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CHOOSING SIDES : FORMATION OF REGIONAL PARTNERSHIP FOR ECONOMIC DEVELOPMENT IN METROPOLITAN AREA AND LANDSCAPE THEORY OF AGGREGATION

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Political fragmentation and the hyper-pluralism of the metropolitan area make it difficult to address more complicated issues such as economic development, income inequality, and growth management. In some metropolitan areas local governments have collectively developed a metropolitan civil society to combine the metropolis across multiple jurisdictions and to constitute the provision side of a local public economy. The new and innovative concept, "new regionalism" achieves these goals of promoting regional action through "governance," which is defined as the use of inter-governmental collaboration rather than hierarchical regional government in order to resolve area-wide public issues. Although complexity of metropolitan areas induces local jurisdictions to be engaged in collaborative strategy, it is only a necessary condition for interlocal collaboration. Whom they decide to choose as a cooperation partners is another part of the story. Based on agent-based model the "landscape theory" by Axelrod provides a general theoretical background to predict aggregation pattern by putting highly compatible components together and less compatible components apart in social sciences. This "landscape theory" is applied to explain why regional development partnership alliances among local governments are successful in some metropolitan areas but not in others.

Key Words: Agent-Based Model, Landscape Model, New Regionalism, Regional Development Partnership

INTRODUCTION

The modern metropolitan area typically contains not only multiple jurisdictions but also the interests of many stakeholders. Concerns about the formation in metropolitan areas have created some of the most important questions for the field of urban politics and economics. The traditional approach for this complexity sheds more light on political fragmentation and the efficiency in providing local public service. In this light, local competition is considered an efficient and effective way of handling the local public service provision issues. Experience over the last two decades reveals that political fragmentation and hyper-pluralism of the metropolitan area make it difficult to address more complicated issues such as economic development, income inequality, and growth management (Bish 1971). Zero-sum game arguments are concerned that if the welfare of community economy is determined by factors beyond the control of local decision-making

mechanism, then the economy of one jurisdiction can achieve success at the expense of others (James 1984; Blair and Kumar 1997). This type of social dilemma has been often portrayed in the game theory context as the prisoners' dilemma. A simple illustration of prisoners' dilemma implies that selfish individual behavior under fragmented decision-making system and interaction prevent participants from creating a desirable public good (Feiock 2002; Aylward 2005).

These more complex issues require a new and innovative way of solving the current dilemma. In some metropolitan areas local governments have collectively developed a metropolitan civil society to integrate the metropolis across multiple jurisdictions and constitute the provision side of a local public economy (Oakerson 1999). These integrations are based on collaborative efforts amongst local governments. It is believed that cooperation among fragmented local government is not uncommon (Friesema 1970; Ostrom, Bish and Ostrom 1988; Post 2002; 2004). The nature of cooperation has changed over the last three decades as well; Rather than centralization and governmental consolidations, decentralized regionalism entails cooperation among governmental entities in urban metropolitan areas throughout horizontally and vertically connected organizations (Stevens and Wickstrom 2000; Park 2005). Creation of multipurpose governments through consolidation of existing units has declined, but there have been remarkable increases in targeted collective action through intergovernmental agreements (Post 2002), creation of special districts (McCabe 2000; 2003) and regional partnerships among local governments in a metropolitan area (Olberding 2002). Voluntary cooperation among governments and sectors include public-private, intercommunity partnerships replace top-down approaches (Park, 2005, Feiock 2004).

"New regionalism," as a response to renewed interest in decentralized governance, is initiated in order to deal with the emerging and urgent issues that involve the interests of multiple parties such as fiscal disparities, social segregation, environmental problems, and economic expectations (Savitch and Vogel 2000). The "new regionalism" movement responds to growing problems that occur on a regional scale and that seem to require some sort of regional solution, in particular, infrastructure problems that drive from sprawling patterns of development (Parks and Oakerson 2000). In order to do so local governments share the resources and jointly respond to emergencies as well as deliver routine services (Feiock, Park, & Steinacker forthcoming).

"New regionalism" is both a policy agenda and a public-sector intervention designed to address that agenda (Savitch and Vogel 2000). It enhances the cost-effective provision of public infrastructures and services to wide metropolitan areas and encourages the equitable distribution of fiscal resources and development outcomes across the metropolitan area. It also supports global economic competition for the city-region and provides solutions for the ecological and sustainable patterns of land use and development (Downs 1994; Dodge 1996; Orfield 1997).

"New regionalism" achieves these goals of promoting regional action through the relatively new concept, "governance," which is defined as the use of inter-organizational collaboration rather than hierarchical regional government in order to resolve area wide public issues. Governance conveys the idea that existing institutions can be impeded in new ways, that cooperation can be achieved on a flexible and voluntary basis among localities, and that people can best control themselves by horizontally linked organizations. One form of governance is self-governance, a network not only of governmental but also of non-governmental private and not-for-profit organizations arrayed in various configurations at multiple levels that develops the plans to meet regional-wide needs (Wallis 1991; Parks and Oakerson 2000).

The regional partnership for economic development is one example of formalized configuration of this self-organization. Although the results somewhat vary due to the new and revolutionary concept of self-governance (Swanstrom 2001), new regionalists argue that collaborative regional governance will not only improve the quality of local services but also enhance the competitiveness of the regions in the global economy. Some empirical works identify economic spillovers and linkage between central cities and suburbs (Feiock and Park 2003). Several studies articulate correlations between central-city income and suburban income in U.S. metropolitan areas increased significantly over the last two decades (Savitch et al. 1993; Ledebur and Barnes 1992; Voith 1998). Some studies revealed that suburban political affiliation is more closely aligned with those of central-cities that suburbs surround over time (Gainesborough 2001; Orfield 2002). These results suggest that regional coordination and cooperation is

more achievable than expected.

In addition, an increasingly popular strategy in regional governance field is the regional partnership approach. Development partnership alliances are formed by local governments to enhance the economy of multiple jurisdictional areas, often with the aid of private firms and not-for-profit organizations (Olberding 2002). Regional partnerships typically play an important role in conducting regional promotion, coordinating local development activities or incentives, and sometimes directly providing services (Park 2005). The formation of regional partnerships approach is not always successful as there is variation in both formation and performance. Based on these phenomena observed in metropolitan areas this study is interested in the reason why only some metropolitan areas have success in forming regional partnerships over the economic development.

