The Metropolitan Governance of Urban Security. A Game Theory Approach

by

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Abstract

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This paper proposes a bargaining game to model under which conditions local governments in a metropolitan area decide to cooperate in the joint provision of urban security. In the context of political and spatial fragmentation, and resource and strategic interdependence of local governments, theories of metropolitan governance have fallen short to explain and describe the dynamics of urban security. While some policy areas like land use or environmental and economic development have received wide attention by scholars of metropolitan organisation, urban security still lacks theoretical and empirical developments that help understand the specific logics of intergovernmental relations, and the formation of security provision networks. Drawing insights from network governance and public policy theories, the Institutional Collective Action framework, security studies, and behavioural public administration, this paper, thus, offers a general framework to study the metropolitan governance of urban security. The focus is placed on the mechanisms of network formation, the characterisation of security as a metropolitan issue, and the influence of risk preferences of public officials.

The document is organized into seven sections. After a brief introduction to the problem, in the second section, I define metropolitan governance and frame it in terms of network governance. I pay special attention to the concepts of resources and strategic interdependencies as a rationale for the appearance of network-based arrangements, and focus on the analysis of network formation mechanisms. In the third section, I connect these categories with the Institutional Collective Action framework to understand the collective action dilemmas implied in the metropolitan governance. In the fourth section, I concentrate on the behavioural contribution of this research, i.e., on how public officials and their behavioural characteristic are decisive in the theory of metropolitan governance, taking a specific look at the risk preferences. In the next section, I proceed to define urban security as a metropolitan issue and elaborate a general conceptualisation of the dimensions and characteristics of the metropolitan provision of security. I suggest a simple typology of metropolitan security issues to frame and facilitate the governance analysis. In section six, I present the bargaining game and by comparative statics I derive some key prepositions about the network formation. After, I propose some extensions of the model and a future research agenda. The last section concludes.

Key words: Metropolitan governance, Network governance, Urban Security, Institutional Collective Action, Risk preferences, Behavioural Public Administration.

JEL Classification: C78, D9, H110, H41, H7, R58

Contents

1 Introduction

As it was predicted during the 80s, cities are no longer the main spatial fix of policy issues (Harvey, 1985). Due to the demographic and economic growth, accelerated urbanization processes, social diversification, and interconnectedness brought by the globalization, the scope and complexity of public issues have been reshaped out of the local traditional administrative borders (Sellers & Hoffmann-Martinot, 2008). Big urban settings are now defined by multiple functional cores, cross-border problems, highly interconnected dynamics, and several authorities with fragmented jurisdictions —i.e. multiple and autonomous governmental units spread over a single integrated territory.

In this context, services such as public transport, environmental and water management, land use, economic development, public security, among others, are services that municipalities cannot deliver independently. Because of the nature of the policy problem, the intervention scales and jurisdictional scope of each local government often do not match. Thus, the decisions made by one government in a policy area impact the other metropolitan governments and their functions, causing spillovers, diseconomies of scale, duplication of functions, and common-pool resource problems (Klink, 2005; Sellers & Hoffmann-Martinot, 2008; Lefèvre, 2010; Feiock & Scholz, 2010). Collective action dilemmas arise from this partitioning of authority in the territory, where there are "too many governments and not enough government" (Ostrom, Tiebout & Warren, 1961, p. 831). Is in this setting where the issue of metropolitan governance emerges, posing the question of how local governments should face together the new dimensions of the public. This is the general motivation of the present paper.

While some policy areas like land use, environmental resources, transport, regional planning, and economic development have received wide attention by

scholars of metropolitan organisation, urban security still lacks theoretical and empirical explorations that help us understand the specific logics of intergovernmental relations, and the formation of security provision networks under fragmentation and interdependence conditions like those referred previously. In this paper, I outline a general framework in this regard and offer a game theory model to formalise one of the specific cases of metropolitan governance of urban security: a two-players policy articulation network for a joint provision project.

For this purpose, I bring together two different theories that help understand when and how local governments decide to cooperate in the provision of urban security: network governance theories and the Institutional Collective Action (ICA) framework. I also suggest a novel approach to the metropolitan governance literature, by making an emphasis on the role of the public officials' risk preferences. I include a risk aversion parameter to investigate how risk preferences of officials affect cooperation. I argue that metropolitan (and governmental) decisions are the outcome of multiple interactions made by individuals within particular institutional settings and with very variable political and cognitive characteristics that may alter the whole policy process and its final results (Scharf, 1997). Indeed, the extent to which individual features of the public servants may change the outcomes of the public interventions is not clear. Although these kinds of questions have somehow been addressed in the emergent discussions on the personnel economics of the state (Finan, Olken & Pande, 2015), and behavioural public administration (Bellé, Cantarelli & Belardinelli, 2018; Buttaglio et al. 2018), little to none attention has been paid to these sort of issues in the metropolitan governance literature.

The document is organized into seven sections. After a general introduction to the problem, in the second section, I define metropolitan governance and frame it in terms of network governance. I pay special attention to the concepts of resources and strategic interdependencies as a rationale for the appearance of network-based

arrangements, and focus on the analysis of network formation mechanisms. In the third section, I connect these categories with the Institutional Collective Action framework to understand the collective action dilemmas implied in the metropolitan governance, using as main analytical categories the transaction costs of cooperation, the integration arrangements, the institutional scope of the dilemma, and the risks of collaboration. In the fourth section, I concentrate on the behavioural contribution of this research, i.e., on how public officials and their behavioural characteristic are decisive in the theory of metropolitan governance, taking a specific look at the risk and time preferences. In the next section, I proceed to define urban security as a metropolitan issue and elaborate a general conceptualisation of the dimensions and characteristics of the metropolitan provision of security. I suggest a simple typology of metropolitan security issues to frame and facilitate the governance analysis. In section six, I present the bargaining game and by comparative statics, I derive some key prepositions about the network formation. After, I propose some extensions of the model and a future research agenda. The last section concludes.

