, accountability, and transparency of local public goods, collaborative arrangements complicate residents' ability to identify sources of services, evaluate performance, and hold providers accountable (Spicer 2017). Another relevant consideration may be institutional homogeneity (Feiock 2007), which facilitates IMC. Political characteristics of a municipality have been used to explain service delivery decisions (Gradus, Dijkgraaf, and Budding 2024).

In particular, political participation has been seen as a potential factor in the decision to join an IMC. Scholars within the management literature have emphasized that electoral turnout can shape the municipal decision to implement IMC. High turnout has been associated with reluctance to contract out services to private vendors, as IMC represents a means to exploit scale economies while maintaining municipal control (Garrone and Marzano 2015). Blåka (2017) suggests that high voter turnout may indicate greater citizen participation and scrutiny, which could motivate cost-saving initiatives such as IMC. Therefore, this would lead us to expect more political participation -which we measure with electoral turnout-positively associated with participation in IMC.

Furthermore, we must take into account assessments of recent experiences of "quasi-obligatory cooperation" (see Tricaud 2025 for France). The French experience suggests that state-mandated IMC has enabled both low and high levels of integration, the latter associated with lower voter turnout (di Porto, Parenti, and Paty 2024).[4] Thus, in addition to political participation affecting decisions to join the IMC, joining an IMC may in turn affect electoral participation. These dynamics further complicate the anticipated relationship between voter turnout and IMC. Given that Catalan municipalities are free to enter and leave IMC arrangements, we may anticipate a positive relationship between voter turnout and IMC.

H3a: Political participation has a positive association with IMC.

[4]In other countries, such as Italy, mandatory cooperation has been put in place (see Casula 2020, Arachi et al. 2024). However, the degree of implementation has not been as complete as in France, and we are not aware of any analysis on the effects of compulsory cooperation on electoral participation, other than di Porto, Parenti and Paty (2024).

"On the other hand, however, democratic consolidation depends on perceptions of institutional legitimacy (Moehler and Lindberg 2009) which can be reinforced by institutional innovations (Fung 2012). Democratic legitimacy in governance arrangements is fundamentally multi-dimensional, encompassing input legitimacy (democratic decision-making and representation), throughput legitimacy (the quality and transparency of processes), and output legitimacy (policy outcomes aligned with public values and expectations) (Eneqvist et al. 2022). When these dimensions are undermined – particularly through poor electoral outcomes such as low voter turnout – governing institutions risk losing public trust. As Grönlund and Setälä (2007) demonstrate, weak electoral engagement is strongly associated with diminished political trust, which in turn erodes the legitimacy of representative institutions.

Such legitimacy deficits are not merely passive indicators of democratic decline – they actively generate pressure on political actors and institutions to innovate. Research on public sector innovation suggests that external legitimacy threats, such as declining public confidence or accountability concerns, and especially political pressures, often serve as catalysts for institutional change (Verhoest, Verschuere, and Bouckaert 2007). In particular, the literature on sociological institutionalism highlights how legitimacy-seeking behavior drives organizations to adopt new structures or practices perceived as modern, rational, or democratically responsive (Powell and DiMaggio 1991).

In this regard, institutional innovations like IMC can be understood as strategic responses to legitimacy crises. Flexible arrangements, such as IMC, may offer opportunities to design institutional arrangements tailored to specific problems – defined by who participates and how their decisions influence public action – rather than adherence to rigid models (Fung 2012). IMC may be considered an optimal option to attain citizens' acceptance (Lieberherr 2016), and enhance legitimacy (Dixon and Elston 2020); thus, improving support for the institutional system, such as increasing electoral participation. Hence, a politician's reaction to poor electoral outcomes (e.g. low voter turnout) and the corresponding need to strengthen legitimacy might be to innovate through IMC. Taking all this into account, we formulate a second hypothesis related to political participation:

H3b: Political participation negatively influences the choice of entering an IMC.

Overall, expectations about the relationship between political participation and IMC are ambiguous, and we see this as an empirical issue. Since endogeneity may be a potentially relevant concern in the relationship between cooperation and political participation, we later resort to a dynamic methodological approach, the Cox proportional hazards model, which allows us to assess this issue.

Data and variables

Our research is based on data on IMC from the *Observatori de Govern Local* (Local Governance Observatory), a comprehensive dataset maintained by the *Fundació Carles Pi i Sunyer* (Carles Pi i Sunyer Foundation) that has documented patterns in the delivery of municipal public services for 20 years through regular surveys of municipalities in Catalonia. The earliest surveys included only municipalities with more than 5,000 inhabitants. Subsequently, municipalities with a population of more than 500 inhabitants were included, and the surveys were biannual. We use information from seven surveys administered between 2011 and 2022.[5] The average coverage of these seven surveys was 96.2% (% of municipalities surveyed responding). The minimum rate was 90.7% in 2016, and the maximum was 99.5% in 2022.