A THEORY OF AGGREGATION

A multiplicity of small economic entities creates unequal resource endowments and demands. In the regional governance context, this implies that some jurisdictions encounter many fundamental problems with a limited tax-base and other jurisdictions are abundant with the riches and few considerable difficulties. On the other hand, critical resource exchange does not occur only from rich jurisdictions to poor jurisdiction since there is an asymmetry in resource endowments and administrative capacity. In this sense, the need or demand side of institutional arrangements addressing the lack of resources influences the likelihood of establishing a regional partnership for economic development. Social exchange theory views that limited resources of local jurisdictions enhance regional cooperation (Pfeffer and Salancik 2003; Gulati and Gargiulo 1999). Thus, regional governance approach by interlocal collaboration is a viable alternative for local governments.

Considering collaborative development strategy responding to resource dependence as a viable option is a necessary condition for interlocal collaboration. Among many, with whom each local jurisdiction will choose to cooperate, which is sufficient condition for interlocal cooperation is a more important question for local jurisdictions. There are two contrasting theoretical arguments regarding partnership choice criteria: Resource dependence theory argues that the motivation to fill the resource gap from other jurisdictions enhance regional cooperation (Pfeffer and Salancik 2003; Gulati and Gargiulo 1999) and the theory of homophily views that political and economic similarity easily brings cooperative strategy since actors seek to forge relationships with others with whom they share similar attributes (Park 2005; Ibarra 1992; Carley 1991). This argument is particularly important in that risk-averse government entities seek for reliable cooperation partnership to achieve same policy goals. This implies that more rigorous investigation on how each local jurisdiction decides regional partnership counterparts will provide a more complete explanation of interlocal collaboration.

In this venue, Axelrod and Bennett (1993) provide a formal theory of aggregation among multiple actors called "landscape theory." "Aggregation" means the organization of components of a system in patterns that tend to put highly compatible components together and separate less compatible components apart (Axelrod and Bennett 1993). Landscape theory originates from physical sciences and biology in particular to study the dynamics of a complicated system. It turns out that the concepts provide many helpful ways of analyzing various aggregation problems in social science fields as well ranging from international alignments to alliances of business firms setting standards that have previously been thought of in isolation. This theory provides a deeper understanding of what kind of aggregation pattern exists in several different areas by answering why a certain element is similar to and different from others. The theory also provides a coherent explanation of why some particular aggregation forms in a given system and not in others (Axelrod and Bennett 1993).

In general, how and what landscape theory predicts regarding the aggregation mechanism is closely related to the recent development of a "agent-based model." The basic idea of "agent-based model" is to construct the computational devices, which are known as agents with some properties, and simulate them in parallel to model the real phenomena. The process starts with the behavioral characteristics of micro level of the social system and constructs the complexity of macro level based on interaction among micro level actors. In an agent-based model with computational method complement traditional theory building and analytical methods. Whereas the traditional approach allows us to characterize the equilibrium of a system, agent-based

models enable us to explore the possibility of generating that equilibrium. The landscape theory is able to suggest where leverage can be efficiently applied to move from one configuration to another and which partnerships are inherently unstable and which would become stable if critical subgroups could be induced to make minor changes (Axelrod and Bennett 1993).

Applying this landscape theory (or agent-based model in general) can provide a rich explanation of whether or not some metropolitan areas are successful in forming regional partnership for economic development. This article will provide an empirical test of a theory of aggregation in metropolitan governments over the economic development policy by introducing a new theoretical explanation of aggregation dynamics with the specificity of measurement.

LANDSCAPE THEORY MODEL: AGENT-BASED MODEL

Based on agent-based approach, landscape theory predicts how actors will act for aggregations such as alliances, coalitions, and organizational structures. The theory is based on two simple and plausible assumptions, both drawn from the recognition that it is difficult for a player to assess the value of each potential alignment (Axelrod 1997; Axelrod and Bennett 1993).

The first assumption is that a player evaluates how to adequately maintain the relationships with any of others independent of all other members in the system. Only pair-wise evaluations are possible and it is possible to avoid the difficulty in assessing all combinations of players simultaneously implied by game theory. The second assumption is that adjustments to alignment are possible by only marginal movement of individual players. This assumption excludes the possibility that any sub-alignment will come to exist within an alignment and then change the alliance as a block. This second assumption is essential when payoff information is made uncertain by increasing the negotiation costs and reducing the ability of players to use side payments to reach an optimal solution.

Based on these assumptions the landscape theory starts with a set of n players such as nations, firms, and local governments. Each player has the size, si>0, which is a measurement of the influential power of them to others. Size might reflect demographic or economic factors or a combination of both. Size plays an important role as having an appropriate relationship with a large player is likely to provide more benefits to each member.

The conspicuous feature of landscape theory is the propensity to work together, which means each pair of random players, *i* and *j*, has a propensity to cooperate. The propensity, p_{ij}, is simply a measurement of the willingness for two players to belong to the same alliance together. The propensity is positive if the two players act together and negative when they have many sources of potential conflict. For the simplicity, the theory assumes that propensity is symmetric, so that $p_{ij}=p_{ij}$ (Axelrod and Bennett 1993). Obviously, the details of measurement of propensity will vary from one application to another (Axelrod and Bennett 1993). Creating a proper propensity function will be the most challenging but essential work in this analysis.

A configuration is a partition of the players in the system and a specific configuration, *X*, determines the distance, d_{ij}, between any two players, *i* and *j*. For simplicity a certain configuration is dichotomous so the distance is 0 if the two players are in the same alliances and 1 if the two players are in the different alliances.

With size, propensity, and distance, it is now possible to formulize a frustration function, which is defined as how well a given configuration satisfies the propensities of a given player to be near or far from each other. A player, *i*, is willing to switch sides if the frustration would be less on the other side. Therefore the frustration of player *i* in a particular configuration *X* is

$$F_i(X)=\sum_{i\neq j} s_i p_{ij} d_{ij}(X) \qquad (1)$$

where s_j is the size of *j*, p_{ij} is propensity of *i* to be close to *j*, and $d_{ij}(X)$ is the distance from *i* to *j* in configuration *X*. The summation is taken over all players except $i = j$.