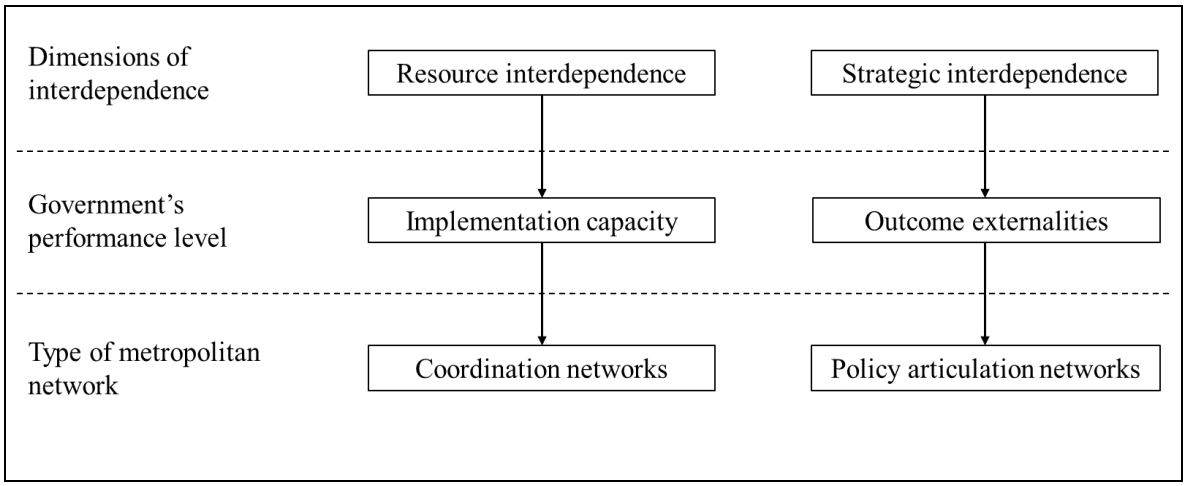
2 Metropolitan Governance as a Network

The concept of *metropolitan governance* is often used ambiguously to talk about the coordination of the complex economic and social environment of big cities, and about the institutional collective actions regarding the management of city regions (Sellers, 2002; Subirats & Brugué, 2005; Klink, 2005; Sellers & Hoffmann-Martinot, 2008; Lefèvre, 2010).). More precisely, the term refers to *policy networks* among governmental units of multiple levels, non-governmental and civil organizations, private industries, etc, in the context of a fragmented metropolitan area (Sellers & Hoffmann-Martinot, 2008). From a functionalistic point of view, metropolitan policy networks imply "patterns of linkages" amidst interdependent organizations as well as the informal coordination institutions that emerge to face shared issues (O'Toole, 1997; Hertting, 2007). The metropolitan governance encompasses both the specific *outcomes* in the management of metropolitan issues (externalities reduction, scale economies, optimal management of common-pool resources, etc.), and the particular *processes* of participation, bargaining, monitoring and accountability (Kling, 2005; Vásquez, 2014).

In this paper, I define metropolitan governance as the set of networks in a metropolitan institutional context involving: i) *coordination of actors* in a metropolitan policy arena, and/or ii) *articulation of policies* among those actors (Rapetto, 2005; Licha & Molina, 2006). These network-based relations appear and evolve from the existence of *resource* and *strategic* interdependencies among actors (Klijn 1997; Hertting, 2007). First, several functional areas of local governments depend on the exchange of resources with other local governments and public agencies to design and implement policies (Scharpf, 1978). These exchanges are closely related to the lack of autonomous implementation capacity and can be made more efficient if coordinated through network relations. Second, even if local governments enjoy resources independence, their actions may be affected by, and be

dependent on, the action of other governments and public agencies, causing strategic externalities. Public performance, then, becomes a matter of strategic interaction of interdependent choices. Analytically, all above said means that metropolitan actors are interdependent both in the *outcome* level as in the *action* level (Hertting, 2007).

Table 1. Dimensions of interdependence and network relations in metropolitan governance.



This approach to governance stands in the middle of two traditions concerned with the management of urban fragmentation. On the one side, under the umbrella of the *Chicago School of Urban Studies* and the so-called *spatial Keynesianism* (Brenner, 1999; 2004), the tradition of the consolidation considered fragmentation inefficient and harmful for public administration performance. Consequently, many studies in this stream —also known as the tradition of the metropolitan reform (Ostrom, 1972)— argued that the best solution to metropolitan organisation was to establish a hierarchical model of governance with a sole decision centre that simplified the collective action problems: only one government for one functional area (Sellers & Hoffmann-Martinot, 2008).

On the other side, and closer to the neoliberal reforms of the '70s, the political economy of the *Public Choice* tradition started to criticise the metropolitan reform proposals. They posited that if fragmentation was managed as a polycentric open system, it could render even better results than a rigid, ultra-bureaucratised, and

monolithic government. Under the market logic of Tiebout's local expenditure model, local governments would compete amidst each other to attract more voters, offering better combinations of services and taxes (Tiebout, 1956; Ostrom, Tiebout & Warren, 1961; Ostrom, 1972).

Although it remains an open debate, new perspectives trying to link the advantages and successes of both traditions, have proposed diverse research agendas gathered around the rather ambiguous epithet of New Regionalism (Jouve, 2002; Kübler & Heinelt, 2005; Tomàs, 2015). Instead of simply opting for fragmentation or consolidation, these approaches privilege the understanding of the nature of the problems and the network-based arrangements designed for specific policy areas (Zimmermann, 2014). Empirical and comparative research has become a major trend to inform which could be the best solution to metropolitan fragmentation. Many studies in Europe and North America have shown, for example, that voluntary and horizontal cooperative networks offer a good answer to capital intensive projects (Zimmerman, 2014; Lee, 2016; Lubell et al., 2017; Gil & Pinto, 2018) and, at the same time, that the lack of a central authority may foster a disordered planning process (Nunes, 2002; Arias & Borja, 2007; Lefèvre, 2010; Den Uyl & Russel, 2018).

While some scholars acknowledge that collaboration is not enough (Weir, Rongerude & Ansell, 2009; Scholz, Berardo & Kile, 2008; Chen, Feiock & Yi, 2016), the main conclusion of the New Regionalism is that heterarchical and network structures with strong political representation and coordinated authorities offer better instruments and outcomes to mitigate fragmentation and collective action dilemmas in metropolitan regions (Jessop, 2000; Lefèvre, 2010). Metropolitan networks with these characteristics benefit from a) using the expertise of other actors, b) widening the understanding of the problems, and c) minimizing the potential externalities of the isolated action of interdependent governments (Kwon, S-W. & Park, S-C. 2014).

Despite this empirical advances, metropolitan governance networks have received little theoretical formalisation. Typical functionalistic perspectives on governance networks assume fragmentation and interdependence as sufficient conditions to explain the emergence of some sort of coordination networks (Hertting, 2007). Nevertheless, as 'the second generation of network generation research' points out, it is still necessary to investigate and understand the *mechanisms* through which networks emerge and operate (Hay & Richards, 1998; Sørensen & Torfing, 2007; Hertting, 2007). According to this perspective, it is of interest to examine under which conditions "more or less strategic real-world actors" decide to engage (or not) in a cooperative network and which are the "potential cooperation problems and dilemmas of organizing [such] governance networks (Blom-Hansen 1997; Hay & Richards 1998)" (Hertting, 2007, p. 44). This approach may offer an intermediate level analysis "in-between pure description and story-telling, [...] and universal social norms" (Hedström & Swedberg, 1996) to explain the kind of relationships that define the network-based provision of public services by local governments in the context of metropolitan governance.