The key variable of interest is the presence or absence of IMC in the provision of services for which the municipalities are responsible.[6] To ensure meaningful analysis, we established two selection criteria for services to be included in our analysis: (1) a minimum of 5% IMC rate in 2022 in Catalonia; and (2) data availability for at least two years. Eight services satisfied these parameters and were incorporated into our study. Listed in order of decreasing IMC frequency among providing municipalities >500, these are: waste treatment, waste collection, fire services, public library, drinking water, transport, civil protection, and sewage.

Table 1 displays the varying mandatory requirements of provision for these services, and the frequency of cooperation for each service in our sample.[7] Column 4 shows the frequency of cooperation for all municipalities in 2022. Notice that data for all municipalities have been available only since 2016, when the smallest municipalities were also included in the survey. The services in which cooperation is most frequent are those in which the population plays a more important role in the decision to cooperate, as demonstrated by our results: waste treatment and collection. It is worth noting that these two services are characterized by significant economies of scale, and since they are crucial transportation activities, cooperation is easier for smaller municipalities. In this regard, it is important to bear in mind that Catalonia has many small municipalities: in the period we studied, the average municipal population was around 8,000 inhabitants. More importantly, the median population was just over 1,500.

On the contrary, within the services we considered, those with strong physical network characteristics are the services where cooperation is least frequent: sewage and drinking water. In fact, strong physical networks make the number of inhabitants less relevant, and make the contiguity or dispersion of populations more important. In this regard, while cooperation in drinking water is slightly more common than in transportation and civil protection, it should be noted that drinking water is a mandatory service for all municipalities, while transportation and civil protection are required to be provided only by municipalities with larger

[5]The surveys include municipalities with fewer than 500 inhabitants since 2016. As we want to ensure homogeneity of the sample over time, we include only municipalities above 500 inhabitants in all the years of our estimation. We take 2011 as the first year in our sample due to the availability of homogeneous data for control variables. For completeness, we included the municipality of Barcelona (not included in the surveys), because we had data available for all the years and services studied here.

[6]Our analysis focuses on interlocal (horizontal) cooperation and does not include services for which cooperation is intergovernmental -vertical- (e.g. social services), as the drivers of both types of cooperation are not comparable (i.e. due to mandatory regional regulations for vertical cooperation).

[7]A few municipalities responded to the surveys that had both individual and cooperative provision in one service (or in several). In these cases, the observation was excluded from services and years for which the response given by the municipality was hybrid.

Table 1. Services included in the analysis

Service	Threshold for mandatory provision	IMC 2011 > 500 (1)	IMC 2022 > 500 (2)	Growth rate (%) (3)	IMC 2022 All (4)
Waste treatment	Municipalities > 5,000	65.1	67.7	4.0	73.0
Waste collection	All municipalities	38.8	53.5	37.9	62.7
Fire services	Municipalities > 20,000	10.2	11.7	14.7	10.9
Public library	Municipalities > 5,000	1.7	10.9	541.2	9.3
Drinking water	All municipalities	4.9	10.6	116.3	9.5
Transport	Municipalities > 50,000	5.4	10.3	90.7	8.7
Civil protection	Municipalities > 20,000	1.7	6.0	252.9	10.3
Sewerage	All municipalities	3.1	5.6	80.6	4.0

Note: The service may also be provided by municipalities that are not legally obliged to provide it.
The first year with data for waste treatment and fire services is 2014.
Source: Authors, based on data from the Observatory of Local Government.

populations. Therefore, the frequency of cooperation between municipalities providing these services is higher in civil protection and, in particular, in transportation.[8]

By comparing frequency of cooperation in 2011 and 2022 in municipalities > 500 inhabitants (columns 1 and 2) we can see that IMC has expanded in all services (column 3) in the period that we analyze. Relative growth is relevant in almost all services, and extreme in some cases (for example, public libraries, civil protection, drinking water, transport and sewers). The only exception is waste treatment, which already had a very high IMC frequency since the first wave of data when the service was included.

We supplemented this core dataset with several control variables: *Population, Population squared, Population density, Debt per capita* and *Voter turnout,* which we explain and discuss next.

Population: Economies of scale are primarily related to the volume of service, and the population served is a common measure used to approximate the scale of operation, when data on the production of the service is not available, as is the case for most of the services we analyze. Population indicates the inhabitants of each municipality in the corresponding year.

Population squared: This variable was intended to capture the non-linear form of scale economies.

[8]Table 4, below, presents frequency of IMC between municipalities that provide each service. Transportation is also a key feature of the two services where cooperation is more relevant, after waste-related services: fire services and transport. It should be noted that these two services are mandatory only for municipalities with more than 20,000 inhabitants. Therefore, when considering the frequency of cooperation between providers (as shown later in Table 4), transport and fire services are the services with the highest frequency of cooperation between providers, after waste-related services.

Population density: Density of population is the ratio between municipality inhabitants and municipal surface. Agglomeration of population, particularly in metropolitan areas, may facilitate cooperation to share fixed costs when physical networks are relevant for service delivery, so that economies of density can be exploited.