Then it is possible to construct the energy of given configuration, *X*, as the weighted sum of the frustration of each player in that configuration. This gives the energy of configuration as follows:

$$E(X)=\sum_{i\neq j} s_i F_i(X) \qquad (2)$$

Substituting the definition of frustration, equation (1), into this equation (2) allows the calculation of the energy of a configuration with respect to size,

propensity, and distance:

$$E(X)= \sum_{i \neq j} s_i s_j p_{ij} d_{ij}(X) \qquad (3)$$

Once the energy of each configuration is given it is possible to advance to building energy landscape. The landscape is simply a graph which has a point for each feasible configuration and height above this point for the energy of that configuration. Because the energy of a configuration is defined as a weighted sum of the frustrations of individual players, the decrement of the frustration of a player on given configuration lowers the energy of the entire system (Axelrod and Bennett 1993). Thus the effort of a player to change the sides in order to minimize the frustration stops at the local minimum point in the energy landscape of the entire system. Because no one in the same alignment has an incentive to revert the decision at this point, the alignment patterns reach stability. In this sense the predicted alliance configurations in the system are simply the Nash equilibria, those sets of alliances for which no single player has a motivation to switch to another alliance (Axelrod et al. 1995). The Nash equilibrium is a proper solution concept in many game theoretic settings because it may provide a large number of possible outcomes. As mentioned earlier, the second assumption that incremental adjustments should be made by only individual players is critical because it ensures that there can be no cyclical solutions by ruling out the possibility that players change sides simultaneously.

Implications of the prediction from this model are; first that the equilibrium point need not to be necessarily global optimum, which means wherever a initial point starts, it reaches the nearest local minimum and second that it might be impossible to have any configuration that is perfectly satisfied by everybody which means the majority of players are disappointed by having some friends in the opposite group and some enemies in the same group. Finally, concerning the first implication, the outcome that landscape theory predicts shows how history and expectations affect the decision of a stable outcome in the case of multiple possible equilibria (Katz and Shapiro 1985, Krugman 1991).

APPLYING THE THEORY TO FORMATION OF REGIONAL PARTNERSHIP

To calculate the Nash equilibria of potential partnership configurations among the local governments it is required to measure both individual jurisdiction size and identification of propensities to cooperate with others. The size, s, should reflect economic influence of certain local government over others. The rationale behind this expectation is that the larger economic power a local government has the more initiatives on forming partnership the local government is able to utilize. Central-cities are likely to influence neighboring suburbs in forming a regional partnership for economic development because of the economic size in this model. It is assumed that the economic size of a local jurisdiction is an appropriate measurement to capture the concept of "size" in landscape theory. On the other hand, Oliver (2000) argues that as city size increases people are less likely to know neighbors and less likely to have social contacts that are "geographically proximate." What is meant by "geographically proximate" is density, a condition related to population (Stein and Dillingham 2004). This analysis considers governmental expenditure, multiplied by the number of the population, and divided by area size as an approximation of the economic size of local government. Meanwhile transformed natural log is used for the purpose of calculation. Finally the size of local government, si, will be

$$s_i = ln\left(\frac{GovermentExpenditure_i \times Poupulaation}{AreaSize}\right) \qquad (4)$$

In order to operationalize the concept of propensity, several parameters are introduced to capture the likelihood to collaborate with others based on the characteristics and development strategies of members in regional partnership alliance. These several variables reflect the arguments that the more homogeneous the actors within the system, the more likely they will cooperate with each other. In the analysis the propensity model will include three parameters, α, β, γ, which represent different categories weighting the incentive or disincentive to ally with others.

The first variable, α, represents the degree of strength in network relationship among actors, which accounts for informal contacts between the two local governments. The basic hypothesis implied is that frequent contact breeds a strong propensity to cooperate. As collaborative and multi-organizational networks have played more important roles in delivering public

services than before (O' Toole 1997; Ostrom 1998; Agranoff and McGuire 1998; Provan and Miward 2001; Thurmaier and Wood 2002), the network framework is thought to be more useful in analyzing other public issues, the formation and the effectiveness of alliances or agreement. Also, network structure of interlocal relation is applied to explaining local economic development by specifying the mechanism of complex relationship among the participants. Communication allows individuals to increase trust in the reliability of others. Through a repeated opportunity to talk with others, a participant can evaluate whether they trust others sufficiently to try to reach a simple agreement regarding the level of joint effort and allocation (Ostrom 1998). To capture the degree of network strength, some literature researchers (Ostrom 1998; Agranoff and McGuire 1998; 2003) investigate with whom cities contact, how frequently cities are involved in communication activities, for what specific strategic purpose they contact with each other in analyzing collaborative linkages for local economic development. Reflecting the operation of previous literatures it is possible to measure the concept of network by investigating the number of contacts between two governments. A national wide survey conducted by authors provides the contact frequency of each local jurisdiction regarding economic development issues with other jurisdictions. For simplicity this frequency of communication is normalized by a simple operation as follows:[1]

$$\alpha_{ij} = \frac{N_{ij} - Avg\{N_{ij}\}}{max\{N_{ij}\} - Avg\{N_{ij}\}} \quad \text{, if } N_{ij} - Avg\{N_{ij}\} > 0$$

$$= \frac{N_{ij} - Avg\{N_{ij}\}}{Avg\{N_{ij}\} - min\{N_{ij}\}} \quad \text{otherwise} \qquad (5)$$

where N_{ij} is the number of contact between government *i* and *j*. By this simple operation, values of parameter α lie between -1 and 1. For example, if government A and B use the communication channel most frequently in the metropolitan C, the propensity is assumed to be 1, maximum value of α_{ij}. On the other hand, government E and F with less communication established than average level, the propensity for them to collaborate is expected to have negative value. And if two governments show minimum level of contact frequency in the entire system, the propensity is considered to be -1.

Second, parameter β captures the economic heterogeneity among the local government. The degree of economic heterogeneity among participants plays an important role in collective action (Olson 1965; Ostrom 1990). Negotiations will cost more and interest is less likely to be uniform in heterogeneous than in homogeneous groups (Gadgil et al. 1998; Sporrong 1998; Alcorn and Toledo 1998; Jodha 1998). Similar implications are found in a regional partnership setting. If there are great heterogeneity in prosperity between central city and suburban areas, they have different preferences regarding economic development cooperation. In that case, cooperation is difficult to form or maintain (Feiock and Steinacker 2003; Steinacker 2003). Based on the measurement in the previous research (Park 2005) the study will collect the value of the prosperity index for each jurisdiction, especially those for the central city and suburban regions in each metropolitan area, so as to capture difference of wealth in each jurisdiction of metropolitan area. By using a prosperity index variable it is possible to simplify and normalize the heterogeneity among the participants as follows:[2]

$$\beta_{ij} = \frac{|I_i C_{ij} I_j|}{max\{I_i, I_j\}} \qquad (6)$$

where I_i is the prosperity index value of government *i*.