Investigating the mechanisms of metropolitan network formation, then, requires some methodological and context-oriented assumptions that help us narrow the scope and complexity of the different political situations in which policy actors interrelate (Hertting, 2007). First, the analysis of the mechanisms must establish a close relation between the input and output elements of the local provision of a specific good or service —urban security in this case. And second, it is based on the principles of *methodological individualism* and *bounded rationality* (Coleman, 1990; Hedström & Swedberg, 1996; Hertting, 2007). This means that the processes and outcomes of the metropolitan governance are produced by individual actors with meanings and intentions linked to their specific decision situations, and with limited cognitive processing capacity (Simon, 1955; Coleman, 1990). Following these

assumptions, Hertting (2007) proposes that the network formation mechanisms respond to three main aspects that shape the preferences of involved actors: i) the 'contextual incentives' for network formation, [1] ii) the expected 'strategic calculations and choices' of each interdependent policy actor and, iii) the 'interaction or game' that supports the institutionalisation of the governance network.[2]

How contextual incentives, strategic calculations, and the institutionalization process interact to produce different types of metropolitan networks (or fail to do so) is not completely clear, yet. Perhaps one of the most systematic attempts to advance in this direction is the Institutional Collective Action (ICA) framework (Feiock, 2009; 2013). Whereas the network mechanisms analysis focuses on *interdependencies*, the ICA framework places its attention on the collective action dilemmas brought about by political and functional *fragmentation* to compare the impact, evolution and selection of the available mechanisms to mitigate them. In general terms, the ICA framework studies why and how local authorities decide whether to cooperate or not in the solution of a metropolitan public problem, where local governments need to produce and provide public goods and services that have "different economies of scale and that are demanded by citizens at different levels of quantity and quality" (Feiock, 2013, p. 398). This framework complements the interdependence approach of networks literature, offering a more specific treatment of the metropolitan fragmentation and collective actions and highlighting the importance of transaction costs in metropolitan coordination and cooperation.

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[1] Here, we can refer to policy dimensions such as political preferences and policy beliefs, the policy agenda, the influence of advocacy coalitions, territorial and functional connectedness, etc, that allow for an opportunity structure to develop a network; or hinders its appearance (Clingermayer & Feiock, 2001; Sabatier & Weible, 2007; Sabatier, 2007; Ostrom, 2007; Casar & Maldonado, 2008;).

[2] Indeed, Game theory has offered important insights into the institutionalisation process of the networks. The Prisoner's Dilemma, the Assurance Game and the Battle of the Sexes have been the most used games to model the process of governance cooperation institutionalisation in network-based relations (Hertting, 2007; Steinacker, 2002; 2004; Feiock & Steinacker, 2003; Feiock & Parks, 2007). Still, the formalisation and development of these models are scarce.

3 The Institutional Collective Action Framework

To understand how metropolitan governance networks and mechanisms form and perform, the ICA framework builds directly on the well-known collective action literature, "concerned with situations in which individual incentives lead to collective outcomes not desired by any of the individuals", applying its main developments to composite actors "defined by institutionally determined position, authority, and aggregation rules (Ostrom, 1990, 2005)" (Feiock, 2013, p. 399). This framework draws on the theory of policy instruments (Salamon, 2002), network theories of social embeddedness (Uzzi, 1997; Berardo & Scholz, 2010), the theory of local public economies (Tiebout, 1956; Ostrom, Tiebout & Warren, 1961; Ostrom, 1990), and the transaction theories of organizations (Williamson, 1985; Miller, 2000; Feiock & Scholz, 2010).

Contrary to the standard prediction proposed by Olson (1965), in very complex systems like metropolitan areas, voluntary cooperation does occur. Feiock (2007) argues that these kinds of agreements of cooperative interventions arise from a "dynamic political contracting process", through which two or more local governments achieve to capture "the gains from providing or producing services across a larger area". Subsequently, network formation for the provision of services is not a distinctive phase of metropolitan governance. "A governance network is never formed, established or institutionalized once and for all. To work as an institution for coordination, interdependent actors need to continuously constitute the network" (Hertting, 2007, p. 52). From the levels of policy production to operative actions, actors must acknowledge their relation and participation in the network (Ostrom, 1990; Hertting, 2007; O'Toole, 2007). The decision to cooperate, then, depends on how public officials perceive the costs and benefits of the bargaining setting at every moment of its configuration —i.e. the type of good or service, the collaboration risks, the characteristics of the local government, and so on. The central aspects analysed

in this approach are 1) the integration mechanisms, 2) the institutional scope, and 3) the collaboration risks.

The *integration mechanisms* are the horizontal and vertical instruments through which local actors can collaborate to address the institutional collective action dilemma and integrate the decision making. These mechanisms range from informal networks (based on the social embeddedness) to externally imposed authorities and determine how costly it is for governments to take part in or get out of the collaboration (Feiock, 2009; 2013).

The *institutional scope* refers to the complexity of the public issue addressed, i.e. it accounts for "the number of actors and the number of policy functions involved" (Feiock, 2013, p. 405). The scope, then, goes from individual and dyadic relationships related to information exchange (low transaction costs) to multiple collective relationships concerning several services or functions at once (high transactions costs). ICA framework focuses on matching the institutional scope of the collective action dilemmas to the integration mechanisms that best solve them and provide benefits to the participating actors. Therefore, it is of interest to evaluate the effectiveness, incentives, and transaction costs each mechanism imposes to the different actors (Feiock & Scholz, 2010, Feiock, 2009, 2013). From this perspective, the preference for informal networks is not always the case. The complexity of the institutional scope may demand a higher formalisation level of the policy network.

The *collaboration risks*, finally, "reflects the actor's assessments of the likelihood that collaboration efforts will fail to hold together or fail to effectively resolve the collective dilemma" (Feiock, 2013, p. 406). Three categories shape this concept: discoordination risks (failing to organize interjurisdictional activities), unfair division risks (agreement on general goals, but not on how to divide the common benefits), and defection risks (conflicting interest that may cause one participant to

leave). The nature of the problem defines, to a high extent, the level of risk each collective action dilemma issue imposes to the actors. The higher the collaboration risks, the more encompassing and authoritative the mechanisms needed to mitigate the ICA dilemma; but, also, the higher the transaction costs imposed on the participants. In this sense, "incentives to participate will favour the type of mechanism that provides the greatest gain for the least cost" (Feiock, 2013, p. 408).

Insofar as it has been developed, the ICA framework has proved to be very useful to understand metropolitan governance and inform policymakers about good avenues to mitigate collective action dilemmas. For instance, in The USA, Regional Economic Development Partnerships as mechanisms designed to cooperate in economic development policies (instead of competing, as in the Tiebout framework), have shown to have a positive impact in densely populated metropolitan areas (Chen, Feiock & Yi, 2015). In China, some studies like the one by Yi et al. (2017) have shown the empirical links amongst the number of policy actors, the heterogeneity of economic conditions, and the structure and effectiveness of different collaboration agreements –informal, formal, and imposed agreements.