Debt per capita: Debt per capita is the most common indicator employed to measure fiscal constraints that municipalities face (Bel and Warner 2016). Another common measure is municipal wealth (which indicates fiscal capacity), and could be measured with per capita income. However, per capita income data at the municipal level are not available for municipalities with fewer than 1,000 inhabitants in most years of our sample, so we would experience a large reduction in our database if we used it, especially affecting municipalities that operate on a smaller scale. Debt per capita indicates the local public debt per inhabitant

Voter turnout: Among the different forms of expression of political participation, electoral participation in local elections is the most relevant in terms of decisions on local public services. Voter turnout indicates the participation rate (%) in the municipal election immediately preceding each year in the database.

Notice that we do not include variables related to service-specific transaction costs because we analyze services separately. Therefore, they do not vary between observations. However, we use service-specific transaction costs (as in Hefetz and Warner 2012) to discuss the results. Along the same lines, we do not include transaction costs related to institutions because in almost all cases cooperation is developed through delegation to city councils, all with the same governance rules.[9] Table 2 provides an overview of the main variables, sources and expectations; Table 3 displays the descriptive statistics for the main variables.

Factors explaining cooperation: methodology and results

First, we investigate the primary drivers of IMC adoption. This static analysis focuses on identifying the key determinants that influence whether a municipality participates in cooperative arrangements. For this purpose, we use multilevel modeling techniques, i.e. multilevel analysis.

Methodology

Our policy adoption model is used to understand how differences among municipalities affect the adoption of IMC for services. The general model is the following:

$$IMC_{i,\,s,\,t} = f\left(Scale\ dimension_{i,t}, Municipal\ debt_{i,t}, Electoral\ turnout_{i,t}\right) \quad (1)$$

Here, $IMC_{i,\,s,\,t}$ is a binary variable that represents whether a municipality i of the municipalities in year t over the period of 2011–2022 was involved in IMC for the service s of the eight services considered in this analysis. At this point, it is important

[9] In a minority of cases in which cooperation is implemented through mancommunities (or through the metropolitan area of Barcelona), the cooperation is also governed jointly. Interlocal contracts are extremely rare in Catalonia, which reduces the disparity in governance-related transaction costs.

Table 2. Overview of the main variables

Independent Variable	Description	Source
IMC	Dummy variable = 1 if the municipality participates in IMC, and 0 otherwise	FCPiS & Own calculation
Dependent Variables		
Population	Total population of the municipality	Idescat
Population^2	Population squared	Idescat
Density	Population density (inhabitants per km^2)	Idescat
Debt p.c.	Debt per capita in the municipality	INE
Electoral Turnout	Voter turnout rate in the municipality	Idescat
Political Competition (-HHI)	Hirschman-Herfindahl Index of political concentration. Measures political concentration in vote-share across all parties. Multiplied by (−1)	Ministry of Interior (Spain) & Own calculation
Political competition (- Dif 1st vs 2nd)	Difference in vote percentage between the first and second most voted parties. Multiplied by (−1)	Ministry of Interior (Spain) & Own calculation

Note: valid blank ballots (for no party) are also taken into account in the computations of votes for political competition. Notes on Sources: *FCPiS:* Fundació Carles Pi I Sunyer; *Idescat*: Institut d'Estadística de Catalunya; *INE*: Instituto Nacional de Estadística (Spain).

Table 3. Descriptive statistics of the main variables

Variable	Mean	SD	Min	Max	N
IMC	0.27	0.44	0.00	1.00	21,857
Population	15,206.88	78,918.79	502.00	1,664,182.00	21,857
Density	818.55	2,137.92	3.60	21,724.40	21,857
Debt p.c.	68.07	73.60	0.00	1,857.03	21,827
Turnout %	66.65	9.59	38.05	95.45	21,857
Political Competition (- HHI)	−0.42	0.16	−0.13	−0.93	21,857
Political competition (- Dif 1st vs 2nd)	−27.71	24.70	−0.04	−95.55	21,857
Year	2016.67	3.55	2011	2022	21,857

to note that we cannot simultaneously include population size, which operationalizes economies of scale, and population density, which operationalizes economies of density. They have a huge correlation, as the individual variance inflation factor (VIF) of these two variables ranged from seven to eight when included simultaneously in the estimations. To simplify our exposition, we use the term "population" below (for economies of scale); it is sufficient to replace it with "density" for the alternative analysis of density economies, since everything else is equal.

We estimate this model using a GLMMs and the "glmer" function in R. Mixed models, also known as multilevel, random-coefficient, or hierarchical models, represent a generalization of linear and generalized linear modeling. As Gelman (2006) notes, these techniques provide -to varying degrees- an improvement over classical methods. This regression approach allows us to model the log odds of the binary outcome variables as a linear combination of the explanatory variables. The GLMM technique is particularly useful when data are clustered and both fixed and random effects are at hand.

Compared to conventional fixed or random effects logistic regression, the GLMM method offers several key advantages. It can properly account for necessary random or fixed effects, as well as address issues of non-independence in the data. In contrast, logistic (or probit) regression with clustered standard errors can adjust for non-independence but lacks the capacity to incorporate random effects. The widespread presence of hierarchical structures or repeated observations has contributed to the growing popularity of multilevel models across diverse disciplines, particularly in the social, educational, and medical sciences where nested datasets are commonplace (Asampana Asosega et al. 2024).