According to theories discussed above because adverse heterogeneity, which is identically same as homogeneity, is likely to increase the propensity to work together and is interested in measuring ($1-\beta_{ij}$), which is a homogeneity parameter.

Third, parameter γ measures the degree of formal cooperation accumulated in the past, "institutional persistence," regardless of partnership area. The assumption behind this variable is that once formal regional partnership is formed in one policy area, another partnership such as alliance for economic development is easily established as well. The experience of cooperation begets another cooperative activity. Cooperative intergovernmental arrangement is likely to be sustained by reducing transaction cost and building social capital (Park 2005). If local governments

utilize the previously set partnership with others, it could reduce even more transaction costs and partnership could be more fortified. In addition the pattern of cooperation is path-dependent so that history may affect the determination of stable alliance when there are multiple potential outcomes (Katz and Shapiro 1985; Krugman 1991). In this sense, history plays an important role because participants use previous and current information available to evaluate each other (Axelrod et al. 1995). The number of previous partnership in other related areas will be treated as a measurement of formal cooperation previously established or "institutional persistence." The way of normalizing γ is identically same with the case of α. Thus parameter γ is

$$\gamma_{ij} = \frac{C_{ij} - Avg\{C_{ij}\}}{max\{C_{ij}\} - Avg\{C_{ij}\}} \quad \text{, if } C_{ij} - Avg\{C_{ij}\} > 0$$

$$= \frac{C_{ij} - Avg\{C_{ij}\}}{Avg\{C_{ij}\} - min\{C_{ij}\}} \quad \text{otherwise} \qquad (7)$$

where C_{ij} is the number of inter-local agreement initiated between government i and j.3 By this simple operation, values of parameter γ also lie between -1 and 1. Any relationship between government i and j with maximum value of C_{ij} constitutes parameter γ as 1. Likewise, any governmental relationship which has minimum value of C_{ij} among the entire metropolitan area ends up with system γ equivalent to -1.

To put these altogether it is possible to construct a propensity function of regional partnership for economic development in this particular setting as follows:

$$p_{ij} = \alpha_{ij}(1-\beta_{ij})\gamma_{ij} \quad -1 \le \alpha_{ij}, \beta_{ij}, \gamma_{ij} \le 1, \; 0 \le 1-\beta_{ij} \le 1 \qquad (8)$$

One advantageous property of equation (8) is that a product of any values between 0 and 1 is lying between 0 and 1 as well. Therefore it is possible to interpret 1 as perfectly identical inclination, which is more likely lead to collaboration and -1 as perfectly bipolar propensity or simply indifferent from the existence of others. The propensity function (8) is put into previous constructed energy function (3) to obtain the energy function in this specific case:

$$E(X) = \sum_{i \neq j} s_i s_j \alpha_{ij}(1-\beta_{ij}) \gamma_{ij} d_{ij}(X) \qquad (9)$$

DATA AND ANALYSIS

Some examples of metropolitan areas and their patterns of forming regional partnership are investigated for economic development in this empirical analysis based on computer simulation. From a nationwide mail survey of city governmental officers responsible for economic development programs, the clusters of 7 metropolitan areas of Boston, Cleveland, Denver, Miami-Fort Lauderdale, Los Angeles- Riverside-San Bernardino, Salt Lake City, and San Francisco-San Jose-Oakland are selected to find out the equilibrium point that locally minimizes the frustration of the entire system by computing optimized output in each metropolitan area. The simulation for each case of metropolitan area is conduct based on the energy equation developed in the previous section. The unit of analysis in this setting is the economic agent, local governments within each metropolitan area. For instance the case of San Francisco-Oakland-San Jose metropolitan area consisting of 33 different cities which have different characteristics and development strategies especially a local economic capacity and intensiveness of communication channel with other cities. This substantial variation in size and propensity from empirical data makes the prediction of cooperation pattern based on the model possible and meaningful. Finally, the applicability of agent-based approach is discussed since estimation results provide the comparison with empirical patterns of partnership alliance in reality based on national-wide mail survey results.

The basic data of constituent cities is collected in each case regarding the size of local governments, which are total population in each cities, area size, and financial expenditure from U.S. census data in 2000, and online Census data reports.

Difficulty occurs when the data constructing propensity function is collected because most survey data currently available is extremely limited in that it does not reflect information about the dyadic relationship of a one to one relationship. Since the

model counts heavily upon a strong assumption that a local government evaluates how well it maintains the relationships with other governments independent of all other members in the system, only pair-wise evaluations are meaningful. The model requires specific data on N_{ij} in equation (5), which is the number of contact between government *i* and *j*. Mail survey data available only provides information on N_j, which measures contact frequency with official/agencies in other cities. Therefore, it is interpreted as overall frequency of contact, which is scale variable from 1 to 5. In this sense the ideal survey question on this particular inquiry should ask not how many times city A contacts with other cities in general but how many times city A contacts respectively with city B, city C, and city D. This difficulty can be overcome in a sense that the interest here is the normalized propensity rather than specific value of N_{ij} or Ni. It is possible to construct αij without creating any serious flaws. α_{ij} representing the degree of propensity to cooperate and lying between -1 and 1 can inferred from partial propensity information of N_i and N_j as follows:

$$N_{ij} = N_i + N_j \qquad (9)$$

where N_{ij} is an integer between 2 to 10. Although this treatment is limited, generated value of N_{ij} does not create any critical problems because the ultimate goal is to construct α_{ij} in equation (5). As explained in detail in the previous section it is possible to create α_j based on the information of contact frequency with other cities from the mail survey data of local government in metropolitan areas.

In the previous section γ can be constructed from C_{ij} in the same manner to generate α. Several reliable measurements of formal cooperative relation other than economic development partnership are found in the past from the same survey data collection. Those measurements come from questions regarding cooperative economic development activities or programs previously used by local jurisdictions. From several survey questions 4 questions are selected related to cooperative policy for development and code 0 or 1 depending on whether or not a local government participates in formal partnership in each case of the cooperation issue. Those questions are whether or not a city 1) is engaged in a joint venture with other cities, 2) is engaged in private of public venture, 3) has community redevelopment agency to promote projects in specific areas, and 4) use business improvement districts or a main street program. The number of formal partnership is counted in which two local governments simultaneously take part, and consider it as C_{ij}. Minimum and maximum numbers of alliances which each city can join are 0 and 4, respectively. Then, the value of C_{ij} could also lie from 0 to 4. The remaining part of constructing γ_{ij} from C_{ij} is identically same with the way of constructing parameter α_{ij}, and was explained in detail in the equation (7). The parameter of "institutional persistency" differs depending on the degree of variation in previous cooperation decision of each local government from average participation level within the entire metropolitan area.