However useful, the ICA framework still lacks a consistent formal treatment of the hypothesis and propositions advanced by the empirical research. As a result of strategic interaction, some works have tried to model metropolitan cooperation in a game-theoretical fashion. The general model is elaborated by Steinacker (2004). She assesses different models that may fit the logics of interlocal agreements. In the end, she concludes that a bilateral bargaining non-cooperative game is the only one that allows for the conditions that define metropolitan cooperation: 1) repeated play is possible, 2) the asymmetries in players' strengths and preferences are accommodated, 3) the size of joint gains determine if the good is provided collaboratively or not, 4) the strength of players determines division of the good, and 5) cooperation becomes a Nash equilibrium depending on the parameters capturing

the strength of the players. This model is replicated by Steinacker (2002), and Feiock and Steinacker (2003) in the context of economic development policies. The model I propose in section 6 builds directly from these works.

4 The Role of Public Officials: Risk Preferences (and some Behavioural Notes)

Policy decisions are usually examined through the lens of a rational choice structure (Feiock, 2007). Even when cooperating, in rational choice models, actors' decisions are driven by a self-interested calculus of egoist motivations, in a context of information asymmetries, risk and uncertainty (Ostrom, 2005). Cooperation will not occur unless each member is better-off collaborating than by its own (Steinacker, 2004). What is more, almost all public policy analysis approaches assume that "position and authority rules grant individuals the right to act in the name of an organization", i.e. the "focus is primarily on government units and their constituencies" (Feiock, 2013, p. 399). In other words, collective actions are explained in terms of composite actors, independently of the individuals who constitute or oversee them.

However, I argue that metropolitan (and governmental) decisions are the outcome of multiple interactions made by individuals within particular institutional settings and with very variable political and cognitive characteristics that may alter the whole policy process and its final results (Scharf, 1997). Institutional decisions are not taken by mere abstract agencies, and those who act on behalf of them have certain behavioural features that may alter the results of the public performance (Backes-Gellner et al., 2008; Finan, Olken & Pande, 2015; Grimmelikhuijsen et al., 2017; Bellé, Cantarelli & Belardinelli, 2018; Buttaglio et al. 2018). The same institutional role (e.g. a mayor) occupied by different individuals can lead to very different choices. In the same sense, one individual in different institutional roles can produce similar outcomes. Thus, contrary to most governance perspectives (Feiock,

2007; Hertting, 2007) I stress that the institutional setting is not enough to explain governmental decisions.[3]

The extent to which individual features of the public servants may change the outcomes of the public interventions is not clear. Only recently, behavioural insights have been used by scholars to understand the performance of public officials. Belardinelli et al (2018), for instance, investigate the effects of framing on how public managers use performance information. With data from artefactual survey experiments, the authors show that public managers process information differently depending on its use. While framing does not have important effects in *ex ante* uses of information (e.g. resources allocation), in the *ex post* use of information (e.g. performance evaluation) managers seem to be more prone to this cognitive bias. "This means that the way information is provided may be central in affecting the evaluation of public managers", and more generally speaking, "the evaluation of organizational units' performance, including performance-related sanctions and rewards" (Belardinelli et al., 2018, p. 845). Thus, when it comes to officials deciding about cooperation and the perception of its probable gains, special attention must be paid to their behavioural traits.

For the present study, the methodological individualism and the bounded rationality assumptions of mechanisms analysis, accommodate perfectly to the inclusion of behavioural parameters. In fact, when it comes to metropolitan areas, the fragmentation and dependency patterns need not be objectively real: "It is perceptions together with desires that stimulate actors to build institutional arrangements, for tomorrow including networks" (Hertting, 2007, p. 49). Functional domains by themselves do not determine entirely the criteria and opportunity structures for network formation; also, the perceptions and representations of power

[3] For this reason, every time in the text when I talk about the decisions of a municipality, I refer to the choices taken by the official in charge of that municipality's action.

by the actors involved are critical (Durand & Lamour, 2014). Even though we cannot fully explain how these perceptions and representations come to exist, we consider and use them as explaining factors (Wildavsky, 1991; Hertting, 2007).

Here I focus on risk preferences. Following the seminal work of Knight (1921), risk preferences refer to how individuals perceive the probabilities of a potential decisional outcome. Decisions under risk can be considered, then, as a "function of the probability of an event and its positive and negative consequences for the decision maker's payoff" (Tepe & Prokop, 2018, p. 2). Depending on her preferences, an individual can be risk averse, risk neutral or risk loving. When confronted with two decisions with similar expected returns and different risks, a risk avers official would prefer the lower-risk option. Risk averse individuals will always prefer certain over risky options (Schoemaker, 1982; Starmer, 2000; Just, 2014). The contrary is true for a risk loving official. A risk neutral individual decides on the actually expected payoffs of the decisions independently on their relative risks. When deciding whether to cooperate or not, a risk averse public official may behave differently from a risk neutral one.

Risk preferences, and particularly risk aversion, have been a major topic in public administration studies. Bureaucratic positions, for instances, have been strongly associated with risk averse personalities (Merton, 1940; Thompson, 1961; Tepe & Prokop, 2018). Many empirical studies argue that public employees value job security to a greater extent than their private counterparts, i.e. public officials are more risk averse in job decisions than private workers (Finan, Olken & Pande, 2015; Tepe & Prokop, 2018). Risk aversion in public sector employees has also been associated with less innovative decisions. Innovative decisions may be eluded if risk averse officials are in charge, causing efficiency losses (Torugsa & Arundel, 2017; Nicholson-Crotty, Nicholson-Crotty & Webeck, 2019). It is also the case of public managers: innovative practices have shown to depend on their risk attitudes towards

the perception of organization performance (Nicholson-Crotty, Nicholson-Crotty & Fernandez, 2016). Evidence on all these cases is still mixed.

Any the case, although these kind of questions have somehow been addressed in the emergent discussions on the personnel economics of the state (Finan, Olken & Pande, 2015), and behavioural public administration (Bellé, Cantarelli & Belardinelli, 2018; Buttaglio et al. 2018), little to none attention has been paid to these sort of issues in the metropolitan governance studies. How risk attitudes and preferences of public officials and managers affect the disposition to engage in the bargaining process of a provisioning network is a question to be answered. As the ICA framework suggests, the perceived collaboration risks should affect the outcome of how collective action dilemmas are solved. The model I present in the forthcoming section offers a simple attempt to include risk preferences of officials as a parameter.

5 The Governance of Urban Security

In this section, I define the main traits of the metropolitan governance of urban security. As stressed in section 2, the scope of the mechanisms' analysis must be context-limited to specific phenomena. Thus, I describe urban security as a type of public service that needs to be provided by local governments of a metropolitan area, and whose institutional scope involves, at the same time, different functional areas of the multiple metropolitan governments (security, culture, public health, and planning offices, among others), police departments, criminal investigation units, the judiciary, the central government, among others. This implies a very high complex provision context, imposing collective action problems on the management of the security when no coordination exists. Fragmentation may cause duplication and overlapping of services, inefficient competition, grey areas, etc.