Let *imc* be the binary response variable of the *j*th service in the *i*th municipality at year *t* indicating whether municipality was part of or not of an IMC arrangement in that service. Our model equation can be expressed as follows:

$$logit\left(\Pr\left(imc_{ijt}=1\right)\right)=\beta_0+\beta_1 * Population_{ijt}+\beta_2 * Population_{ijt}^2 + \beta_3 * Debt_{ijt} + \beta_4 * Turnout_{ijt} + u_i + v_t + e_{ijt} \quad (2)$$

Here, β_0 is the intercept, that represents the baseline log-odds when all the predictor variables have a value of 0. The other fixed effects include β_1, that represents the effect of the population size on the outcome, β_2 allows for non-linear effects of the population, β_3 is the effect of debt per capita and β_4 is the effect of the turnout percentage on the outcome . There is also a random intercept for each municipality *i*, that captures the unobserved heterogeneity across municipalities represented by $\mathrm{u_i} \sim \mathcal{N}\left(0,\ \sigma_\mathrm{u}^2\right)$. Additionally, there is a random intercept for each year *t* accounting for year-specific effects given by the term $v_i \sim \mathcal{N}\left(0, \sigma_v^2\right)$ and last e_{ijt} is the error term.

Furthermore, to address non-linear relationships and improve model convergence, variables exhibiting significant skewness underwent logarithmic transformation for positive skewness and exponential transformation for negative skewness, followed by standardization. All variables were subsequently standardized to ensure comparability across measures. We inspected the VIF for the estimation of each service, to check for potential multicollinearity concerns. We found average VIF and all individual VIFs below two in all services.

Results

To examine the primary drivers of IMC, we estimated the GLMM specified in Equation (1). The GLMM approach is well-suited for this analysis, as it can handle the hierarchical structure of the data (municipalities nested within years) as well as the binary nature of the IMC decision. Table 4 reports the results, which provide insights into the factors influencing IMC across various public services.[10] The coefficients represent the relationship between the predictors *Population, Population squared, Debt p.c., Turnout.*, and the likelihood of IMC across different public services.

[10]The results from the multilevel model estimation must be taken with caution in the case of the Transport service, due to computational singularities stemming from minimal temporal variation in service provision patterns within municipalities. While we observed cross-sectional heterogeneity in transport service delivery across local governments, the temporal stability within individual municipalities hinders the robustness model estimation.

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Table 4. GLMM results for factors influencing IMC (population size)

	Waste treatment	Waste collection	Transport	Fire	Libraries	Civil protection	Drinking water	Sewer
Intercept	4.882***	−0.039	0.046	−10.229***	−11.221***	−11.277***	−10.771***	−10.765***
	(0.500)	(0.330)	(0.430)	(0.914)	(0.665)	(1.001)	(0.609)	(0.680)
Population	−3.063***	−8.642***	−1.171+	1.787	0.211	−3.510	0.899	1.444
	(0.616)	(1.243)	(0.632)	(1.310)	(1.033)	(2.262)	(0.662)	(0.906)
Population^2	0.180**	1.443***	0.096	−0.341	−0.040	0.256	0.060	−0.225
	(0.065)	(0.238)	(0.082)	(0.347)	(0.259)	(0.751)	(0.069)	(0.256)
Debt per capita	−0.385**	−0.167	−0.585*	−0.283	−0.479+	−0.218	−0.294	−0.605*
	(0.147)	(0.120)	(0.250)	(0.387)	(0.278)	(0.240)	(0.203)	(0.286)
Turnout	0.802***	0.422**	1.441***	1.239+	0.510	−0.014	0.659*	0.378
	(0.179)	(0.147)	(0.297)	(0.639)	(0.337)	(0.307)	(0.272)	(0.345)
SD (Intercept municipality)	6.747	5.176	5.037	22.935	16.873	15.248	11.876	12.043
SD (Intercept year)	0.107	0.338	0.000	1.087	0.599	0.380	0.483	0.288
# Observations	2673	3951	1046	850	2864	2256	4097	4090
% IMC among providers	73.2	55.1	38.3	36.8	11.6	9.7	7.6	4.4
R2 Marginal	0.121	0.535	0.590	0.011	0.002	0.028	0.009	0.006
R2 Conditional	0.941	0.949	–	0.994	0.989	0.986	0.977	0.978
AIC	1877.0	2933.4	847.5	623.9	903.3	711.7	1025.0	723.4
BIC	1918.2	2977.4	882.2	657.1	945.0	751.7	1069.2	767.6
RMSE	0.21	0.23	0.21	0.12	0.13	0.13	0.13	0.11

Notes: + $p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Percentage IMC among providers only takes into account the municipalities where the service is actually provided, thus better illustrating the service-related frequency. Recall that municipalities that do not provide the service are excluded from the estimations.
Robust standard errors in parenthesis.

Generally, the effect of population shows a consistent pattern across all the services for which cooperation is more frequent (waste treatment, waste collection and transport). Firefighters, public library, drinking water, civil protection and sewage show no significant relationship between cooperation and population. For most services, therefore, larger municipalities are generally less likely to engage in IMC, as expected. The relationship between population and cooperation appears to be weaker in the case of services that rely heavily on buildings for citizens' use (e.g. firefighters as public library), or physical networks (e.g. sewage or drinking water).