Decision on cooperation is difficult to achieve or sustain in case that great differences in economic characteristics among the participant cities lead them to choose different economic incentives and development strategies. To measure economic dissimilarity of participant cities in metropolitan areas the parameter β_{ij} is calculated which represents the degree of difference in prosperity index values between matching city *i* and j. As developed in the previous section, β_{ij} could be computed from prosperity index among local government, Ii. Prosperity index values take all the economic indicators including per capita income, median income, percentage of college graduate, homeowner, percentage of occupied house, and percentage of professionals into account and overall index value can be calculated from the average of standardized scores on every indicator, where a higher index value implicates more prosperity (Park 2005).

Finally, the information of the distance among local governments on particular configuration X in the equation (9) collected from same 2003-2004 survey data. Survey question is designed to investigate whether or not a local government in metropolitan area adopts regional partnership for economic development. More specifically the question asks whether or not a local government provides financial support for economic development partnership. This survey data is also limited in that it does not provide dyadic relationship data. As recognized while addressing the issue of contact number, this survey question provides partial information on di rather than dij. Treatment on distance data is very similar to infer N_{ij} from N_i. It is possible to consider the dyadic distance between two cities as 0 if both cities choose the provision of financial support for

economic development or neither city decides to activate financial support, and as 1 for the rest of the cases. Noted here is that although we normally code 0 for non-provision of particular policy and 1 for provision of it, measuring the distance is conducted in reverse way. This is because the same stance on issuing financial support is understood as identical position on this policy choice, thus zero distance between two governments. Therefore, in case that only one government utilizes financial support program, d_{ij} is assumed to be 1, which implies perfectly remote from each other in terms of configuration X, economic development policy. In this manner it is possible to construct complete information on dij for configuration X, where X is the provision of financial support for economic development program.

FINDINGS

The result matrix1 shows estimated distance on the configuration of a regional partnership. Each cell in matrix has either 0 or 1. If both cities belong to same alliance, strategic distance has 0. This implies that two cities demonstrate same stance on utilizing cooperative development strategies. As discussed above, those estimated results are the Nash equilibria so that no member in the alliances has incentive to switch its membership, which also means it represents stable local minimum. Based on this result it is possible to compare the estimates to the empirical outcomes and the predicted alliances in these comparisons provide moderate support for the landscape approach. For example, the simulation predicts 65.7% city of Los Angeles-Orange county-Riverside correctly (23 out of 35 cities)2. Despite a couple of variations in Denver (100%, 11 out of 11) and Cleveland (36.8%, 7 out of 19), most of metropolitan areas report 53-78% (Boston 72.7%, 8 out of 11; San Francisco-San Jose-Oakland-78.8%, 26 out of 33; Salt Lake City- 53.8%, 7 out of 13; Miami-Ft. Lauderdale 66.7%; 10 out of 15) correct prediction of cooperation patterns in each metropolitan setting. These variations might be caused by variations in number of sample size, misspecification of propensity function, or incorrect measurement on each component such as size, network, economic background, and distance. In the empirical analysis, alternative way of measuring dyadic relationship might be problematic as well. The simulation procedures show that propensity between two members plays an especially important role in determining with whom to cooperate. In the model, this means stronger network relationship, more homogenous economic background, more frequent former relationship experience can increase the likelihood for local governments to choose to be a cooperation partners. In this sense, more refined propensity function is able to enhance the explanatory power of the formal model for regional partnership setting. A sensitivity analyses on propensity parameters and inclusion of additional factors such as forms of government, representing political homogeneity will improve the model in the future analysis.

CONCLUSION

Experience over the last two decades shows that political fragmentation and hyperpluralism of the metropolitan area make it difficult to address more complicated issues such as economic development, income inequality, and growth management. Zero-sum or negative-sum game arguments view that fragmented decision making systems for economic development may decrease the welfare level of society. This implies that realizing interdependence among local jurisdictions in metropolitan areas provide reasonable grounds for initiating collaborative development strategies. The nature of cooperation has changed as well. Rather than centralization and governmental consolidations, local governments voluntarily decide to cooperate with others and to join regional partnership for economic development seeking for mutual benefits. In fact, there have been remarkable increases in targeted collective action through inter-governmental agreements (Post 2002), creation of special districts (McCabe 2000; 2003) and regional partnerships among local governments in a metropolitan area (Olberding 2002).

Interdependency over achieving economies of scale in service provision or addressing policy externalities or spillovers makes both formation and maintenance of strategic alliance for economic development attractive but this is only a necessary condition for local governments to enter alliances. Interdependence itself is not sufficient to articulate the formation patterns of a cooperative partnership between two specific local governments. Interdependency does not determine with whom the each local government cooperates. By applying formal model previously developed by

Axelrod (1993) to a specific issue of forming regional partnership, the research paper investigates sufficient conditions for local government to utilize strategic alliance. The analysis shows that the characteristics of cities, network relationships in which local governments are embedded, and path dependency based on past history and future expectation, equally play an important role in choosing with whom to build strategic alliance. As discussed in the previous section, agent-based model with computational method provides a useful way of complementing traditional theory building and analytical methods for partnership formation. The traditional approach makes it possible to characterize the equilibrium of a system; agent-based models enable us to answer the sufficient conditions for establishing partnership by exploring the possibility of generating that equilibrium. The structure of interlocal relations can be viewed as a "macro" phenomenon emerging out of the "micro" decisions of local governments seeking to gain access to resources and to minimize the uncertainty associated with choosing alliance partners (Gulati and Gargiulo 1999).

Institutional collective action approach provides a useful framework for understanding interlocal cooperation in fragmented metropolitan area by focusing not only on the calculation of benefits and costs of forming cooperative alliance but also on the aspects of transaction costs (Feiock and park 2005). ICA framework studies both the necessary and sufficient condition for cooperative activities among local governments in a systematical manner by outlining how characteristics of communities, political institutions, and policy networks affect bargaining, information, agency, enforcement and division issues for regional partnership for economic development. Although politically fragmented metropolitan areas are polycentric system without central governing system, repeated relationships among local governments can enhance local government cooperation in fragmented metropolitan areas. Second-generation models of rational choice theory also posit that repeated face-to-face communication (Ostrom et al. 1992; 1994) and substantial amount of net benefits makes cooperation not only a feasible but also a sustainable strategy. While there has been a substantial volume of research that articulates motivation of collectively developing an intercommunity partnership under the fragmented local government in metropolitan areas, the patterns or the conditions for sustainable cooperative alliance are rarely developed. This paper is one of those that take initial steps for studying how local governments determine with whom they cooperate.