The outlined context is aggravated by the fact that urban security lingers to be one of the most difficult 'wicked problems' of big cities, especially in Latin America. Although formally 'in peace', Latin America ranks among the top of the world's most violent regions (Muggah & Aguirre, 2018), and the largest part of this violence is urban violence (Moncada, 2016). This situation turns even more complicated, considering that political and administrative fragmentation of metropolitan regions makes it difficult to match security policies to the transborder and international dynamics of organised crime (Jaramillo & Barajas, 2012; Giraldo, Rendón & Duncan, 2014; CAP, 2015). "Contemporary processes of political, cultural and economic globalisation have generated a new world of security risks" that go beyond administrative and sovereign borders. At the metropolitan level, as much as at the transnational level, single and unified state institutions "no longer monopolise the 'governance of security' (Johnston & Shearing 2003; Wood & Dupont 2006)" (Fleming & Wood, 2006, p. 1). Weak states, along with the informal and illegal logics of the Latin-American economies, have allowed the expansion of criminal

groups that compete with —and in many cases replace— the functions of the legal authorities (Misse, 2009; Duncan, 2014). Thus, urban security raises as a major challenge to metropolitan policy actors. Here, state-building, security studies, public policy and public administration literature should come together. However, each of these areas has taken very different paths to approach the problem.

From one side, the literature on security and state-building studies has focused mainly on security as a regime issue: from civil and interstate wars, to cartels, mafias and gangs violence (e.g. Schelling, 1960; 1967; Gambetta, 1993; Leander, 2004; Kalyvas, 2001; 2006; 2015; Duffield, 2011; Duncan, 2014; Lessing, 2017). The emphasis is made in the behaviour and relationship between two or more confronting actors disputing possession or control over a good or value (Lessing, 2013; 2015; Wydick, 2008). The models used typically explain violent behaviour either as the result of grievance or greed (Blattman & Miguel, 2010) or in terms of old and new wars (Kalyvas, 2001). In both cases, states are, if not the only actors, one of the most important.

Some models and theoretical approaches, —like the turf wars among cartels model by Lessing (2015; 2017), and the mafia and protection rackets models by Gambetta (1993), Volkov (2000; 2002) and Finckenauer (2005)— have taken the comprehension of war beyond the mere limits of the state-building. Yet, all these approaches assume the government as a unified actor that needs to take decisions against other players, or as a divided or weak player struggling to hold to its functions while other players are in conflict. The discussion seems to be far from the reach of the public administration agenda: these scholars usually assume urban security provision as a central government function, and in that sense, as a regime-related issue from the public security perspective (Baldwin, 1997).

Moreover, although regarded as one of the basic state functions (Mann, 1984; Tilly, 1992; González, 2014) in an era of a post-regulatory state, urban security has not received much of attention as a public service subject to fragmentation and collective action problems (Gallego et al., 2018; Mesa-Mejía et al., 2018). The local dimension of security stands in-between the project of organising the state in a more territorial manner, and a stage of the weakening of its power (Durand & Lamour, 2014). The traditional centrality of the state assumed by this kind of works implies an "incoherent conception of 'state craft' embedded in the clash between ambitions and limited capacities" (Crawford, 2006, p. 476). Consequently, fragmentation and collective action problems are either failures of the process of state re-scaling or symptoms of a weak stateness (Mann, 1984).

From a very different standpoint, the provision of urban security has been widely studied by public policy and public administration scholars. As Ostrom (1972; 2009) and Ostrom & Parks (1999) pointed out, the right answer to metropolitan fragmentation depends on the nature of the good or service to be provided. The optimal processes and mechanisms vary depending on whether the issue at stake refers to local development policies (Feiock & Steinacker, 2004; Feiock & Park, 2005), water resources and watershed partnerships (Lubell et al., 2002; Berardo & Scholz, 2010), land use coordination (Kwon, S.-W. & Park, S.-C. 2014), environmental sustainability (Yi et al., 2017), regional planning (Gerber Henry & Lubell, 2013), etc. In this sense, since the pioneering studies by Ostrom et al. (1973), Ostrom & Parks (1973), Ostrom, Parks & Whitaker (1973; 1978), and Ostrom et al. (1978), police service was treated as a good subject for polycentric provision. Actually, some of the first extensive empirical studies that supported the ideas of polycentric fragmentation as a better way for managing urban services provision —as posited by the *Public Choice* tradition— were related to police services like patrolling, criminal laboratory services, police radio communication, and so forth (Ostrom, 2010). Ostrom and

collaborators found that complexity is not the same as chaos in the metropolitan governance of police services: duplication of services was rare, a larger number of autonomous producers achieved higher levels of technical efficiency, and multiplicity of police departments serving the same metropolitan area had no negative impact on police performance (Ostrom & Parks, 1999; Ostrom et al., 1973; Ostrom, Parks & Whitaker, 1973; 1978; Ostrom, 2010).

In most western democracies, the use of networks for police services has been an important concern both for policy researchers and practitioners for the last two decades (Fleming & Wood, 2006, p. 4). Especially in Europe, policing, crime prevention, and security strategies have been widely subject to collaborative networks between public agencies, decentralized authorities and community actors. Through nodal governance arrangements, —as criminologists and police service scholars usually refer to cooperative multiple-actor partnerships (e.g. Fleming & Wood, 2006; Wood & Shearing, 2007)— urban security provision has been 're-imagined' in a managerial fashion, involving different governmental agencies, civil groups, private firms, social movements, among others —i.e., security through community co-responsibility and multilevel partnerships or as Ostrom (2010) called it, the 'co-production of security'. The traditional command and control functions of the state, as the only and unified actor responsible for the security, are strongly questioned (Wood & Shearing, 2007). This trend is also understood as a part of the re-scaling processes of the state (Brenner, 2004; Durand & Lamour, 2014), but instead of being framed as a failure or weak development —as in the state-building literature— it is regarded as a logical outcome of the spatial re-distribution of local powers and a changing conception of the state's control.

However, decentralised and polycentric structures are not always effective nor efficient. Contrarywise the Ostrom's conclusions, the contemporary space dynamics of crime and urban insecurity have posed growing challenges to fragmented

authorities. Under the presence of 'dark networks' of crime, interjurisdictional criminal organizations, international terrorism, fuzzy administrative borders, and so on, state agencies retain the central role in the provision of security, even if co-production patterns exist. In the field of security, the state "remains not only a resource of last resort, when all else fails, but also one that is symbolically and culturally distinct" (Crawford, 2006, p. 476). The collective action dilemmas arise from the fact that, while security phenomena occur independently of administrative borders and across them, the assessment of local governments' performance, —and therefore their focus of attention— is directly linked and limited to their constituencies. In this regard, local agencies are usually more preoccupied with attending the demands of their specific community and addressing security problems that circumscribe to their jurisdictions. Their tactics, strategies, and technologies usually accommodate to this spatial scope (Taylor & Russell, 2012), and overlook the wider interlocal characteristics of the whole phenomena.