As for the squared population variable, only the services in which cooperation is more frequent show a highly significant coefficient: waste treatment and waste collection. The likelihood of the IMC stops decreasing in the population at a certain point, and then starts to increase again, may suggest a U-shaped relationship in these services. This dynamic is different for services where cooperation is less frequent, for which the squared population tends to be not significant at all.

Turning now to the relationship between municipal *Debt p.c.* and IMC, we observe that the coefficient tends to be negative, and in half of the cases the association is statistically significant: waste treatment, transport, public library and sewage. Overall, little can be said in general terms about the effect of public debt on cooperation. It may well be that studies conducted with the aggregate level of cooperation (e.g. % of municipality expenditure spent on cooperative delivery) are more appropriate for analyzing a potential effect of debt on cooperation.

Voter turnout shows positive associations with IMC in most services, with variations in economic and statistical significance. This relationship is stronger and more significant in services where cooperation is more frequent (waste treatment, waste collection, transport, firefighters), and it is also significant for drinking water. These patterns suggest that civic engagement generally is correlated with higher frequency of IMC, especially in services of high public visibility and direct citizen impact such waste management, water, transport, and fire.

The marginal R^2 values, representing the variance explained by fixed effects alone, show considerable variation across services, suggesting that the observable characteristics of *Population, Debt p.c. and Turnout* explain a substantial portion of IMC decisions in the services where cooperation is more frequent. In contrast, in services for which cooperation is less frequent we find lower marginal R^2, indicating that our explanatory variables alone explain very little of the IMC variation in these services. However, the conditional R^2 values, which include both fixed and random effects, hence also the year and municipality effects, are consistently high across all services, indicating that municipality-specific and temporal factors are crucial for explaining cooperation patterns. The model fit statistics (AIC -Akaike Information Criterion- and BIC -Bayesian Information Criterion) allow for comparison across services, with lower values indicating better fit while penalizing model complexity. The Root Mean Squared Error (RMSE) values, representing the standard deviation of prediction errors, are relatively low across all services, indicating good predictive accuracy.

As explained above, we specified the variable "population density" to analyze density economies. For this purpose, we re-estimated the model with this variable and without the variables related to population size, due to serious multicollinearity problems, and the results are presented in Table 5.[11] The results that we obtain for debt and for electoral turnout are practically identical to those we obtained when we estimated with population. Therefore, we focus on the results of the variable that measures population density.

First, we can see that for services where population was negative and significant (waste treatment, waste management, and transportation), density is negative and significant, which is consistent with our previous estimate. However, population density is now positive and significant for urban water and sewage. This is consistent with the fact that these two services are the only ones that have strong physical networks, because in our context local transport is the bus service, not the rail network, and firefighters and libraries are characterized by singular facilities rather than physical networks.

Dynamic analysis of cooperation: methodology and results

Our second analytical approach examines the factors that either accelerate or delay IMC implementation. This dynamic approach centers on variables that significantly impact the *timing* of cooperation adoption. Survival analysis using time-to-event outcomes can be very informative considering that it gives more insights, beyond just stating whether an event occurred. This approach effectively tackles the presence of units whose event outcomes become unobservable; or that due to the limited period of observation, we don't observe an event happening although it might happen after. Using "censoring" survival analysis can handle this issue (George, Seals, and Aban 2014).

While survival analysis has its origins in life sciences and medical research, it is also frequently employed to study questions in economics or public administration. In the context of policy reforms and innovations such as IMC, hazard models prove useful in identify the factors driving their adoption (Bergholz 2018; Bischoff and Wolfschütz 2021). Discrete time survival models have also been utilized to examine financial and political factors behind privatization of municipal services (Zafra-Gómez et al. 2016), timing of amalgamation in Japan (Nakazawa and Miyashita 2013), or timing of land development in Poland (Reyman and Maier 2022).

By exploring this temporal dimension, we gain insights into the processes underlying IMC formation. To unpack the dynamic relationships between IMC and the explanatory variables we turn to survival analysis, specifically employing the Cox proportional hazards model (Cox 1972) for each of the eight services. In this dynamic analysis, political changes (or their probability of occurrence) may have more relevance than in the static analysis we carried out previously. Political competition has been shown to have significant effects on government performance and policy adoption (Besley, Persson, and Sturm 2004). Politicians who do not face a credible threat of losing their position may be less inclined to adopt reforms. With

[11]When we estimate the model by simultaneously including population size and population density, we obtain the same results for all services and variables, except for density, in urban water and sewerage, where statistical significance disappeared. We believe that this change is an effect of the high correlation between population size and population dimension. Results of this estimation are available as Table SM1 in online appendix.