Implication and Limitation

In two different literatures, Axelrod et al. (1993; 1995) applied landscape theory to international alignment among European countries and the alliance over the technological standard setting, and concluded that the simple theory and parsimonious operationalization of its concepts are very effective in predicting the dynamics of forming alliance.

The essential components of regional partnership formation for economic development include how an individual local government in metropolitan areas chooses cooperation partners. The mechanism in which micro level of cooperative motivations works toward a specific configuration can be described as the decision making problems by an agents in a game theoretic situation. Agent-based model basically posits that limited cognitive ability of agents allows only pair-wise assessment of different scenarios and that adaptive adjustments to alignment are possible only by marginal movement of individual players. The intuition of how an alliance configuration is established against another in this particular setting is relatively straightforward although some of the basic assumptions in agent-based model can be considered to be too simplistic.

In analyzing the decision process of forming regional partnership, this article is one of the few works to count on the value of agent-based model approach, which not only provides precise predictions, but also provides a deeper understanding of factors that affect the decision making on partnership formation.

Even though current analysis would be limited to a simple model, this study warrants further analyses as to expand the scope and applicability of this approach. A more general way of capturing size and propensity will be insightful. Those include the more rigorous specifications of size and propensity in capturing regional partnerships. Also, relaxing some rigid assumptions in this model will be helpful such as allowing a player to decide either to be neutral or to have dual membership in alliances and admitting asymmetric propensities. To explore nonlinear specification of the energy function or to consider the endogenous change in size and frustration elements will be another contribution to broaden this approach. This

analysis is still informative in that constructed frustration and energy function in this theory could be interpreted and utilized as a type of cooperation index that measures likelihood to form an alliance. The index can be used as an explanatory variable in the multiple regression context or a component of another function in future research.

The analysis is limited to the assumption in which local governments in metropolitan areas are the only players in forming regional partnership for economic development. In fact, it is more common for private firms and not-for-profit organizations to play important roles in forming a development partnership alliances and delivering local public services. In this sense, the model is difficult to capture this complexity around regional partnership in reality and a more sophisticated model that takes not-uniform, hetrerogenous organizations into account is useful and needed in future research.

NOTES

1. See Appendix1
2. See Appendix2
3. Correspondent Author

REFERENCE

Agranoff, Robert and Michael McGuire. 1998. "Multinetwork Management: Collaboration and the Hollow State in Local Economic Policy" *Journal of Public Administration Research and Theory* 8(1): 67-91.

_____. 2003. ***"Collaborative Public Management: New Strategies for Local Governments"*** Washington, D.C., Georgetown University Press.

Allard, Scott, Nancy Burns, and Gerald Gamm. 1998. "Representing urban interests: The local politics of state legislatures" ***Studies in American Political Development*** 12 (2): 267- 302.

Axelrod, Robert. 1997. ***The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration*** Princeton, NJ: Princeton University Press.

_____ and Scott D. Bennett. 1993. "A Landscape Theory of Aggregation" ***British Journal of Political Science*** 23(2): 211-233.

_____. Will Mitchell, Robert E Thomas, Scott D. Bennett and Erhard Bruderer. 1995. "Coalition Formation in Standard-setting Alliances" ***Management Science*** 41(9): 1493-1508.

Aylward, Stephen R. 2005. "Interjurisdictional Competition and Urban Area Fragmentation" University of Maryland Dissertation.

Barlow, I.M.1991. ***"Metropolitan Government"*** London: Routledge.

Becker, Fred W. and Milan J. Dluhy 1998. eds. ***"Solving Problems in Urban Areas Characterized by Fragmentation and Divisiveness"*** Volume 7 of Research in urban policy, Stamford, Connecticut, JAI Press.

_____. 1986. "Technology Adoption in the Presence of Network Externalities" ***Journal of Political Economy*** 94: 822-841.

Bickers, Kenneth N. and Robert M. Stein 2002. "Inter-local cooperation and the distribution of federal grant awards" Paper presented at the Devoe L. Moore Center Conference on Decentralized Governance: The Implications of Government Organization in Metropolitan Areas, October 4-6, 2002, Tallahassee, Florida.

Bish, Robert. 1971. ***The Political Economy of Metropolitan Areas*** Chicago, IL: Markham.

Blair, John P. and Rishi Kumar. 1997. Is Local Economic Development a Zero-Sum Game? In R. Bingham and J. Blair (Eds.) ***Dilemmas of Urban Economic Development*** Beverly Hills, CA: Sage.

Brookings Institution. 2002. ***"Beyond Merger: A Competitive Vision for the Regional City of Louisville"*** Washington, D.C., Brookings Institution Press.

Brueckner, Jan K. 1998. "Testing for Strategic Interaction Among Local Governments: The Case of Growth Controls" ***Journal of Urban Economics*** 44: 438-467.

Burns, Nancy. 1994. ***"The Formation of Local Governments: Private Values and Public Institutions"*** New York: Oxford University Press.

Burt, Ronald S. 1999. "Private Games are too Dangerous" Computational and Mathematical Organizational Theory 5: 311-341.

Carley, K. 1991. "A Theory of Group Stability" ***American Sociological Review*** 56: 331-54.

Carr, Jered B. and Linda S. Johnson. 2002. "A War of Words: The Herestics of Creating Regional Governance" paper presented at the annual meeting of the American Political Science Association, Boston, September 3-5.

Clingermayer, James C. and Richard C. Feiock. 2001. ***"Institutional Constraints and Policy Choice: An Exploration of Local Governance"*** NY. Albany. SUNY press.

Dodge, William R.1990. "Regional Problem Solving in the 1990s: Experimentation with Local Governance for the 21st Century" ***National Civic Review*** (July/August): 354-366.

_____. 1992. "Strategic Intercommunity Governance Networks: 'SIGNETs' of Economic Competitiveness in the 1990s" ***National Civic Review*** (Fall/Winter): 403-417.

_____. 1996. "Regional Excellence: Governing Together to Compete Globally and Flourish Locally" Washington, D.C, National League of Cities.