Most studies interested in the local provision of urban security assume a static an defined territory, and concentrate on the relations between local agencies and their communities or between different levels of government that occur on it, but fail to recall the role of horizontal relations amongst municipalities who share an amalgamated and multiplex[4] territorial system. The re-scaling of the state at the metropolitan level may cause problems over the spatial dynamics of provision that are not solved through simple co-production (Feth, 2011). In this sense, security provision networks across metropolitan municipalities is still a topic to be explored.

The ICA literature is not an exemption to the previous statement. In fact, urban security provision remains almost unadvanced by scholars within the ICA

[4] This concept refers to "the reality of interrelated policy arenas and service function" that create collective action dilemmas and "require encompassing solutions (Bae & Feiock, 2012; Lubell, Henry, & McCoy, 2010; Shrestha & Feiock, 2009)." (Feiock, 2013)

framework. Perhaps, one of the only consistent attempts to use this framework for studying the metropolitan governance of security is the research carried by Gallego and collaborators (2018) in the metropolitan area of Medellín. This work aims at the understanding of the metropolitan setting in Colombia through its multiple historical reforms and tries to propose the possible institutional solutions to the political and administrative fragmentation of the security provision. They suggest some instruments and mechanisms from the lens of the ICA framework. Although an important contribution, the research still lacks a formal and empirical development that allows assessing the outcomes of the theory and the policy suggestions.

5.1 The Metropolitan Provision of Urban Security

In this work, I use the concept of urban security as a synonym of citizen security (Mesa, 2015; Gallego et al. 2018). From the perspective of the citizen security, the focus of every intervention is the individual (not the state, as it is for the traditional approach of national or public security, see Baldwin, 1997). This approach is fundamentally anthropocentric. It seeks to establish "political and social situation that guarantees people the enjoyment of their rights, with enough institutional mechanisms to prevent and control threats [...] that may harm such rights" (Rodríguez & Santiago, 2010, p. 68). The core of fundamental rights urban security tries to protect are usually summed up to life, integrity and property. Accordingly, in this perspective, the threats to security include both common and organised crime as well as co-existence and civic culture conflicts (Gallego et al., 2018). Thus, to the traditional triad of public security instruments (police, judiciary, and jail), citizen security adds social and community prevention, educational programs and civic culture strategies.

Because of the diversity of urban security phenomena, the provision of this service at the metropolitan level implies a wide range of functions, actors and spatial

scopes that collaborative mechanisms must encompass. As it includes both pedagogic and coercive activities, not all security-related policies can be taken as equal. Traditional classifications of urban security policies are not helpful to understand its metropolitan dimension, as they adopt a single-city-centred territorialisation (Gallego et al., 2018). In this work, I aim at proposing some elements to develop a different typology of urban security policies that take into account the metropolitan logics of citizen security.

For analytical proposes, following Arbeláez et al. (2018) and CAP (*forthcoming*), I classify the metropolitan security issues in three simple categories according to their spatial scope and possible integration mechanisms: 1) *localised issues*, 2) *common issues*, and 3) *shared issues*.

First, *localised issues* refer to specific security and co-existence phenomena whose occurrence is limited to a single city territory but requires resources from other municipalities and affect their strategic operation. Although the manifestation of these issues is strongly localised, its impact is metropolitan. Some examples of localised issues are big city events like concerts or sports matches, natural disasters or big-scale instrumental violence like terrorist attacks. In these cases, the problem is spatially concentrated, but its consequences may spread over the territory and generate negative externalities on other municipalities or may alter their normal operation of security services. The externalities produced by these types of issues can be managed through coordination networks that inform operational decisions and allow participants to know how their resources are affected. Strategic policy choices reduce transactions costs and maintain the information flows of the network.

Second, *common issues* comprise those phenomena that are common to several municipalities and can be linked thematically but do not create interconnected territorial dynamics across the metropolitan region. Common issues do not

immediately suggest territorial relations, but typically indicate cultural or social common traits that make them frequent all over the metropolitan region. Co-existence problems like interpersonal violence, domestic violence, common crime, and so on, are good examples of this kind of phenomena. Here, policy articulation networks can be useful to generate scale economies, and avoid overlapping and duplications in the design and implementation of local policies. Arrangements for knowledge and best practices transfers can be a potential instrument of these networks.

Lastly, *shared issues* refer to security phenomena that, by nature, connect two or more municipalities of the metropolitan region at the same time, and require the joint action of all implied governments to tackle them effectively. These are usually the most prominent security phenomena: cartels' violence, car thefts by organised crime, human trafficking, etc. For these cases, both policy articulation and coordination networks may be needed, insofar as no individual solution to these issues is possible. The autonomy of municipalities impedes comprehensive actions against criminal actors that spread over the territory and take advantage of the administrative-border limitations of public interventions. A strong prosecuting strategy made by one municipality may cause an increase of violence in other weaker municipality, as criminal structures relocate or hide there. Unless municipalities decide to come together, shared issues can only be confronted partially and insufficiently.

Each type of provision indicates different institutional scopes, transaction costs and risks, and must be addressed through different mechanisms. As I suggested, for some cases, simple coordination networks can improve local operational capacities; in other cases, strong policy articulation networks are deemed necessary to avoid the externalities of individual choices and to attend the security problems

effectively. Higher complexity imposes higher transaction costs but also implies higher levels of interdependence that foster the emergence of provisioning networks.

From this analytical classification, thus, it is easier to study in detail the configuration of the metropolitan governance of security, and to understand the mechanisms that allow for network formation. In the next section, I offer a first attempt to formalise a specific type of metropolitan cooperation between two municipalities.