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Table 5. GLMM results for factors influencing IMC (population density)

	Waste treatment	Waste collection	Transport	Fire	Libraries	Civil protection	Drinking water	Sewer
Intercept	4.352***	1.113***	0.315	−10.427***	−11.263***	−10.583***	−10.810***	−10.963***
	(0.484)	(0.293)	(0.445)	(0.899)	(0.616)	(0.668)	(0.572)	(0.675)
Density.	−1.721***	−3.259***	−1.138*	0.029	0.094	−0.948*	0.915*	0.886*
	(0.287)	(0.325)	(0.471)	(0.536)	(0.456)	(0.448)	(0.398)	(0.448)
Debt	−0.437**	−0.248*	−0.699**	−0.252	−0.475+	−0.279	−0.286	−0.581*
	(0.145)	(0.119)	(0.263)	(0.378)	(0.276)	(0.238)	(0.202)	(0.287)
Turnout	0.747***	0.450**	1.234***	0.732	0.516	−0.001	0.737**	0.441
	(0.174)	(0.146)	(0.314)	(0.556)	(0.349)	(0.303)	(0.284)	(0.352)
SD (Intercept municipality)	5.587	4.840	5.095	22.880	16.885	15.345	12.114	11.881
SD (Intercept year)	0.073	0.446	0.000	1.043	0.600	0.361	0.472	0.285
# Observations	2673	3951	1046	850	2864	2256	4097	4090
% IMC among providers	73.2	55.1	38.3	36.8	11.6	9.7	7.6	4.4
R2 Marginal	0.136	0.317	0.594	0.001	0.002	0.005	0.004	0.005
R2 Conditional	0.918	0.917	–	0.994	0.989	0.986	0.978	0.977
AIC	1874.8	2939.3	842.4	624.1	901.3	709.8	1026.2	720.5
BIC	1910.1	2977.0	872.1	652.6	937.1	744.1	1064.1	758.4
RMSE	0.21	0.23	0.21	0.12	0.13	0.13	0.13	0.11

Notes: + $p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Percentage IMC among providers only takes into account the municipalities where the service is actually provided, thus better illustrating the service-related frequency. Recall that municipalities that do not provide the service are excluded from the estimations.
Robust standard errors in parenthesis.

little risk to their re-election, they are less constrained by accountability mechanisms (Ashworth et al. 2014). At the local level, Padovano and Ricciuti (2009) found evidence that more political competition forces governments to make efficiency-enhancing policy choices at the Italian regional level.

While electoral turnout may be relatively stable over time, political competition may be more volatile between elections. For this reason, we have added a political variable to our dynamic analysis: political competition. Local elections in our institutional context and for our sample (municipalities with more than 500 inhabitants) are based on a highly proportional allocation of municipal seats to party lists (and subsequently the councilors elect the mayor at the first municipal meeting). Therefore, we have chosen to use a concentration index, the Hirschman–Herfindahl Index (HHI), to measure the level of political competition after each municipal election. We used vote-share measures (following Cox, Fiva, and Smith 2020). Note that we have multiplied the HHI by –1 so that the interpretation of the results is immediate rather than counterintuitive. We checked for possible collinearity between political competition and electoral participation, and after including the HHI, the VIF remained low, so there are no relevant collinearity problems.

The model equation for each service is initially as follows:

$$\lambda\,(t) = \lambda_0(t)\exp\,(\beta_1 * Population_{ijt} + \beta_2 * Population^2_{ijt} + \beta_3 * Debt_{ijt} + \beta_4 * Turnout_{ijt} + \beta_5 * PolComp_{ijt}) \quad (3)$$

In this specification, the $\lambda_0(t)$ represents the baseline hazard when all the covariates are equal to zero. It can be interpreted as the probability that the unit of observations experiences the event (IMC) at time t even though all the other covariates are 0. That is to say, the probability of adoption of IMC. The quantities of $\exp(\beta_i)$ are referred to as the hazard ratios. If the value of $\exp(\beta_i)$ is greater than one, or equivalently, β_i is greater than zero, as the value of the corresponding covariate x_i increases, the event probability increases, hence the probability of survival decreases. As we have already done before, when we explained Equation (2), we observe that by replacing the variables related to population size with population density, we would have Equation (3) intended to analyze density economies.

Table 6 shows the results from the Cox proportional hazards models, which provide further insights into the factors influencing the timing of IMC across various public services. To interpret the results, it is important to recall that this method assesses how different variables affect the time until an event occurs (in our case participation in IMC for a given service). Therefore, positive coefficients indicate increased hazard – higher probability of event occurrence. So, factors with a positive coefficient accelerate the IMC adoption, while negative coefficients suggest factors that delay cooperation. Note that the results of estimating Equation (3) with population density instead of population size are virtually identical to those presented in Table 6. We include them as Table SM2 in the online appendix.