Downs, Anthony. 1994. ***"New Visions for Metropolitan America"*** Washington, D.C., Brookings Institution

Farrell, J and N. Gallini. 1988. "Second Sourcing as a Commitment" ***Quarterly Journal of Economics*** 103: 673-694.

Feiock, Richard C. 2002. "A Quasi-Market Framework for Local Economic Development Competition" ***Journal of Urban Affairs*** 24: 123-42.

_____ and Jered B. Carr 2001 " Incentives, Entrepreneurs, and Boundary change: A Collective Action Framework" ***Urban Affairs Review*** 36: 382-405.

_____ and Annette Steinacker. 2003. "A Bargaining Framework for Local Development Policy Choices" Presented at Annual American Political Science Association Meeting 2003, Philadelphia, August 26-31.

_____ and Hyung-Jun Park. 2003. "Social Capital and the Formation of Regional Partnerships" Presented at Annual American Political Science Association Meeting, August 27-30, 2003.

_____, Hyung Jun Park and Annette Steinacker Forthcoming "Institutional Collective Action and Economic Development Joint. ***Public Administration Review.***

_____. 2004. ***"Decentralized Governance: The Organization of Local Governments in Metropolitan Areas"*** Washington, D.C., Georgetown University Press.

Friesma, H.P. 1979. "Interjurisdictional Agreements in Metropolitan Areas" ***Administrative Science Quarterly*** 3: 242-252.

Grell, Jan and Gary Gappert. 1993. "The New Civic Infrastructure: Intersectoral Collaboration and the Decision-Making Process" ***National Civic Review*** 82(2): 140-148.

Gulati, Ranjay and Martin Gargiulo. 1999. "Where Do Interorganizationl Networks Come From?" ***The American Journal of Sociology*** 104(5): 1439-1493.

Hart, S. and M. Kurz. 1980. "Endogenous Formation of Coalition" ***Econometrica*** 51: 1047-1064

Ibarra, H. 1992. "Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm" ***Administrative Science Quarterly*** 37: 442-47.

James, F. 1984. Urban Economic Development: A Zero Sum Game? In R. Bingham and J. Blair (Eds.) ***Urban Economic Development*** Beverly Hills, CA: Sage.

Katz, M. and C. Shapiro. 1985. "Network Externalities, Competition, and Compatibility" ***American Economic Review*** 75: 424-440.

_____. 1986. "Technology Adoption in the Presence of Network Externalities" Journal of Political Economy 94: 822-841.

Krugman, P. 1991. "History versus Expectations," ***Quarterly Journal of Economics*** 106: 651-667.

Ledebur, Larry C. and William R. Bames. 1992. "City Distress, Metropolitan Disparities and Economics

Growth" Washington, D.C., National League of Cities.

Lubell, Mark, Mark Schneider, John T. Scholz and Mihriye Mete. 2000. "Watershed partnerships and the emergence of collective action institutions" ***American Journal of Political Science*** 46 (1): 148-163.

_____ and John T. Scholz. 2001. "Cooperation, Reciprocity, and the Collective Action-Heuristic" ***American Journal of Political Science*** 45:160-178.

McCabe, Barbara. 2000. "Special-District Formation among the States" ***State and Local Government Review*** 32(2): 121-131.

_____. 2003. ***'Special Districts as an Alternative to Consolidation: In Reshaping the Local Landscape: Perspectives on City-County Consolidation and its Alternatives,*** edited by Jered Carr and Richard C. Feiock Armonk, N.Y.: M.E. Sharpe.

North, D. C. 1990. ***'Institutions, Institutional Change, and Economic Performance"*** New York, NY: Cambridge University Press.

Oakerson, Ronald J. 1999. ***'Governing Local Public Economics: Creating the Civil Metropolis"*** Oakland, California, ICS Press.

_____. 2004. " The Study of Metropolitan Governance" in Richard C. Feiock, ***Decentralized governance: The organization of local governments in metropolitan areas.*** Washington D.C.: Georgetown University Press.

Olberding, Julie C. 2000. "The Formation, Structure, Process and Performance of Regional Partnerships for Economic Development in Metropolitan Areas" . Ph.D. Dissertation, University or Kentucky, Lexington.

_____. 2002a. " Does Regionalism Beget Regionalism?: The Relationship between Norms and Regional Partnerships for Economic Development" ***Public Administration Review*** 62: 480-491.

_____. 2002b. "Diving into the 'Third Waves' of Regional Governance Strategies: A Study of Regional Partnerships for ***Economic Development in U.S. Metropolitan Areas"*** Economic Development Quarterly 16 (August): 251-272.

Oliver, J. Eric. 1999. "The Effects of Metropolitan Economic Segregation on Local Civic Participation" ***American Journal of Political Science*** 43 (January):186-212.

_____. 2000. "City Size and Civic Involvement in Metropolitan America" American Political Science Review 94 (June): 361-373.

Orfield, Myron. 1997. "Metropolitics: A Regional Agenda for Community and Stability" Washington, D.C., Brookings Institution.

Ostrom, Elinor, V. Ostrom and R.Bish.1988. ***'Local Government in the United States"*** San Francisco: Institute for Contemporary Studies Press.

_____. 1990. ***"Governing the Commons: The Evolution of Institutions for Collective Action"*** New York: Cambridge University Press.

_____, James Walker and Roy Gardener. 1992. "Covenants with and without a Sword: Self-Governance is Possible" ***American Political Science Review*** 86: 404-417.

_____, Roy Gardener and James Walker. 1994. ***"Rules, Games, and Common-Pool Resources"*** Ann Arbor: University of Michigan Press.

_____. 1998. "A Behavioral Approach to the Rational Choice Theory of Collective Action" ***American Political Science Review*** 92(1):1-22.

_____. 1999. ***'Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework"*** In P.A. Sabatier, ed., Theories of the Policy Process. Boulder, CO: Westview Press.

_____ and T.K. Ahn. 2002. "Social Capital and the Second Generation Theories of Collective action: An Analytical Approach to the Form of Social Capital." Paper presented at the 2002 Annual meeting of America Political Science Association.

Parks, Roger B. and Ronald J. Oakerson. 2000. "Regionalism, Localism, and Metropolitan Governance: Suggestion from the Research Program on Local Public Economies" ***State and Local Government Review*** 32(3): 169-179.

Park, Hyung Jun. 2005. Collaborative Approach to Economic Development of Local Governments and Institutional Collective Action, Ph,D dissertation. Florida State University.