6 A Bargaining Model of Metropolitan Cooperation

As an initial exploratory exercise, the institutional scope of the problem is presented in a very simplified fashion. I present a basic two-players network arrangement that can be formed or dismissed at any moment by any of the participants (Hertting, 2007). As it is very common in urban security governance settings, no legal exogenous enforcement nor a hierarchical structure is possible. Although simple, the model can be very useful to propose some testable hypothesis to understand when and why institutional collective action emerges (or fails to emerge) for the joint provision of metropolitan security. [5] I analyse a simple scenario where two public officials, A and B, from two different municipalities of the same metropolitan area decide whether to participate in a joint project (a policy articulation network) to attend a shared security problem —e.g. an intelligence unit for prosecuting a criminal gang or a cartel that operates in both territories, a security planning committee, etc. Each official must decide the amount, C_i, of her security budget, I_i, that is going to be invested in the common project, and the amount, P_i, spent in the security of the municipality independently of the other player, where

$$I_i \geq C_i + P_i \tag{1}$$

When no cooperation occurs, $C_i = 0$ and all budget is located privately, $I_i = P_i$. The security that can be 'produced' by the cooperative project is a set $S = \{(z_A, z_B - \theta \mid C_A, C_B, P_A, P_B) : 0 \leq z_A \leq S \; and \; z_B = S - z_A\}$ where z_i is the proportion of the total security resulting from collaborating which produces a positive impact on the municipality i $(i = A, B)$ and θ represents the transactions costs of

[5] As said before, this model is inspired in a Nash bargaining setting as proposed by Steinacker (2002; 2004). The specification and interpretation of the parameters differ widely, though.

participating in the network.[6] That is, the security in each municipality will increase in z_i if they cooperate minus some value θ that captures the costs of engaging in a collective provision network. The relation between the size of S and θ captures the scale economies of acting collaboratively in relation to the amounts C_A and C_B. Factors which reduce the costs θ of cooperating, like proximity between municipalities, for instance, could imply that the efficiency of C_A and C_B is higher. I assume that transaction costs are charged equally to all members of the project.

The production of security in each municipality is a function, Z_i, that depends on the amount spent individually and cooperatively, that is, $\mathrm{Z}_i(z_i(C_A + C_B) + P_i - \theta)$. When $C_i = \theta = 0$, then $\mathrm{Z}_i(P_i) = P_i > 0$, i.e., when no network is formed or cooperation fails to happen, the security of each municipality is reduced to what it invests alone. For this case, I assume that the utility $U(\mathrm{Z}_i)$ of the official i $(i = A, B)$ depends on the security produced in her municipality, as a result of both the individual and cooperative investment. The utility function of the public official, $U_i(\mathrm{Z}_i) : [0, S] \rightarrow \Re$ is strictly increasing and concave. Therefore, in order to reach an agreement in the cooperative venture, there must be a pair of values z_A and $z_B \in S$ for which $U_A(z_A + P_i - \theta) > \mathrm{Z}_A(P_A)$ and $U_B(z_B + P_B - \theta) > \mathrm{Z}_B(P_B)$, s.t. to (1). These inequalities represent the participation constraints for each municipality.

This specification can be solved as the Nash axiomatic model of bargain (S, P), where the values are the result of the next maximisation problem

$$\max_{(z_A,\, Z_B \in S)} (U_A(z_A) - P_A)^{\alpha}\, (U_B(z_B) - P_B)^{1-\alpha} \qquad (2)$$

[6] As security is not a good that can be transferable in the sense of money or assets, in all the model I am assuming that the security produced is a direct function of the amounts invested together in security services. There is no way to disentangle how much of S is due to C_A and how much to C_B. Therefore z_A and z_B are expected values of the resulting enhancement in security.

Where $U_A(z_A) > P_A$ and $U_B(z_B) > P_B$ are continuous and differentiable. Parameter $\alpha \in (0,1)$ is a measure official A's bargaining power, that is, an inverse measure of how in need of cooperation is the municipality A.[7] For this specification, the public officials reach an agreement at z_A^* and z_B^*. The solution for this maximisation problem is given by the functions

$$z_A^* = P_A + \alpha(S - P_A - P_B - \theta) \tag{3}$$

And

$$z_B^* = P_B + (1 - \alpha)(S - P_A - P_B - \theta) \tag{4}$$

As the cooperative provision of security denoted by S is a direct function of C_A and C_B, and P_i is dependent on the condition in (1) ($P_i = I_i - C_i$), the interpretation of these Nash bargaining values is simple. Each player achieves a value equal to her individual production of security, P_i, plus a proportion α or $(1 - \alpha)$ of the remaining security produced by the joint project $S - P_A - P_B - \theta$, i.e. the security surplus they could not obtain by working alone minus the costs inherent to participating in the provisioning network.

As 'produced security' is a rather abstract operationalisation of security provision, I propose to interpret the Nash model in a slightly different way than usual. The design is typically understood as a bargaining over how to divide a 'pie', that is, how gains are going to be distributed between two players. As security can hardly be 'distributed', the portions z_A^* and z_B^* of the 'pie' must be interpreted as the *expected gains* in security achieved by the official i when participating in the

[7] Note that this parameter α describes the municipality condition and not a behavioural state of the official. Nevertheless, as it will be shown later, these two can be connected.

network. According to this, now I suggest some results of the comparative statics of the game.

Lemma 1. *Municipalities with higher levels of individual investment,* P_i*, demand higher levels of* z_i^* *in order to continue in the joint venture,* $\left(\frac{dz_i^*}{dP_i} > 0\right)$.

As the utility of security is strictly increasing and concave, when the individual provision of security is already high, higher gains are demanded from the cooperative venture. Everything else constant, this condition implies that if the official from the municipality A invests more in its individual security, the official from the municipality B will have to increase its participation $\left(\frac{dz_A^*}{dP_B} < 0\right)$ so the official A does not defect.[8]

Proposition 1. *As the need for cooperation increases for official* A *(a lower* α*), the equilibrium value for official* A *decreases and increases for* B*,* $\left(\frac{dz_A^*}{d\alpha} > 0\,;\, \frac{dz_B^*}{d\alpha} < 0\right)$.

Or phrased differently: stronger municipalities demand higher results from the cooperative arrangement. Conversely, weaker municipalities receive a greater impact from cooperating than those whose security provision is already high. As the utility of security is strictly increasing and concave, marginal gains produced by cooperation have a greater impact in those cities with initial worse conditions (a lower α). As $\alpha \to 1$ the portion of the cooperative security gains for the weaker municipality converges towards 0, and its results are limited to what it gets by working alone. Therefore, an official from a weaker municipality will be more willing to participate in the joint project, even if gains are relatively small.

[8] Here, remember that $P_i = I_i - C_i$

Proposition 2. *As transactions costs* θ *are higher, the necessary expected improvements in security,* z_i*, brought about by the agreement are lower,* $\left(\frac{dz_i^*}{d\theta} < 0\right)$.

Nonetheless, extremely high transaction costs may render $z_i^* < 0$ and make the utility $U(z_i^* + P_i - \theta)$ obtained from the cooperation smaller than the $\mathrm{Z}_i(P_i)$ from producing security alone, in which case municipality i will not participate in the joint provision. This is a rather novel conclusion from this model: ICA framework assumes that high transactions costs are enough to prevail collaboration from happening. That relatively small transaction costs might make collaboration even easier is never contemplated. This result can be interpreted in the same way transaction costs are used to encourage Coasean bargaining (Robson, 2013), imposing a direct burden that mitigates instability between participants and preventing an empty core.