In the previous sections we could observe that the effect of *population* tended to be important in explaining why municipalities cooperate, and population seems to be relevant also in explaining when IMC is adopted. In all eight services, we found that population is negatively and significantly related to the speed of adoption of

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Table 6. Dynamic analysis of cooperation adoption

	Waste treatment	Waste collection	Transport	Fire	Libraries	Civil protection	Drinking water	Sewer
Population	−0.778***	−1.267***	−0.848***	−0.471**	−1.611***	−1.604***	−0.437*	−0.491*
	(0.082)	(0.111)	(0.153)	(0.153)	(0.197)	(0.227)	(0.204)	(0.233)
Population^2	−0.039	−0.178***	0.156+	0.131	0.215+	0.115	0.193	0.261
	(0.041)	(0.049)	(0.095)	(0.095)	(0.111)	(0.140)	(0.129)	(0.166)
Debt p.c.	0.267***	0.246***	0.108	0.506***	0.421***	0.435***	0.257*	0.357*
	(0.044)	(0.052)	(0.092)	(0.105)	(0.108)	(0.110)	(0.121)	(0.151)
Turnout %	−0.336***	−0.378***	−0.354**	−0.528***	−1.211***	−0.514***	−0.593***	−0.916***
	(0.060)	(0.068)	(0.132)	(0.128)	(0.138)	(0.138)	(0.176)	(0.207)
Political Competition (- HHI)	+0.120*	+0.202**	– 0.130	– 0.087	+0.527***	+0.165	+0.201	+0.365+
	(0.056)	(0.065)	(0.125)	(0.109)	(0.136)	(0.127)	(0.158)	(0.206)
Num.# Obs.	721	590	287	324	633	623	759	772
AIC	6855.4	4393.0	1440.0	1443.7	1192.3	1057.9	1022.3	709.6
BIC	6878.3	4414.9	1458.3	1462.6	1214.5	1080.1	1045.4	732.8
RMSE	0.87	0.81	0.71	0.64	0.41	0.39	0.33	0.27

Notes: + $p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Robust standard errors in parenthesis.

cooperation for those municipalities that were not cooperating in 2011 but entered into cooperation in the following years. This includes services for which no relationship with population was found before, but now we find that timing of adoption of cooperation is negatively associated with population.

Higher *public debt p.c.* tends to accelerate the adoption of IMC. We find a positive effect from debt on the timing of adoption in all services, and in all cases but transport, with relevant levels of significance. While our previous static analysis did not allow us to draw robust conclusions about the effect of debt on cooperation, our results from the dynamic analysis show that public debt accelerates the adoption of cooperation. This suggests that financial pressure motivates municipalities to seek cost-sharing arrangements and to explore cost savings through cooperation. Consequently, joining IMC could lead to debt reduction, which would help understand our per capita debt results in the static estimates (Table 4)

Turning now to *voter turnout*, for all services we observe a negative and statistically significant coefficient. Lower voter turnout is thus associated with a higher probability of cooperation, meaning that municipalities with less civic engagement tend to accelerate the adoption of cooperation. This result is somewhat contradictory to the participation result we most frequently found in the static analysis: positive and significant association between participation and cooperation. Suggesting, again, that joining IMC may increase political participation. Further research is needed, indeed.

Finally, our results for *political competition* tend to show that more intense electoral competition is associated with faster adoption of cooperation, and this result is statistically significant for waste treatment, waste collection, libraries, and water. In addition to this, we took into account that, although the municipal electoral system in our context is basically proportional, in practice the party that obtains the most votes has a great advantage in obtaining the mayorship. Therefore, we checked an alternative measure: the difference in vote percentage between the top two candidates (which we also multiplied by − 1, to facilitate direct interpretation). The results were virtually identical with this new specification and are included as supplementary material (Table SM3) in the online appendix.

Discussion

This study provides valuable insights into the complexity of factors shaping IMC in public service delivery. By employing a comprehensive analytical approach that combines both static and dynamic perspectives, we uncover nuanced relationships between population size, municipal debt, voter turnout and political competition, and the adoption and timing of IMC arrangements.

Consistent with prior research, we tend to find that smaller municipalities are generally more likely to engage in IMC in the services for which cooperation is more frequent, and our dynamic analysis shows that the smaller the population, the faster the adoption of cooperation by municipalities that do not yet cooperate. This said, the relationship between population and IMC is complex. Population size tends not to be significant for services where cooperation is less frequent in our static (more structural) analysis. A possible reason for this lack of significance could be that service provision is not mandatory for small municipalities, which could explain the results in fire services, libraries and civil protection. However, drinking water and sewerage are also mandatory for smaller municipalities. In both cases, the key factor is likely to be the strong physical networks that these two services require for delivery, which would be more related to economies of density than to volume-related economies.

In fact, when we re-estimate our model by replacing population size with population density, the (negative) effect for waste treatment, waste collection, and transportation remains the same. But in urban water and sewerage, population density shows a positive and statistically significant relationship with cooperation. This can be interpreted as meaning that a higher population density, which is usually correlated with urban agglomerations, facilitates the connection of physical networks and, therefore, the sharing of fixed costs. The results we obtain provide an interesting methodological lesson. While the possibility of exploiting economies of scale tends to have a significant association with participation in IMC (consistent with Hypothesis 1), the type of returns to scale involved (e.g. economies of scale or economies of density) needs to be considered, as they may differ depending on the cost characteristics of the service.