Pfeffer, Jeffrey and Gerald Salancik. 2003. ***The External Control of Organizations: A Resource Dependence Perspective*** Stanford, CA: Stanford Business Books.

Post, Stephanie. 2002a. "Metropolitan area governance and institutional collective action" Paper presented DeVoe Moore Symposium, October 5-6, Florida State University at Tallahassee, Florida.

_____. 2002b. "Local Government Cooperation: The Relationship between Metropolitan Area Government Geography and Service Delivery" Paper presented at the annual meeting of the American Political Science Association, August 29-31, Boston.

Savitch, H.V. and Ronald K. Vogel. 2000a. "Path to New Regionalism" ***State and Local Government Review*** 32(3): 158-168.

_____. 2000b. "Metropolitan Consolidation versus Metropolitan Governance in Louisville" ***State and Local Government Review*** 32(3): 198-212

Schneider, Mark, Paul Teske and Michael Mintrom. 1995. ***"Public Entrepreneurs: Agents for Change in American Government"*** Princeton: Princeton University Press.

Stein, Robert M. and Gavin Dillingham. 2004. "Political Participation in an Urbanized Society" working paper, Houston, Texas.

Steinacker, Annette. 200.3 "Model of Metropolitan Cooperation: The Case of Economic Development" Presented Midwest Political Science Annual Conference Paper. Chicago, April 4-8, 2003.

Stephens. G. R. and N. Wickstron. 1999. ***"Metropolitan Government and Governance Theoretical Perspectives, Empirical Analysis, and the Future"*** Oxford University Press.

Stevens, J. B. 1993. ***"The Economics of Collective Action"*** Boulder, Colorado, Westview Press.

Swanstrom, Todd. 2001. "What We Argue About When We Argue about Regionalism" ***Journal of Urban Affairs*** 23(5): 479-496.

Voith, Richard. 1998. "Do Suburbs Need Cities?" ***Journal of Regional Science*** 38 (3):445-464.

Wallis, John Joseph. 1991. "The Great Depression: Have We Learned Our Lessons?" ***Second Thought: The Uses of American Economic History,*** Oxford University Press .

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Appendix 1. Case of San Francisco-San Jose-Oakland: Estimated distance (N=33)

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24	X25	X26	X27	X28	X29	X30	X31	X32	X33
1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	1	0	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	0	0	0	1	1	1	1
6	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	0	0	0	1	0	0	1	0	1	0	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	0	0	0	1	1	1	1
10	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
14	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	1	0	0	1	1	1	0	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	0	0	1	1	1	1
16	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	1	0	0	0	1	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
31	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
32	1	0	0	0	1	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0
33	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 2. A Case of Los Angeles-Orange county-Riverside: Simulation Results (N=35)

Members: Cities that has 0 as distance for utilization of regional partnership for economic development (N=29) **Simulated Prediction**	Actual Pattern of Cooperation (21 out of 29 are correct)	Non-Members: Cities that has 0 as distance for non-utilization of regional partnership for economic development (N=6) **Simulated Prediction**	Actual Pattern of Non-cooperation (2 out of 6 are correct)
Brea City	V	Fontana city	
Buena Park City	V	Irvine city	V
Burbank city	V	Rancho Cucamonga city	
Cerritos City		West Covina city	
Chino City	V	Whittier city	V
Chino Hills City		Long Beach city	
Corona City	V		
Costa Mesa City			
Gardena City	V		
Lakewood City			
Ontario City	V		
Oxnard City			
Palmdale City	V		
Palm Springs City	V		
Pico Rivera City	V		
Rialto City	V		
Riverside City	V		
San Clemente City			
Santa Fe Springs City	V		
Santa Paula City	V		
Simi Valley City	V		
Temecula City	V		
Thousand Oaks City `	V		
Torrance City	V		
Glendale City	V		
Santa Monica City			
Fullerton City			
Huntington Beach City	V		
San Bernardino City	V		

Appendix 2 shows that simulation results predict that whereas 29 local jurisdictions will participate in regional partnership formation, 6 local governments will be non-members of this cooperative activity. This simulated result also can be easily compared with actual cooperation patterns around regional partnership. Second and forth column of this figure is marked when simulated outcomes and actual patterns are correctly

matched. Results demonstrate that 23 out of 35 local governments' decision making patterns in Los Angeles metropolitan area are correctly predicted (21 out of 29 for members and 2 out of 6 for non-members). This means that 8 actual non-members of regional partnership are predicted to become participants and 4 actual members of regional partnership are predicted as non-participants. Therefore Appendix 2.B reports that there are 25 actual members and 10 actual non-members in reality.

Appendix 2.B. Case of Los Angeles-Orange county-Riverside: Actual Pattern (N=35)

City that utilizes cooperative strategy for economic development (N=25)		Cities that do not utilize cooperative strategy for economic development (N=10)	
Brea City	Buena Park City	Cerritos City	Chino Hills City
Burbank City	Chino City	Costa Mesa City	Irvine City
Corona City	Fontana City	Lakewood City	Oxnard City
Gardena City	Ontario City	San Clemente City	Whittier City
Palmdale City	Palm Springs City	Santa Monica City	Fullerton City
Pico Rivera City	Rancho Cucamonga City		
Rialto City	Riverside City		
Santa Fe Springs City	Santa Paula City		
Simi Valley City	Temecula City		
Thousand Oaks City	Torrance City		
West Covina City	Glendale City		
Long Beach City	Huntington Beach City		
San Bernardino City			

[1] This operation is to normalize the dyadic data capturing the number of contact for economic development. $Avg\{N_{ij}\} = \frac{1}{N-1}\sum_{i \neq j} N_i$ represents the average number of contact which city i has with other local jurisdictions. Likewise, indicates the case which city i has the most frequent contact with while indicates the case which city i has the least frequent contact with.

[2] This operation is also to normalize the difference in prosperity index between two cities. $max\{I_i, I_j\} = I_i$, if I_j and $max\{I_i, I_j\} = I_j$, otherwise. In other words, $max\{I_i, I_j\}$ represents whatever the greatest number in prosperity index between I_i and I_j.

[3] Operational procedure is identical with the case of α. C_{ij} represents the number of interlocal agreement initiated between government i and j. Therefore, $Avg\{C_{ij}\} = \frac{1}{N-1}\sum_{i \neq j} C_i$ indicates the average number of interlocal agreement which city i has with other local jurisdiction. and can be interpreted in the same way with the case of α