6.1 Model with risk aversion

Now I allow for risk aversion in the model. Let $U_A(z_A) = z_A^{1-\tau}$ for every $z_A \in [0, S]$, where $0 < \tau \leq 1$ is a parameter of risk aversion. I assume a simplified version of a Constant Relative Risk Aversion (CRRA) function, strictly increasing and concave, in which higher values of τ imply higher risk aversion (Muthoo, 1999; Chavez, Milanesi & Pesce, 2017).[9] For simplicity, I will assume $U_B(z_B) = z_B$, i.e. official B is risk neutral. Given these functional forms, (3) and (4) can be rewritten as

$$z_A^* = P_A + \alpha\left[\left(\frac{S(1-\tau)}{2-\tau}\right) - P_A - P_B - \theta\right] \tag{5}$$

And

$$z_B^* = P_B + (1-\alpha)\left[\left(\frac{S}{2-\tau}\right) - P_A - P_B - \theta\right] \tag{6}$$

[9] This risk aversion function fulfils the conditions of relative aversion to constant risks and absolute aversion to decreasing risks. Also, it will be very useful to calculate the risk aversion parameters in the empirical strategy (Chavez, Milanesi & Pesce, 2017).

It is straightforward to see that as τ increases, z_A^* decreases $\left(\frac{dz_A^*}{d\tau} < 0\right)$. In the limit, when τ converges towards 1 ($\tau \to 1$), z_A^* receives a value equal or lower than P_A and z_B^* receives the whole security surplus from cooperation.

Proposition 3. *To higher values of risk aversion, τ, an official is willing to accept lower gains from cooperation in order to establish an agreement.*

Conversely, an official that has low levels of risk aversion or is risk neutral or risk loving will demand a higher surplus from the cooperative project. Since a more risk averse official might expect the braining to break easily, she will be willing to accept a less advantageous position to achieve an agreement. Here, the risk aversion can be interpreted a measure of the official's perception that the network will fail, and the surplus of security achieved through it will disappear. In this sense, the hypothesis of the model is similar to that proposed by Steinacker (2002) and Feiock and Steinacker (2003). When risk aversion is higher, collaboration risks might lead the official to perceive that negotiations will not hold for long, and to increase its participation to keep the network alive and receive the benefits of cooperating. Risk aversion imposes a disadvantaged position on the official A if the other player, like B in this case, is risk neutral. This conclusion goes against some empirical evidence on the impact of risk aversion for cooperation. Instead of obstructing institutional change (the emergence of the network), if gains of cooperation are only marginally superior to the individual provision, with some efficiency losses, risk aversion can help to keep the network working.

Proposition 4. *To higher levels of α (less need for cooperation), the size of the negative relation between the parameter of risk aversion, τ, and the provision of security demanded from the agreement, z_i^*, decreases.* $\left(\frac{\partial^2 \alpha}{\partial \tau \partial z_i^*} < 0\right)$.

As the risk aversion parameter is understood here in strict behavioural terms, it is completely exogenous to the municipality's characteristics. I assume, then, that the behavioural risk preferences of the officials in charge of security, and the security conditions of their cities are completely independent. All the same, the model permits to pose a relation between risk preferences of the official and the need for cooperation of her city. The conditions of a stronger municipality (higher α) reduces the distance between the optimal value (for a risk neutral official) and the value of z_i^* a risk averse official is willing to accept to participate in the network. The relation between these two parameters balances to some point the 'objective' conditions of the municipality and the behavioural characteristics of the official. The bargaining position of the municipality is determined to a great extent by factors that are exogenous to the official —say, the fiscal and budgetary strengths, contextual situations, the policy agenda, etc. Thus, this municipality's condition moderates the impact of the behavioural trait of the official.

6.2 Extensions

Simple as it is, this model still supports many other variations on its basic specifications and the behavioural parameters of the public officials. It is of interest to see how the model reacts when evaluating the time dimension. So far, I have only referred to the conclusions of the model as in a one-shot game. However, multiple rounds could lead to important conclusions. First, the time dimension would allow for the incorporation of time preferences of the officials. How time discounting factors affect the permanence of the provisioning network? Time preference reflects the way individuals discount the utility that will be realised in a future period (Frederick, Loewenstein & O'Donoghue, 2002). This parameter has been usually used to capture the policy preferences of a municipality (Steinacker, 2004). But in its behavioural sense, it can be used to represent, for instance, the political expectations of the official. The way a public manager values a distant reward (future benefits of the

cooperation) will change inconsistently depending on their expected time in office. Thus, an appointed official designated for a short term in a post will have arguably less disposition to cooperate than a permanently hired civil servant.

In the same direction, when multiple shots are evaluated, the loss aversion feature of officials could be reviewed. Loss aversion refers to the behavioural tendency to prefer avoiding losses instead of seeking similar gains (Kanheman & Tversky, 1979). "Loss aversion produces inertia, meaning a strong desire to stick with your current holdings" (Thaler & Sunstein, 2008). Fix the previous agreement as a reference point, will imply that the expected gains of the next bargaining period will be compared to cooperative gains and not to the individual investment of each municipality. If official present loss aversion, the probabilities of a successful negotiation will fall every new round, as decreasing security production functions will be unable to guarantee enough production surplus to hold the network together indefinitely. This fact might explain, as it were, the temporal length of security provision networks.

The next stage for the extensions of this theoretical framework and model is the contrast of the key predictions with empirical evidence. Naturally occurring data has been the usual resource scholars have used to tackle the empirical questions of the metropolitan governance. But because predictions of the proposed model depend sensitively on the options and features of the players (the public officials), how they value the risks and the outcomes, what they know about the bargaining, etc., the control offered by the experimental approach results particularly useful (Camerer, 2003).

7 Conclusions

In this paper, I tried to offer a general framework to understand under which conditions local governments in a metropolitan area decide to cooperate or not in the joint provision of urban security, in the context of political fragmentation and interdependencies. Because of the contemporary nature of the urban security, the intervention scales and jurisdictional scope of each local government do not match anymore. Decisions made by one public manager in a security policy impact the other metropolitan governments and their related functions, causing spillovers, diseconomies of scale, duplication of functions, and common-pool resource problems (Klink, 2005; Sellers & Hoffmann-Martinot, 2008; Lefèvre, 2010; Feiock & Scholz, 2010). Collective action dilemmas in the field of security interventions arise from this partitioning of authority in the territory, where there are "too many governments and not enough government" (Ostrom, Tiebout & Warren, 1961, p. 831). Is in this setting where the issue of the metropolitan governance of security emerges, posing the question of how local governments should face together the new dimensions of the security dynamics.

To tackle this question, in this paper I offered several theoretical links among resources and strategic interdependencies, spatial and political fragmentation, collective action dilemmas, transaction costs, and network-based arrangements, for providing urban security at the metropolitan scale. With a game theory model of bargaining, I specified the relationships among some of these variables and proposed some key hypothesis about the formation of provisioning networks. I also suggested the relevance of public officials' risk preferences in the decision to cooperate, and showed in the model that, contrary to some empirical predictions, a relatively high parameter of risk aversion can foster the participation in the joint provision.

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