The influence of municipal debt on IMC decisions is complex. Our static analysis shows mixed results, with a few services exhibiting a negative relationship with debt others no significant association, we argued in the previous section that it might be caused by the static nature of the multilevel analysis and lack of causal inference. Furthermore, we argued that single service analysis may be less apt than more aggregate analysis (e.g. share of cooperation expenditures among overall municipal expenditures) to robustly study the effect of debt on cooperation. This picture is clarified by the dynamic analysis, which points to a more consistent pattern. Higher debt levels tend to accelerate the adoption of IMC in all services, and only in the case of transportation the coefficient lacks statistical significance. Therefore, high debt level leads to IMC, not the other way around. This also lends support to the notion that fiscal constraints are a key driver of cooperation. This finding aligns with the theoretical perspective that municipalities facing tighter budgetary conditions are more inclined to explore cost-saving strategies through collaborative arrangements. Hence, although the static analysis seems to show mixed results with respect to H2, the dynamic analysis confirms that higher debt levels consistently accelerate IMC adoption, thus overall supporting our hypothesis.

Another notable finding is the consistently positive relationship between voter turnout and the probability of IMC. This pattern aligns with the notion that more engaged and politically active communities may be more receptive to institutional innovations like IMC, which can enhance municipal efficiency and organizational capacity. However, the dynamic analysis paints a somewhat different picture, because lower voter turnout is associated with an acceleration in the timing of IMC adoption. This perhaps suggests a reverse causality: lower voter turnout positively influences the adoption of cooperation, to promote legitimacy through policy innovation. Cooperation then has a positive influence on electoral participation.

Regarding the competing hypotheses about political participation, H3a and H3b, our findings do not allow us to definitively reject either hypothesis. Instead, our results suggest a more complex relationship and the need for more nuanced theoretical frameworks and empirical evaluations to test these relationships. In fact, our results on the influence of political competition when conducting our dynamic analysis shed some light on the influence of political motivations, as we found that the higher the political competition (i.e. the higher the electoral threat to the policymaker), the faster the adoption of cooperation. Overall, low legitimacy (low participation) and high political competition accelerate reform.

Furthermore, we believe that our main results can be generalized to other European countries where cooperation through delegation or joint governing bodies is a predominant form of governance (see Bel et al. 2023, for a comparative analysis of governance forms in European countries). However, our results on fiscal constraints as a trigger for cooperation might be less applicable to cooperation in England or in some services in Scandinavian countries (such as healthcare), where contracts between municipalities are more frequent, and host municipalities might be reluctant to cooperate with client municipalities that suffer from fiscal constraints. To be more precise, it is not that fiscal constraints are not a motivation for cooperation in these cases; is that cooperation could be rejected by the "potential partner" with a better fiscal situation. If this were the case, cooperation would not materialize in practice and, therefore, might not be reflected in quantitative analyses based on the agreements concluded. Mixed methods research would be useful to better understand these possible scenarios.

Conclusion

We investigated both static and dynamic factors that can affect IMC. To this end, we employed two distinct analytical strategies. First, we used GLMMs for our static analysis. We found that population size was generally negatively related to cooperation, although population density had a positive relationship in the case of drinking water and sewer. Second, we employed survival analysis using time-to-event outcomes for our dynamic analysis. In addition to confirming the negative relationship between population and cooperation, our dynamic analysis showed that fiscal constraints (measured in debt per capita) and political legitimacy and political competition accelerated the adoption of cooperation.

Overall, this study makes several important contributions to the literature on IMC. By disentangling the static and dynamic determinants of IMC, we provide a more comprehensive understanding of the multifaceted forces shaping collaboration in public service delivery. The findings highlight the need to consider both organizational and political factors, as well as the unique characteristics of different public services, when analyzing the antecedents and dynamics of IMC. In this particular sense, a specific contribution worth highlighting is that the operationalization of returns to scale when analyzing the cooperation decision must depend on the cost structure of each service, something that is often overlooked in both the theoretical literature and empirical applications. Indeed, the relationship between political processes, political participation and competition, and IMC requires further research, possibly including mixed quantitative and qualitative analyses, which can be extended to local policy reforms in general.

The nature of our key research question and the corresponding empirical strategy we designed and implemented do not allow for strong claims of causality. That said, we believe that our dynamic analysis is very useful for evaluating possible directions of causal relationships when we find significant results. This may be particularly relevant to the way in which fiscal constraints and political motivations influence the adoption of reforms beyond the specific area in which we analyze policy reform, that of the provision and delivery of local public services, and may be useful for analyzing the dynamics of government reforms in other dimensions as well.

Relevant policy implications emerge from our results. On the one hand, our dynamic analysis confirms that municipalities with higher debt levels and policy makers who need legitimation and face intense competition are more prone to accelerate the adoption of cooperation. On the other, the available evidence on the effects of cooperation is far from consensual, both in terms of financial and quality improvements, which can differ substantially depending on the type of service and the municipality. Therefore, policymakers must carefully consider whether improvements in the costs or quality of cooperation can be expected, depending on the particular characteristics of the service and the municipality. Otherwise, the effects could be different than expected.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0143814X25100718

Data availability statement. Replication materials are available in the Journal of Public Policy Dataverse at https://doi.org/10.7910/DVN/43ZBKR.

Replication materials are available in the Journal of Public Policy Dataverse at https://doi.org/10.7910/DVN/2BFDUR.

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